Factors Affecting Patients' Use of Electronic Personal Health Records

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا ۖ إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ)

(سورة البقرة - اية 32)

In the Name of Allah, the Most Compassionate, the Most Merciful.

(They said, “Glory be to You! We have no knowledge except what You have taught us. It is you who are the Knowledgeable, the Wise")

(Surat Al-Baqara, verse 32)

Declaration

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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Dedication

To the soul of my beloved grandmother
Rasmiyah Hailat,
Who was waiting impatiently for coming back to Jordan

To my beloved parents
Ali Abd-Alrazaq and Jamilah Samarah,
Whose support and prayers make me able to work hard and finish this thesis

To my dear bother
Osama Abd-Alrazaq,
Who was a brother, friend, father, and advisor in all parts of my life

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Abstract

England has recently introduced a nationwide electronic personal health record (ePHR) called Patient Online. Although ePHRs are widely available, adoption rates of ePHRs are usually low. Understanding the factors affecting patients' use of ePHRs is considered important to increase adoption rates and improve the implementation success of ePHRs. Therefore, the current study aims to examine the factors that affect patients' adoption of ePHRs in England.

A systematic review was conducted to identify factors that affect patients' adoption of ePHRs. Then, the most common theories and models relevant to technology adoption and human behaviour were reviewed to select an appropriate theory and use it as a theoretical lens for examining the factors in the current study. The Unified Theory of Acceptance and Use of Technology (UTAUT) was selected and tailored to the context of ePHRs by including the most influential factors identified by the systematic review. A cross-sectional survey of 624 patients in four general practices in West Yorkshire was carried out to empirically examine the proposed model via structural equation modelling.

The results showed that performance expectancy, effort expectancy, and perceived privacy and security were significant predictors of behavioural intention. The relationship between social influence and behavioural intention was not statistically significant. Both facilitating conditions and behavioural intention affected use behaviour. Performance expectancy was also a significant mediator of the effect of both effort expectancy and perceived privacy and security on behavioural intention. Eleven relationships were moderated by age, sex, income, education, ethnicity, and internet access. The proposed model accounted for 76% and 48% of the variance in behavioural intention and use behaviour, respectively.

The current study makes a significant contribution by adapting and validating a theoretical model (UTAUT) in a new context (ePHRs). Further, this study contributes to practices by providing several implications for developers, marketers, and GP practices.

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List of Abbreviations

AA	Alaa Abd-Alrazaq
AGFI	Adjusted Goodness-of-Fit Index
AMOS	Analysis Moment of Structures Software
AVE	Average Variance Extracted
β	Standardised Estimate
BI	Behavioural Intention
C-TAM-TPB	Combined Technology Acceptance Model&Theory of Planned Behavior
CCAT	Crowe Critical Appraisal Tool
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CHIT	Consumer Health Information Technology
CI	Confidence Interval
CMB	Common Method Bias
CRD	Centre for Reviews and Dissemination
D^2	Mahalanobis Distance
EE	Effort Expectancy
EHRs	Electronic Health Records
EMRs	Electronic Medical Records
ePHRs	Electronic Personal Health Records
FC	Facilitating Conditions
GFI	Goodness-of-Fit Index
GP	General Practice
HBM	Health Belief Model
HITs	Health Information Technologies
HIV	Human Immunodeficiency Virus
HRA	Health Research Authority
IDT	Innovation Diffusion Theory
IQR	Interquartile Range
IS	Information System
K	Cohen’s kappa
M.I	Modification Indices
MK	Mohammad Khasawneh
ML	Maximum Likelihood
MM	Motivation Model

MMAT	Mixed Methods Appraisal Tool
MPCU	Model of Personal Computer Utilisation
NFI	Normed-Fit Index
NHS	National Health Service
PAM	Patient Activation Measure
PE	Performance Expectancy
PMT	Protection Motivation Theory
PPS	Perceived Privacy and Security
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QATSDD	Quality Assessment Tool
R&D	Research and Development
R^2	Coefficient of Determination
REC	Research Ethics Committee
RMSEA	Root Mean Square Error of Approximation
SCR	Summary Care Records
SCT	Social Cognitive Theory
SD	Standard Deviation
SEM	Structural Equation Modelling
SI	Social Influence
SPSS	Statistical Package for the Social Sciences
SRMR	Standardised Root Mean Square Residual
TAM	Technology Acceptance Model
TAM 2	Technology Acceptance Model 2
TAM 3	Technology Acceptance Model 3
TLI	Tucker-Lewis Index
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TTF	Task Technology Fit
UB	Use Behaviour
UK	United Kingdom
UTAUT	Unified Theory of Acceptance and Use of Technology
UTAUT 2	Unified Theory of Acceptance and Use of Technology 2
VIF	Variance Inflation Factor
χ^2	Chi-Square Statistic
χ^2/df	Relative Chi-square
Z-Value	Critical Value

Chapter One:

Introduction

Chapter 1 Introduction

1.1 Introduction

According to the key report published by the Institute of Medicine (2001), the quality of health care can be improved through achieving six aims. One of these aims is converting the care from physician-centred to patient-centred (Institute of Medicine, 2001). One of the main characteristics of a patient-centred care practice identified by Davis et al. (2005) is that practices should enable patients to easily access care, such as booking appointments, messaging providers, refilling prescriptions, and accessing their medical records. Electronic Personal Health Records (ePHRs) are one of Consumer Health Information Technologies (CHITs) that enable patients to easily access care, thereby, converting the care to patient-centred (Amante et al., 2014; Baird, 2012; Ozok et al., 2014).

In 2015, the National Health Service (NHS) in England provided patients with ePHRs that enable patients to book appointments, request repeat prescriptions, and view summary information in GP records (NHS Choices, 2016; NHS England, 2017). The adoption rate of ePHRs in England is very low (19%) (NHS Digital, 2018). Identifying and understanding factors that affect patients' use of ePHRs is considered crucial to increasing patients' adoption and, in turn, improving implementation success of ePHRs (Huygens et al., 2015; Najaftorkaman et al., 2014; Or et al., 2011; Sanders et al., 2013). The current research aims to examine the factors affecting patients' use of ePHRs in England.

This chapter commences by defining ePHRs and providing an overview of their types, functionalities, benefits, and state in England. The research problem regarding ePHRs is discussed in Section 1.3. In Section 1.4, the research aim and objective are presented. The importance of the current research is outlined in Section 1.5. Section 1.6 highlights the structure of the dissertation. In the final section, a summary of the chapter is outlined.

1.2 Research Background

For decades, healthcare consumers (i.e. patients and healthy individuals) gathered and stored health information (e.g. immunisation records, medication lists, and laboratory results) in a paper-based format (Assadi, 2013). However, paper-based health records have several drawbacks, notably: (1) they may not be intelligible by others except the one who wrote it; (2) they are more likely to be lost, misplaced, and damaged; (3) they may be large, unwieldy, and difficult to be searched; and (4) they may contain inaccurate, incomplete, out-of-date information (Coiera, 2015).

In the era of information technology, healthcare consumers began collecting and storing their health information in an electronic format such as spreadsheets and word processors (Detmer et al., 2008). With more advancements in information technology, Electronic Personal Health Records (ePHRs) have been developed to enable healthcare consumers to systematically collect and store their health records (Assadi, 2013). Definition, types, functionalities, and benefits of ePHRs are outlined in the following four subsections. The current status of ePHRs in England is discussed in the fifth subsection.

1.2.1 Definition of Electronic Personal Health Records

The term “ePHRs” is an evolving term due to rapid and continuous advances of Health Information Technologies (HITs) (Gartrell, 2014; Nguyen, 2011; Patel et al., 2011a). Hence, there is no universal consensus on the definition of ePHRs among organisations, professionals, and researchers of health information technology (Gagnon et al., 2016; Gartrell, 2014; Liu et al., 2013; Wu, 2013). ePHR has been defined by several authors and organisations such as the American Health Information Management Associations (AHIMA) (2010), the Healthcare Information and Management Systems Society (HIMSS) (2007), and the Markle Foundation (2003) (see Appendix 1). The current dissertation uses Markle Foundation’s definition of ePHRs as it is the most cited in the literature and the most comprehensive (Gartrell et al., 2015; Macpherson et al., 2014; Thompson et al., 2016; Van Appeven, 2015), which is as follows:

> *“An electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorised, in a private, secure, and confidential environment”*
>
> (Markle Foundation, 2003, p.14)

1.2.2 Types of Electronic Personal Health Records

Although different ePHRs have been developed, they can be categorised into three types according to the degree of integration with other systems: standalone PHRs, tethered PHRs, and integrated PHRs (see Figure 1.1) (Archer et al., 2011; Feistel, 2014; Gee, 2014; Jackman, 2016; Rice, 2014; Toscos et al., 2016).

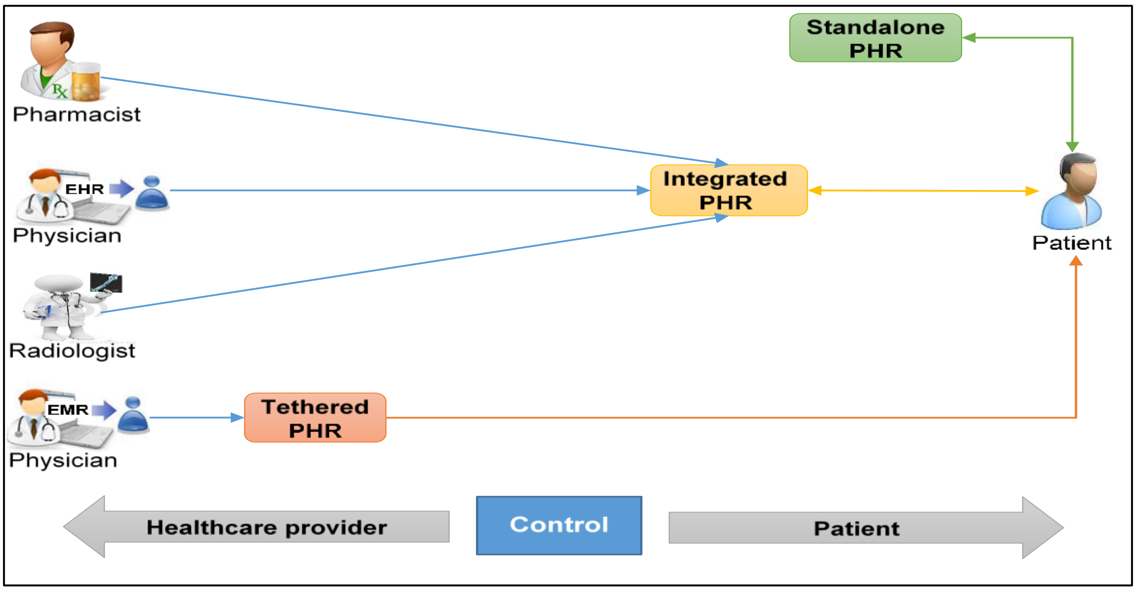


Figure 1.1: Types of ePHRs

Standalone PHRs are those records that are not connected with any healthcare provider systems such as electronic health records (EHRs) or electronic medical records (EMRs) (Feistel, 2014; Gee, 2014; Jackman, 2016; Van Appeven, 2015). In this type, patients fully control and manage their records through viewing, adding, editing, storing, and sharing their own data (Daglish, 2013; Jackman, 2016; Van Appeven, 2015). Standalone PHRs can be in one of two forms: computer-based such as word processor, spreadsheets, smartcards, and USB drive; and internet-based such as Google Health, Microsoft’s HealthVault, and Indivo (Emani et al., 2012; Gartrell et al., 2015; Wu, 2013). Standalone PHRs have the following shortcomings. First, there are concerns regarding the accuracy and completeness of the data since it is entered manually by patients (Detmer et al., 2008; Wright and Sittig, 2007). Second, standalone PHRs, especially computer-based, are more vulnerable to loss, ruin, and robbery (Detmer et al., 2008; Tang et al., 2006). Third, standalone PHRs may contain out-of-date data (Detmer et al., 2008; Tang et al., 2006; Wright and Sittig, 2007).

As shown in Figure 1.1, tethered PHRs refer to systems that are connected to a single healthcare provider system (e.g. a primary care clinic or a hospital) and enable patients to get access to their data that are uploaded by their providers (Assadi, 2013; Daglish and Archer, 2009; Feistel, 2014; Gee, 2014; Van Appeven, 2015). In contrast to the standalone PHRs, the healthcare provider has the full control over patients’ data in tethered PHRs (Assadi, 2013; Daglish and Archer, 2009; Pirtle and Chandra, 2011). For that reason, data in tethered PHRs are more accurate, complete, up-to-date, and secure (Daglish and Archer, 2009; Detmer et al., 2008). Some tethered PHRs allow patients to add supplementary data to their records (Assadi, 2013; Detmer et al., 2008). Further, these systems may provide other services to patients such as booking appointments and refilling repeat prescriptions (Arauwou, 2017; Jackman, 2016; Tavares and Oliveira, 2016; Wallace et al., 2016). The main flaw of tethered PHRs is that patients are vulnerable to losing access to their records when they change healthcare provider as a result of difficulties transferring data due to system incompatibilities (Baird, 2012; Daglish, 2013; Tang et al., 2006). The most common examples of tethered PHRs are My Health Manager and MyHealthVet in the USA, and SystemOnline and Patient Access in England (Gartrell, 2014; NHS Choices, 2016; Sprague, 2006).

Integrated PHRs refer to those systems that are connected to multiple healthcare provider systems and enable patients to get access to their data that are drawn from different sources such as patients, EHRs, insurance companies, laboratories, and pharmacies (see Figure 1.1) (Assadi, 2013; Detmer et al., 2008; Gee, 2014; Van Appeven, 2015). Patients have more control over data in the integrated PHRs (Daglish and Archer, 2009; Detmer et al., 2008; Tang et al., 2006; Van Appeven, 2015). Integrated PHRs share the main features of the standalone and tethered PHRs, which are: giving patients more control over their records and combining data entered by different healthcare providers with data entered by patients themselves (Assadi, 2013; Detmer et al., 2008; Kahn et al., 2009). One of the limitations of integrated PHRs is that providers or other sources must use EHRs instead of paper-based records so as to be able to import the data to integrated PHRs (Gee, 2014). Zweena Health is an example of integrated PHRs (Gee, 2014). Table 1.1 shows the characteristics of types of ePHRs.

Table 1.1: Characteristics of Types of ePHRs

Attribute	Standalone	Tethered	Integrated
Integration	Not integrated with any system	Integrated with one provider system	Integrated with more than one provider system
Source of data	Patients	Providers	Patients and providers
Privacy	Low	High	Moderate to high
Complexity	Simple to moderate	Simple	High
Form	Computer-based Internet-based	Internet-based	Internet-based
Shortcomings	Accuracy & completeness of data. Vulnerability to loss, robbery, and ruin. Non-updated data.	Losing data if the patient changes provider or location	Unable to import paper-based data.
Cost	Free and paid	Free	Free and paid
Examples	Microsoft's HealthVault, Google Health	My Chart, kp.org, MyHealthVet	Zweena Health

1.2.3 Functionalities of Electronic Personal Health Records

As discussed earlier, standalone PHRs offer simple functions to help patients to gather, manage, store, and share their personal health information such as health history, hospital and practice visits, insurance status, immunisation records, and medical and emergency contacts (Detmer et al., 2008). More advanced ePHRs (i.e. tethered and integrated PHRs) may provide additional functionalities, namely:

1. Accessing electronic health records: ePHRs allow patients to view their own health information that is stored in EMRs such as history, problems list, allergies, medications list, test results, clinical summary (Kao and Liebovitz, 2017; Nazi et al., 2013; Tulu et al., 2016a). Patients may be given a permission to add or amend some information (Detmer et al., 2008).
2. Clinical transactions: Several transactional services may be available through ePHRs; for instance, scheduling appointments, requesting repeat prescriptions, ordering referrals, and paying bills (Nazi et al., 2013; Pai et al., 2013; Tulu et al., 2016a).
3. Secure messaging: ePHRs may enable patients and their healthcare providers to communicate through sending secure emails (Kao and Liebovitz, 2017; Pai et al., 2013; Ricciardi et al., 2013; Tulu et al., 2016a).
4. Self-management support: Patients may effectively manage their own health by getting instructive feedback or motivational advice, using decision support tools, setting prevention and wellness reminders/alerts, and following tailored care plans (Gu and Day, 2013; Kaelber et al., 2008; Pagliari et al., 2007b; Wakefield et al., 2012).
5. Home monitoring and tele-reporting tools: ePHRs may allow signs, symptoms, or health behaviour data to be recorded manually by patients themselves or by importing them automatically from the clinical devices used by patients at home (Kruse et al., 2012; Pagliari et al., 2007b; Pai et al., 2013; Wakefield et al., 2012).
6. Educational tools: ePHRs may provide patients with useful links or multimedia of educational materials about illnesses, treatments, or popular health topics such as nutrition, weight management, and smoking cessation (Pagliari et al., 2007b; Pai et al., 2013; Ricciardi et al., 2013; Wakefield et al., 2012).
7. Other services: Some ePHRs offer useful tools such as discussing groups or peer support (Pai et al., 2013; Ralston et al., 2007), patient questionnaires (e.g. quality of life and patient-reported outcomes) (Kaelber and Pan, 2008; Pai et al., 2013), and links to other organisations and networks (Pagliari et al., 2007b; Pai et al., 2013).

1.2.4 Benefits of Electronic Personal Health Records

Using ePHRs offers at least five main benefits. First, ePHRs enhance patient empowerment by: improving patient engagement in healthcare process and decision making (Rice, 2014; Vermeir et al., 2017), boosting patient self-management and medication adherence (Rice, 2014; Vermeir et al., 2017), enhancing patients' sense of control over health (Ertmer and Uckert, 2005; Morton, 2012), and increasing patient health knowledge (Morton, 2012; Pagliari et al., 2007a).

Second, ePHRs can improve the quality of care by: enhancing the relationships and communications between patients and health care providers (Alyami and Song, 2016; Ochoa III et al., 2017; Vermeir et al., 2017), enabling patients to easily access health services (e.g. booking appointments & requesting repeat prescriptions) (Morton, 2012; Pagliari et al., 2007a), decreasing provider responsibility presuming enhanced health and self-management (Pagliari et al., 2007a; Smith et al., 2012), and improving patient safety through verifying the accuracy of information recorded by providers, documenting medications and treatments not prescribed by the provider, and lowering adverse drug interactions and allergies (Alyami and Song, 2016; Endsley et al., 2006; Honeyman et al., 2005; Morton, 2012; Pagliari et al., 2007b).

Third, ePHRs can reduce the burden of care by: decreasing unnecessary consultations and waiting lists (Pagliari et al., 2007a), and reducing costs through enhancing health and decreasing utilisation of health services and treatments (Endsley et al., 2006; Pagliari et al., 2007a), avoiding duplicated tests (Alyami and Song, 2016; Morton, 2012), and reducing medical errors (Endsley et al., 2006; Rice, 2014).

Fourth, ePHRs can increase health gains through decreasing illnesses, supporting wellness activities, providing disease preventive tools, and improving the quality of life (Morton, 2012; Pagliari et al., 2007a).

Fifth, ePHRs can improve patients' privacy by enabling patients to control their records and select individuals to share them with (Alyami and Song, 2016; Endsley et al., 2006).

1.2.5 The State of Electronic Personal Health Records in England

England, as many other countries, enacted a government policy that authorises patients to get access to their medical records (Bartlett et al., 2012; Pagliari et al., 2007b). Therefore, the NHS had offered patients in England access to their Summary Care Records (SCR) through HealthSpace (Greenhalgh et al., 2008b; Kahn et al., 2009; Pagliari et al., 2007b). HealthSpace is a secure web-based personal health record that has several functions: booking or cancelling hospital appointments, recording and charting health indicators (e.g. vital signs, weight, and peak flow), calendar with email reminders, NHS address book, links to educational sources, secure messaging, in addition to access to the SCR (Greenhalgh et al., 2010a; Greenhalgh et al., 2010b; Pagliari et al., 2007b). The SCR is a summary of key health information (allergies, adverse reactions, current medications, and main diagnoses) extracted from patients electronic medical records held by their general practitioners, and it is stored centrally and accessible by authorised NHS staff in urgent situations (Greenhalgh et al., 2008b; Greenhalgh et al., 2010b; Kahn et al., 2009). Patients must create an advanced HealthSpace account to access their SCR. According to a study conducted by University College London in 2008, only 0.12% of patients who were invited to use HealthSpace created an advanced HealthSpace account (Greenhalgh et al., 2008a). That percentage increased by only 0.01% after two years (Greenhalgh et al., 2010a). Due to the low adoption rate and technical issues, HealthSpace was shut down in December 2012 (de Lusignan et al., 2013; NHS Connecting for Health, 2013).

After the failure of HealthSpace, Department of Health set a ten-year strategy aiming to improve healthcare quality and outcomes of patients and service users by exploiting information and technologies (Department of Health, 2012). According to this strategy, all GP practices in England must provide patients with online services by April 2015 (Department of Health, 2012). NHS England launched a program called Patient Online (NHS Choices, 2016; NHS England, 2017). In 2015, this program included several online services such as booking and cancelling appointments, requesting repeat prescriptions, and viewing summary information in GP records (medications and allergies only) (NHS Choices, 2016; NHS England, 2017). One year later, patients were able to access more detailed coded information in their records such as demographics, test results, problems list, immunisations, and medical and surgical procedures (NHS Choices, 2016). Patient Online services are provided by six different suppliers: TPP, EMIS, INPS, MICROTEST, WigglyAmps, and Evergreen Life, and their systems are called SystemOnline, Patient Access, Patient Services, The Waiting Room, Engage Consult, and Evergreen Life/i-Patient, respectively (NHS Choices, 2016).

1.3 Research Problem

Although ePHRs are widely available and many patients are very interested in using them, adoption rates of ePHRs are usually very low (Arauwou, 2017; Huygens et al., 2015; Martinez et al., 2013; Mishuris et al., 2015; Najaftorkaman et al., 2014; Ozok et al., 2017; Sandefer, 2017; Tulu et al., 2016b). As mentioned earlier, the adoption rate of HealthSpace was very low (0.12%) (Greenhalgh et al., 2010a). In respect to Patient Online, the overall adoption rate was 18.9% in April 2017 and reached 23.8% in February 2018 (NHS Digital, 2018). These figures indicate that the adoption rate of Patient Online is not only low, it increases slowly. The situation of ePHRs in the United

States of America (USA) was not better than England. Three recent American national surveys conducted by California HealthCare Foundation (2010), Markle Foundation (2008), and Markle Foundation (2011) reported that about 7%, 3%, and 10% of US adults had ever utilised ePHRs, respectively. Similarly, the adoption rate of ePHRs was around 5% in several European countries, such as France, Denmark, and Estonia (de Lusignan et al., 2013).

Identifying and understanding factors that affect patients' use of ePHRs is considered crucial to increase patients' adoption and, in turn, improve implementation success of ePHRs (Fung et al., 2006; Huygens et al., 2015; Kaelber et al., 2008; Logue and Effken, 2012; Najaftorkaman et al., 2014; Or et al., 2011; Sanders et al., 2013). Understanding these factors enables healthcare institutions, ePHRs developers or suppliers, and policymakers to identify the suitable interventions (e.g. training, outreach, marketing, system adjustments, and enacting policies) to increase patients' adoption of ePHRs and avoid failure of implementation of ePHRs (Daulby, 2015; Kim et al., 2007; Liu et al., 2013; Logue and Effken, 2013; Morton, 2012; Patel et al., 2012; Tulu et al., 2012). For that reason, many studies have been conducted to understand the factors that affect patients' use of ePHRs such as Arauwou (2017), Ozok et al. (2017), Sandefer (2017), and Tavares and Oliveira (2016). However, previous literature has many shortcomings and gaps, namely:

First, most of the ePHRs research has not been theory-based (Andrews et al., 2014; Assadi, 2013; Emani et al., 2012; Najaftorkaman et al., 2014; Or and Karsh, 2009). In other words, few studies have utilised theories or models to understand the factors that impact patients' use of ePHRs, such as theory-based studies conducted by Lazard et al. (2016), Razmak and Bélanger (2018), and Tavares and Oliveira (2016). Further, most of those few studies have adopted one model called Technology Acceptance Model (TAM) despite the existence of other competing theories such as Theory of Reasoned Action (TRA) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Najaftorkaman et al., 2014; Thompson et al., 2016). Use of a theory in research has several benefits, namely: it increases the predictive power of the adopted variables (Daulby, 2015; Or et al., 2011); it improves understanding of the adoption process of ePHRs (Daulby, 2015; Emani et al., 2012; Stolyar, 2011); it enables designers and decision makers to make use of prescriptive findings and guidance on increasing the adoption (Emani et al., 2012; Or et al., 2011); and it produces a testable model for subsequent research in similar contexts. Moreover, Bhattacherjee (2012) pointed out that the scientific knowledge depends on theories and observations, and scientific research is not considered valid if it ignores theories. This shortcoming will be addressed in the current research by conducting a theory-based study.

Second, many studies focused on the factors that affect patients' intention to use ePHRs instead of actual use (e.g. Abramson et al., 2014; Nambisan, 2017; Ozok et al., 2017; Razmak and Bélanger, 2018). Using intention to use as a proxy for actual use is a controversial issue for the following reasons. (i) There is no or little empirically rigorous foundation on considering intention to use as a proxy for actual use (Wu and Du, 2012). (ii) The relationship between intention to use and actual use is usually not strong (Forquer et al., 2014; Gebauer et al., 2013; Haun et al., 2014; Kim, 2012; Kim, 2014; Wu and Du, 2012). This weak relationship may be attributed to the existence of other important factors affecting actual use directly rather than the intention to use (Logue, 2011; Venkatesh et al., 2012). Specifically, actual use is influenced directly by habit (Kim and Malhotra, 2005; Kim, 2012; Tavares and Oliveira, 2016; Venkatesh et al., 2012), facilitating conditions (Ajzen, 1985; Chen and Chan, 2014; Venkatesh et al., 2003; Venkatesh et al., 2012), perceived usefulness (Or, 2008), and technology self-efficacy (Chen and Chan, 2014). (iii) Intention to use is formed before actual use, and the time gap between the intention and use may be large (Bagozzi, 2007), therefore, the intention to use measured earlier may change (Sheeran and Orbell, 1998). Given these reasons, it is highly recommended that researchers assess factors influencing patients' actual use in addition to their intention to use (Assadi, 2013; Logue and Effken, 2012). The current research will address this limitation by assessing both use and intention to use.

Third, to the best of the researcher's knowledge, all previous studies examined independent variables (e.g. perceived usefulness and ease of use) and dependent variables (e.g. use and intention to use) at one point in time (e.g. Gordon and Hornbrook, 2016; Ruiz et al., 2016; Tavares and Oliveira, 2016). For this reason, those studies are subject to the common method bias (CMB) (Assadi, 2013; Bhattacherjee, 2012; Gebauer et al., 2013). This bias results from assessing dependent and independent variables at the same time and/or using the same data collection instrument (questionnaires) (Bhattacherjee, 2012; Campbell and Fiske, 1959). CMB inflates the results of analysis and, thereby, it can lead to invalid conclusions (Podsakoff et al., 2003; Straub et al., 2004). It is worth mentioning that this limitation is not particular to cross-sectional studies, but it is also a limitation in studies using alternative designs (e.g. longitudinal). Therefore, it is highly recommended to avoid this bias by examining the independent variables and dependent variables at two different points in time and using two different instruments (Assadi, 2013; Bhattacherjee, 2012). The current research will address this shortcoming by there being time between the measurement of independent variables (e.g. performance expectancy and effort expectancy) and the measurement of dependent variable (i.e. use behaviour), and by using two different data collection instruments (i.e. questionnaires and system logs).

Fourth, many studies have assessed the factors that affect subjectively-measured use of ePHRs (Gebauer et al., 2013; Legris et al., 2003; Or and Karsh, 2009; Rodman, 2015; Turner et al., 2010). Subjectively-measured use (or self-reported use) refers to asking end-users directly about their use of a system (Wu and Du, 2012). Subjective measure of use may introduce bias as it does not usually reflect the actual use (Burton-Jones and Gallivan, 2007; Karahanna et al., 2006; Lee et al., 2003; Podsakoff et al., 2003; Straub et al., 1995; Turner et al., 2010; Venkatesh et al., 2012; Wade-Vuturo et al., 2013). This may be attributed to the assertion that light users may overestimate their use of a system, and vice versa (Collopy, 1996). Another explanation is that it is difficult for users to recall their previous uses, thereby, they are very error-prone in reporting their use (Devaraj and Kohli, 2003). Ideally, actual use is measured objectively by checking system logs (Wu and Du, 2012). The current research will address this shortcoming by objectively measuring the use of ePHRs.

Fifth, although numerous studies measured use objectively, almost all of them focused on personal factors (e.g. age, sex, race, education, and health status) as they depended on secondary data extracted from Electronic Health Records (EHRs) (Emani et al., 2012). Those studies ignored the important role of other factors such as human-technology interaction, organisational, and social factors (Emani et al., 2012). The current research will address this shortcoming by assessing factors from different groups (e.g. personal, human-technology interaction, organisational, and social factors).

Sixth, many studies recruited users and nonusers to investigate the factors that affect their intention to use ePHRs such as Abramson et al. (2014), Cho et al. (2010), Lazard et al. (2016), and Tavares and Oliveira (2016). However, it is well known that the factors before using the system may change after using it (Bhattacherjee, 2001; Han, 2003; Karahanna et al., 1999; Peek et al., 2014). For example, perceived ease of use is considered an influential factor among nonusers, but its effect considerably decreases after they use the system (Venkatesh et al., 2003). Ideally, studies should recruit patients who never use the system in order to investigate the factors affecting intention to use. More details regarding this issue are discussed in Section 1.4. The current research will address this shortcoming by recruiting only non-users of ePHRs.

Seventh, there is no consensus among studies on the factors affecting patients' use of ePHRs (Tulu et al., 2012; Tulu et al., 2016a). For example, while several studies found that females are more likely to use ePHRs than males (Garrido et al., 2015; Leveille et al., 2016; Mikles and Mielenz, 2015), other studies found contrary results (Rodman, 2015; Ronda et al., 2013; Tulu et al., 2016a). Furthermore, other studies demonstrated that there is no association between sex and use of ePHRs (Ancker et al., 2016; Jhamb et al., 2015; Raghu et al., 2015).

Finally and most importantly, to the best of the researcher’s knowledge, there are no studies in England in order to identify factors affecting patients’ use of ePHRs (Patient Online). In a systematic review conducted by Thompson et al. (2016), no studies were conducted in England among 55 studies investigating factors that affect patients’ use of ePHRs. In another review conducted by Kim et al. (2011) to review history and trends of ePHR studies published in PubMed, only 6 of 108 studies were published in the United Kingdom (UK). However, none of these six studies tested the factors affecting patients’ adoption of ePHRs. Although a large number of studies have been conducted in countries other than England, their findings may not be generalisable to England context since the adoption of technology highly depends on the context where the technology is implemented (Pagliari et al., 2007a; Pagliari et al., 2007b). For example, most healthcare services in England are provided for free at the point of access, and this is not the case in many countries such as USA (Roland et al., 2012). Further, while the healthcare system in several countries (e.g. USA) enables patients to communicate their healthcare providers via ePHRs (Ancker et al., 2016; Emani et al., 2012; Shimada et al., 2014), this service is not provided by Patient Online (NHS England, 2017). In addition, patients in England are more satisfied with healthcare system than patients in the USA, Australia, Canada, and New Zealand (Schoen et al., 2004). It is well documented that patients’ satisfaction with the healthcare providers affects patients’ adoption of ePHRs (Abramson et al., 2014; Agarwal et al., 2013; Patel et al., 2011a). The spread of internet access and computers in the UK is higher than many developed countries such as the USA. Specifically, whereas the percentages of households with computers and internet access in the UK were 88% and 90% in 2017 respectively (Office for National Statistics, 2018), the percentages of households with computers and internet access in the USA were 79% and 77% in 2015 respectively (Ryan and Lewis, 2017). Accordingly, the previous studies in other countries do not reduce the necessity of carrying out similar studies in England, especially, where a nationwide system (Patient Online) has recently been implemented (Pagliari et al., 2007a; Pagliari et al., 2007b). This gap will be addressed by conducting an empirical study in England.

1.4 Research Aim and Objectives

Taking into account the benefits of using ePHRs (Subsection 1.2.4) and the research problem (Section 1.3), the overall research aim of this project is:

> *To examine the factors that affect patients’ adoption of electronic personal health records (ePHRs) in England.*

The process of adoption of an information system (IS) by end-users consists of three stages that happen over time: pre-use stage, initial use stage, and continuing use stage (see Figure 1.2) (Bhattacherjee, 2001; Gebauer et al., 2013; Karahanna et al., 1999). In the pre-use stage, individuals' beliefs and attitudes regarding a given IS are developed based on information provided by mass media, interpersonal communications, and reports (Bhattacherjee, 2001). In the initial use stage, individuals assess the degree to which their beliefs and attitudes match their initial experience with the IS use (Bhattacherjee, 2001). Individuals may modify their beliefs and/or behaviour to achieve more agreement between them (Bhattacherjee, 2001). In the last stage, individuals' beliefs and attitudes become more stable since they become more realistic and fixed in behaviour (Bhattacherjee, 2001). It is well documented that the factors that make individuals move from one stage to another are different since their beliefs and attitudes regarding the IS differ from stage to stage (Bhattacherjee, 2001; Han, 2003; Karahanna et al., 1999; Peek et al., 2014). In other words, factors that affect individuals' initial use may differ from those that influence their continuing use (Bhattacherjee, 2001; Han, 2003; Karahanna et al., 1999; Peek et al., 2014). For example, perceived ease of use of a technology is a strong predictor of initial use but not continuing use (Venkatesh et al., 2003). In contrast, habit is an influential factor in relation to continuing use but not to initial use (Forquer et al., 2014; Kim and Malhotra, 2005; Limayem et al., 2007). Although examining the factors that affect both initial and continuing use are very important for IS success (Bhattacherjee, 2001; Forquer et al., 2014; Gebauer et al., 2013; Nijland et al., 2011), this dissertation focuses particularly on the factors that affect patients' initial use of ePHRs for two reasons. First, studying the factors that influence continuing use requires the researcher to employ longitudinal survey design, and this design is risky and impractical for projects restricted with time and resources, such as the current project (Bowling, 2014; Collis and Hussey, 2014; Saunders et al., 2015). Second, as Patient Online has been recently launched, and about 76% of patients have never used it (NHS Digital, 2018), it is more appropriate to investigate the factors that make nonusers become users (i.e. initial use stage) in this phase of the implementation. Consequently, the term "use" refers to "initial use" throughout this dissertation.

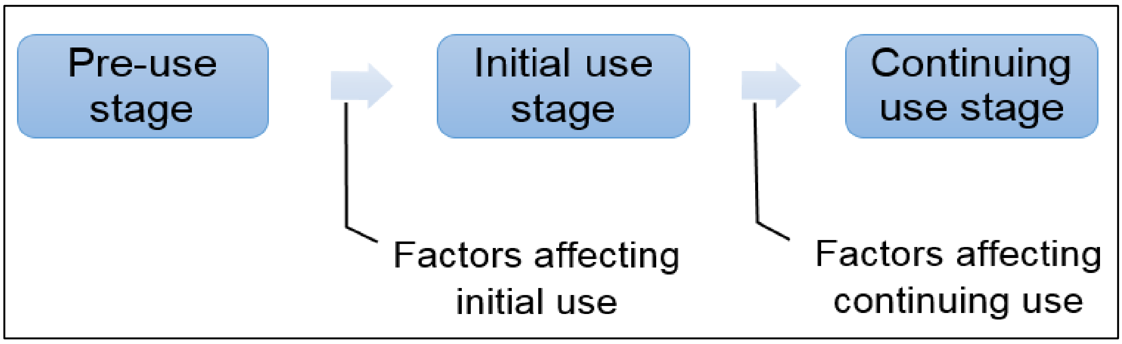


Figure 1.2: Process of Adoption of Information Systems

To achieve the aim of this research, it is very important to explore all possible factors affecting patients' use of ePHRs by reviewing the literature. After that, a conceptual model will be developed by selecting the most appropriate theory or model for this study. Then, the most influential factors identified by reviewing literature will be added to that model to make it more suitable to the context of ePHRs. The adapted model will be examined empirically. Lastly, the findings of this project will be discussed in order to come up with recommendations for researchers, general practices, and ePHRs developers. To be more precise, the aim of the current research will be achieved by accomplishing the following objectives:

1. To systematically review the evidence regarding factors that influence patients' use of or intention to use ePHRs. This objective will be achieved by conducting a systematic review. Chapter 2 is dedicated to achieving this objective.
2. To develop a conceptual model that is suitable for the study context. This objective will be accomplished by critically reviewing well-established theories and models that are related to the adoption of technology and human behaviour, selecting the most appropriate theory/ model for the study context, and adding the most influential factors found by the systematic review to the selected model. Chapter 3 is devoted to accomplishing this objective.
3. To empirically examine the proposed conceptual model. This objective will be achieved by carrying out a cross-sectional survey. Chapters 4 and 5 are dedicated to achieving this objective.
4. To formulate practical and theoretical implications for general practice, policy makers, system developers, and researchers. This objective will be achieved by discussing the findings of this study in Chapter 6.

1.5 Significance of the Research

As indicated earlier, using ePHRs achieves many benefits for patients and healthcare providers. However, the adoption rate of ePHRs must be high to gain these benefits. Since this study aims to identify the factors that affect the adoption rate of ePHRs, findings of the study will provide research and practical contributions.

In respect to research contributions, the current study will bridge the gap in the literature of ePHRs adoption by examining the factors that affect patients' use of ePHRs in England context, which has not been examined before. In contrast to previous systematic reviews, the systematic review in the current project will focus on one type of ePHRs (i.e. tethered) as the factors that affect patients' use of each type of ePHRs may be different due to differences in the characteristics and functionalities that these types have (Archer et al., 2011; Feistel, 2014; Gee, 2014; Jackman, 2016; Rice, 2014; Toscos et al., 2016). After adopting and validating a theoretical model, the current research will contribute to consumer health information technology literature (CHIT) (in general) and ePHR literature (in particular) by providing a model suitable for assessing adoption of CHITs and ePHRs. The current research adds to the literature by applying the best practices to examine the developed model such as conducting a theory-based study, assessing both intention to use and actual use, measuring the actual use objectively, and examining the independent variables and the main dependent variable at two different points in time and using two different instruments. Hopefully, the current research will attract the attention of researchers to validate and develop the model in other types of ePHRs and CHITs and other contexts.

In respect to the practical contributions, the findings of this study will enable healthcare providers, developers of ePHRs, and policymakers to get a better understanding of ePHRs adoption. Therefore, they will be able to develop appropriate strategies and interventions and allocate effectively their resources to increase the adoption rate and gain benefits of ePHRs. For example, healthcare providers will direct their interventions (e.g. training, marketing, and outreach) to certain groups of patients based on the findings of the current study. Further, developers of ePHRs may use findings of this study to identify the characteristics or functionalities of the system that improve patients' adoption such as usability and security of the system. Findings of this study may also help policymakers in establishing organisational and/or public policies to motivate individuals to use the system and to mitigate their concerns.

1.6 Structure of the Dissertation

To achieve the research aim and objectives outlined in Section 1.4, the rest of this thesis is organised into five chapters. A summary of these five chapters is as follows:

Chapter 2 aims to achieve the first objective of this study, which is to systematically review the evidence regarding factors that influence patients' use of ePHRs. The chapter starts with defining the concept "systematic review" and its characteristics. Then, the review question and objectives are outlined. This is followed by identifying and justifying the systematic review methods that will be used in the current research. Next, results of the systematic review are presented. The chapter concludes with a discussion of the review findings.

Chapter 3 is dedicated to accomplishing the second objective of the current research, which is to develop a conceptual model suitable for the study context. This chapter starts with explaining the processes of developing a conceptual model. This chapter also provides an overview of relevant behavioural theories and models. Then, the most appropriate model is selected according to well-developed criteria. The selected model is tailored to the context of this study by selecting and mapping the constructs found by the systematic review. The researcher defines the selected constructs and identifies the relationship between them. Lastly, the conceptual model and proposed hypotheses of this research are presented.

Chapter 4 is devoted to attaining the third objective of the present study, which is to empirically examine the proposed conceptual model. To begin with, the research philosophy, purpose, approach, and methodology that this research follows are determined and justified. Then, the researcher explains the reasons for choosing survey method rather than experimental or case study methods. This is followed by providing the justification for selecting the survey instrument and clarifies how it was developed. The process of sampling is also outlined in this chapter. Next, the research settings where the current study is carried out are identified and justified. The data collection process is described in details. The chapter ends with discussing the main ethical considerations taken into account throughout the research process.

Chapter 5 endeavours to accomplish the third objective of the present study, which is to empirically examine the proposed conceptual model. The chapter starts with outlining the response rate. It also presents the findings of data screening related to outliers, normality, linearity, and multicollinearity. This is followed by presenting results of the descriptive analysis for characteristics of participants and non-participants, and participants' responses. Results of the inferential analysis for the measurement model and structural model are reported. The chapter concludes with results of the thematic analysis of the qualitative data collected through an open-ended question.

Chapter 6 is dedicated to achieving the fourth objective of the current research, which is to formulate practical and theoretical implications for general practice, policy makers, system developers, and researchers. The chapter starts by summarising, interpreting, and discussing the results of the validation of measurement model and structural model. The contributions of the current study to theory and practices are outlined in this chapter. Then, the researcher reports the main strengths and limitations of the current study. This is followed by suggesting several recommendations for future research. The chapter ends with the conclusion of this study.

1.7 Chapter Summary

This chapter has provided an overview of the research proposed in this dissertation. The chapter started with providing background information regarding definition, types, functionalities, and benefits of ePHRs in addition to its status in England. This was followed by critically discussing the research problem. Then, the research aim and objectives were outlined. The significance of this study was stated. Lastly, the structure of the dissertation was described briefly.

Chapter Two:

Systematic Review

Chapter 2 Systematic Review

2.1 Introduction

This chapter is devoted to achieving the first objective of this study, which is to systematically review the evidence regarding factors that influence patients' use of or intention to use ePHRs. The current project conducted a systematic review for several reasons. Firstly, the systematic review enables the researcher to formulate a better understanding regarding factors that affect patients' adoption of ePHRs. Secondly, it is a very useful tool for developing and confirming the boundaries of a theory by adding the most influential factors that are not covered by that theory (Popay et al., 2006). Thirdly, according to the scoping review that was conducted before the current review, there are many primary studies that are relevant to the present research topic and need to be summarised. Lastly, systematic reviews are considered, in general, very strong evidence that is placed at the top of the hierarchy of evidence along with meta-analysis (Glasziou et al., 2001).

After this brief introduction, the definition of the term "systematic review" is presented in the next section. In Section 2.3, the review question and objectives are outlined. The systematic review methods that were used in the current review are identified and justified in Section 2.4. Then, results of the systematic review are presented in Section 2.5. Section 2.6 is dedicated to discussing the findings of the review. Lastly, a summary of the chapter is shown in Section 2.7.

2.2 Definition of Systematic Review

Systematic review is defined as a review of all available evidence about a specific research question using systematic, transparent, and accountable processes (Boland et al., 2017; Gough et al., 2017; Grant and Booth, 2009; Green et al., 2008; Littell et al., 2008). The terms systematic, transparent, and accountable were defined by Gough et al. (2017) and Littell et al. (2008) as follows: "systematic" refers to using organised and structured methods; "transparent" refers to reporting clearly and intelligibly the adopted methods and relevant details; and "accountable" means justifying responsibly the selected methods. These characteristics of systematic reviews were considered in conducting the current review.

The Centre for Reviews and Dissemination (CRD) and many journals encourage reviewers to follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Tacconelli, 2010). The PRISMA statement was developed to ensure sufficient and transparent reporting of systematic reviews and meta-analyses (Liberati et al., 2009), and this allows readers to easily replicate it and assess its strengths and weaknesses (Higgins and Green, 2008; Liberati et al., 2009; Tacconelli, 2010). Accordingly, this review adheres to the PRISMA statement. However, not all PRISMA items could be applied on the current review since some items are related to meta-analyses, which are item 15, 16, 22, and 23 (Liberati et al., 2009).

2.3 Review Question and Objectives

It is highly recommended that the review question consists of four substantial components abbreviated by the acronym PICO: population, intervention, comparison, and outcome (Khan et al., 2011; O'Connor et al., 2008; Tacconelli, 2010). However, it is not compulsory that the review question contains all these components since not all of them may be relevant to each review (O'Connor et al., 2008; Tacconelli, 2010). Accordingly, the question of this review was made of three components. The first is population which refers to patients. The second is intervention that refers to ePHRs. The third is outcome that refers to the use or intention to use. Accordingly, the review question is *"what are the factors that influence patients' use of or intention to use ePHRs?"* This question was answered by achieving the following objectives:

1. To critically choose the review methods (Section 2.4).
2. To identify and classify the factors that affect patients' intention to use ePHRs (Section 2.5).
3. To identify and group the factors that influence subjectively-measured use of ePHRs among patients (Section 2.5).
4. To identify and categorise the factors that impact objectively-measured use of ePHRs among patients (Section 2.5).
5. To formulate practical and theoretical implications (Section 2.6).

2.4 Review Methods

Scholars recommend reviewers to identify six elements of review: study eligibility criteria, search strategy, study selection methods, data extraction methods, study quality assessment methods, and data synthesis methods (Gough et al., 2017; Higgins and Green, 2008; Petticrew and Roberts, 2008; Tacconelli, 2010). These elements are discussed in the following six subsections.

2.4.1 Study Eligibility Criteria

The PRISMA statement and other scholars identified five main aspects of studies that should be fully specified to develop well-defined study eligibility criteria: population, intervention, comparison, outcome, and study design (Liberati et al., 2009; Littell et al., 2008; O'Connor et al., 2008). Other important aspects should be considered to develop more comprehensive eligibility criteria such as language, year, and type of publication (Liberati et al., 2009; Littell et al., 2008). The current review developed eligibility criteria for each aspect outlined above. More details about those eligibility criteria are presented in the following eight subsections.

2.4.1.1 Population

The population refers to people who were recruited in primary studies and to whom the intervention was applied (Littell et al., 2008). The eligibility criteria regarding the population should identify the individuals' demographic data and health problems of interest (Littell et al., 2008; O'Connor et al., 2008).

In respect to the inclusion criteria, this review focused on healthcare consumers whether they are patients or healthy individuals. This is reasonable because ePHRs are designed to be used by healthcare consumers in the first place and, thereby, their adoption is an important aspect to be assessed. As the current review is not concerned with a specific socio-demographic characteristic of patients, studies were included regardless of the socio-demographic characteristics of their samples.

With respect to exclusion criteria, studies that assessed adoption of ePHRs among healthcare providers or caregivers were excluded since the factors that affect their adoption of ePHRs may be different from those factors affecting patients' adoption (Or and Karsh, 2009; Thompson et al., 2016). Also, studies that examined the factors affecting patients' adoption of ePHRs from others' perspectives (e.g. healthcare providers, caregivers, system suppliers, or developers) were excluded as their perceptions about these factors may not reflect the truth.

2.4.1.2 Intervention

Eligibility criteria should describe the main characteristics of the intervention such as its purposes, main types, functions, and the settings where it is applied (Littell et al., 2008; O'Connor et al., 2008; Tacconelli, 2010).

Based on the foregoing, studies that concentrated on tethered PHRs were included in this review since it is the most common type of ePHRs (Davis, 2008; Emani et al., 2012; Thompson et al., 2016), and it is the same system type that is used in England (Patient Online) (NHS England, 2017). Moreover, this review focused on ePHRs that provide at least one of the following functions in addition to viewing medical records: booking appointments, requesting repeat prescriptions, and messaging healthcare providers. And this is because these are the main functions of the tethered PHRs (as presented in Chapter 1), and the ePHRs in England (i.e. Patient Online) include most of these functions (NHS England, 2017). Studies that focused on free of charge ePHRs were included in this review because (i) most tethered PHRs are free of charge, (ii) Patient Online is provided for free (NHS England, 2017), and (iii) factors affecting patients' use of non-free ePHRs and free ePHRs may be different. Furthermore, studies that assessed the ePHRs used through one of the following platforms were included in this review: computers, tablets, and mobiles as Patient Online can be used by these platforms (NHS England, 2017).

In respect to the intervention exclusion criteria, studies that focused on standalone or integrated PHRs were excluded because their features are different from the tethered PHRs, thereby, the factors might be different (Assadi, 2013; DesRoches et al., 2010). Also, studies that focused on the adoption of other health information technologies such as electronic health records (EHR), electronic medical records (EMR), and telemedicine were not included because they are not developed to be used by patients, and they do not have similar characteristics. Last but not least, studies that assess the adoption of paper or USB PHRs were excluded because their characteristics are totally different from ePHRs characteristics.

2.4.1.3 Comparison

As the current review is not interested in comparing the factors affecting patients' use of different types of ePHRs or health information technologies, the eligibility criteria regarding comparison were not identified.

2.4.1.4 Outcome

Littell et al. (2008) pointed out that study eligibility criteria should identify outcomes of interest and their measurements. This review focused on two main outcomes: use and intention to use. The reason for selecting the outcome "use" is that it is the main focus of the current project (as outlined in Section 1.4). Further, intention to use was selected because many studies considered intention to use as a proxy for actual use (e.g. Abramson et al., 2014; Lazard et al., 2016; Ozok et al., 2017; Razmak and Bélanger, 2018; Sanders et al., 2013; Wakefield et al., 2012). The outcome "use" in the current review refers to initial use since it is the focus of the main project (as mentioned in Section 1.4), and factors affecting initial use may be different from those influencing continuing use (Bhattacherjee, 2001; Gebauer et al., 2013; Han, 2003; Karahanna et al., 1999; Patel et al., 2011a; Peek et al., 2014). As discussed in Section 1.3, use can be assessed subjectively or objectively. The current review focused on both subjectively and objectively-measured use in order to have a better understanding of all possible factors and identify the difference between predictors of each outcome.

With regard to the outcome exclusion criteria, studies that assessed ePHRs design, functionalities, usability, benefits, clinical outcomes, and patients' or providers' satisfaction were excluded since they are not the focus of the current project. Further, studies that focused only on continuing use were excluded.

2.4.1.5 Study Design

According to the scoping review that was carried out before the current systematic review, studies of interest used different study designs: surveys, cohort studies, and case-control studies. In respect to research approach, studies of interest were quantitative, qualitative, and mixed methods. Those studies collected the data using different tools; questionnaires, interviews, secondary data, and/or system logs. Studies that used any of those designs, approaches, and tools were included in the current review. On the other hand, non-empirical articles such as commentaries, editorials, opinions, meeting abstracts, letters, or reviews were excluded.

2.4.1.6 Language of Publication

Restricting the review to English language studies may produce a certain bias called language bias (Glasziou et al., 2001; Khan et al., 2011; Tacconelli, 2010). Reviewers can use both English and non-English language keywords in the search process; however, this is very rare to happen because it consumes time, money, and resources for retrieving, selecting, and translating non-English language studies (Lefebvre et al., 2008; Littell et al., 2008; Tacconelli, 2010). For that reason, the current review did not use non-English keywords. However, to reduce the language bias, the current review endeavoured to include non-English language studies retrieved by using English language keywords. Specifically, authors of such studies were contacted to obtain a version translated to English. Yet, if a translated version of non-English language studies could not be obtained, the reviewer excluded them since it is not practical to translate a large number of studies in a review restricted to time, money, and resources (Tacconelli, 2010).

2.4.1.7 Type of Publication

The current review included different types of publications in order to minimise the effect of publication bias (Sterne et al., 2008; Tacconelli, 2010). The following types of publications were included in the current study: peer-reviewed articles, formal reports, dissertations, book sections, and conference papers.

2.4.1.8 Year of Publication

It is advisable that reviews should not be restricted to a certain time frame unless there is a convincing reason (Lefebvre et al., 2008; Littell et al., 2008). The reviewer restricted the search on studies that published in 2000 onwards because ePHRs were not widespread before the year 2000 or even before 2006 (Irizarry et al., 2015). Further, three systematic reviews similar to the current review were restricted to studies published in 2000 onwards (Amante et al., 2014; Jabour and Jones, 2013; Thompson et al., 2016). The aforementioned reviews are different from the current review in terms of study eligibility criteria, search sources and terms, quality assessment, and data synthesis (see Subsection 2.6.2.1 for detail).

2.4.1.9 Study Eligibility Criteria Form

After identifying all eligibility criteria, the reviewer developed a study eligibility criteria form in order to document the decision regarding the eligibility of each study in this review (see Appendix 2). So as to make the selection process more systematic, transparent, and reproducible, the eligibility criteria in this form were explained in details using another form shown in Appendix 3.

2.4.2 Search Strategy

In order to develop a well-defined search strategy, two important elements should be clearly determined; search sources and search terms (Brunton et al., 2017; Tacconelli, 2010). The search sources and search terms were critically identified and justified in the following two sections, respectively.

2.4.2.1 Search Sources

There is a variety of search sources that can be used to find studies relevant to a review, notably: bibliographic databases, hand searching, reference list checking, contacting experts and professionals, and web searching (Brunton et al., 2017; Lefebvre et al., 2008; Littell et al., 2008; Tacconelli, 2010). As the search process should retrieve as many relevant studies as possible (Tacconelli, 2010), all these sources were utilised in this review. More details about each search source were explained below.

2.4.2.1.1 Bibliographic Databases

It is highly recommended that reviewers search many bibliographic databases because contents of databases differ (Brunton et al., 2017; Littell et al., 2008). The bibliographic databases should be chosen based on the area of review (Tacconelli, 2010). Since this review is composed of two main areas; healthcare and information technology, the main electronic databases that are related to those areas were selected to be searched. Specifically, MEDLINE, EMBASE, PsycINFO, Global Health, and Cumulative Index to Nursing and Allied Health (CINAHL) were searched in the current review as they are the most common databases in the healthcare area (Littell et al., 2008; Tacconelli, 2010).

In respect to information technology-related databases, IEEE Xplore and ACM Digital Library were used in the current review as they are among the most powerful resources in the information technology area (ACM Digital Library, 2017; IEEE Xplore, 2017) and they were used in several systematic reviews similar to the current review (e.g. Jabour and Jones, 2013; Najaftorkaman et al., 2014; Thompson et al., 2016).

There are other large bibliographic databases that contain studies from both healthcare and information technology fields such as Scopus and Web of Science (Elsevier, 2017). Those databases were used in reviews similar to the present review, such as those carried out by Goldzweig et al. (2013), Najaftorkaman et al. (2014), and Or and Karsh (2009). Accordingly, Scopus and Web of Science were searched in the current review.

Further, there are several journals that specialise in health informatics topics such as Journal of the American Medical Informatics Association (JAMIA), International Journal of Medical Informatics (IJMI), Telemedicine and e-Health Journal, Health Informatics Journal (HIJ), and Journal of Medical Systems (JMS). Therefore, all these journals were searched in this review.

Cochrane Collaboration recommends reviewers to search national bibliographic databases that index studies conducted in certain countries (Lefebvre et al., 2008). For example, KoreaMed, IndMED, and African Index Medicus databases contain studies that carried out in Korea, India, and Africa, respectively (Lefebvre et al., 2008). Such databases may include studies that are not published in popular databases such as MEDLINE (Lefebvre et al., 2008). Therefore, this review searched the following databases that are based in different regions: African Index Medicus (AIM), Africa library database (AFROLIB), National Library of Australia (NLA), WHO Regional Office for Europe, Index Medicus for the Eastern Mediterranean Region (IMEMR), Western Pacific Region Index Medicus (WPRIM), WHO Regional Office for South-East Asia (WROSEA), WHO Regional Office for Americas (PAHO), Library & Information Networks for Knowledge Database (WHOLIS), IndMED, and KoreaMed.

Popular bibliographic databases such as MEDLINE and EMBASE do not usually index dissertations and theses, which are considered very important for reviews (Lefebvre et al., 2008). However, they are indexed in special databases such as ProQuest Dissertations & Theses Database, Electronic Theses Online Service (EThOS), DART-Europe E-theses Portal, Networked Digital Library of Theses and Dissertations (NDLTD), Theses Canada, Brazilian Digital Library of Theses and Dissertations (BDLTD), South African Theses and Dissertations (SATD), and Hong Kong University Theses. This review searched all the above-mentioned databases.

It is highly advisable to find as much as possible of grey literature in order to avoid bias when conducting a systematic review (Lefebvre et al., 2008). This review searched the following databases that are specifically dedicated to indexing grey literature: the System for Information on Grey Literature in Europe (openSIGLE), Copac, BMC Proceedings, ISI Proceedings, NHS Evidence, ISRCTN registry, Health Management Information Consortium (HMIC), and Explore the British Library (Lefebvre et al., 2008; Petticrew and Roberts, 2008).

As mentioned before, this review endeavoured to avoid language bias by not restricting the search to English language studies. Searching databases that index large proportions of non-English language studies can reduce the risk of the language bias (Tacconelli, 2010). The following databases were searched in the current review since they include numerous non-English language studies: The Latin American and Caribbean Health Sciences Literature (LILACS) and Web of Science.

Several databases have an AutoAlert service that frequently carries out an automatic search based on the search terms used by the researchers and sends the results of the search to them. Of all bibliographic databases that were used in this review, the following databases have the AutoAlert service: MEDLINE, CINAHL, EMBASE, PsycINFO, Global Health, ACM Digital Library, IEEE Xplore, Scopus, Web of Science, and ProQuest Dissertations & Theses Database. The AutoAlert service was activated after searching each of the previous databases.

2.4.2.1.2 Reference List Checking

The current study used backward and forward reference list checking (Brunton et al., 2017; Glasziou et al., 2001; Lefebvre et al., 2008). With regard to backward reference list checking, the reference lists of all studies included in this review were scanned. Given that it is recommended to scan reference lists of relevant reviews (Lefebvre et al., 2008), the following review databases were searched in addition to the aforementioned databases to check reference lists of relevant reviews: Cochrane Database of Systematic Reviews, Centre for Reviews and Dissemination (CRD), and the Database of Promoting Health Effectiveness Reviews (DoPHER).

In regard to forward reference list checking, several bibliographic databases have the functionality that enables reviewers to find studies that cited a study of interest, such as Google Scholar, Scopus, and Web of Science (Brunton et al., 2017; Glasziou et al., 2001; Lefebvre et al., 2008). The reviewer used Google Scholar so as to check studies that cited each study included in the current review.

2.4.2.1.3 Hand Searching

Hand searching refers to the process of searching for relevant studies through browsing page-by-page contents of predefined issues of journals (Brunton et al., 2017; Lefebvre et al., 2008; Tacconelli, 2010). In order to identify the suitable journals for hand searching, Cochrane Collaboration and the CRD recommend reviewers to identify the journals that index a large number of the included studies (Lefebvre et al., 2008; Tacconelli, 2010). The current review followed this recommendation to select issues of journals appropriate for hand searching. Since hand searching consumes much effort and time (Littell et al., 2008), this process was performed on issues of journals that were published only between 2010 and 2016. This period was identified as the scoping review found that the majority of studies of relevance were published between 2010 and 2016.

2.4.2.1.4 Contacting Experts and Professionals

Contacting experts and professionals is deemed another method to find unpublished or grey literature (Glasziou et al., 2001; Littell et al., 2008; Tacconelli, 2010). The best way to choose suitable experts is through identifying authors who published a large number of studies included in the review (Glasziou et al., 2001; Petticrew and Roberts, 2008; Tacconelli, 2010). Using that way, 12 authors were identified. Those authors were contacted via an email shown in Appendix 4. The reviewer contacted those experts after accomplishing the selection process in order to send a list of included studies and study eligibility criteria to experts and ask them to identify missing studies and name other experts who may help to find relevant studies (Littell et al., 2008; Tacconelli, 2010; Petticrew and Roberts, 2008). If any expert did not reply after one week of sending the email, a second email was sent. Further reminder emails were not sent because of the time restriction of this study.

2.4.2.1.5 Web Searching

Searching the web, in general, may retrieve many relevant studies such as unpublished studies, studies not indexed in bibliographic databases, reports, and proceeding abstracts (Khan et al., 2011; Petticrew and Roberts, 2008). Search engines such as Google and Turning Research Into Practice (a healthcare-focused engine) may be very useful to retrieve such studies (Khan et al., 2011; Lefebvre et al., 2008; Popay et al., 2006). Therefore, this review searched Google Scholar and Turning Research Into Practice. The reviewer scanned only the first 100 records resulted from searching Google Scholar for the following reasons: (1) Google Scholar usually retrieves several thousands of citations, (2) The search results are normally ordered by their relevance to the search topic (Google Scholar, 2018), and (3) the current review had a limited time to be completed.

2.4.2.2 Search Terms

The search terms should be identified based on the components of the review question (Khan et al., 2011). Since the question of this review consists of three components: intervention, population, and outcome, the search terms were determined and categorised into three groups according to these components as presented in Table 2.1. A librarian assisted in developing these search terms.

Several databases index references using controlled vocabulary (standardised subject terms) such as Medical Subject Headings (MeSH) in MEDLINE (Lefebvre et al., 2008; Brunton et al., 2017). It is advisable to search such databases using controlled vocabulary terms in addition to free-text terms that are selected by the reviewer (Brunton et al., 2017). The reviewer used both the predefined free-text terms and controlled vocabulary terms in the following databases: MEDLINE, EMBASE, PsycINFO, Global Health, CINAHL, and Health Management Information Consortium (HMIC). Appendix 5 shows the search details for each database.

Table 2.1: Search Terms

Related to	Search terms
Population	patient*, consumer*, elder*, old*, adult*, senior*, and veteran*
Intervention	personal health record*, personal medical record*, patient-held record*, patient-held medical record*, patient-held health record*, personal electronic health record*, personal electronic medical record*, patient accessible electronic medical record*, patient accessible electronic health record*, personally controlled health record*, personally controlled medical record*, individual health record*, individual medical record*, interactive preventive health record*, personal health information management system*, patient portal*, patient internet portal*, patient web portal*
Outcome	use*, usage, adopt*, utilis*, utiliz*, accept*, intention*, attitude*, satisf*, adhere*, reject*, abandon*

2.4.3 Study Selection

Before starting the study selection process, the current review performed the following three procedures to facilitate the selection process (Lefebvre et al., 2008; Tacconelli, 2010): (1) exporting all retrieved references to EndNote X8, (2) excluding the duplicated references, (3) pilot testing the predefined eligibility criteria through applying them on ten retrieved references. This pilot test did not find any issues and confirmed the ability of the study eligibility criteria to identify all relevant studies.

The selection process of studies retrieved from bibliographic databases usually consists of two steps: screening titles and abstracts, and reading full texts (Brunton et al., 2017; Higgins and Deeks, 2008; Tacconelli, 2010). The current review followed both steps to select studies. Specifically, in the first step, the title and abstract of each retrieved study were sifted in order to assess its eligibility. Studies were included to be assessed in the second step if either they met all eligibility criteria or a decision could not be taken due to lack of information in the titles and abstracts. On the other hand, studies were excluded if they did not meet any of the eligibility criteria. Figure 2.1 presents the flowchart of the first step of study selection process.

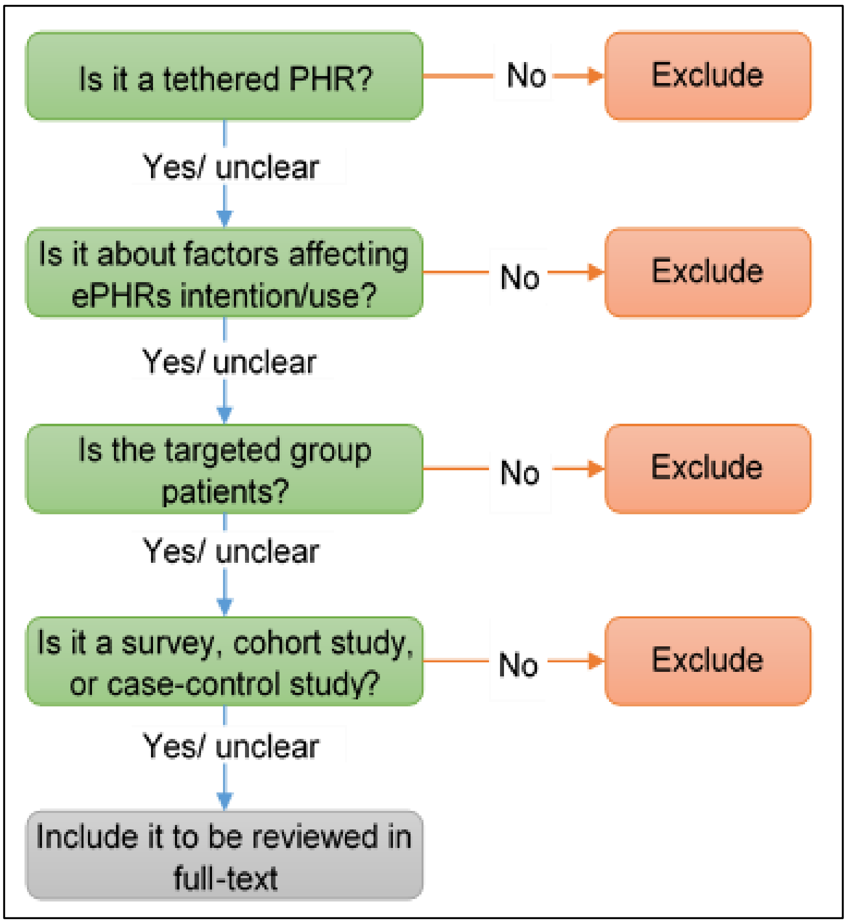


Figure 2.1: The First Step of Study Selection Process

In the second step, full texts of studies included by the first step were retrieved and read to assess their eligibility. Studies were included in the review if they met all eligibility criteria whereas studies were excluded if they did not meet any criterion. As decisions regarding some eligibility criteria could not be drawn in some studies because of lack of information, authors of these studies were contacted to get more details and to check their eligibility. The second step of study selection process is depicted in Figure 2.2.

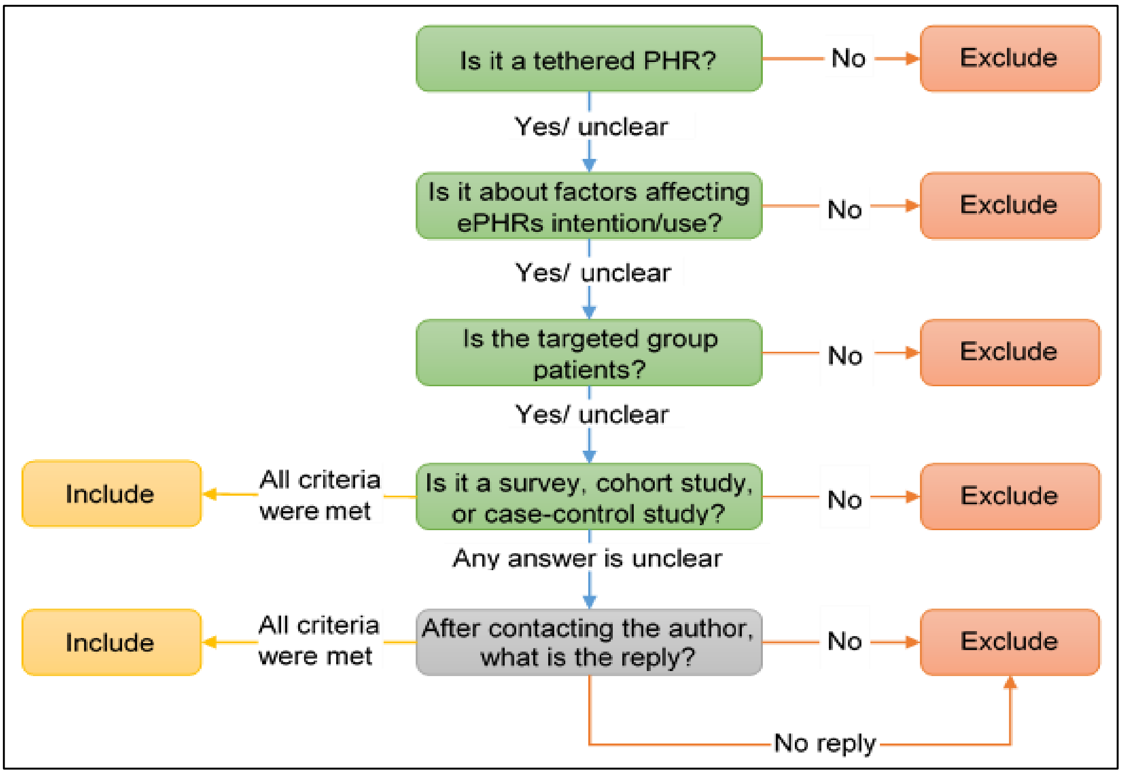


Figure 2.2: The Second Step of Study Selection Process

It is advisable that the study selection process is carried out by at least two reviewers in order to perform a reliable and reproducible selection process (Higgins and Deeks, 2008; Littell et al., 2008; Tacconelli, 2010). The whole study selection process was carried out independently by the principal reviewer (AA) and a research assistant, Dr Mohammad Khasawneh (MK). Disagreements were resolved by both assessors (AA & MK) through further check and discussion. Since the Cochrane Collaboration and the CRD recommend reviewers to assess the interrater agreement between reviewers (Higgins and Deeks, 2008; Tacconelli, 2010), it was calculated using Cohen’s kappa (*K*), and it was 0.82 and 0.88 for the first and second steps of the study selection process, respectively. Agreement is considered as “poor” if the value of *K* is 0.20 or less, “fair” if *K* is between 0.21 and 0.40, “moderate” if *K* ranges from 0.41 to 0.60, and “good” if *K* is between 0.61 and 0.80, and “very good” if *K* more than 0.80 (Altman, 1991). Accordingly, the agreement was very good in the first and second steps.

2.4.4 Data Extraction

A well-developed data extraction form is very important to conduct a consistent, reliable, and unbiased review (Tacconelli, 2010). In accordance with Cochrane Collaboration and the CRD guidelines related to developing a data extraction form (Higgins and Deeks, 2008; Tacconelli, 2010), the current review developed a data extraction form using Microsoft Word 2013 (see Appendix 6). In order to ensure the ability of the form to extract the necessary data, it was pilot tested on ten included studies before starting the data extraction process, and it worked very well in extracting the required data.

As study selection process, the data extraction process should be independently executed by at least two reviewers (Higgins and Deeks, 2008; Petticrew and Roberts, 2008; Tacconelli, 2010). The data extraction process was carried out independently by the principal reviewer (AA) and the research assistant (MK). Disagreements were resolved by both assessors (AA & MK) through further check and discussion. The interrater agreement between the two assessors was calculated using Cohen’s kappa (*K*) and reached 0.79 (good).

2.4.5 Methodological Quality Assessment

Assessing the quality of included studies is deemed a vital process in systematic reviews (Harden and Gough, 2017; Tacconelli, 2010). Various quality assessment tools have been developed to assess the quality of studies (Tacconelli, 2010). Selecting a suitable tool usually depends on the study design of included studies (Tacconelli, 2010). As this review included studies with different study designs (e.g. surveys, cohort studies, and case-control studies), three tools are suitable for this review; which are Mixed Methods Appraisal Tool (MMAT), Quality Assessment Tool (QATSDD), and Crowe Critical Appraisal Tool (CCAT) (Crowe and Sheppard, 2011; Pluye et al., 2009; Sirriyeh et al., 2012). The current review used the MMAT for the following reasons. Firstly, it uses the checklist method (i.e. assigning a non-numerical value for each quality item such as “Yes”, “No”, and “Not clear”) which is highly recommended by scholars (Higgins and Altman, 2008; Liberati et al., 2009; Littell et al., 2008; Tacconelli, 2010). In contrast, QATSDD and CCAT use the scale method (i.e. scoring each quality item numerically), where it is advisable to avoid it as assigning numerical value for a quality criterion is subjective, thereby, reviewers criticise transparency of such tools (Higgins and Altman, 2008; Liberati et al., 2009; Littell et al., 2008; Tacconelli, 2010). Secondly, MMAT has been designed specifically for the study quality assessment in systematic reviews that include different study designs (Pluye et al., 2011). Thirdly, MMAT enables reviewers to concomitantly assess the study quality for the most common research designs. Hence, the reviewers avoid using different tools for assessing different designs (Pluye et al., 2011). Fourthly, it provides a tutorial that describes each criterion, thereby, it makes the appraisal process easier and more consistent (Pluye et al., 2011). Fifthly, it has good interrater reliability scores (Global appraisal score of 0.717) (Pace et al., 2012). Sixthly, it has been widely used by more than 100 systematic reviews (Benjamin and Donnelly, 2013; Souto et al., 2015). Finally, the National Institute of Excellence in Health Services in Quebec and the National Collaborating Centre for Methods and Tools highly recommend this tool (National Collaborating Centre for Methods and Tools, 2015; Souto et al., 2015).

The MMAT consists of 21 criteria categorised into four groups (Pluye et al., 2011). The first group has two screening questions that must be applied to all studies regardless of their design. If the response to both screening questions is not “Yes”, the reviewer should stop appraising that study and assign low quality for it. The second group is composed of four questions that are specific to assess the quality of qualitative studies and the qualitative part of mixed methods studies. The third group consists of 12 criteria for appraising quantitative studies and the quantitative part of mixed methods studies, and those criteria are divided into three subgroups: four criteria for assessing randomised controlled trials, four criteria for appraising the quantitative non-randomised studies (i.e. non-randomized controlled trials, cross-section analytic studies, cohort study, and case-control study), and four criteria for assessing quantitative descriptive studies (e.g. case series and case report). The last group includes three criteria that need to be applied to mixed methods studies. Appendix 7 shows the quality criteria form that was used in the current review.

Since the MMAT is a checklist, the alternatives to answer each criterion are “Yes”, “No”, or “Can’t tell” (Pluye et al., 2011). The answer “Yes” always indicates that the study meets that quality criterion, thereby, its quality is high in terms of the aspect that criterion assesses. In contrast, the answer “No” always indicates that the study does not meet that quality criterion, thereby, its quality is low in terms of the aspect that criterion assesses. The answer “Can’t tell” indicates that a judgment cannot be drawn because of lack of information in the study. It is advisable that reviewers develop tailored coding guidelines for each quality criterion in order to increase the reliability and consistency of the quality assessment process (Reitsma et al., 2009). Coding guidelines tailored to the current review were developed and presented in Appendix 8. As it is recommended to pilot the study quality assessment tool and the coding guidelines form before beginning the quality assessment process (Reitsma et al., 2009; Tacconelli, 2010), both of them were piloted using 10 studies, and they worked well in assessing the quality of studies.

The current review used two ways for reporting the results of the study quality assessment, which are recommended by the PRISMA statement and the Cochrane Collaboration: (1) summarising the quality of studies collectively by presenting graphically proportions of studies that score “Yes”, “No”, and “Can’t tell” for each quality criterion; (2) recording the quality of studies separately by presenting the response (Yes, No, or Can’t tell) that each study scored for each criterion using a table (Higgins and Altman, 2008; Liberati et al., 2009). As the current review included studies with different study methods (quantitative, qualitative, and mixed-method), the quality of studies was presented according to the study method in Section 2.5.

Since it is advisable that the data extraction and study quality assessment processes are performed simultaneously (Petticrew and Roberts, 2008; Tacconelli, 2010), the MMAT form was added to the data extraction form.

It is highly recommended that the quality assessment process is carried out independently by at least two reviewers in order to avoid potential biases (Petticrew and Roberts, 2008; Tacconelli, 2010). The quality assessment process was carried out independently by the principal reviewer (AA) and the research assistant (MK). Disagreements were resolved through further checks and discussion by both assessors (AA & MK). The interrater agreement between the two assessors was calculated using Cohen's kappa (*K*) and reached 0.84 (very good).

2.4.6 Data Synthesis

There are two types of data synthesis: narrative and quantitative (Deeks et al., 2008; Tacconelli, 2010). A narrative synthesis refers to describing, explaining, and summarising findings of the included studies using texts (Popay et al., 2006). A quantitative synthesis refers to combining results of included studies using statistical methods such as meta-analysis (Tacconelli, 2010). A narrative synthesis can be performed in all systematic reviews (Popay et al., 2006; Tacconelli, 2010). In contrast, a quantitative synthesis is not suitable for all reviews, especially when the included studies are exceptionally diverse in terms of outcomes, settings, populations, interventions, etc. (Deeks et al., 2008; Petticrew and Roberts, 2008; Tacconelli, 2010). The current review synthesised findings of the included studies narratively, but they could not be synthesised statistically for the following reasons. First, the included studies in this review are extremely heterogeneous in terms of outcome (intention to use, subjectively-measured use, and objectively-measured use), setting (primary care practices, hospitals, and specialised clinics), study method (qualitative, quantitative, and mixed methods) study design (surveys, cohort studies, and case-control studies), and population. Second, relationships between factors were examined using different statistical analyses; significant test, odds ratio, Pearson's r, and/or and path coefficients. Third, few studies reported data enough to calculate simple statistics such as odds ratio.

It is highly recommended that the narrative synthesis is divided into smaller groups in order to make the synthesis more feasible and to ease comparisons within and across groups (Petticrew and Roberts, 2008; Popay et al., 2006). The findings of included studies were categorised into three groups according to the outcome: intention to use, subjectively-measured use, and objectively-measured use. This is attributed to the fact that factors affecting those outcomes may be different as intention to use may not be a good proxy for actual use (Forquer et al., 2014; Gebauer et al., 2013; Kim, 2014; Wu and Du, 2012), and subjective measure of use may not reflect the actual use (Burton-Jones and Gallivan, 2007; Karahanna et al., 2006; Podsakoff et al., 2003; Straub et al., 1995; Turner et al., 2010; Venkatesh et al., 2012).

Further, factors affecting each outcome were categorised into subgroups based on a conceptual framework used by Or and Karsh (2009) in a review of consumer health information technology acceptance. Or and Karsh (2009) adopted this framework from other frameworks developed by Holden and Karsh (2009) and Karsh (2004) in the health information technology adoption. According to this framework, adoption of health information technologies is predicted by: (1) individual factors, which refer to sociodemographic characteristics, personality characters, and health status; (2) human-technology interaction factors, which refer to individual’s perceptions and expectations about a technology; (3) organisational factors, which refer to facilitating conditions provided by organisations, implementation processes, organisation’s structures, and end-user perceptions of them; (4) social factors, which refer to the effect of other people to which a person belongs; (5) environmental factors, which refer to characteristics of the physical setting where a system is used; (6) task factors, which refer to the degree to which a technology influences a task and individual’s perceptions of this effect (Or and Karsh, 2009). Before categorising the factors into subgroups, the reviewer merged the factors that have similar definitions. For example, the factor perceived usefulness emerged from merging the following factors: perceived usefulness, effort expectancy, perceived value, relative advantage, outcome expectations, and extrinsic motivation.

As statistical analyses (e.g. meta-analysis) could not be performed to draw a definitive conclusion about the effect of a factor, the current review developed the following conditions that the factor needs to meet to conclude its effect. Firstly, the factor must be examined by at least four studies. Fewer number of studies (e.g. 2 or 3 studies) was not identified as a cut-off point because the current review included many studies with weak and moderate quality, thereby, more studies are required to confirm the effect of a factor. In the same time, more number of studies (e.g. 5 or 6) was defined as a cut-off point as this reduces considerably the number of factors that meet this criterion thereby reducing the utility of the model. Four studies was a compromise which enabled sufficient number of factors to be included for consideration while at the same time ensuring enough data was available to make an informed decision on the factors effect. Secondly, the effect of the factor must have a consensus among most studies that examined it. Thirdly, those studies that have consensus on the effect of the factor must be superior to the few studies that show a contrary effect in terms of study quality, sample size, and study method (i.e. quantitative, qualitative, and mixed-method).

2.5 Review Results

In keeping with the PRISMA statement (Liberati et al., 2009), this section starts with describing results of the search process. Then, characteristics of the included studies are summarised. In the third subsection, the quality of the included studies is presented and explained. The last subsection summarises the main findings of the included studies.

2.5.1 Results of Search

As mentioned in Subsection 2.4.2.1, five search sources were used in the review. The results of the search of each source are summarised in this subsection. The search process of 42 bibliographic databases and two web engines (Google Scholar and Turning Research Into Practice) started on 8th June 2016 and finished on 16th June 2016. AutoAlert service was active until the end of data synthesis process on 30th November 2016. The search of databases and engines retrieved 4843 records. Of those records, 1596 duplicates were removed. After scanning titles and abstracts of 3247 records, 3002 records were discarded for the following reasons: 2663 records were clearly irrelevant to the current review, 334 records did not meet at least one of eligibility criteria (population (n=41), intervention (n=46), outcome (n=188), and study design (n=59)), and 5 non-English language records with no translation. After scanning the full text of the remaining 245 publications, 179 publications were excluded for the following reasons: 154 publications did not match at least one of the eligibility criteria (population (n=5), intervention (n=94), outcome (n=35), and study design (n=20)), 10 duplicates, 5 publications had abstracts in English language but the full texts were not in English language, and 10 publications could not be found in full text. Authors of those non-English language studies were contacted via email, but none of them replied. Fifteen publications were not available in the full text, but the full text of five publications was found by either contacting their authors (n=2) or using inter-library loan service (n=3). The remaining 10 publications were only abstracts of conference proceedings, and their authors were contacted to ascertain whether a full text of the abstracts is available. Unfortunately, none of those authors replied. One additional study was identified through AutoAlert service. In total, 67 publications were included through searching bibliographic databases. The entire search process is depicted in Figure 2.3. Appendix 9 shows numbers of studies included in each step of the selection process in each database. Appendix 10 presents numbers of studies that were excluded in each step of the selection process and the reasons for exclusion.

The process of reference list checking started immediately after finishing the selection process (10th September 2016), and it finished after including the last study retrieved from other sources (29th November 2016). The backward reference list checking was carried out by scanning the reference lists of all included publications in addition to 17 relevant reviews retrieved by searching the predefined reviews databases and 44 primary study databases. As a result, six additional publications were included in the review. With regard to forward reference list checking, Google Scholar was used in order to check the eligibility of studies that cited each of the included studies. As a result, nine relevant publications were included. As shown in Figure 2.3, in total, fifteen studies were included using reference list checking.

Hand searching continued from 25th September 2016 until 5th October 2016. The following journals indexed several studies of those included in the current review: Journal of the American Medical Informatics Association (JAMIA), Journal of Medical Internet Research, Journal of General Internal Medicine, AMIA Annual Symposium Proceedings, and Studies in Health Technology & Informatics. Issues of those journals between 2010 and 2016 were handsearched, and this led to finding two eligible publications.

On 10th October 2016, 12 authors, who published at least two of the included studies, were contacted via email. After one week, the same email was sent to those who had not replied to the first email. Only two experts replied to emails. The first is James Ralston who stated that he does not know any further studies suitable for the review, but he suggested some authors who may help. Studies conducted by those suggested authors were already included in the review. The second expert is Jessica Ancker who sent three studies to the reviewer; two studies were already included in the review, and the third study had just been accepted to be published and was eligible to the review. So, only one additional study was identified by contacting authors.

Overall, the number of all included publications from all search sources reached 85. However, those publications consist of 79 unique studies because four studies were reported in two publications, and one study was reported in three publications. From now on, the word “study” refers to the 79 studies whereas the word “publication” refers to the 85 publications. So, they were not used interchangeably in this review.

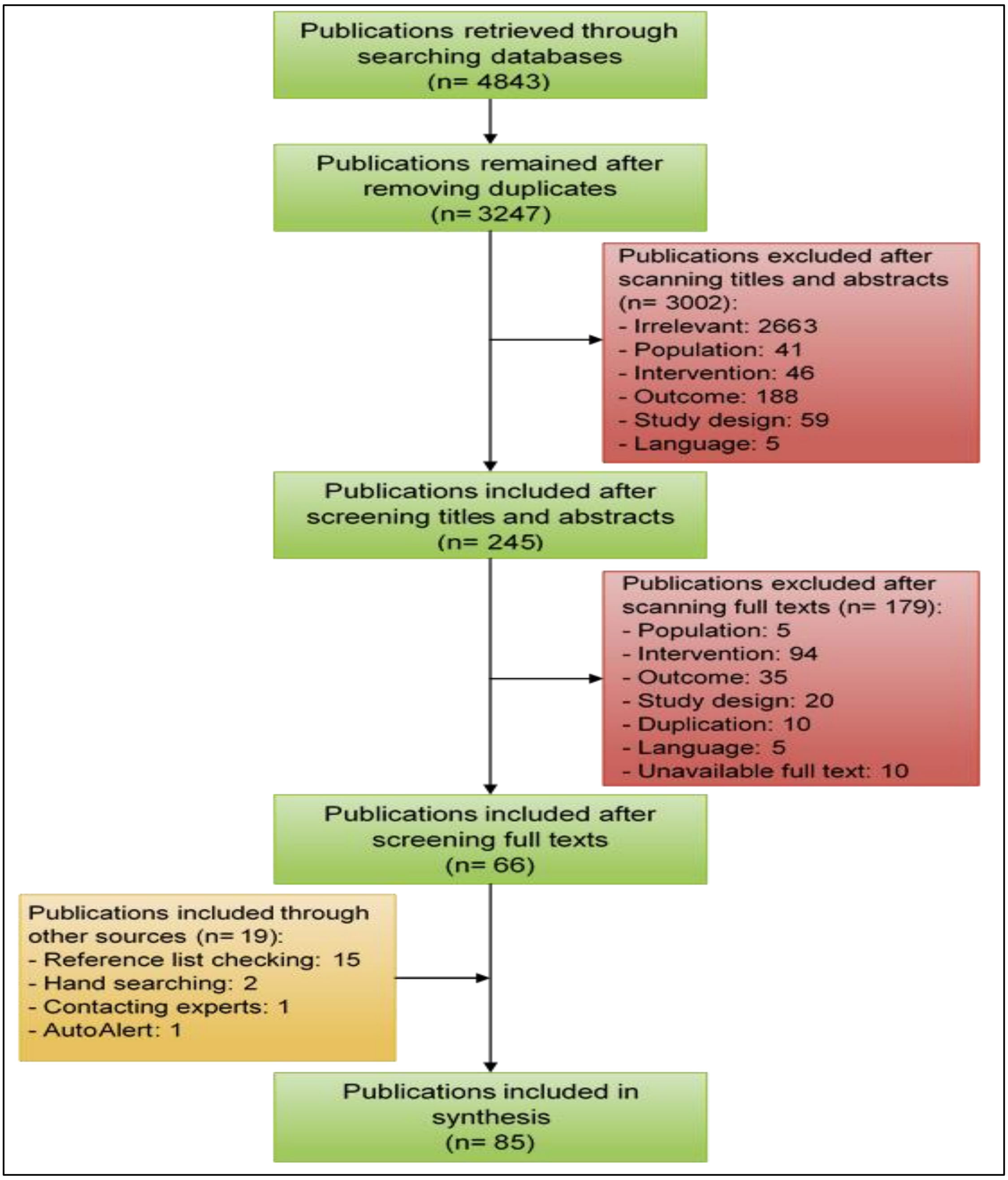


Figure 2.3: Flow Chart of the study selection process

2.5.2 Characteristics of Included Studies

In this section, the reviewer outlines characteristics of studies included in this review. As shown in Table 2.2, most of studies were quantitative (n=67, 85%), survey (n=67, 85%), journal article (n=74, 94%), and published in the USA (n=67, 85%). As shown in Figure 2.4, about two third of studies were published between 2012 and 2016 (n=55). On the other hand, there are no studies published between 2000 and 2005, and this confirms that limiting the search process on studies published from 2000 onwards was a correct decision. While 31 studies had a low quality score (≤25%), 34 studies had high quality (≥75%). More details about study quality are explained in the next subsection. Of 79 studies, only 11 studies were theory-based.

Table 2.2: Characteristics of Included Studies

Characteristics	Number of publications (number of studies)[1]
Study method	**Quantitative**: 71 (67), **Qualitative**:10 (8), **Mixed methods**:4
Study design	**Survey**: 73 (67), **Cohort**:10, **Case-control**:2
Type of publication	**Journal article**:74, **Conference proceeding**:5, **Thesis**:6
Country	**USA**:71 (67), **Netherlands**:4, **Canada**:4 (3), **Portugal**:1, **New Zealand**:2 (1), **Korea**:1, **Argentina**:1, **Finland**:1
Year of publication	**2000-2005**:0, **2006-2011**:30, **2012-2016**:55
Study quality	**0%**:14, **25%**:17, **50%**:17 (14), **75%**:16 (14), **100%**:22 (20)
Theory used	**TAM**:9 (6), **UTAUT2**:1, **SCT**:1, **PMT &TTF**:1, **IDT**:1, **C-TAM &TPB**:1
Sample size	<**500**:39 (35), **500-999**:8, **1000-4999**:11[2], **≥5000**:28[2] (26)
Mean age	54.4[3] years
Age range	18-98[4]
Sex	**Female**:49.8%[5]
Conditions	**General**:56 (52), **Diabetes**:17 (16), **HIV**:3, **Cancer**:2, **Chronic diseases**:2, **Without diseases**:2 (1), **Rheumatic diseases**:1, **Kidney diseases**:1, **Multiple sclerosis**:1
ePHR name	**MyChart**:12, **My HealtheVet**:7, **kp.org**:6 (5), **MyGroupHealth**:6 (5), **MyHealthManager**:5, **MyHealthAt Vanderbilt**:3, **Digitaal Logboek**:3, **Patient Gateway**:2, **PatientSite**:2, **UPMC HealthTrak**:2, **Portal Personal de Salud**:1, **OpenNotes**:1, **HealthView Portal**:1, **MyMDAnderson**:1, **MiCare**:1, **DirectMD**:1, **DTC PHR**:1
ePHR provided by	**Primary care**:32 (28), **Specialised clinic**:16, **Hospital**:8, **Various settings**:8
ePHR functions	**Accessing records**:79, **Booking appointments**:57, **Refilling prescriptions**:59, **Messaging providers**:79, **Educational materials**:42, **Setting reminders**:12, **Tracking system**:10, **Adding information**:9, **Assessment tools**:5, **Requesting referrals**:4, **Checking billing**:3, **Discussion groups**:3, **Tele-monitoring**:1 **Calendar**:1, **Communicating peers**:1, **Clinical decision support system**:1
Tips	[1]: Numbers in brackets refer to number of studies not publications. [2]: One study has 2 different samples. [3]: Mean Age was reported in 42 publications. [4]: Age range was reported in 18 publications. [5]: Sex was reported in 81 publications.
Abbreviations	**C-TAM &TPB**: Combined TAM and TPB, **IDT**: Innovation Diffusion Theory, **PMT**: Protection Motivation Theory, **SCT**: Social Cognitive Theory, **TAM**: Technology Acceptance Model, **TTF**: Task Technology Fit, **UTAUT 2**: Unified Theory of Acceptance and Use of Technology 2

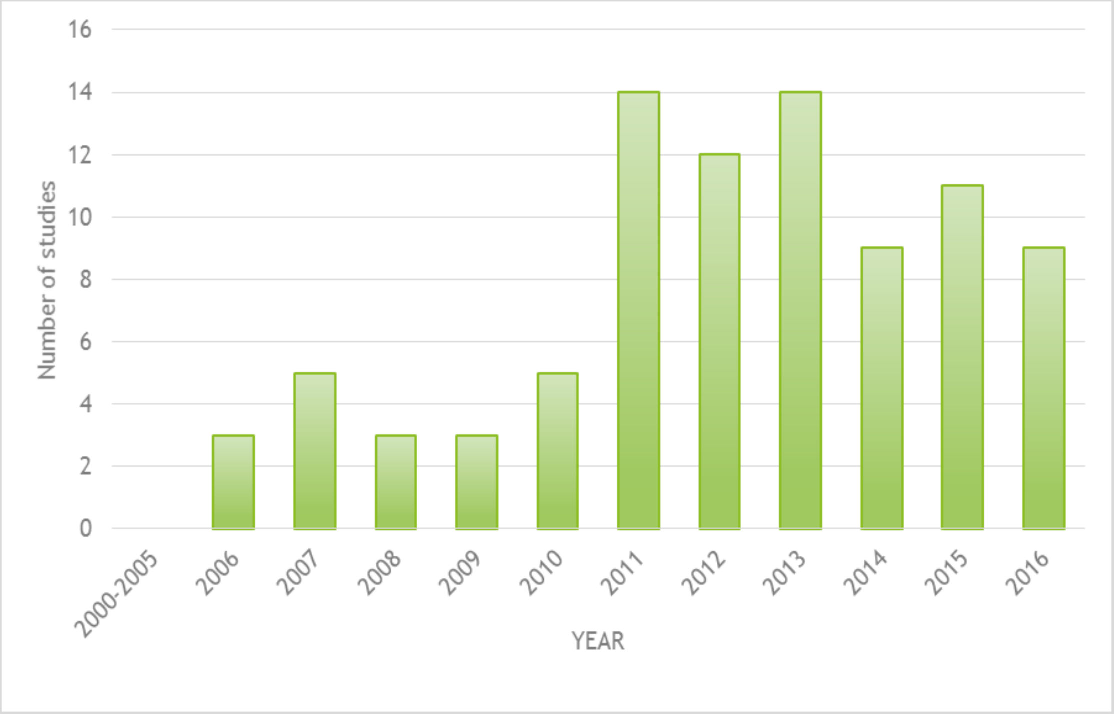


Figure 2.4: Number of Included Studies by Year of Publication

With respect to population characteristics, the sample size was less than 500 participants in 35 studies, between 500 and 999 participants in eight studies, between 1,000 and 4,999 participants in 11 studies, and 5,000 participants or more in 26 studies. The mean age of participants was reported in 42 studies, and the average of the mean ages reported in those studies was 54.4 years. The proportion of females was stated in 76 studies and the average of those percentages was 49.8%. Most of the included studies (52 studies) did not restrict their sample to a specific disease.

With regard to intervention characteristics, the name of ePHRs was known in 55 studies, and those studies assessed the adoption of 17 different ePHRs. MyChart was the most examined system (n=12 studies). Among 60 studies reported the place where ePHRs were implemented, 28 studies assessed the adoption of ePHRs implemented in primary care settings. ePHRs in all studies provided at least two functions: accessing records and messaging providers. The second most common functions offered by ePHRs were requesting prescriptions, booking appointments, and educational materials that were reported by 59, 57, and 42 studies, respectively.

2.5.3 Methodological Quality of Included Studies

This section summarises the quality of studies using figures and tables. As the current review used different groups of criteria for assessing the quality of studies with different methods (i.e. quantitative, qualitative, and mixed-method), the quality of studies is presented according to their methods in the following three subsections.

2.5.3.1 Quality of Quantitative Studies

In general, the quality of the 67 quantitative studies was moderate. The mean and median of the overall quality scores of the quantitative studies were about 64% and 50%, respectively. The overall quality score was low (≤25%) in 28 studies, moderate (50%) in 12 studies, and high (≥75%) in 27 studies. As shown in Figure 2.5, the sample was representative of the population in only 42% of the quantitative studies. According to the second quality criterion, the instrument was clearly appropriate and valid, and the variables were clearly defined in 53% of studies. Forty-five studies (67%) met the third quality criterion that indicates that researchers addressed the most important factors, listed the key demographic information, and took into account any dissimilarity between groups in the analysis. In the fourth quality criterion, about half of studies (49%) had adequate outcome data (≥80%) as well as a high response rate (≥60%). For more transparent review, Table 2.3 lists the quality criterion met by each quantitative study.

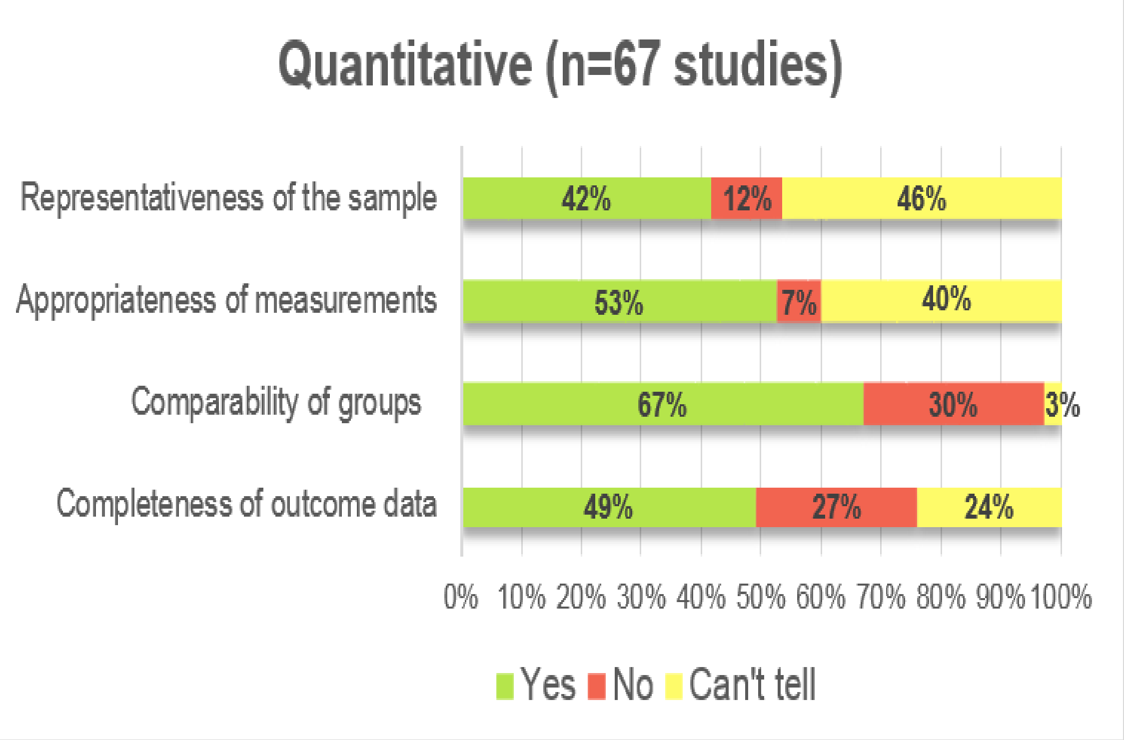


Figure 2.5: Proportion of Quality Criterion Met for Quantitative Studies

Table 2.3: Quality Criterion Met for each Quantitative Study

Study ID	Author (year)	Criterion 1	Criterion 2	Criterion 3	Criterion 4
1	Abramson et al. (2014)	?	?	☺	☹
2	Agarwal et al. (2013)	☹	☺	☺	☹
3	Cho et al. (2010)	?	?	☹	☹
4	Gordon et al. (2016)	☹	☹	☹	☹
5	Kim et al. (2009)	?	?	☺	?
6	Klein (2007)	?	☺	☺	☹
7	Laugesen (2013)	?	☺	☺	?
8	Lazard et al. (2016)	?	?	☹	?
9	Noblin (2010)	?	☺	☺	?
10	Noblin et al. (2012)	?	☺	☺	?
11	Noblin et al. (2013)	?	☺	☺	?
12	Patel et al. (2011a)	?	?	☺	?
13	Patel et al. (2011b)	?	?	☹	?
14	Patel et al. (2012)	?	?	☹	?
15	Sanders et al. (2013)	?	?	☺	?
16	Tavares et al. (2016)	?	☺	☺	☹
17	Torres (2011)	?	?	☹	☺
18	van der Vaart et al. (2011)	☹	?	☹	☹
19	Wakefield et al. (2012)	?	?	☹	?
24	Butler et al. (2013)	?	☹	☹	?
25	McInnes et al. (2013)	?	?	☹	?
26	Morton (2012)	?	?	☺	☹
27	Ruiz et al. (2016)	?	?	☺	☹
28	Tsai et al. (2012)	☹	☹	☺	☺
39	Ancker et al. (2011)	☺	☺	☹	☺
40	Ancker et al. (2015)	?	?	☺	?
41	Ancker et al. (2016)	☺	☺	☺	☺
42	Cahill et al. (2014)	?	☺	☹	☺
43	Carrell et al. (2006)	☺	?	?	?
44	Davis et al. (2015)	☹	☺	☺	☺
45	Emani et al. (2012)	☺	?	☺	☹
46	Garrido et al. (2015)	☺	☺	☺	☺
47	Gerber et al. (2014)	☺	☺	☺	☺
48	Goel et al. (2011a)	?	?	☺	☹
49	Goel et al. (2011b)	☺	☺	☺	☺
50	Hibbard et al. (2011)	☺	☺	☺	☺
51	Horvath et al. (2011)	?	☺	☺	☺
52	Jhamb et al. (2015)	☺	☺	☺	☺
53	Lau et al. (2014)	☺	☹	☺	☺
54	Leveille et al. (2016)	☺	☺	☺	☺
55	Lyles et al. (2012)	?	?	☺	☺
56	Lyles et al. (2013)	?	?	☹	?
57	Martinez et al. (2013)	☺	☺	☺	☺
58	Mikles et al. (2015)	☺	☺	☺	☺
59	Miller et al. (2007)	☺	☺	☺	☺
60	Nazi (2010)	?	☹	☹	☹
61	Nielsen et al. (2012)	?	☺	☺	☺
62	Palen et al. (2012)	☺	☺	☺	☺
63	Raghu et al. (2015)	☺	☺	☺	☺
64	Ralston et al. (2007)	☺	☺	☺	☺
65	Ralston et al. (2006)	☺	☺	☺	☺

66	Ralston et al. (2013)	☺	☺	☹	☺
67	Riippa et al. (2014)	?	?	☺	☹
68	Roblin et al. (2009)	?	?	☺	☹
69	Rodman (2015)	☺	☺	☺	☺
70	Ronda et al. (2013)	☹	?	☺	☺
71	Ronda et al. (2014)	☹	?	☺	☹
72	Ronda et al. (2015)	☹	?	☺	☹
73	Sarkar et al. (2010)	☺	?	?	☺
74	Sarkar et al. (2011)	☺	?	?	☺
75	Shimada et al. (2014)	☺	☺	☺	☺
76	Silvestre et al. (2009)	?	?	☹	☹
77	Smith et al. (2015)	?	?	☹	?
78	Sue et al. (2011)	☺	☺	☺	☹
79	Sue et al. (2013)	☺	☺	☺	☺
80	Tenforde et al. (2012)	☺	☺	☺	☺
81	Tulu et al. (2016)	☺	☺	☺	☺
82	Wallace et al. (2016)	?	☺	☺	☹
83	Weingart et al. (2006)	☺	☺	☺	☺
84	Weppner et al. (2010)	☺	☺	☹	☺
85	Yamin et al. (2011)	☺	☺	☺	☺
Codes	**Criterion 1**: Representativeness of the sample **Criterion 2**: Appropriateness of measurements **Criterion 3**: Comparability of groups **Criterion 4**: Completeness of outcome data ☺: “Yes” answer; ☹: “No” Answer; ?: “Can’t tell” answer				

2.5.3.2 Quality of Qualitative Studies

Generally speaking, the quality of the eight qualitative studies was moderate and slightly higher than quantitative studies. The mean and median of the overall quality scores of the qualitative studies were about 68% and 75%, respectively. The overall quality score was low (≤25%) in one study, moderate (50%) in one study, and high (≥75%) in six studies. Figure 2.6 indicates that most studies met all qualitative criteria except the fourth criterion. To put it differently, in 88% (n=7) of qualitative studies, the data sources and data analysis were appropriate, and suitable considerations were given to the influence of the context on the findings. No qualitative studies critically explained how researchers’ perspective, role, and interactions with participants affected the findings. Table 2.4 shows the quality criterion met by each qualitative study.

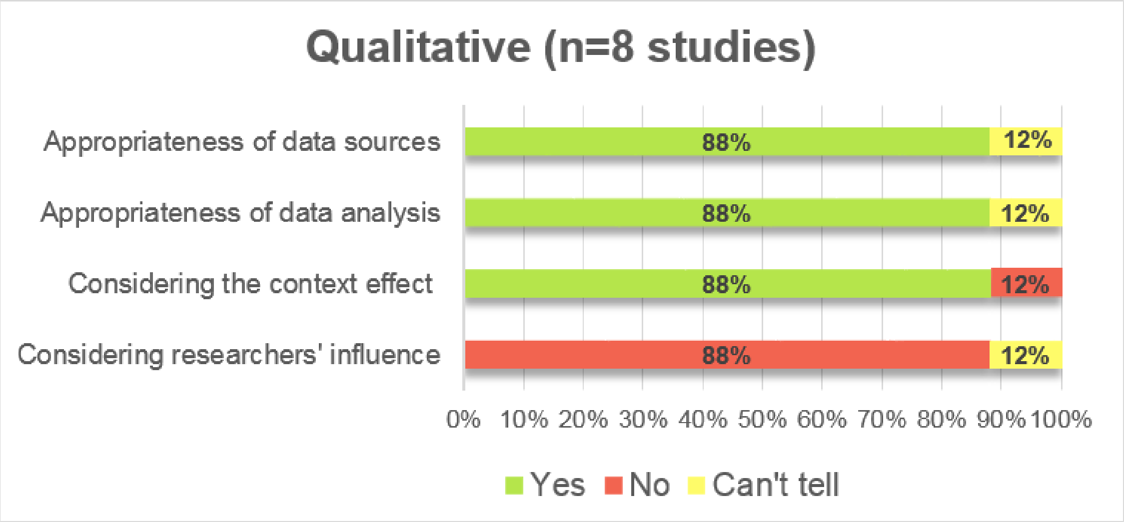


Figure 2.6: Proportion of Quality Criterion Met for Qualitative Studies

Table 2.4: Quality Criterion Met for each Qualitative Study

Study ID	Author (year)	Criterion 1	Criterion 2	Criterion 3	Criterion 4
20	Nguyen (2011)	☺	☺	☺	?
21	Nguyen et al. (2016)	☺	☺	☺	?
22	Zickmund (2008)	☺	☺	☺	☹
28	Day et al. (2012)	☺	☺	☺	☹
29	Gu et al. (2013)	☺	☺	☺	☹
30	Dontje et al. (2014)	☺	☺	☺	☹
31	Hess et al. (2007)	?	☺	☹	☹
32	Mishuris et al. (2015)	☺	☺	☺	☹
33	Tieu et al. (2015)	☺	☺	☺	☹
34	Turner et al. (2015)	☺	?	☺	☹
Codes	**Criterion 1**: Considering researchers' influence **Criterion 2**: Considering the context effect **Criterion 3**: Appropriateness of data analysis **Criterion 4**: Appropriateness of data sources ☺: “Yes” answer; ☹: “No” Answer; ?: “Can’t tell” answer				

2.5.3.3 Quality of Mixed-Methods Studies

There were four mixed-methods studies. The overall quality of these studies was low with mean and median of 25%. As shown in Figure 2.7, three criteria were not met by any mixed-methods study, which are: researchers’ influence on the findings critically reported, the integration process of qualitative and quantitative data clearly addressed the research question, and the limitations of this integration process were critically reflected. Other three criteria, suitability of data sources and the instrument and the representativeness of the sample, were met by 25% of studies. Half of studies met criteria regarding the relevance of data analysis, completeness of outcome data, and comparability of groups. Criteria regarding explaining the context effect on findings and relevance of mixed-methods design to address the research questions were met by 75% of studies. Table 2.5 shows the quality criterion met by each mixed-methods study.

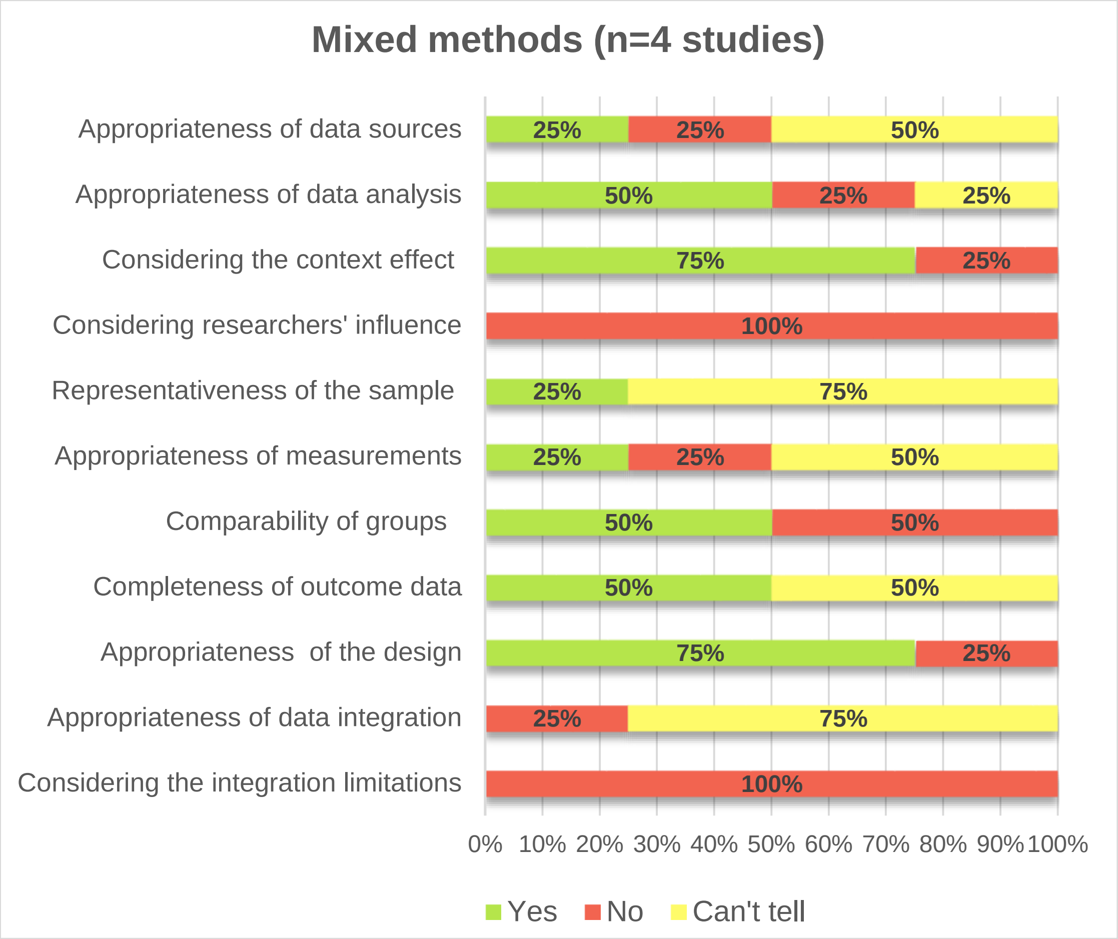


Figure 2.7: Proportion of Quality Criterion Met for Mixed-Methods Studies

Table 2.5: Quality Criterion Met for each Mixed-Methods Study

Study ID	Author (year)	Qualitative part				Quantitative part				Mixed-methods part		
		Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11
23	Luque et al. (2013)	☹	?	☹	☹	?	☹	☹	?	☺	☹	☹
35	Mayberry et al. (2011)	?	☺	☺	☹	?	?	☺	☺	☹	?	☹
36	Osborn et al. (2013)	☺	☺	☺	☹	?	☺	☺	☺	☺	?	☹
37	Tulu et al. (2012)	?	☹	☺	☹	☺	?	☹	?	☺	?	☹
Codes	**Item 1**: Appropriateness of data sources **Item 2**: Appropriateness of data analysis **Item 3**: Considering the context effect **Item 4**: Considering researchers' influence **Item 5**: Representativeness of the sample **Item 6**: Appropriateness of measurements **Item 7**: Comparability of groups **Item 8**: Completeness of outcome data **Item 9**: Appropriateness of the design **Item 10**: Appropriateness of data integration **Item 11**: Considering the integration limitations ☺: “Yes” answer; ☹: “No” Answer; ?: “Can’t tell” answer											

2.5.4 Findings of Included Studies

Findings of the included studies were synthesised narratively and categorised into three groups according to the outcome: intention to use, subjectively-measured use, and objectively-measured use. Before presenting the findings to each outcome in the following subsections, using the Harvard referencing style (author-date style) to refer to a large number of included studies is not practical since it will be intrusive and interrupt the flow of the work. The Vancouver referencing style (numbered referencing style) has been used in many reviews similar to the current review such as Amante et al. (2014), Goldzweig et al. (2013), Jabour and Jones (2013), and Or et al. (2011). Therefore, the Vancouver referencing style is used henceforth until the end of this section to refer only to the included studies. The reference list at the end of the dissertation includes Harvard and Vancouver referencing styles presented in two different sections.

2.5.4.1 Findings Regarding Intention to Use

This part begins with describing characteristics of studies that assessed factors affecting patients' intention to use ePHRs. Then, findings of those studies are summarised.

2.5.4.1.1 Characteristics of Studies

The number of publications that assessed factors affecting intention to use ePHRs was 23.[1-23]. These publications contained 20 unique studies since Noblin reported her study in three publications,[9,10,11] and Nguyen published her study in two reports.[20,21] When referring to publications for one study, the forward slash symbol (/) are used between those publications from now on. For example, Noblin's publications will be referred to as [9/10/11] to indicate that they represent one study. The 23 studies will be called intention studies from now on. Characteristics of each study are summarised in Appendix 11.

As shown in Table 2.6, while most studies were quantitative (17 of 20),[1-19] there were two qualitative studies[20/21,22] and one mixed-methods study.[23] Survey study design was used in all 23 studies. Whereas nineteen publications were journal articles,[1-6,8,10-16,18,19,21-23] there were four thesis publications.[7,9,17,20] Fifteen studies were conducted in the USA whilst the remaining five studies were conducted in other countries: Canada,[7,20/21] Netherlands,[18] Korea,[5] and Portugal.[16] Thirteen publications[1,2,4,7,8,10,11,14-16,19,21,23] were published between 2012 and 2016, the rest being published between 2006 and 2011. Thirteen studies scored a low quality (≤25%).[1,3-5,8,12-15,17-19,23] In contrast, only two studies[21,22] had a high quality score (≥75%) and five studies had a moderate quality score (50%).[2,6,7,9/10/11,16] Six theories were used in seven studies: TAM,[6,8,9/10/11] UTAUT 2,[16] Social Cognitive Theory (SCT),[2] Combined TAM and Theory of Planned Behaviour (C-TAM&TPB),[17] and Task Technology Fit (TTF) & Protection Motivation Theory (PMT).[7]

Table 2.6: Characteristics of Intention Studies

Characteristics	Number of publications (number of studies)
Study method	**Quantitative**:19 (17), **Qualitative**:3 (2), **Mixed methods**:1
Study design	**Survey**:23 (20), **Cohort**:0, **Case-control**:0
Type of publication	**Journal article**:19, **Conference proceeding**:0, **Thesis**:4
Country	**USA**:17 (15), **Canada**:3 (2), **Netherlands**:1, **Portugal**:1, **Korea**:1
Year of publication	**2000-2005**:0, **2006-2011**:10, **2012-2016**:13
Study quality	**0%**:8, **25%**:5, **50%**:7 (5), **75%**:3 (2), **100%**:0
Theory used	**TAM**:5 (3), **UTAUT2**:1, **SCT**:1, **PMT &TTF**:1, **C-TAM &TPB**:1
Sample size	<**500**:19 (16), **500-999**:3, **1000-4999**:1, **≥5000**:0
Mean age	46.3 years
Age range	18-87
Sex	**Female**:58.3%
Conditions	**General**:16 (14), **Diabetes**:3, **HIV**:1, **Without diseases**:2 (1), **Rheumatic diseases**:1
ePHR name	**MyChart**:1, **MyHealtheVet**:1, **kp.org**:1, **UPMC HealthTrak**:1, **MiCare**:1
ePHR provided by	**Primary care**:7 (5), **Specialised clinic**:3, **Various settings**:1
ePHR functions	**Accessing records**:20, **Booking appointments**:14, **Refilling prescriptions**:13, **Messaging providers**:20, **Educational materials**:9, **Setting reminders**:4, **Tracking system**:3, **Adding information**:2, **Requesting referrals**:2, **Checking billing**:2, **Discussion groups**:1, **Tele-monitoring**:1 **Calendar**:1, **Communicating peers**:1, **Clinical decision support system**:1
Abbreviations	**C-TAM &TPB**: Combined TAM and TPB, **PMT**: Protection Motivation Theory, **SCT**: Social Cognitive Theory, **TAM**: Technology Acceptance Model, **TTF**: Task Technology Fit, **UTAUT 2**: Unified Theory of Acceptance and Use of Technology 2

With regard to population characteristics, the sample size was 500 or more in four studies,[1,4,15,19] and the remaining studies recruited less than 500 participants. Eight studies reported the age mean of participants, and the average of those means was 46.3 years.[2,3,5,6,8,17,18,22] Six studies reported age range of participants,[4-6,8,17,20/21] and it ranged from 18 to 87. The sex of participants was documented in all intention studies, and the mean of female percentages was higher than male percentages and reached 58.3%. While there were no restrictions on a participants' health condition in 14 studies.[1,2,4-6,8-17,19] the remaining six studies focused on patients with diabetes mellitus,[3,7,22] rheumatic diseases,[18] HIV,[23] and healthy patients.[20/21]

With reference to characteristics of intervention, the name of ePHRs was known in only five studies; MiCare,[2] My HealtheVet,[3] kp.org,[4] UPMC HealthTrak,[22] and MyChart.[23] The setting where ePHRs were implemented was reported in nine studies: primary care settings,[9/10/11,15,17,19,22] specialised clinics,[3,18,23] and various settings.[6] ePHRs in all studies provided patients with two main functions; accessing records and messaging providers. Booking appointment service was provided by ePHRs in all intention studies except six studies,[2,3,5,6,18,22] and requesting prescription service was provided by all intention studies except seven studies.[2,5,7,8,14,18,22] ePHRs offered educational materials in nine studies.[1-5,7,18,20/21,22] The following functions were provided by ePHRs in few studies: setting reminders,[1,3,5,7] tracking system,[7,19,22] adding information,[1,2] checking billing,[6,8] requesting referral,[1,12] clinical decision support system,[5] communicating peers,[18] tele-monitoring,[18] discussion groups,[7] and calendars.[7]

2.5.4.1.2 Main Findings

Appendix 12 summarises findings of each intention study so as to make the analysis reproducible (Liberati et al., 2009). The 20 studies tested the effect of 55 factors on the patients' intention to use ePHRs. According to the conceptual framework used by Or and Karsh (2009), these factors were categorised into four main groups as follows: 34 personal factors, ten human-technology interaction factors, ten organisational factors, and one social factor. Personal factors were also divided into three subgroups: 11 sociodemographic factors, 10 digital divide-related factors, and 13 health-related factors. Appendix 13 shows factors in each group, studies that tested each factor, and type of association (i.e. positive, negative, and no association) that each study found between each factor and intention to use.

As mentioned in Subsection 2.4.6, any factor must meet the following three conditions to draw a definitive conclusion about its effect: (1) the factor must be examined by at least four studies; (2) there is a consensus among most studies on its effect; (3) those studies that have a consensus on the effect of the factor must be superior to the few studies that reported a contrary effect in terms of study quality, sample size, and study method (i.e. quantitative, qualitative, and mixed-method). In respect to the first condition, fifteen factors were assessed by four studies or more (see Figure 2.8). Of those 15 factors, the effect of eight factors had a consensus among most studies that assessed them: perceived usefulness, sex, internet access, health status, ethnicity, privacy and security concerns, internet access, and facilitating conditions. All of these eight factors met the third condition. More details about how these factors met the third condition and the definitive conclusion drawn about the effect of each factor are outlined below.

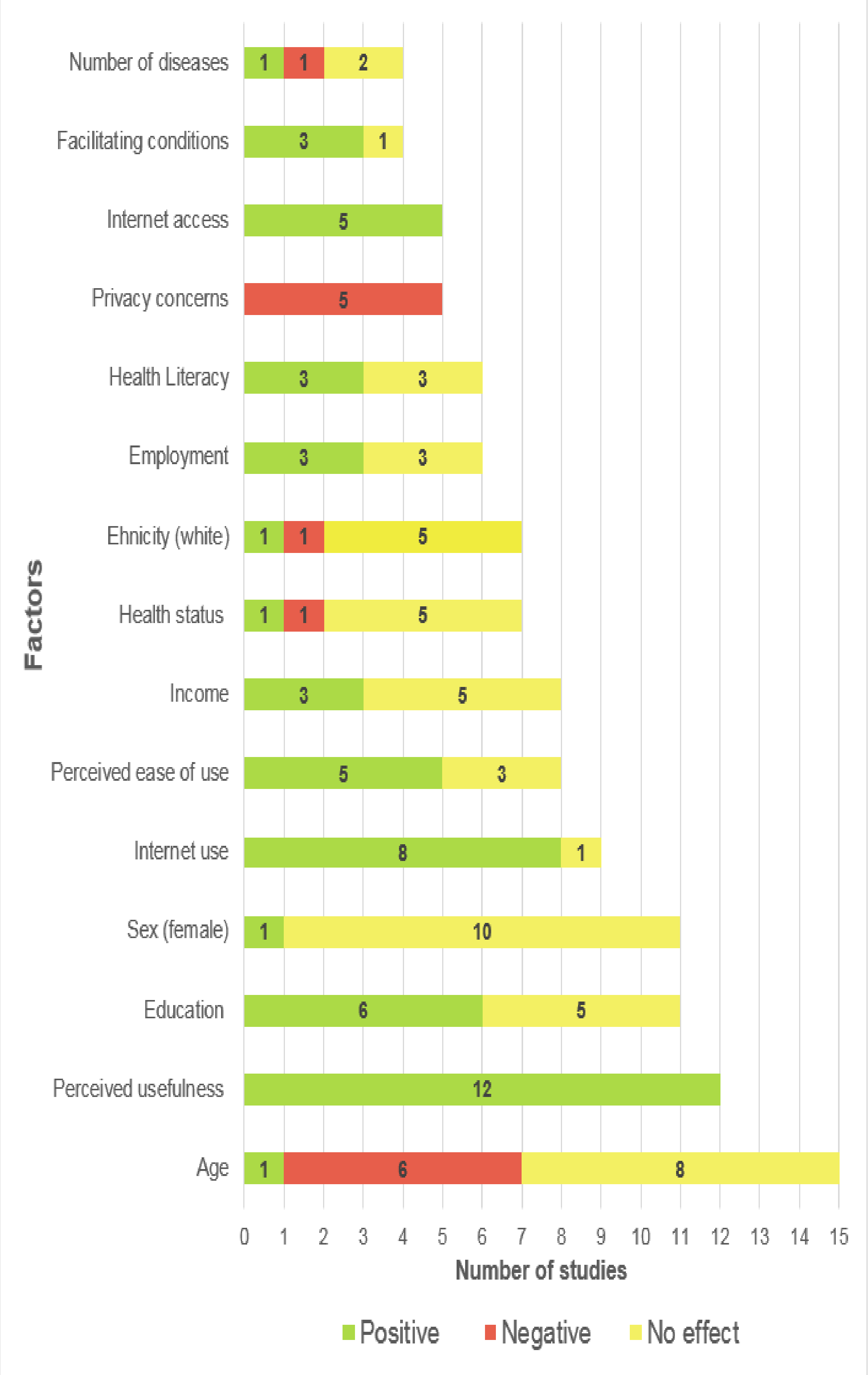


Figure 2.8: Factors Examined by Four or More Intention Studies

As shown in Table 2.7, perceived usefulness was tested by 12 studies.[1,2,5-14,16,22] All of them found that patients who perceive that ePHRs are useful are more likely to intend to use the system. As there are no contrary findings to this effect of perceived usefulness, the current review drew the following definitive conclusion: there is a significant positive relationship between perceived usefulness and intention to use.

The influence of sex on intention to use ePHRs was examined by ten studies. While nine studies declared that there is no relationship between sex and intention to use ePHRs,[1,5,12,13,15-18,23] one study concluded that females are more likely to intend to use ePHRs.[9/10/11] As shown in Table 2.7, the latter study has low quality and 73% of its sample was females. Accordingly, the current review concluded that sex is not a predictor of intention to use ePHRs.

The effect of internet use was tested by eight studies.[1,5,12,13,14,15,19,20/21] There is a consensus among seven studies that patients with internet experience are more likely to intend to use ePHRs. The remaining study[14] stated that the effect of internet use depends on the purpose of using the internet. Specifically, using the internet for finding health information or managing healthcare positively affects intention to use ePHRs while using the internet for sharing personal information such as purchasing or paying bills online does not affect intention to use ePHRs. As shown in Table 2.7, this study has a small sample size and low quality. Moreover, about 73% of the sample was females. Thus, it can be concluded that patients who use the internet are more likely to intend to use ePHRs.

Influence of ethnicity was assessed by seven studies. Five of them did not find any relationship between ethnicity and intention to use.[3,12,13,15,17] Of the remaining studies, one study declared that white patients are more likely to intend to use ePHRs,[1] the another found the contrary.[4] Both studies[1,4] had low quality (see Table 2.7). Further, the study conducted by Gordon et al.[4] was focused only on elderly patients (65-79 years), thus, their results may not be generalisable to other age groups. The findings of the study conduct by Abramson et al.[1] might be affected by the additional functions provided by ePHRs (i.e. adding information, providing educational materials, and setting reminders), which were not provided by ePHRs in other studies. Accordingly, the current review concluded that ethnicity does not affect intention to use ePHRs.

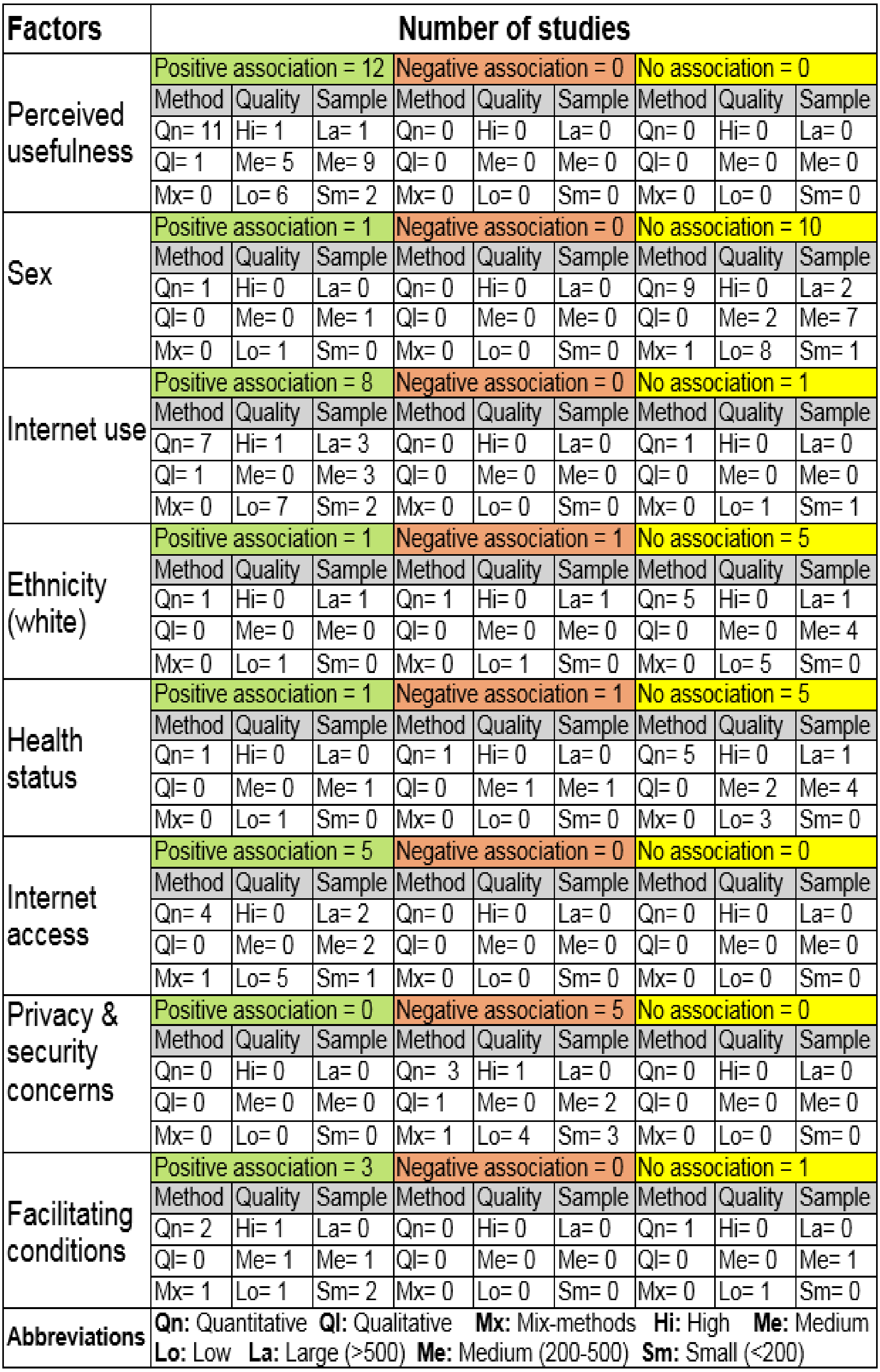
Of six studies, four studies concluded that health status does not influence intention to use ePHRs[1,7,9/10/11,12] while one study found that individuals with poor health are more likely to intend to use ePHRs.[6] The sixth study conducted by van der Vaart [18] was more specific and stated that physical health status has no effect on intention to use while mental health status positively impacts on intention. However, van der Vaart focused on patients with rheumatic diseases and it had low quality. As a result, the current review concluded that intention to use ePHRs is not influenced by health status.

The effect of having internet access was assessed by five studies,[1,3,12,15,23] and they found that patients with internet access are more likely to intend to use ePHRs. As there are no any contrary findings to this effect of having internet access, the current review concluded that patients who have internet access are more likely to intend to use ePHRs.

The effect of privacy and security concerns on intention to use ePHRs have a consensus among all five studies that assessed it.[12,13,14,20/21,23] Those studies demonstrated that patients who are more worried about the privacy and security of ePHRs are less likely to intend to use them. Therefore, the definitive conclusion regarding this factor is that privacy and security concerns negatively influence intention to use ePHRs.

Facilitating conditions, e.g. training and technical support, were tested by four studies. Three studies found a positive relationship between facilitating conditions and intention to use ePHRs,[14,17,23] and only one study reported no relationship between them.[16] As the latter study had low quality, the current review concluded that facilitating conditions positively affect intention to use ePHRs.

Table 2.7: Effects of the Most Tested Factors, Study Method, Quality of Intention Studies, and Sample Size



Factors	**Number of studies**								
Perceived usefulness	Positive association = 12			Negative association = 0			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 11	Hi= 1	La= 1	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 1	Me= 5	Me= 9	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 6	Sm= 2	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Sex	Positive association = 1			Negative association = 0			No association = 10		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 1	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0	Qn= 9	Hi= 0	La= 2
	Ql= 0	Me= 0	Me= 1	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 2	Me= 7
	Mx= 0	Lo= 1	Sm= 0	Mx= 0	Lo= 0	Sm= 0	Mx= 1	Lo= 8	Sm= 1
Internet use	Positive association = 8			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 7	Hi= 1	La= 3	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0
	Ql= 1	Me= 0	Me= 3	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 7	Sm= 2	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 1	Sm= 1
Ethnicity (white)	Positive association = 1			Negative association = 1			No association = 5		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 1	Hi= 0	La= 1	Qn= 1	Hi= 0	La= 1	Qn= 5	Hi= 0	La= 1
	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 4
	Mx= 0	Lo= 1	Sm= 0	Mx= 0	Lo= 1	Sm= 0	Mx= 0	Lo= 5	Sm= 0
Health status	Positive association = 1			Negative association = 1			No association = 5		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 1	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0	Qn= 5	Hi= 0	La= 1
	Ql= 0	Me= 0	Me= 1	Ql= 0	Me= 1	Me= 1	Ql= 0	Me= 2	Me= 4
	Mx= 0	Lo= 1	Sm= 0	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 3	Sm= 0
Internet access	Positive association = 5			Negative association = 0			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 4	Hi= 0	La= 2	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 0	Me= 0	Me= 2	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 1	Lo= 5	Sm= 1	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Privacy & security concerns	Positive association = 0			Negative association = 5			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 0	Hi= 0	La= 0	Qn= 3	Hi= 1	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 0	Me= 0	Me= 0	Ql= 1	Me= 0	Me= 2	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 0	Sm= 0	Mx= 1	Lo= 4	Sm= 3	Mx= 0	Lo= 0	Sm= 0
Facilitating conditions	Positive association = 3			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 2	Hi= 1	La= 0	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0
	Ql= 0	Me= 1	Me= 1	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 1
	Mx= 1	Lo= 1	Sm= 2	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 1	Sm= 0
Abbreviations	**Qn:** Quantitative **Ql:** Qualitative **Mx:** Mix-methods **Hi:** High **Me:** Medium **Lo:** Low **La:** Large (>500) **Me:** Medium (200-500) **Sm:** Small (<200)								

2.5.4.2 Findings Regarding Subjectively-Measured Use

This part starts with describing characteristics of studies that assessed factors affecting subjectively-measured use of ePHRs. Then, findings of those studies are summarised.

2.5.4.2.1 Characteristics of Studies

The number of publications that assessed factors affecting subjectively-measured use of ePHRs was 18.[4,16,19,24-38] These 18 publications consisted of 17 unique studies since Day and Gu reported their study in two publications.[29/30] Those 18 studies will be called subjective use studies from now on. Characteristics of each subjective use study are summarised in Appendix 14.

As shown in Table 2.8, the study method was quantitative in eight studies,[4,16,19,24-28] qualitative in six studies,[29-35] and mixed-methods in three studies.[36-38] Survey design was used by all 17 studies. Whereas sixteen publications were journal articles, one publication[26] was a thesis and the remaining study was a conference proceeding.[38] Fifteen subjective use studies were conducted in the USA, and the remaining two studies were carried out in New Zealand[29/30] and Portugal.[16] Sixteen publications were published between 2012 and 2016 whereas the remaining two publications were published between 2006 and 2011.[32,36] The quality of studies was low (≤25%) in nine studies,[4,19,24-27,32,36,38] moderate (50%) in four studies,[16,28,35,37] and high (≥75%) in five studies.[29/30,31,33,34] Two theories were used in three studies: TAM,[26,29/30] and UTAUT 2.[16]

With regard to population characteristics, the sample size was less than 500 in 12 studies,[16,24,26,29-38] between 500 and 999 in two studies,[19,27] and between 1000 and 4999 in three studies.[4,25,28] Age mean of participants was reported in eight studies and the average of those means was 60.4 years.[27,28,31,32,34-37] Only four studies reported age range of participants,[4,27,29/30,35] and it ranged between 22 and 93 years. Sex of participants was documented in all subjective use studies except one study,[31] and the mean of female percentages was 31.8%. While there were no restrictions on a participants' health condition in 11 studies,[4,16,19,24,27-31,33,35] the remaining six studies focused on patients with diabetes mellitus,[26,32,36,37] chronic diseases,[34] and HIV.[25]

With reference to characteristics of intervention, the name of ePHRs was known in only ten studies; My HealtheVet,[25,27,28,33] MyHealthAtVanderbilt,[36,37] kp.org,[4] UPMC HealthTrak,[32] DirectMD,[24] and DTC PHR.[26] The setting where ePHRs implemented was reported in 13 studies; primary care settings,[19,24,25,29-33,36-38] specialised clinics,[27] and hospitals.[26,34] ePHRs in all studies provided patients with two main functionalities; accessing records and messaging providers. Requesting prescriptions service was provided by ePHRs in all studies except three studies.[31,32,35] ePHRs offered educational materials in 11 studies.[4,24-30,32,33,36,37] The following functions were provided by ePHRs in few studies: booking appointments,[4,16,19,26,33,36,37] tracking system,[19,25,27-29/30,32] setting reminders,[24,25,27-29/30] adding information,[33] and checking billing.[24]

Table 2.8: Characteristics of Subjective Use Studies

Characteristics	Number of publications (number of studies)
Study method	**Quantitative**:8, **Qualitative**:7 (6), **Mixed methods**:3
Study design	**Survey**:18 (17), **Cohort**:0, **Case-control**:0
Type of publication	**Journal article**:16, **Conference proceeding**:1, **Thesis**:1
Country	**USA**:15, **New Zealand**:2(1), **Portugal**:1
Year of publication	**2000-2005**:0, **2006-2011**:2, **2012-2016**:16
Study quality	**0%**:4, **25%**:5, **50%**:4, **75%**:5, **100%**:0
Theory used	**TAM**:3 (2), **UTAUT2**:1
Sample size	<**500**:13 (12), **500-999**:2, **1000-4999**:3, **≥5000**:0
Mean age	60.4 years
Age range	22-93
Sex	**Female**:31.8%
Conditions	**General**:12 (11), **Diabetes**:4, **HIV**:1, **Chronic diseases**:1
ePHR name	**My HealtheVet**:4, **MyHealthAt Vanderbilt**: 2, **kp.org**:1, **UPMC HealthTrak**:1, **DirectMD**:1, **DTC PHR**:1
ePHR provided by	**Primary care**:11 (10), **Hospital**:2, **Specialised clinic**:1
ePHR functions	**Accessing records**:17, **Booking appointments**:7, **Refilling prescriptions**:14, **Messaging providers**:17, **Educational materials**:11, **Setting reminders**:5, **Tracking system**:6, **Adding information**:1, **Checking billing**:1, **Communicating peers**:1
Abbreviations	**TAM**: Technology Acceptance Model, **UTAUT 2**: Unified Theory of Acceptance and Use of Technology 2

2.5.4.2.2 Main Findings

Findings of each subjective use study are summarised in Appendix 15. The 17 studies in this group tested the effect of 43 factors on subjective use of ePHRs. Based on the conceptual framework used by Or and Karsh (2009), these factors were categorised into four main groups as follows: 30 personal factors, nine human-technology interaction factors, three organisational factors, and one social factor. Personal factors were organised into three subgroups: 15 sociodemographic factors, 6 digital divide-related factors, and 9 health-related factors. Appendix 16 presents factors in each group, studies that examined each factor, and type of association (positive, negative, and no association) that each study found between each factor and subjectively-measured use.

As mentioned in Subsection 2.4.6, any factor must meet three conditions to draw a definitive conclusion about its effect. In respect to the first condition, thirteen factors were examined by four studies or more (see Figure 2.9). Of those 13 factors, the effect of nine factors had a consensus among most studies that assessed them (see Figure 2.9). Seven of those factors met the third condition: perceived usefulness, education level, perceived ease of use, privacy and security concerns, awareness of ePHRs, income, and internet access. More details about how these factors met the third condition and the definitive conclusion drawn about the effect of each factor are outlined below.

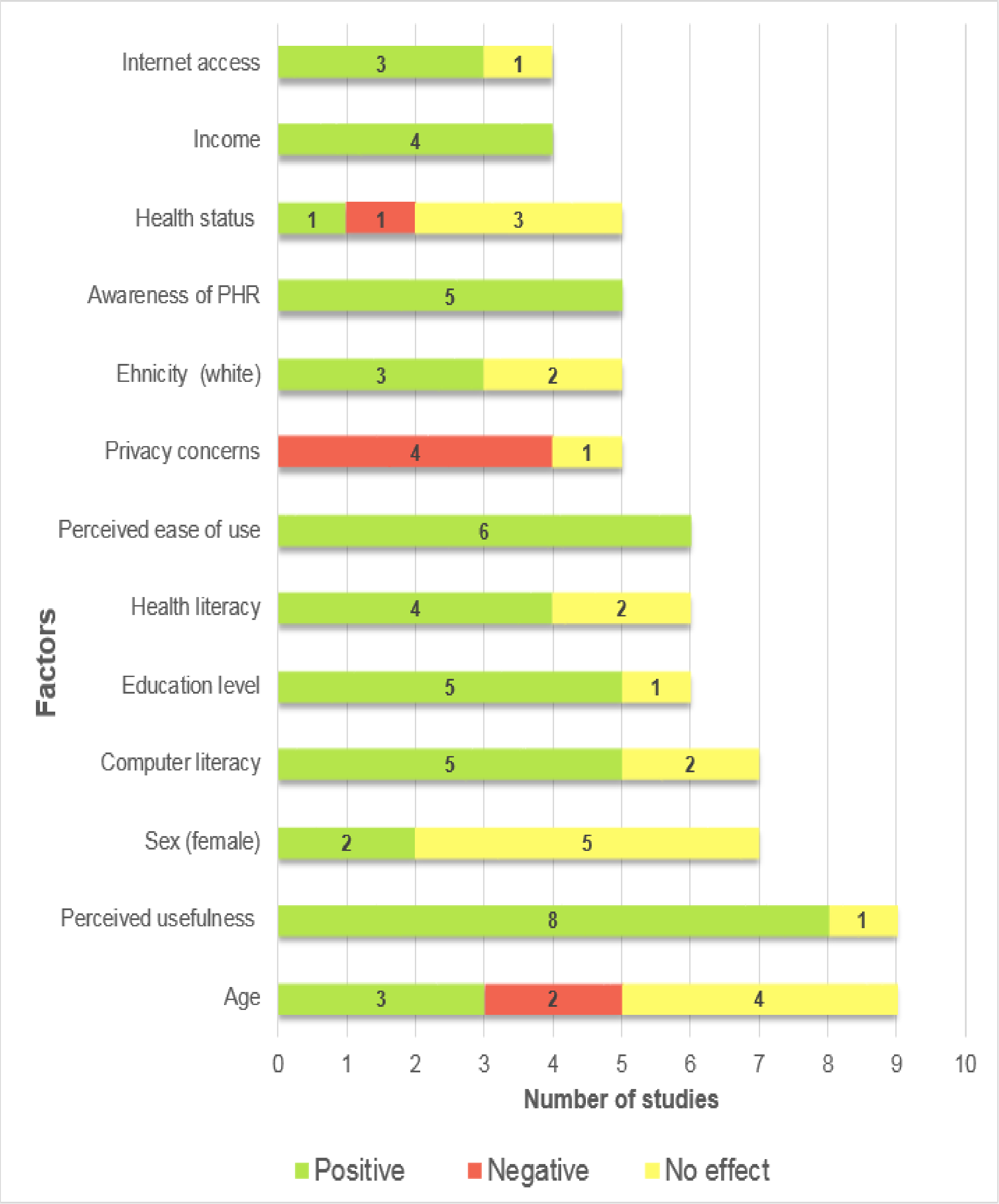


Figure 2.9: Factors Examined by Four or More Subjective Use Studies

As shown in Figure 2.9, eight studies concluded that patients who perceive that ePHRs are useful are more likely to adopt them.[29-35,37,38] However, one study showed that there is no relationship between perceived usefulness and subjectively-measured use.[26] As shown in Table 2.9, the latter study had low quality and small sample, and it concentrated only on patients with diabetes mellitus. Accordingly, the current review drew the following definitive conclusion: there is a significant positive relationship between perceived usefulness and subjectively-measured use.

Whereas five studies reported that sex does not affect subjectively-measured use,[24-26,28,37] two other studies found that females are more likely to use ePHRs.[19,38] As presented in Table 2.9, the latter and former studies are comparable in terms of study method, sample size, and study quality. Thus, this factor did not meet the third condition, thereby, no decisive conclusion could be drawn for the effect of sex.

The effect of computer literacy was reported by seven studies; five of them concluded that patients with higher computer literacy are more likely to use ePHRs,[29/30,33,34,35,37] and the remaining two studies did not find any association between computer literacy and subjectively-measured use of ePHRs.[26,36] As shown in Table 2.9, all former studies had smaller sizes of samples in comparison with the latter studies, and four of the former studies were qualitative. Consequently, this factor did not meet the third condition, thereby, the current review could not draw a definitive conclusion regarding its effect on subjectively-measured use of ePHRs.

The effect of education level on the subjectively-measured use of ePHRs was examined by six studies. Five studies pointed out that patients with a higher level of education are more likely to use ePHRs,[4,19,25,26,28] and only one study reported no relationship between them.[37] As shown in Table 2.9, the latter study recruited only 75 patients with diabetes mellitus. Therefore, it can be concluded that education level positively affects subjectively-measured use of ePHRs.

Perceived ease of use was tested by six studies.[26,29/30,31,34,35,38] All these studies stated that patients who perceive ePHRs as an easy-to-use system are more likely to use it. As there are no any contrary findings to this effect of perceived ease of use, the current review concluded that there is a positive relationship between perceived ease of use and subjectively-measured use of ePHRs.

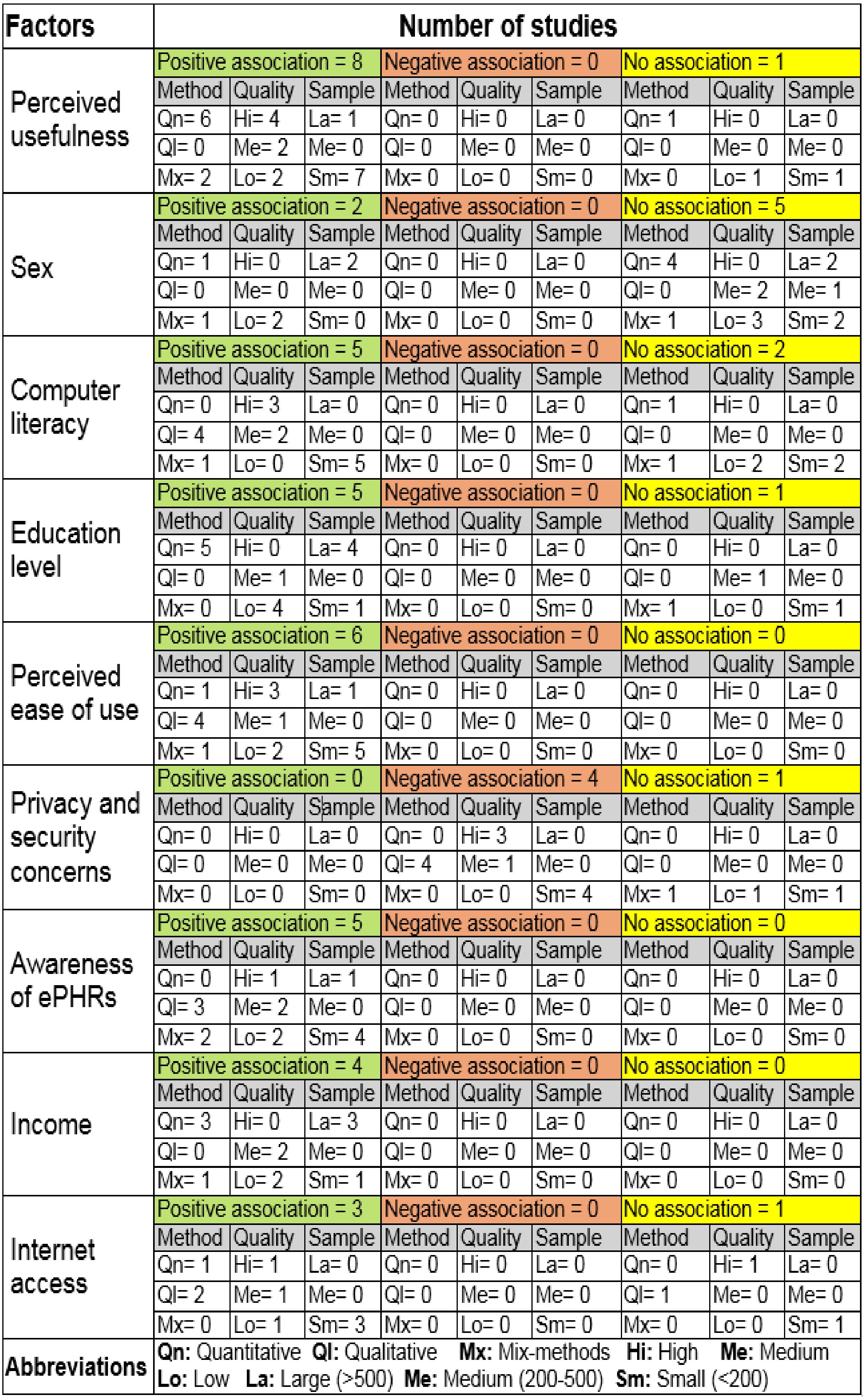
While privacy and security concerns negatively influenced the use of ePHRs in four studies,[31,33,34,35] there was no any association between them in one study.[36] As shown in Table 2.9, the latter study had low quality and a small sample of diabetic patients. Consequently, this review concluded that privacy and security concerns negatively impact subjectively-measured use of ePHRs.

Five studies examined the effect of awareness of presence and functions of ePHRs.[31,32,35,37,38] All these studies found that patients who are aware of the presence and functions of ePHRs are more likely to use it. As there are no any contrary findings to this effect of awareness, the current review concluded that patients who are aware of presence and functions of ePHRs are more likely to use it.

The influence of income on subjectively-measured use was examined by four studies.[19,25,28,37] All these studies concluded that patients with higher income are more likely to use ePHRs. Since there are no any contrary findings to this effect of income, the conclusion drawn in the current review is that income positively affects subjectively-measured use of ePHRs.

Of four studies tested the effect of internet access on the subjectively-measured use of ePHRs, there was a positive relationship in three studies[26,33,35] and no relationship in the remaining study.[34] The latter study was qualitative and had a very small sample size (11 individuals). Therefore, the ultimate conclusion in the current review is that having internet access positively affects subjectively-measured use of ePHRs.

Table 2.9: Effects of the Most Tested Factors, Study Method, Quality of Subjective Use Studies, and Sample Size



Factors	**Number of studies**								
Perceived usefulness	Positive association = 8			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 6	Hi= 4	La= 1	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0
	Ql= 0	Me= 2	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 2	Lo= 2	Sm= 7	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 1	Sm= 1
Sex	Positive association = 2			Negative association = 0			No association = 5		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 1	Hi= 0	La= 2	Qn= 0	Hi= 0	La= 0	Qn= 4	Hi= 0	La= 2
	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 2	Me= 1
	Mx= 1	Lo= 2	Sm= 0	Mx= 0	Lo= 0	Sm= 0	Mx= 1	Lo= 3	Sm= 2
Computer literacy	Positive association = 5			Negative association = 0			No association = 2		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 0	Hi= 3	La= 0	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0
	Ql= 4	Me= 2	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 1	Lo= 0	Sm= 5	Mx= 0	Lo= 0	Sm= 0	Mx= 1	Lo= 2	Sm= 2
Education level	Positive association = 5			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 5	Hi= 0	La= 4	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 0	Me= 1	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 1	Me= 0
	Mx= 0	Lo= 4	Sm= 1	Mx= 0	Lo= 0	Sm= 0	Mx= 1	Lo= 0	Sm= 1
Perceived ease of use	Positive association = 6			Negative association = 0			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 1	Hi= 3	La= 1	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 4	Me= 1	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 1	Lo= 2	Sm= 5	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Privacy and security concerns	Positive association = 0			Negative association = 4			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 3	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 0	Me= 0	Me= 0	Ql= 4	Me= 1	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 4	Mx= 1	Lo= 1	Sm= 1
Awareness of ePHRs	Positive association = 5			Negative association = 0			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 0	Hi= 1	La= 1	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 3	Me= 2	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 2	Lo= 2	Sm= 4	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Income	Positive association = 4			Negative association = 0			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 3	Hi= 0	La= 3	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 0	Me= 2	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 1	Lo= 2	Sm= 1	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Internet access	Positive association = 3			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 1	Hi= 1	La= 0	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 1	La= 0
	Ql= 2	Me= 1	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 1	Me= 0	Me= 0
	Mx= 0	Lo= 1	Sm= 3	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 1
Abbreviations	**Qn:** Quantitative **Ql:** Qualitative **Mx:** Mix-methods **Hi:** High **Me:** Medium **Lo:** Low **La:** Large (>500) **Me:** Medium (200-500) **Sm:** Small (<200)								

2.5.4.3 Findings Regarding Objectively-Measured Use

This part starts with describing characteristics of studies that assessed factors affecting objectively-measured use of ePHRs. Then, findings of those studies are summarised.

2.5.4.3.1 Characteristics of Studies

The number of publications that assessed factors affecting objectively-measured use of ePHRs was 48.[4,39-85] These publications consisted of 46 different studies since Ralston et al. reported their study in two publications[64,65] and Sarker et al. published their study in two reports.[73,74] Those 46 studies will be called objective use studies from now on. Characteristics of each objective use study are summarised in Appendix 17.

As shown in Table 2.10, the study method was quantitative in all 46 studies. The study design was survey in 37 studies,[4,39,40,42-46,48-53,55-60,63-65,67,69-82,85] cohort design in seven studies,[41,47,54,62,66,68,84] and case-control design in two studies.[61,83] Whereas 43 publications were a journal article, four studies were a conference proceeding,[43,44,65,69,78] and the remaining study was a thesis.[69] All studies were conducted in the USA, bar six studies conducted in: Netherlands,[70,71,72] Canada,[53] Finland,[67] and Argentina.[57] Thirty publications were published between 2012 and 2016 while the remaining 18 publications were published between 2006-2011.[39,43,48-51,59,60,64,65,68,73,74,76,78,83-85] The study quality was low (≤25%) in 11 studies,[40,43,48,56,60,67,68,71,72,76,77] moderate (50%) in six studies, [42,45,55,70,73/74,82] and high (≥75%) in the remaining 29 studies. Only two different theories were used in two studies: TAM[76] and Innovation Diffusion Theory (IDT).[45]

With regard to population characteristics, the sample size was less than 500 in eight studies,[40,42,48,53,61,67,82,83] between 500 and 999 in four studies,[45,55,72,77] between 1000 and 4999 in eight studies,[49,52,68,70,71,76,79,81] and 5000 and more in 26 studies. As shown in Table 2.10, age mean of participants was reported in 24 studies and the average of those means was 55.1 years.[42,44,45,47-49,52-54,57,59,62-68,70-75,80,83] Only eight studies reported age range of participants,[4,42,44,56,63,68,76,83] and it ranged from 18 and 98. Sex of participants was documented in all objective use studies except 3 studies,[4,39,43] and the mean of female percentages was 53%. While there were no restrictions on a participants' health condition in 31 studies, the rest of studies focused on patients with diabetes,[53,55,56,68,70-74,80,84] HIV,[66] Cancer,[42,47] multiple sclerosis,[61] chronic diseases,[67] elevated lipid,[68] and kidney diseases.[52]

With reference to characteristics of intervention, the name of ePHRs was known in 40 studies; MyChart,[39-41,47-50,58,59,80,82] kp.org,[4,56,66,68,73/74] MyGroupHealth,[43,55,64/65,66,84] MyHealthManager,[46,62,76,78,79] Digitaal Logboek,[70-72] Patient Gateway,[45,85] PatientSite,[61,83] MyHealtheVet,[60,75] MyHealthAtVanderbilt,[44] Portal Personal de Salud,[57] OpenNotes,[54] HealthView Portal,[51] and MyMDAnderson.[42] As shown in Table 2.10, the setting where ePHRs implemented was reported in 37 studies; primary care settings,[50,54,55,58,63,64/65,67-69,80,81,83-85] hospitals,[44,45,57,75] specialised clinics,[40,42,46-49,52,53,59,61,66,77] and various settings.[39,41,51,60,70-72] ePHRs in all studies provided patients with two main functions; accessing records and messaging providers. Requesting prescription service was provided by ePHRs in all studies except 10 studies,[40,44,51,53,57,63,70-72,80] and booking appointment service was provided by ePHRs in all studies except 11 studies.[40,43,53,63,67,70-72,75,77,80] ePHRs contained educational materials in 24 studies.[4,40-44,46,47,53,59-61,64/65,68,70-80] The following functions were provided by ePHRs in few studies: adding information,[51,70-72,82,83] assessment tools,[43,64/65,68,76] tracking system,[75,77] setting reminders,[59,80] requesting referrals,[83,85] communication peers,[4,47] and discussion groups.[64/65]

Table 2.10: Characteristics of objective Use Studies

Characteristics	**Number of publications (number of studies)**
Study method	**Quantitative**:48 (46), **Qualitative**:0, **Mixed methods**:0
Study design	**Survey**:36 (34), **Cohort**:10, **Case-control**:2
Type of publication	**Journal article**:43, **Conference proceeding**:4, **Thesis**:1
Country	**USA**:42 (40), **Netherlands**:3, **Canada**:1, **Argentina**:1, **Finland**:1
Year of publication	**2000-2005**:0, **2006-2011**:18, **2012-2016**:30
Study quality	**0%**:4, **25%**:7, **50%**:7 (6), **75%**:8, **100%**:22 (21)
Theory used	**TAM**:1, **IDT**:1
Sample size	<**500**:8, **500-999**:4, **1000-4999**:8, **≥5000**:28 (26)
Mean age	55.1 years
Age range	18-98
Sex	**Female**:53%
Conditions	**General**:32 (31), **Diabetes**:10 (9), **Cancer**:2, **HIV**:1, **Chronic diseases**:1, **Kidney diseases**:1, **Multiple sclerosis**:1
ePHR name	**MyChart**:11, **kp.org**:6 (5), **MyGroupHealth**:6 (5), **MyHealthManager**:5, **Digitaal Logboek**:3, **My HealtheVet**:2, **Patient Gateway**:2, **PatientSite**:2, **MyHealthAt Vanderbilt**:1, **Portal Personal de Salud**:1, **OpenNotes**:1, **HealthView Portal**:1, **MyMDAnderson**:1
ePHR provided by	**Primary care**:15 (14), **Specialised clinic**:12, **Various settings**:7, **Hospital**:4
ePHR functions	**Accessing records**:46, **Messaging providers**:46, **Refilling prescriptions**:36, **Booking appointments**:35, **Educational materials**:24, **Adding information**:6, **Assessment tools**:4, **Setting reminders**:2, **Tracking system**:2, **Requesting referrals**:2, **Communicating peers**:2, **Discussion groups**:1
Abbreviations	**IDT**: Innovation Diffusion Theory, **TAM**: Technology Acceptance Model

2.5.4.3.2 Main Findings

Findings of each objective use study are summarised in Appendix 18. The 46 studies in this group examined the effect of 91 factors on objective use of ePHRs. According to the conceptual framework used by Or and Karsh (2009), these factors were categorised into three main groups as follows: 69 personal factors, nine human-technology interaction factors, and 13 organisational factors. Also, personal factors were organised into three subgroups: 13 sociodemographic factors, nine digital divide-related factors, and 47 health-related factors. Appendix 19 presents all factors in each group, studies that tested each factor, and type of association (positive, negative, and no association) that each study found between each factor and objectively-measured use.

As mentioned in Subsection 2.4.6, any factor must meet three conditions to draw a definitive conclusion about its effect. In respect to the first condition, 22 factors were examined by four or more studies (see Figure 2.10). Of these 22 factors, the effect of 11 factors had a consensus among most studies that assessed them (see Figure 2.10). Eight of those factors met the third condition: education, income, language, employment status, internet access, computer access, perceived usefulness, and privacy and security concerns. More details about how these factors met the third condition and the definitive conclusion drawn about the effect of each factor are outlined below.

As shown in Figure 2.10, the effect of ethnicity on the use of ePHRs was examined by 31 studies. While white patients were more likely to use ePHRs in 26 studies,[4,39,40,41,45,46,47,49,51,52,55,58,59,61,62,63,66,68,73/74,77,78,79,80,82,83,85] ethnicity did not affect the objectively-measured use in six studies.[41,42,48,70,71,72] As shown in Table 2.11, the former group of studies are comparable to the latter group in terms of study method, sample size, and study quality. This means that this factor did not meet the third condition. Accordingly, a definitive conclusion could not be drawn regarding the effect of ethnicity on patients' use of ePHRs.

The effect of education level on objectively-measured use was evaluated by 16 studies. Fifteen of those studies concluded that patients with higher level of education are more likely to use ePHRs.[40,42,44,45,55,57,58,66,68,70,71,73/74,77,80,84] The remaining study did not find any association between them.[72] Since the former studies are superior to the latter study in terms of quality and sample size (see Table 2.11), the current review concluded that patients with higher level of education are more likely to use ePHRs.

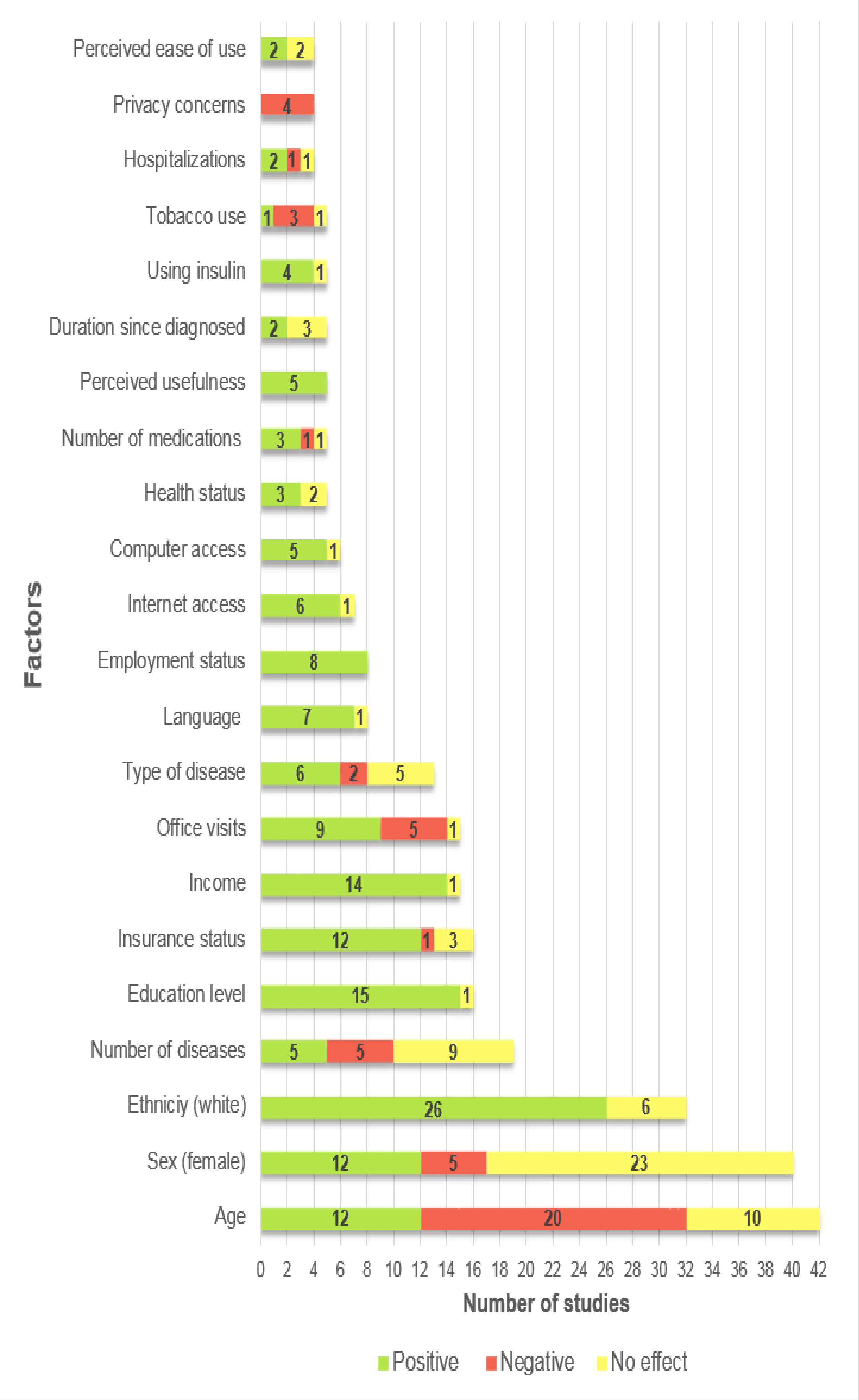


Figure 2.10: Factors Examined by Four or More Objective Use Studies

Of 16 studies assessed the effect of insurance status, 12 studies reported that patients who have private insurance are more likely to use the ePHRs,[39,40,41,51,52,59, 63,64/65,69,80,82,83] three studies did not find a relationship between them,[58,61,85] and one study stated that having private insurance decreases the probability of using the ePHRs.[66] The factor "insurance status" did not meet the third condition as the studies were comparable between groups in terms of study method, sample size, and study quality (see Table 2.11). Thus, it was difficult to draw a definitive conclusion regarding the effect of insurance status in the current review.

The effect of income was reported in 15 studies; 14 of them found that patients with higher income tend more to use ePHRs,[40,42,45,50,52,55,58,66,75,79,80, 82,84,85] and only one study demonstrated that there is no relationship between them.[73/74] The latter study focused on patients with diabetes, thereby, this may affect its findings. Moreover, the former studies were superior to the latter study in terms of study quality and sample size (see Table 2.11). Consequently, the definitive conclusion drawn in the current review is that income positively impacts the objectively-measured use of ePHRs.

The effect of patient's language on the objectively-measured use of ePHRs was investigated by eight studies. Seven of them found that if patients are fluent in the same language of the system, they are more likely to use that system.[39,41,46,58,70,71,82] The remaining study did not find any relationship between the language and use of ePHRs.[72] The latter study focused on diabetic patients and it had a low-quality score (see Table 2.11). Therefore, it could be concluded that patients who are fluent in the same language of the system are more likely to use it.

Eight studies assessed the influence of employment status, and all those studies found that employed patients tend more to use ePHRs.[40,59,61,66,70-72,84] As there are no any contrary findings to the effect of employment status, the current review concluded that the employed patients are more likely to use ePHRs.

The influence of internet access was tested in seven studies; six of those studies concluded that patients who have internet access are more likely to use ePHRs,[40,55,68,70, 71,73/74] and only one study did not find any association between internet access and objectively-measured use.[48] As presented in Table 2.11, the latter study had the smallest sample size among all seven studies, a sample of 72% females, and a low-quality score (25%). Consequently, this review concluded that having internet access positively affects the use of ePHRs.

Whilst having computer access positively influences the use of ePHRs in five studies,[45,55,70,71,73/74] only one study did not find that relationship.[48] As shown in Table 2.11, the latter study had the smallest sample size among the six studies, a sample of

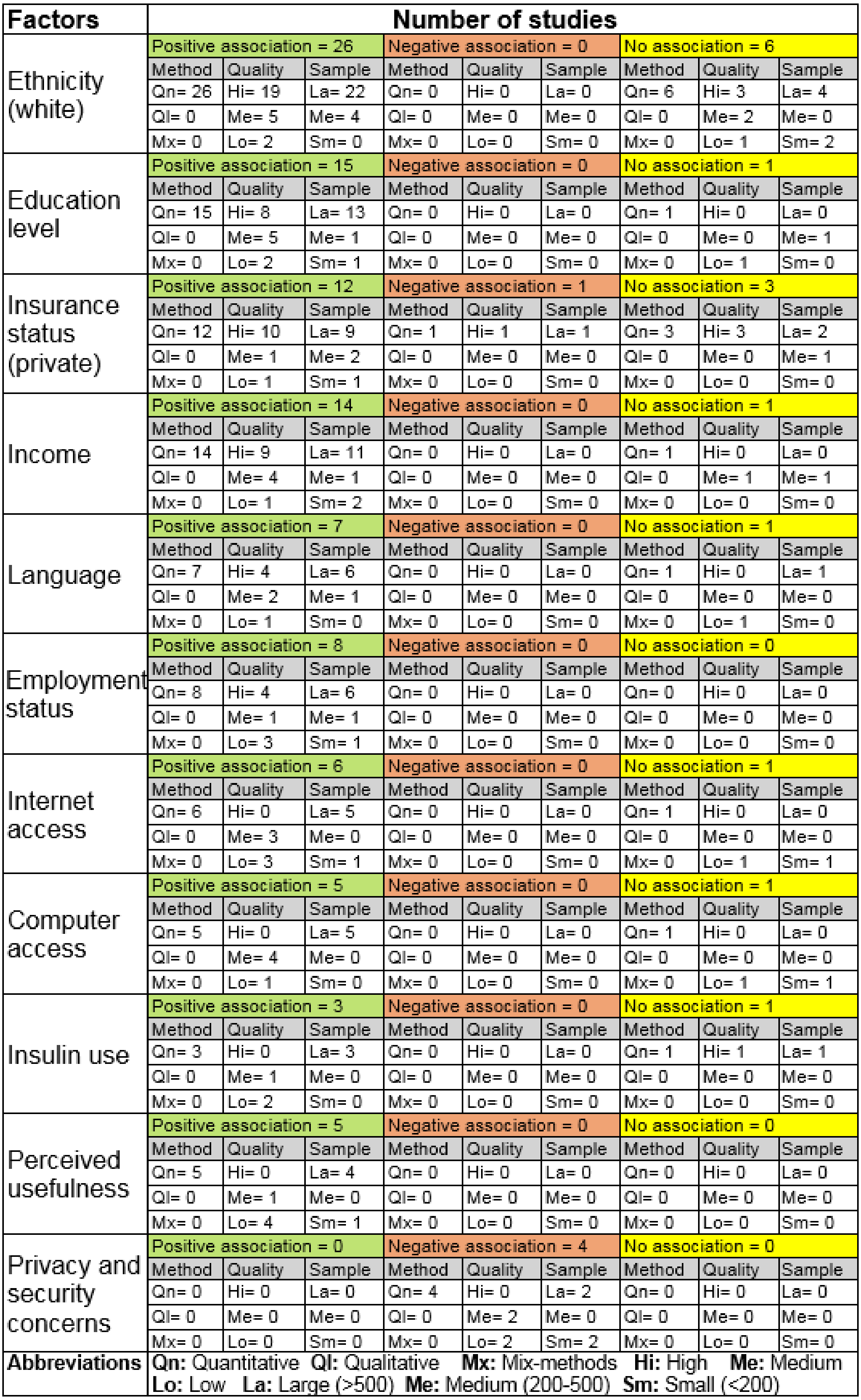
72% female, and a low-quality score (25%). The current review concluded that having computer access increases the probability of using ePHRs.

Four studies demonstrated that patients who use insulin are more likely to use the ePHRs,[55,70,71,72] and only one study did not find any association between insulin use and objectively-measured use of ePHRs.[84] It is difficult to make a definitive conclusion related to the effect of insulin use because the latter study has the highest quality score and the largest sample size of all five studies, thus, the factor insulin use did not meet the third condition.

Five studies examined the effect of perceived usefulness, and all those studies found that patients who perceived ePHRs useful are more likely to use the system.[45,48,71,72,76] As there are no any contrary findings to the effect of perceived usefulness, the definitive conclusion regarding this factor is that patients who perceive ePHRs as a useful system tend more to use the system.

The effect of privacy and security concerns on objectively-measured use of ePHRs was tested in four studies.[40,45,48,55] All those studies concluded that patients who have more concerns about the privacy and security of ePHRs are less likely to use the system. As shown in Table 2.11, there are no contrary findings to the effect of privacy and security concerns. The current review concluded that privacy and security concerns negatively affect objectively-measured use of ePHRs.

Table 2.11: Effects of the Most Tested Factors, Study Method, Quality of Objective Use Studies, and Sample Size



Factors	Number of studies								
Ethnicity (white)	Positive association = 26			Negative association = 0			No association = 6		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 26	Hi= 19	La= 22	Qn= 0	Hi= 0	La= 0	Qn= 6	Hi= 3	La= 4
	Ql= 0	Me= 5	Me= 4	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 2	Me= 0
	Mx= 0	Lo= 2	Sm= 0	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 1	Sm= 2
Education level	Positive association = 15			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 15	Hi= 8	La= 13	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0
	Ql= 0	Me= 5	Me= 1	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 1
	Mx= 0	Lo= 2	Sm= 1	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 1	Sm= 0
Insurance status (private)	Positive association = 12			Negative association = 1			No association = 3		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 12	Hi= 10	La= 9	Qn= 1	Hi= 1	La= 1	Qn= 3	Hi= 3	La= 2
	Ql= 0	Me= 1	Me= 2	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 1
	Mx= 0	Lo= 1	Sm= 1	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Income	Positive association = 14			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 14	Hi= 9	La= 11	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0
	Ql= 0	Me= 4	Me= 1	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 1	Me= 1
	Mx= 0	Lo= 1	Sm= 2	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Language	Positive association = 7			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 7	Hi= 4	La= 6	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 1
	Ql= 0	Me= 2	Me= 1	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 1	Sm= 0	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 1	Sm= 0
Employment status	Positive association = 8			Negative association = 0			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 8	Hi= 4	La= 6	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 0	Me= 1	Me= 1	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 3	Sm= 1	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Internet access	Positive association = 6			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 6	Hi= 0	La= 5	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0
	Ql= 0	Me= 3	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 3	Sm= 1	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 1	Sm= 1
Computer access	Positive association = 5			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 5	Hi= 0	La= 5	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 0	La= 0
	Ql= 0	Me= 4	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 1	Sm= 0	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 1	Sm= 1
Insulin use	Positive association = 3			Negative association = 0			No association = 1		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 3	Hi= 0	La= 3	Qn= 0	Hi= 0	La= 0	Qn= 1	Hi= 1	La= 1
	Ql= 0	Me= 1	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 2	Sm= 0	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Perceived usefulness	Positive association = 5			Negative association = 0			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 5	Hi= 0	La= 4	Qn= 0	Hi= 0	La= 0	Qn= 0	Hi= 0	La= 0
	Ql= 0	Me= 1	Me= 0	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 4	Sm= 1	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 0	Sm= 0
Privacy and security concerns	Positive association = 0			Negative association = 4			No association = 0		
	Method	Quality	Sample	Method	Quality	Sample	Method	Quality	Sample
	Qn= 0	Hi= 0	La= 0	Qn= 4	Hi= 0	La= 2	Qn= 0	Hi= 0	La= 0
	Ql= 0	Me= 0	Me= 0	Ql= 0	Me= 2	Me= 0	Ql= 0	Me= 0	Me= 0
	Mx= 0	Lo= 0	Sm= 0	Mx= 0	Lo= 2	Sm= 2	Mx= 0	Lo= 0	Sm= 0
Abbreviations	**Qn:** Quantitative **Ql:** Qualitative **Mx:** Mix-methods **Hi:** High **Me:** Medium **Lo:** Low **La:** Large (>500) **Me:** Medium (200-500) **Sm:** Small (<200)								

2.6 Discussion

In keeping with the PRISMA statement, this section starts with summarising and discussing the main findings of the current review. In the second subsection, strengths and weaknesses of this review were outlined. Lastly, practical and theoretical implications were presented in the conclusion subsection.

2.6.1 Summary of Main Findings

This systematic review aimed to identify the factors affecting patients' use of or intention to use ePHRs. The current review included 79 individual studies. Factors affecting intention to use, subjectively-measured use, and objectively-measured use were examined in 20, 17, and 46 studies, respectively. The quality of objective use studies was higher than the quality of intention and subjective use studies. More specifically, 29 objective use studies have a high-quality score (≥75%) whereas only five subjective use studies and three intention studies have a high-quality score. However, most objective use studies used secondary data extracted from patients' records, and those studies focused mainly on personal factors.

The current review identified more than 120 different factors: 55 factors related to intention to use, 43 factors regarding subjectively-measured use, and 91 factors related to objectively-measured use. Factors regarding each outcome were categorised into groups according to the conceptual framework used by Or and Karsh (2009). In spite of this large number of factors, the current review drew definitive conclusions regarding the effect of only 15 factors. Definitive conclusions regarding the effect of other factors could not be drawn either because many factors were tested by very few numbers of studies (≤ 4 studies), or there was no consensus among the included studies on their effect. This does not mean that those factors are not influential; therefore, they should not be overlooked.

Of the 15 factors that had a definitive conclusion regarding their effects, three factors affected each of intention to use, subjectively-measured use, and objectively-measured use: perceived usefulness, internet access, and privacy and security concerns (see Figure 2.11). Other two factors influenced each of subjectively-measured use and objectively-measured use: income and education level. The effect of the following five factors on only intention to use was concluded: facilitating conditions, internet use, health status, ethnicity, and sex. Two factors influenced only subjectively-measured use: awareness of ePHRs and perceived ease of use. The remaining three factors affected only objectively-measured use: language, employment status, and computer access (see Figure 2.11). The effect of those 15 factors is discussed below.

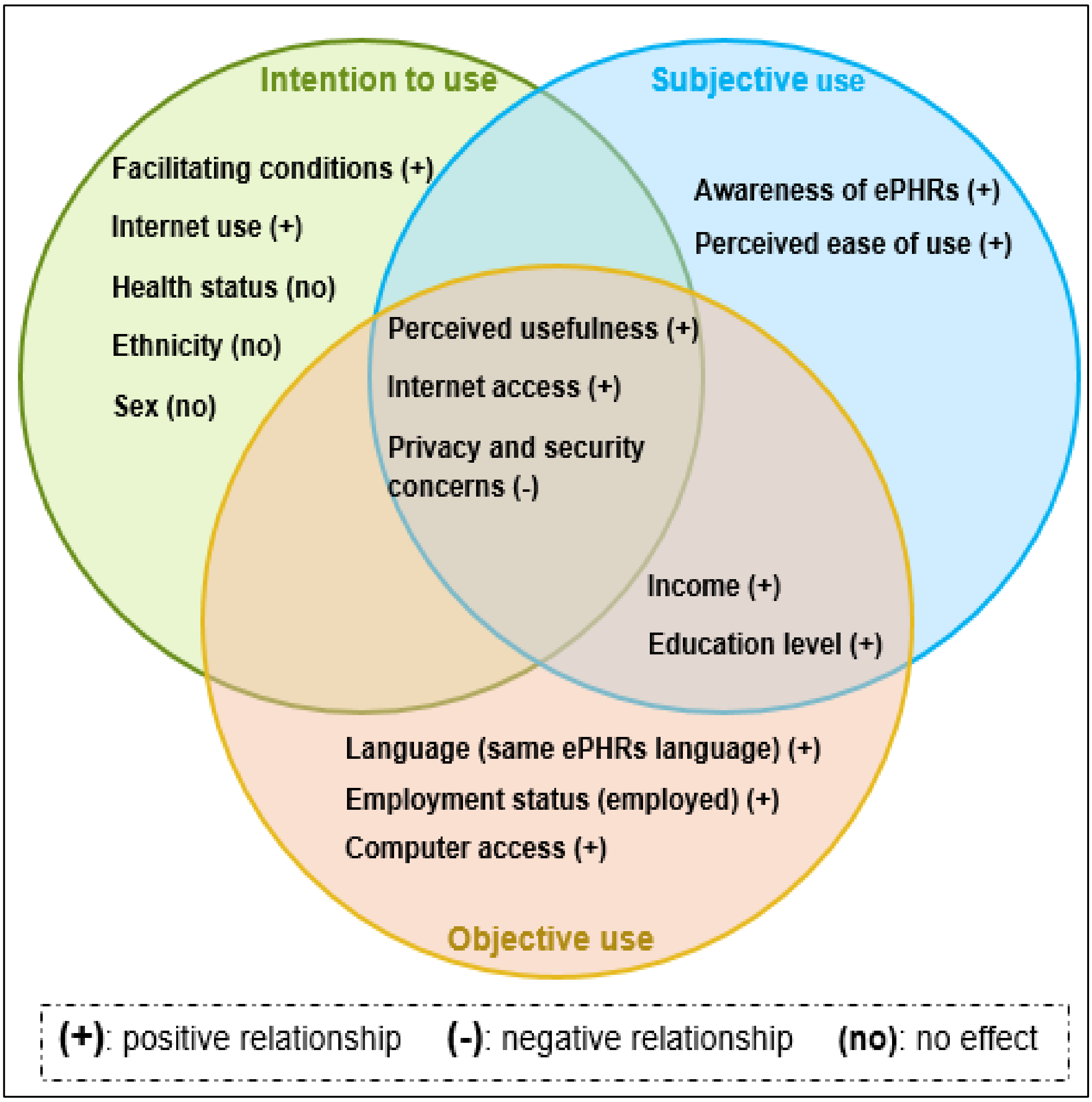


Figure 2.11: Factors that had Definitive Conclusion Regarding their Effect

Starting with perceived usefulness, the current review concluded that patients who perceive ePHRs as a useful system are more likely to use and intend to use it. This effect may be attributed to the fact that perceived usefulness represents the extrinsic motivation of doing any behaviour according to several theories; such as IDT (Rogers, 2003), Motivational Model (MM) (Davis et al., 1992), TAM (Davis, 1989), and UTAUT (Venkatesh et al., 2003). As outlined in Chapter 1, ePHRs have several benefits that are enough to make patients perceive ePHRs as a useful system (e.g. increasing patient empowerment, saving time, saving efforts, enhancing knowledge, and improving patient safety) (Alyami and Song, 2016; Morton, 2012; Pagliari et al., 2007a). This effect of perceived usefulness was supported by several systematic reviews relevant to the current review; Jabour and Jones (2013), Najaftorkaman et al. (2014), Or and Karsh (2009), and Thompson et al. (2016).

The current review drew a conclusion that patients with internet access tend more to use and intend to use ePHRs. This association may be attributed to the assertion that internet access is an essential requirement for using ePHRs, thus, having internet access may reduce patients' perception of barriers of using the system (Wakefield et al., 2012). Further, patients who have internet access are more likely to be internet users and, thereby, they are more likely to have less computer anxiety and higher self-efficacy. Individuals with less computer anxiety and higher self-efficacy tend more to use ePHRs (Archer and Cocosila, 2014; Assadi, 2013; Beenkens, 2011; Daglish, 2013; Klein, 2007a; Laugesen, 2013). The effect of internet access was confirmed by several systematic reviews relevant to the current review; Amante et al. (2014), Najaftorkaman et al. (2014), Or and Karsh (2009), Sakaguchi-Tang et al. (2017), and Thompson et al. (2016).

The following conclusion was drawn regarding the effect of privacy and security concerns: patients who have more concerns about the privacy and security of ePHRs are less likely to use and intend to use them. This effect of this factor may be attributed to the fact that ePHRs typically contain personal and sensitive information, which patients are always concerned about (Daglish, 2013; Howell et al., 2016). This finding is consistent with findings of numerous systematic reviews relevant to the current review (e.g. Najaftorkaman et al., 2014; Powell, 2017; Sakaguchi-Tang et al., 2017; Thompson et al., 2016).

Patients with higher income were more likely to use ePHRs. This positive association may be attributed to the fact that patients with higher income are more likely to have an internet access and computers (Chawla and Joshi, 2018; Cho et al., 2010; Rainie, 2010; Rhee and Kim, 2004; Schickedanz et al., 2013), thus, they are more likely to perceive fewer barriers of using ePHRs. This effect of income was supported by other systematic reviews similar to the current review; Amante et al. (2014), Najaftorkaman et al. (2014), Or and Karsh (2009), and Thompson et al. (2016).

With respect to education level, the conclusion drawn in the current review was that patients with higher level of education are more likely to use ePHRs. This positive association may be attributed to the fact that patients with higher level of education are less likely to find difficulty using the system for the following reasons. Firstly, people with higher level of education are more likely to be computer savvy, use the internet, and have a higher level of health literacy (Baker et al., 2003; Paasche-Orlow et al., 2005; Rainie, 2010; Rhee and Kim, 2004). Secondly, people with higher level of education usually have less computer anxiety (Ellis and Allaire, 1999; Howard and Smith, 1986; Igbaria and Parasuraman, 1989). Thirdly, people with higher level of education have greater ability to learn a new innovation (Agarwal and Prasad, 1999). Lastly, people with a higher level of education are more likely to own the main requirements for using ePHRs; which are computer and internet access (Cho et al., 2010; Schickedanz et al., 2013). Several systematic reviews relevant to the current review confirmed this effect of education level: Amante et al. (2014), Najaftorkaman et al. (2014), Or and Karsh (2009), Powell (2017), and Thompson et al. (2016).

The current review drew the following conclusion regarding the effect of facilitating conditions: patients who perceive that they have enough organisational support (e.g. training, manuals, and technical assistance) are more likely to intend to use ePHRs. This relationship may be attributed to the fact that availability of training, manuals, and technical assistance may make patients more confident in using ePHRs. Facilitating conditions are considered one of the main predictors in several behaviour theories; Model of Personal Computer Utilisation (MPCU) (Thompson et al., 1991), UTAUT (Venkatesh et al., 2003), and TPB (Ajzen, 1985). This finding is consistent with findings of other systematic reviews similar to the current review (e.g. Najaftorkaman et al., 2014; Or and Karsh, 2009; Powell, 2017; Sakaguchi-Tang et al., 2017; Thompson et al., 2016).

It was concluded in the present review that patients who use the internet are more likely to intend to use ePHRs. This may be attributed to the fact that patients who use the internet are more likely to have less computer anxiety and higher self-efficacy, thereby, they tend more to use ePHRs (Archer and Cocosila, 2014; Assadi, 2013; Beenkens, 2011; Daglish, 2013; Klein, 2007a; Laugesen, 2013). The effect of internet use was supported by a systematic review conducted by Or and Karsh (2009).

The current review concluded that patients' health status does not influence their intention to use ePHRs. This may be attributed to the fact that patients with high and poor health status may have the same level of intention to use ePHRs. Specifically, while patients with high health status are more likely to have higher self-efficacy in using the system, they are less likely to perceive that the system is useful for them due to lack of need for interaction with healthcare providers. In other words, patients with good health are able to use the system, but they do not have the extrinsic motivation to use it. In contrast, while patients with poor health status are more likely to perceive that the system is useful for them due to the frequent need of interaction with healthcare providers, they are more likely to have lower self-efficacy in using the system. In other words, patients with poor health have the extrinsic motivation to use it, but they are not able to use it. The following systematic reviews confirmed this effect of health status: Najaftorkaman et al. (2014), Or and Karsh (2009), Powell (2017), and Thompson et al. (2016).

In relation to sex, the current review concluded that sex is not a predictor of intention to use ePHRs. Studies in the current review assessed only the direct effect of sex on the intention to use. However, several scholars recommend researchers to use the factor "sex" as a moderator because it affects differently the direct predictors of intention to use (Alaiad and Zhou, 2015; Faqih and Jaradat, 2015; Richards, 2012; Rho et al., 2015; Venkatesh et al., 2003; Venkatesh et al., 2012; Wu, 2013). For example, while the effect of perceived usefulness on intention to use is stronger among males, the relationship between perceived ease of use and intention to use is stronger among females (Venkatesh et al., 2003; Venkatesh et al., 2012). Accordingly, the findings of studies regarding the effect of sex on intention to use may result from assessing the direct effect of sex instead of moderating effect. In a systematic review similar to the current review, most included studies that assessed the effect of sex found that sex did not affect directly intention to use (Or and Karsh, 2009).

The conclusion drawn in the current review regarding the effect of ethnicity is that there is no relationship between ethnicity and intention to use. As wthe factor "sex", studies in the current review assessed only the direct effect of ethnicity on the intention to use. It is highly advised that researchers assess the moderating effect of ethnicity as it influences differently the direct predictors of intention to use (Goel et al., 2011a; Goel et al., 2011b; Wen et al., 2010). For instance, while the relationship between perceived usefulness and intention to use is stronger among white people (Wen et al., 2010), the effect of ease of use and social influence on intention to use is stronger among non-white people (Goel et al., 2011b; Neufeld, 2015). Consequently, the findings of studies regarding the effect of ethnicity on intention to use may be attributed to assessing the direct effect of ethnicity instead of moderating effect. This finding regarding the effect of ethnicity is consistent with the finding of a systematic review relevant to the current review (Or and Karsh, 2009).

A positive relationship between the awareness of ePHRs and use of ePHRs was concluded in the current review. This relationship may be attributed to the fact that patients need to be aware of the presence of the system and its services in order to make a decision on whether to use or not. Awareness of a presence of an innovation and its functions is considered as the first step of the innovation-decision process according to the IDT (Rogers, 2003). The effect of this factor was supported by two systematic reviews conducted by Powell (2017) and Thompson et al. (2016).

The conclusion drawn in this review regarding the effect of perceived ease of use was that patients who perceive ePHRs as an easy-to-use system are more likely to use it. This may be attributed to the fact that patients need adequate computer and internet skills to use ePHRs. Further, they may need to access it without any help from others to protect their privacy, thereby, the ease of use of the system may be crucial for using it. Perceived ease of use is regarded as an influential factor in various theories and models such as IDT (Rogers, 2003), MM (Davis et al., 1992), TAM (Davis, 1989), and UTAUT (Venkatesh et al., 2003). This effect of perceived ease of use was supported by other systematic reviews similar to the current review (i.e. Najaftorkaman et al., 2014; Or and Karsh, 2009; Sakaguchi-Tang et al., 2017; Thompson et al., 2016).

In regard to language, the present review concluded that patients who are fluent in the same language of the system are more likely to use it. This finding can be reasonably attributed to the assertion that patients whose first language is the same system language are more likely to perceive the system intelligible, and this may make them perceive the system easy to use. Two systematic reviews similar to the current review confirmed this effect of language; Or and Karsh (2009) and Thompson et al. (2016).

With respect to employment status, the review concluded that employed patients are more likely to be users of ePHRs. This positive association may be attributed to the assumption that employed patients are more likely to have an internet access and computers (Cho et al., 2010), thus, they are more likely to perceive fewer barriers to using ePHRs. Further, employed patients are more likely to perceive that ePHRs are easy to use (Noblin, 2010). This finding regarding employment status is consistent with the finding of the following systematic reviews; Najaftorkaman et al. (2014), Or and Karsh (2009), and Thompson et al. (2016).

The last conclusion drawn in the current review was that patients with computer access are more likely to use ePHRs. This association may be attributed to the assertion that computer access is an essential requirement for using ePHRs; thus, having computer access may reduce patients’ perception of barriers for using the system (Wakefield et al., 2012). Further, patients who have computer access are more likely to have less computer anxiety and higher self-efficacy. It is well-known that individuals with less computer anxiety and higher self-efficacy tend more to use ePHRs (Archer and Cocosila, 2014; Assadi, 2013; Beenkens, 2011; Daglish, 2013; Klein, 2007a; Laugesen, 2013). This effect of internet access was supported by several systematic reviews relevant to the current review; Amante et al. (2014), Or and Karsh (2009) and Thompson et al. (2016).

2.6.2 Strengths and Weaknesses

In line with the PRISMA statement, this section was dedicated to determining the strengths and weaknesses of the current review through the following subsections.

2.6.2.1 Strengths

The current systematic review has many strengths that make it a robust review, and these strengths are as follows. First, the current review follows all the applicable PRISMA statement items in order to conduct a systematic, transparent, replicable, and reliable review. Second, of six reviews relevant to the current review (i.e. Amante et al., 2014; Jabour and Jones, 2013; Najaftorkaman et al., 2014; Or and Karsh, 2009; Powell, 2017; Thompson et al., 2016), it is the only review that differentiated between factors affecting the intention to use, subjectively-measured use, and objectively-measured use of ePHRs, and this provides more accuracy in identifying the factors. Third, all study methods that are appropriate for answering the current review question were included in this study. In other words, this review did not focus on a certain empirical method such as qualitative or quantitative. Fourth, it is the only review of the six reviews that tried to reduce the publication bias through including published and unpublished literature (grey studies). Fifth, in comparison with the previous six reviews, it is the only review that used five search sources in order to retrieve the maximum number of relevant studies (i.e. searching bibliographic databases, checking reference lists, hand searching, contacting experts and professionals, and web searching). Moreover, it is the only review that searched 44 different bibliographic databases. Sixth, the search terms in this review were the most comprehensive in all six previous systematic reviews. Seventh, this review appraised the quality of the included studies using a tool that is specifically for reviews that include quantitative, qualitative, and mixed-methods studies. Furthermore, it is the only review that presents the quality of included studies in different ways. Eighth, this review included a large number of relevant studies, which reached 79 different studies. Ninth, this review found the largest number of factors (more than 120 different factors) in comparison with the other six reviews. Tenth, in order to enhance understanding of the effect of factors, the current review used a conceptual framework used by Or and Karsh (2009) for grouping the factors affecting each outcome into main categories (i.e. personal, human-technology interaction, organisational, and social factors). Eleventh, the current review is the first review that drew definitive conclusions regarding the effect of factors, and this was based on predefined criteria developed by the reviewer. Last, the current review identified the type of relationship (i.e. positive, negative, and no relationship) for each factor tested in each study.

2.6.2.2 Weaknesses

Despite these numerous strengths, the current review has the following limitations. First, although investigating factors affecting the use of ePHRs among healthcare providers and caregivers are very important (Haun et al., 2014; Or and Karsh, 2009), this study concentrated on patients' adoption only for the following reasons: (1) ePHRs is designed to be used by patients in the first place, thereby, their adoption is the most important aspect to be assessed. (2) The focus of the main project in this dissertation is patients. (3) The factors that impact the use of ePHRs among providers and caregivers are different to some extent from those affecting patients' adoption (Thompson et al., 2016).

Second, this study focused on the adoption of tethered PHRs, thus, this may mitigate the generalisability of this review to other types of ePHRs (i.e. stand-alone and integrated PHRs). This may be attributed to the fact that standalone and integrated PHRs have features and functions different from the tethered PHRs, thereby, the factors affecting patients' use of each type of ePHRs might be different (Assadi, 2013; Cocosila and Archer, 2014; DesRoches et al., 2010). It was necessary that this study focuses on tethered PHRs because it is the same system type that is used in England (Patient Online) (NHS England, 2017), and it is the most common type in the world (Davis, 2008; Emani et al., 2012; Thompson et al., 2016).

Third, the search process was restricted to studies published in 2000 onwards. This is because the previous reviews found that most studies in this area were published after 2005 (Najaftorkaman et al., 2014), and findings of earlier studies may be different from the recent studies since the huge widespread of the internet and technology in the last two decades. However, this restriction might not affect the findings of this review because this review did not find any relevant study published between 2000 and 2005, and this may indicate that this review has a very low risk of missing studies published before 2000.

Fourth, findings of this review may not be generalisable to other contexts rather than the USA context since most of the included studies (67 studies) were conducted in the USA. Further, none of the included studies in this review was conducted in England.

Fifth, since this review did not exclude studies because of their low-quality, 28 low-quality studies were included in this review. However, including those studies was essential as the purpose of this review is to explore and select the most influential factors in order to be examined empirically in the current project. Further, the quality of studies was considered when drawing conclusions.

Last, data were not synthesised statistically in this review (e.g. meta-analysis). A statistical synthesis could not be performed because of the heterogeneity of included studies in terms of study designs, intervention characteristics, population characteristics, and outcome characteristics. Further, relationships between factors were examined using different statistical analyses; significant test, odds ratio, Pearson’s r, and/or path coefficients. In addition, few studies reported data enough to calculate simple statistics such as odds ratio.

2.6.3 Conclusion

The aim of this review was to systematically review the evidence regarding factors that influence patients’ use of and intention to use tethered PHRs. The review included 79 relevant studies with varied qualities. The studies were grouped into three categories based on the measured outcomes; intention to use, subjectively-measured use, and objectively-measured use. In the current review, 20 studies tested the effect of 55 factors on the intention to use ePHRs, 17 studies assessed the influence of 43 factors on the subjectively-measured use, and 46 studies examined the impact of 91 factors on the objectively-measured use of ePHRs. In spite of this large number of factors, definitive conclusions were drawn regarding the effect of only 15 factors. This is either because most factors were tested by very few numbers of studies, or studies found contrary findings. Based on the conclusions drawn in the current review, practical implications are formulated in the next subsection. Then, theoretical implications are outlined in the second subsection.

2.6.3.1 Practical Implications

The findings of this review are very important to inform practices, health systems, policy makers, and ePHRs’ designers about the factors affecting use and intention to use ePHRs. The current review concluded that several personal factors affecting patients’ adoption of ePHRs: income, education, employment status, language, using the internet, and having computer and internet access. Accordingly, providers of ePHRs should assess the characteristics of patients in the setting where the system will be implemented. If their characteristics are not comparable with the characteristics of users of the system that were found in the current review, system providers should postpone the implementation of the system and provide suitable solutions and intervention to convince those groups to use the system. For example, providers should offer computer and internet access with discounted prices for those who do not have them and cannot afford them, or they should provide computers and internet access in public places, such as public libraries, city halls, and healthcare settings. Another instance is that designers of ePHRs should develop a system with different languages if there is more than one language spoken in a community where the system is implemented (Ochoa III et al., 2017).

As the current study concluded that patients who perceive ePHRs as a useful system are more likely to use and intend to use it, developers of ePHRs should consider incorporating functions and features that fit patients' preferences and desires. To this end, patients should be involved in the process of designing and developing the system so as to identify the required functions of ePHRs and information that patients would like to see in their records. Further, practices must perform advertising campaigns regarding benefits of ePHRs before and after implementation process to increase the perceived usefulness of ePHRs.

The current review inferred that patients who perceive ePHRs as an easy-to-use system are more likely to use it. Therefore, developers of ePHRs should involve potential users in the process of designing and developing the system. Further, they should pilot test the system using potential users before implementing it to determine any difficulty to use. Moreover, ePHRs should present patients' medical records in a clear and understandable way and without medical jargons. In this regard, developers should embed a feature that assists patients to understand medical terms and numbers and complex health information. Practices should give patients a chance to try a beta version of the system through a computer in a waiting room to enhance their perceptions of its ease of use.

This review inferred that patients with high concerns regarding the privacy and security of ePHRs are less likely to use or intend to use ePHRs. Therefore, developers of ePHRs should keep patient records as private as possible by protecting the system using strong security measures, such as strong firewalls, complex and long passwords, regular security reviews, and regular website updates. Additionally, policy makers should develop a policy to assure handing out the usernames and passwords in an appropriate and correct way. Further, practices should alleviate privacy and security concerns by advertising campaigns, which assure patients that the website is secure, and third parties or unauthorised people cannot get access to their records. These advertising campaigns should inform patients about the security measures used in protecting the system, the laws and regulations that practices follow to protect their privacy, how they can use it safely, and how to deal with any suspicious and hacking activities.

This review concluded that facilitating conditions positively affect the intention to use ePHRs. Therefore, practices should provide patients with manuals and guidelines demonstrating how they can use the system. Such guidelines should be simple, understandable, and in different formats (e.g. written, video, and audio). The guidelines should be written and recorded in spoken languages in the community where the system is implemented. Furthermore, practices should provide online assistance and technical support so as to solve any technical issues that face patients when using the system. It also seems advisable that practices educate patients how to use Patient Online through practical training sessions. The abovementioned facilitating conditions (i.e. guidelines, technical support, and training sessions) should be provided more for patients who are unemployed, nonusers of the internet, with lower level of education, with lower income level, and without computer and internet access.

The current review found that patients who are aware of the presence of the system and its functions are more likely to use it. Accordingly, practices should increase patients' awareness of the system using advertising campaigns through different marketing channels, such as public media (e.g. television, radio, and newspapers), social media (e.g. Facebook, Twitter, and YouTube), emails, mails, automated messages on practices' telephone system, and advertisements in general public areas (e.g. shopping centres, healthcare settings, highway streets, and universities). In addition to these channels, face-to-face communication may be one of the most effective ways to increase the awareness of ePHRs (Andrews and Shimp, 2017; Kotler and Armstrong, 2017); physicians, nurses, and receptionists can play an important role in improving the publicity of ePHRs.

2.6.3.2 Theoretical Implications

Theoretical implications are formulated in this section based on the flaws of included studies and limitations of the current review. All included studies examined independent variables and dependent variables at one point in time. For this reason, those studies are subject to the common method bias (CMB) (Assadi, 2013; Bhattacherjee, 2012; Gebauer et al., 2013). This bias results from assessing dependent and independent variables at the same time and/or using the same data collection instrument (questionnaires) (Bhattacherjee, 2012; Campbell and Fiske, 1959). CMB inflates the results of analysis and, thereby, it can lead to invalid conclusions (Podsakoff et al., 2003; Straub et al., 2004). Therefore, future researchers should avoid this bias through examining the independent variables and dependent variables at two different points in time and using two different instruments (such as questionnaires, system logs, and patient records). The current research will address this shortcoming by there being time between the measurement of independent variables (e.g. performance expectancy and effort expectancy) and the measurement of dependent variable (i.e. use behaviour), and by using two different data collection instruments (i.e. questionnaires and system logs).

The majority of studies in this review were carried out in the USA (69/79). Therefore, the findings of this review cannot necessarily be generalised to other countries because the factors that affect the use of ePHRs may be different from contexts to contexts and from country to country. Researchers should conduct studies in other developed countries such as England in addition to developing countries. The empirical study in this project will be carried out in England.

Of all included studies, only 11 studies were theory-based though using a theoretical framework has several benefits, as mentioned in Section 1.3. Further, the majority of those 11 studies utilised TAM despite the existence of other competing theories such as UTAUT and TRA. Hence, the current review recommends researchers to conduct more theory-based studies and adopt other theories rather than TAM. In line with this recommendation, the current research will be a theory-based study.

The methodological quality of quantitative studies included in this review was moderate. To be more precise, representativeness of the sample, appropriateness of measurements, comparability of groups, and completeness of outcome data were met by 42%, 53%, 67%, and 49% of studies, respectively. Therefore, researchers should consider these four quality criteria when conducting quantitative studies. Most qualitative studies in the current review met all quality criteria except the fourth criterion (i.e. considering the researchers' influences). Thus, researchers should pay more attention to explain how their perspective, role, and interactions with participants affected the findings of their qualitative studies. In respect to the mixed-methods studies, of 11 quality criteria, only two criteria were met by most of the studies (i.e. considering the context effect and appropriateness of the design). Thus, future mixed-methods studies should focus on the 11 criteria. All quality items of the MMAT will be considered in the current empirical study.

Most of the studies included in the current review focused on personal factors. To put it differently, while the effect of social factors on the objectively-measured use was not tested by any study, its effect on the intention to use and subjective use was assessed by only two and one studies, respectively. Likewise, the effect of organisational factors on use and intention to use was examined by very few studies. Future studies should pay more attention to social and organisational factors. The current study will assess factors from different groups (i.e. personal, human-technology interaction, organisational, and social factors).

Although the studies in this review tested more than 120 factors, several factors were not tested at all, such as environmental factors (e.g. lighting, temperature, ventilation, and noise) (Salvendy, 2001; Sanders and McCormick, 1998). Other factors were tested by studies included in other reviews but not this review (because they did not meet all eligibility criteria); such as health consciousness, perceived complexity of treatment, autonomy, self-management perception, provider quality measure, trust in the provider, interoperability, promotional ads, and social divide. Consequently, the present review recommends researchers to take into account the abovementioned factors when examining the factors affecting adoption of ePHRs. These factors were not ultimately considered in the current study as it followed a systematic way to develop the model (see Section 3.2), and adding them to the developed model will make the model non-parsimonious and difficult to be examined.

Assessing moderating and mediating effects on relationships between the independent variables and dependent variables enhances understanding of factors that affect the adoption (Or and Karsh, 2009). However, no study included in this review examined moderating and mediating effects on the proposed relationships. Therefore, future research should test the effect of moderators and mediators. The current research will propose moderators and mediators.

As mentioned before, this review focused on factors that influence the initial use of and intention to use ePHRs. Therefore, studies that assessed the effect of factors on continuing use were excluded. Identifying the factors that impact the continuing use is considered very important since long-term viability and eventual success of information technology count on its continuing use more than initial use (Bhattacherjee, 2001; Forquer et al., 2014; Gebauer et al., 2013; Nijland et al., 2011). As a consequence, further studies and systematic reviews should be carried out to assess factors that affect continuing use of ePHRs. The current research will not examine factors that affect continuing use of ePHRs as this requires the researcher to employ longitudinal survey design, and this design is risky and impractical for projects restricted with time and resources (Bowling, 2014; Collis and Hussey, 2014; Saunders et al., 2015).

This review focused on factors that affect the use of tethered PHRs. Thus, studies that assessed other types of ePHRs were not included in this review. While there are likely to be several common factors, researchers should conduct other reviews to identify the factors affecting the use of integrated and standalone PHRs. The current review did not follow this recommendation since tethered PHRs is the most common type of ePHRs (Davis, 2008; Emani et al., 2012; Thompson et al., 2016), and is the system type used in England (Patient Online) (NHS England, 2017).

Lastly, this review focused on factors that affect ePHRs use only among patients. Since the factors that impact use of ePHRs among physicians and caregivers may differ from factors that influence use of ePHRs among patients, further reviews should be carried out to assess the factors that affect ePHRs use among physicians and caregivers. The current research did not address this recommendation as Patient Online is designed to be used by healthcare consumers in the first place (NHS England, 2017).

2.7 Chapter Summary

This chapter achieved the first aim of the main study which is to systematically review the evidence regarding factors that influence patients' use of or intention to use ePHRs. To begin with, the concept of the "systematic review" was defined. Then, the research aim and objectives were outlined.

Selection of the review methods started with determining and justifying the study eligibility criteria according to seven characteristics of studies: population, intervention, outcome, study design, the language of study, year of publication, and type of publication. Then, the current review identified five search sources: bibliographic databases, hand searching, backward and forward reference list checking, contacting experts and professionals, and searching two web engines. Three groups of search terms were developed according to population, intervention, and outcome. For selecting studies, the reviewer screened the title and abstract, and then he read the full text of studies that included from scanning the title and abstract. The data were extracted using data extraction form. The current review used the Mixed Methods Appraisal Tool (MMAT) for assessing the quality of included studies. The findings of studies were synthesised narratively in this review. The factors were categorised into subgroups based on a conceptual framework used by Or and Karsh (2009). The reviewer identified three conditions in order to draw a conclusion regarding the effect of a factor.

The number of all included studies from all search sources reached 79. Most included studies were quantitative, survey, journal article, published in the USA, published between 2012 and 2016, and not theory-based studies. The study quality was low (≤25%) in 31, moderate (%50) in 14 studies, and (≥75%) high in 34 studies. The current review identified more than 120 different factors: 55 factors related to intention to use, 43 factors regarding subjectively-measured use, and 91 factors related to objectively-measured use. In spite of this large number of factors, the current review was able to draw definitive conclusions regarding the effect of only 15 factors, which are: perceived usefulness, internet access, privacy and security concerns, income, education level, facilitating conditions, internet use, health status, ethnicity, sex, awareness of ePHRs, perceived ease of use, language, employment status, and computer access.

The discussion section started with summarising and discussing the main findings of the current review. Then, strengths and weaknesses of the present review were outlined. Lastly, practical and theoretical implications were presented in the conclusion subsection.

Chapter Three:

Conceptual Model Development

Chapter 3 Conceptual Model Development

3.1 Introduction

This chapter is devoted to achieving the second objective of the current study; which is to develop a conceptual model suitable for the context of ePHRs adoption. This chapter starts with explaining the processes of developing a conceptual model in Section 3.2. In Section 3.3, the researcher reviews the main theories and models relevant to human behaviour and technology adoption. Section 3.4 shows the process of selection of an appropriate model for the context of this study. In Section 3.5, the selected model is tailored to the context of this study by selecting and mapping the constructs relevant to the current study. The researcher defines the selected constructs and identifies the relationship between them in Section 3.6. The final conceptual model is presented in Section 3.7. This chapter is summarised in the final section (3.8).

3.2 Process of Conceptual Model Development

According to Walker and Avant (2011), developing a conceptual model consists of two processes; derivation and synthesis (see Figure 3.1). The derivation process entails three steps; conducting an extensive review of literature in other disciplines (e.g. psychology, sociology, and information systems), choosing a suitable theory, and tailoring the selected theory to examine a phenomenon of interest (Walker and Avant, 2011). The synthesis process comprises three steps; defining the concepts of each construct in a way suitable for the phenomenon of interest, specifying relationships between constructs, and presenting constructs and propositions in a well-organised model (Walker and Avant, 2011). The current study followed the above-mentioned steps in order to develop the conceptual model. More details about these steps are provided in the following five sections.

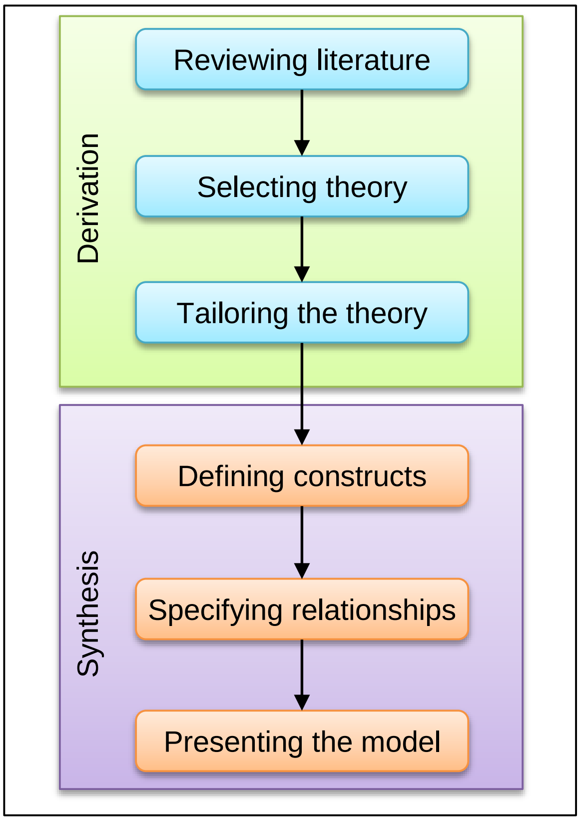


Figure 3.1: Steps of Model Development

3.3 Overview of Behavioural Theories and Models

In this section, the researcher aimed to perform the first step of the model development by reviewing behavioural theories and models originated from various disciplines such as psychology, sociology, and information systems. Several theories and models have been adopted and adapted in similar contexts of the current study. However, the scoping review and the systematic review showed that twelve theories could be adopted in the context of ePHRs and CHITs. Thus, those theories and models were explored in this section.

3.3.1 Innovation Diffusion Theory (IDT)

In 1962, a sociologist, Rogers, developed the Innovation Diffusion Theory (IDT) to understand how a new innovation spread through a certain social system (Rogers, 2003). He defined diffusion as *“the process by which an innovation is communicated through certain channels over time among the members of a social system”* (Rogers, 2003, p.5). Innovation also was defined as an idea, behaviour, product, or device that is new from the individual’s perspective (Rogers, 2003). Despite this definition of innovation, Rogers focused mainly on technological innovations (Rogers, 2003). According to the IDT, there are four main elements affect diffusion of an innovation, which are: an innovation, communication channels, time, and social system (Rogers, 2003) (see Figure 3.2).

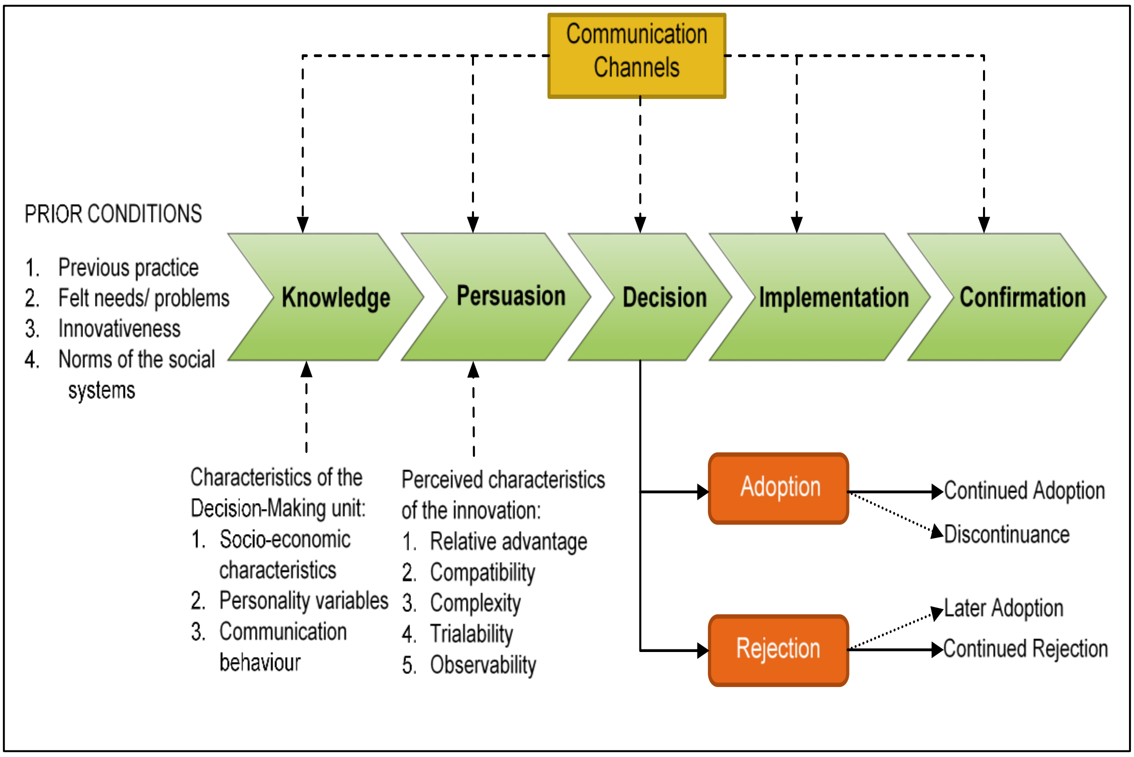


Figure 3.2: Innovation Diffusion Theory (Rogers, 2003)

Starting with the first element (i.e. innovation), Rogers (2003) identified five characteristics of an innovation that influence the adoption of that innovation: (1) relative advantage, which refers to "*the extent to which an innovation is perceived as being better than the idea it supersedes*" (Rogers, 2003, p.229); (2) complexity, which refers to "*the degree to which an innovation is perceived as difficult to understand and use*" (Rogers, 2003, p.257); (3) observability, which refers to "*the degree to which the results of an innovation are observable to others*" (Rogers, 2003, p.258); (4) compatibility, which refers to "*the degree to which an innovation is perceived as being consistent with the existing value, past experiences and needs to potential adopters*" (Rogers, 2003, p.240); and (5) trialability, which refers to "*the degree to which an innovation may be experimented with a limited basis*" (Rogers, 2003, p.258). Rogers (2003) acknowledged that these are not only influential characteristics of an innovation, but they are the most important according to previous literature.

Rogers (2003) defined the second element (communication channels) as methods by which individuals transfer their messages and information to attain a common understanding. The type of communication channels affects diffusion of an innovation (Rogers, 2003). Specifically, mass media channels (e.g. television, radio, and newspapers) are very rapid and influential in raising potential adopters' awareness and knowledge of the presence of an innovation. Additionally, interpersonal channels (e.g. face-to-face communication) are more efficient means to persuade potential adopters to adopt an innovation (Rogers, 2003).

With regard to the third element (i.e. time), Rogers (2003) determined three aspects of diffusion that time dimension is involved in. The first is the innovation-decision process, which refers to the mental process that potential adopters follow in order to adopt an innovation. This process composes of five stages: *knowledge* where potential adopters become aware of the presence of an innovation and its functions; *persuasion* where potential adopters form an attitude towards that innovation based on the previous stage; *decision* where potential adopters take a decision to adopt or reject the innovation; *implementation* where potential adopters implement the innovation; and *confirmation* where individuals reinforce their decisions regarding adoption or rejection of the innovation (see Figure 3.2). The second aspect of time element is innovativeness which means the individual's speed in adopting an innovation in a social system. Rogers (2003) classified individuals in a social system into five groups according to their innovativeness: innovators, early adopters, early majority, late majority, and laggards. While innovators are the first group who adopt an innovation, laggards are the last group who do so. The last aspect is the rate of adoption which refers to the number of individuals in a social system who adopt the innovation in a certain period of time.

In relation to the last element, a social system is defined as a group of interconnected units who participate in solving problems to achieve a common goal (Rogers, 2003). Rogers (2003) specified five aspects of a social system that affect diffusion of an innovation: the social structure of the system, system norms, opinion leaderships and change agents, types of innovation decisions, and consequences of innovations.

Roger's theory has been criticised by several scholars. Firstly, most studies that Rogers reviewed to develop his theory assessed the diffusion of expensive innovations (Emani et al., 2012). However, the theory has been successfully adopted by researchers to examine the diffusion of inexpensive and free innovations (e.g. Baird, 2012; Emani et al., 2012; Rao, 2014). Secondly, Wolfe (1994) doubted the ability of IDT to predict the diffusion of varied types of innovation by different types of adopters in different contexts using one model. Thirdly, the IDT disregarded the effect of technical and physical facilities (Downs and Mohr, 1976). Lastly, in the ePHRs context, three studies of those retrieved by the systematic review (Chapter 2) examined the effect of the five characteristics of an innovation identified by Rogers's theory (Baird, 2012; Emani et al., 2012; Rao, 2014). However, those studies adapted the IDT by adding different external factors such as privacy and security concerns, interoperability, and health status. This may indicate that characteristics of innovation stated by Rogers are not enough to address health information technology diffusion.

3.3.2 Theory of Reasoned Action (TRA)

A social psychological theory called the Theory of Reasoned Action (TRA) was developed by Fishbein and Ajzen (1975) to examine predictors of consciously intended behaviours. This theory formed the base of other subsequent theories such as TPB, TAM, and UTAUT (they are discussed in the following subsections) (Ajzen, 1991; Davis, 1989; Venkatesh et al., 2003). The main assumption of TRA is that individuals are typically rational and depend on their beliefs and conscious analysis of their knowledge in order to make a decision about certain behaviour (Fishbein and Ajzen, 1975). According to TRA, actual behaviour is determined by behavioural intention, which refers to the degree to which an individual wills or desires to do (or not to do) a certain behaviour (Fishbein and Ajzen, 1975). Behavioural intention is a function of individuals' attitudes (personal influence) and subjective norms (social influence) (see Figure 3.3). Fishbein and Ajzen (1975, p.216) defined attitudes towards a behaviour as "*an individual's positive or negative feelings (evaluative effect) about performing the target behaviour*". Subjective norms here refers to "*the person's perception that most people who are important to him think he should or should not perform the behaviour in question*" (Fishbein and Ajzen, 1975, p.302). As shown in Figure 3.3, there are two determinants of attitudes towards a behaviour: (1) behavioural beliefs, which refer to individual's perceptions and beliefs about outcomes or consequences of performing the behaviour; (2) outcome evaluation, which refers to individual's evaluations of the importance of these outcomes (Fishbein and Ajzen, 1975). Similarly, subjective norms are determined by two predictors: (1) normative beliefs, which refer to individual's beliefs that people important and influential to him/her think he/she should (should not) perform the behaviour; (2) motivation to comply, which refers to individual's motivation to comply with expectations and recommendations of those people (Fishbein and Ajzen, 1975).

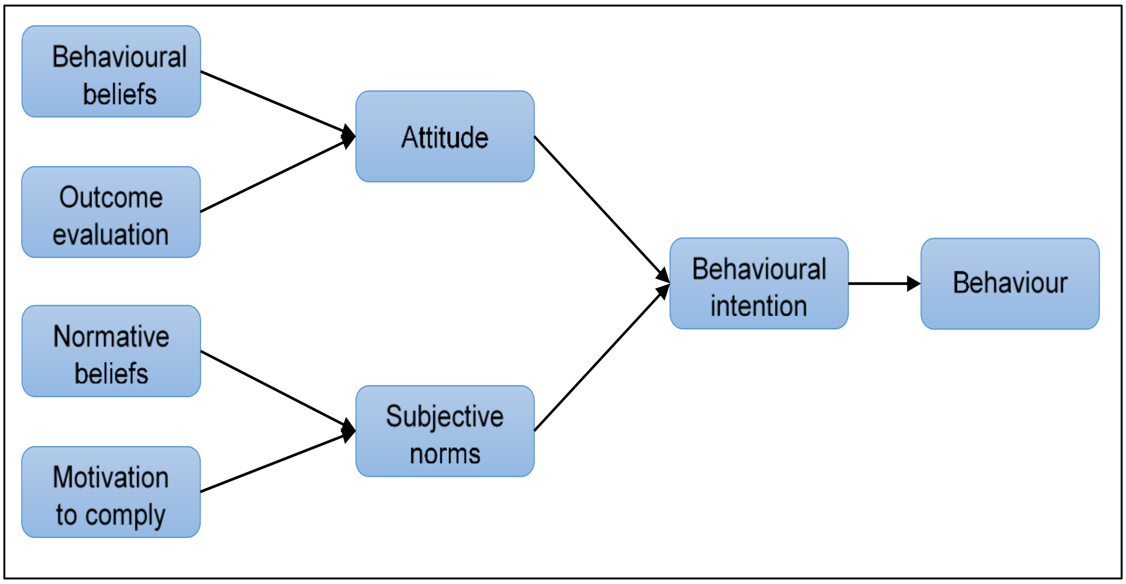


Figure 3.3: Theory of Reasoned Action (Fishbein and Ajzen, 1975)

In spite of the wide use of TRA by researchers from different areas, it has several shortcomings (Davis, 1989; Sheppard et al., 1988). One of the most salient flaws of TRA is that it is only appropriate for identifying predictors of behaviours that are under a person’s volitional control (Ajzen, 1985; Sheppard et al., 1988). In other words, TRA is not appropriate for predicting behaviours that need skills, resources (e.g. internet access and computers), and opportunities (e.g. time) because individuals without skills, resources, and/or opportunities may not be able to do the behaviour though they have a strong intention to do it (Davis et al., 1989; Liska, 1984; Sheppard et al., 1988). TRA was also criticised for its inability to predict irrational, habitual, and spontaneous behaviours that are not consciously considered (Ajzen, 1985; Beenkens, 2011). Another limitation claimed by Davis et al. (1989) is that TRA does not identify the beliefs that work for a certain behaviour as it is a general model. Moreover, Hale et al. (2002) criticised TRA because it does not posit any relationship between subjective norms and attitudes while several studies found that social norms affect attitudes such as Greene et al. (1997), Park (2000), and Shepherd and O'keefe (1984). Lastly, TRA has been criticised because it posits that attitude and subjective norms are the only predictors of a voluntary behaviour, and other external factors may affect the behaviour indirectly only through attitude and subjective norms (Davis, 1989; Hale et al., 2002). Thus, opponents of TRA argued that other factors should be added to the theory which may affect a behaviour without the mediating effects of attitude and subjective norms; such as affect, previous behaviours, and moral obligations (Hale et al., 2002).

3.3.3 Theory of Planned Behaviour (TPB)

As mentioned earlier, TRA was criticised because of its inability to explain behaviours that are not under a person’s volitional control (Ajzen, 1985; Sheppard et al., 1988). To overcome this flaw, Ajzen (1985) extended TRA by adding a new predictor called “perceived behavioural control”, which refers to “*the perceived ease or difficulty of performing the behaviour and it is assumed to reflect past experience as well as anticipated impediments and obstacles*” (Ajzen, 1991, p.188). This extended theory is called as Theory of Planned Behaviour (TPB). Ajzen (1985) posits that perceived behavioural control influences directly behaviour through behavioural intention, and, in this case, it does not reflect the actual control. Further, perceived behavioural control affects directly behaviour, and, in this case, it reflects actual control (Ajzen, 1985). Perceived behavioural control is determined by control beliefs and perceived facilitation (Ajzen and Madden, 1986). While control beliefs refer to individual’s perception of availability of essential resources and opportunities required to perform the behaviour, perceived facilitation refers to perceived importance of those resources to facilitate performance of the behaviour (Ajzen and Madden, 1986).

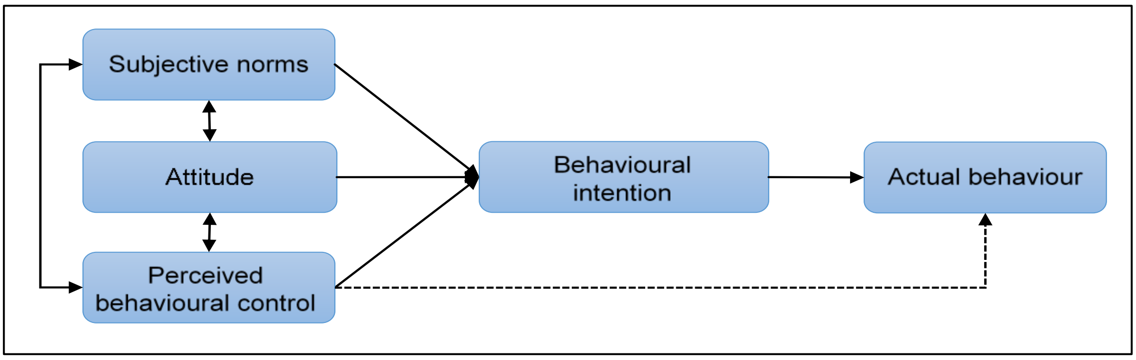


Figure 3.4: Theory of Planned Behaviour (Ajzen, 1985)

In respect to the limitations of TPB, many critics doubted the applicability of TPB in the field of technology adoption because it is a general theory that does not include important factors related to technology use, such as perceived usefulness, perceived risk, moral norms, affect, and habit (Ajzen, 1991; Al Oraini, 2014; Chen et al., 2009; Conner and Norman, 2015; Taylor and Todd, 1995b; Venkatesh et al., 2012; Yousafzai et al., 2010). Several researchers criticised TPB because its unidimensional constructs (i.e. attitude, subjective norms, and perceived behavioural control) include multidimensional beliefs (Taylor and Todd, 1995b; Taylor and Todd, 1995c). In contrast to TRA, this theory is not suitable for examining predictors of behaviours that are under a person’s volitional control (Ajzen, 1985). Lastly, researchers may find the distinction between perceived behavioural control and self-efficacy to be confounding since they appear similar and have a substantial correlation (Ajzen, 2002).

3.3.4 Social Cognitive Theory (SCT)

Drawing on the social learning theory, Bandura (1986) theorised one of the most powerful theories of human behaviour called Social Cognitive Theory (Beenkens, 2011). This theory posits that the human behaviour is influenced by reciprocal interactions between three sets of factors: (1) personal factors that refer to person’s cognitions, traits, drives, and instincts, (2) environmental factors that include social factors and characteristics of physical environments, (3) behavioural factors that indicate consequences of performing a behaviour (Bandura, 1986) (see Figure 3.4). This triadic reciprocity does not mean that those sets of factors have equal strength, or must they happen at the same time (Beenkens, 2011; Logue, 2011).

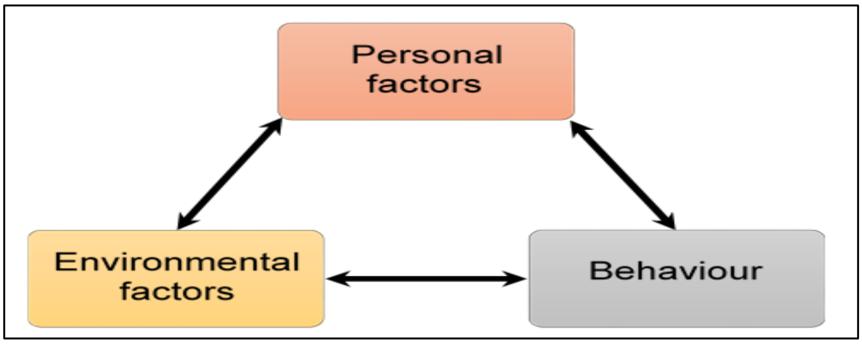


Figure 3.5: Social Cognitive Theory (Bandura, 1986)

Several critics mentioned several flaws of this theory (SCT). Compeau and Higgins (1995) and Munro et al. (2007) criticised the difficulty of operationalising the theory because each construct (i.e. personal, environmental, behaviour factors) may cover an extensive range of factors. This shortcoming was confirmed by three studies in ePHRs contexts, where those studies included a different number of factors that belong to each group (Agarwal et al., 2013; Logue, 2011; Majedi, 2014). Further, while some factors were classified under a certain group of factors (e.g. personal factors) in one study, the same factors were put into a different group in another study. For example, Majedi (2014) classified perceived usefulness and ease of use under personal factors group whereas they were classified under technology factors according to Logue (2011). Another criticism stated by Logue (2011) is that it is not completely clear from this theory how one reaches a behaviour. For example, SCT does not completely explain how individuals use cognitive and affective processes to arrive at behaviour (Logue, 2011). While behavioural intention has been considered as an essential part of most human behaviour theories, it was overlooked in SCT since it focuses on the behaviour itself (Bandura, 1986; Compeau and Higgins, 1995; Chang and Cheung, 2001; Venkatesh et al., 2003). Lastly, SCT is considered as a general theory that can be hard to be applied by itself (Al-Ghamdi, 2012; Logue and Effken, 2012). This was clear in the three studies in the contexts of ePHRs, which they combined SCT with other theories to understand factors affecting ePHRs (Agarwal et al., 2013; Logue, 2011; Majedi, 2014).

3.3.5 Technology Acceptance Model (TAM)

Drawing on the Theory of Reasoned Action (TRA), Davis et al. (1989) developed the Technology Acceptance Model (TAM) in order to explain determinants of computer acceptance, in specific, and technology acceptance, in general. As shown in Figure 3.6, perceived usefulness and ease of use are proposed as direct determinants of behavioural intention which, in turn, affects directly the behaviour. Although attitude was part of the model, it was removed from the final model because its effect as a mediator was not supported, and this made the model more parsimonious (Davis et al., 1989; Dohan and Tan, 2013; Venkatesh et al., 2003; Walldén et al., 2016; Wu et al., 2011). Perceived usefulness is defined by Davis (1989, p.320) as "*the degree to which a person believes that using a particular system would enhance his or her job performance*". Perceived ease of use refers to "*the degree to which a person believes that using a particular system would be free of effort*" (Davis, 1989, p.320). TAM is considered the most parsimonious model to explain technology acceptance (Gartrell, 2014; Holden and Karsh, 2010; Whetstone and Goldsmith, 2009).

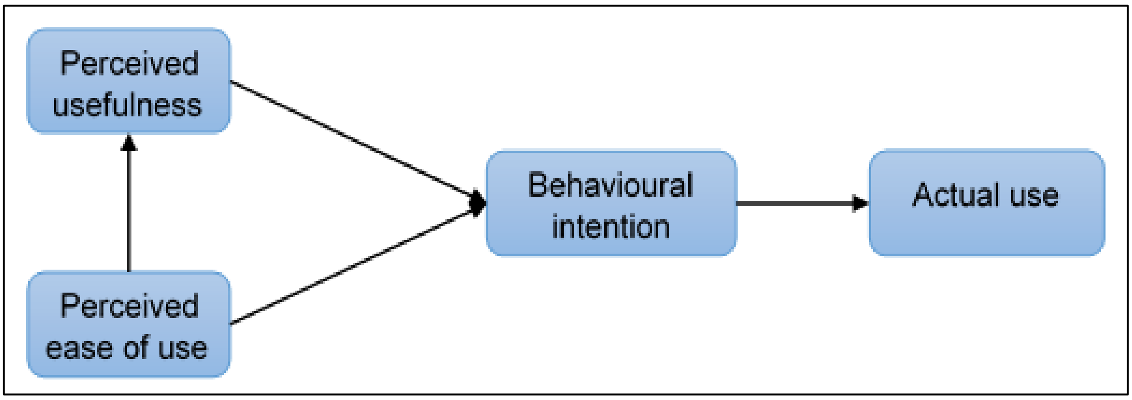


Figure 3.6: Technology Acceptance Model (Davis et al., 1989)

Although TAM has been extensively used in various contexts, it has several shortcomings (Han, 2003; Torres, 2011). Firstly, TAM is not suitable for investigating technology adoption in the healthcare context since it is too simple for exploring complex social situations where factors such as privacy become important (Chau and Hu, 2002; Chismar and Wiley-Patton, 2003; Holden and Karsh, 2010; Legris et al., 2003; Mekawie, 2013; Raitoharju, 2005). This shortcoming is clear through 20 studies retrieved in the systematic review and used TAM as a theoretical framework. Specifically, all 20 studies modified TAM by combining it with other theories or adding other factors (see Appendix 20).

Secondly, TAM has a low predictive power in accounting for behavioural intention and actual behaviour (Curran and Meuter, 2005; Legris et al., 2003; Lu et al., 2009; Sun and Zhang, 2006; Sundarraj and Wu, 2006). Although several studies of the 20 studies that used TAM found a high predictive power, this may be due to the modifications made to TAM by adding some new constructs or combining it with other theories (see Appendix 20).

Thirdly, while TAM focuses on technological factors, it overlooks organisational, social, and personal factors that may affect technology acceptance (Chang et al., 2015; Davis, 1989; Moon and Kim, 2001; Ward, 2013).

Lastly, as with TRA, TAM is considered an inappropriate model to predict non-voluntary behaviours (Torres-Coronas, 2012). Lucas and Spitler (1999) confirmed this limitation when they attributed the failure of TAM to predict use of broker workstations to lack of voluntariness of the behaviour (system use).

In order to overcome abovementioned limitations, Venkatesh and Davis (2000) extended TAM by decomposing perceived usefulness into five other factors, which are: subjective norms, image, results demonstrability, output quality, and job relevance. All these factors affect directly perceived usefulness. Subjective norms also affect directly image and intention to use. Besides, Venkatesh and Davis (2000) introduced voluntariness and experience as moderators of paths from subjective norms to perceived usefulness and intention to use (Figure 3.7). The so-called TAM 2 was validated by a longitudinal study carried out within four different organisations. Use of the system was compulsory in two settings and voluntary in other two settings. The proposed model accounted for 37% - 52% of the variance in intention to use whereas it explained between 44% and 57% of the variance in use behaviour. TAM 2 overcame all limitations of TAM except the first limitation. Further, TAM 2 lost the parsimony of TAM and its applicability to the consumer context since it introduced constructs that are suitable for the employee context (i.e. job relevance and output quality).

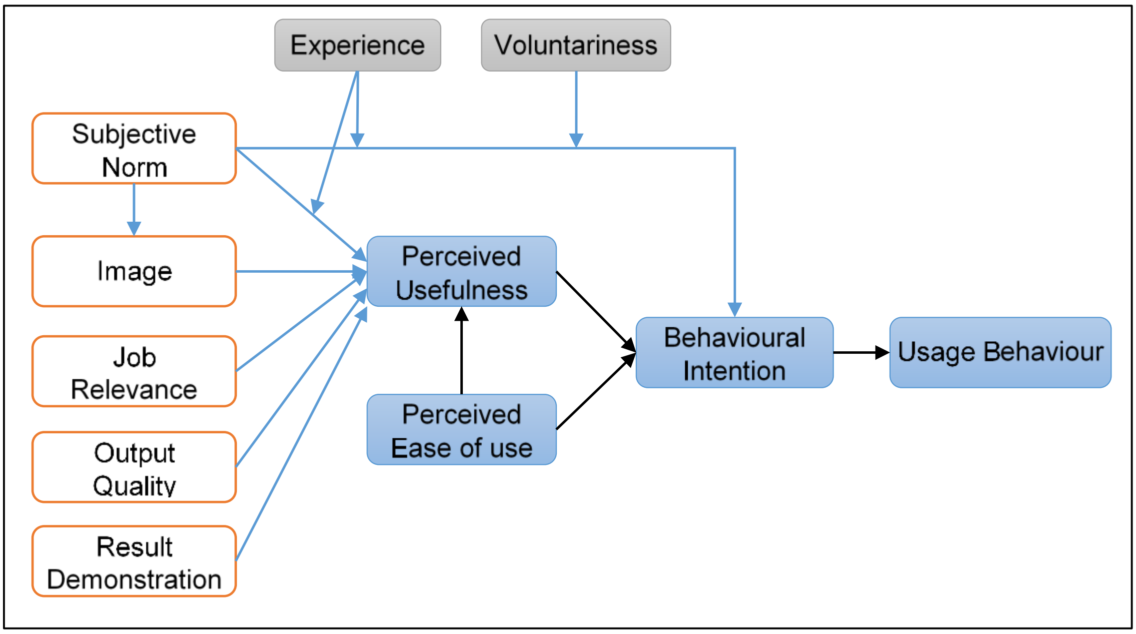


Figure 3.7: Technology Acceptance Model 2 (Venkatesh and Davis, 2000)

TAM 2 was also extended by decomposing the perceived ease of use into six different constructs: computer self-efficacy, computer anxiety, computer playfulness, perceived external control, perceived enjoyment, and objective usability (Venkatesh and Bala, 2008). The so-called TAM 3 posits that all these constructs influence directly perceived ease of use (Venkatesh and Bala, 2008). Further, Venkatesh and Bala (2008) hypothesised that experience moderates all new paths except those from computer self-efficacy and perceived external control to perceived ease of use. Experience also moderates paths from the perceived ease of use to perceived usefulness and behavioural intention (see Figure 3.8). Venkatesh and Bala (2008) tested TAM 3 in the same way TAM 2 was tested. The results showed that TAM 3 accounted for 53% and 35% of the variance in behavioural intention and use behaviour, respectively (Venkatesh and Bala, 2008). In respect to the limitations, TAM 3 has the same limitations of TAM 2 mentioned earlier.

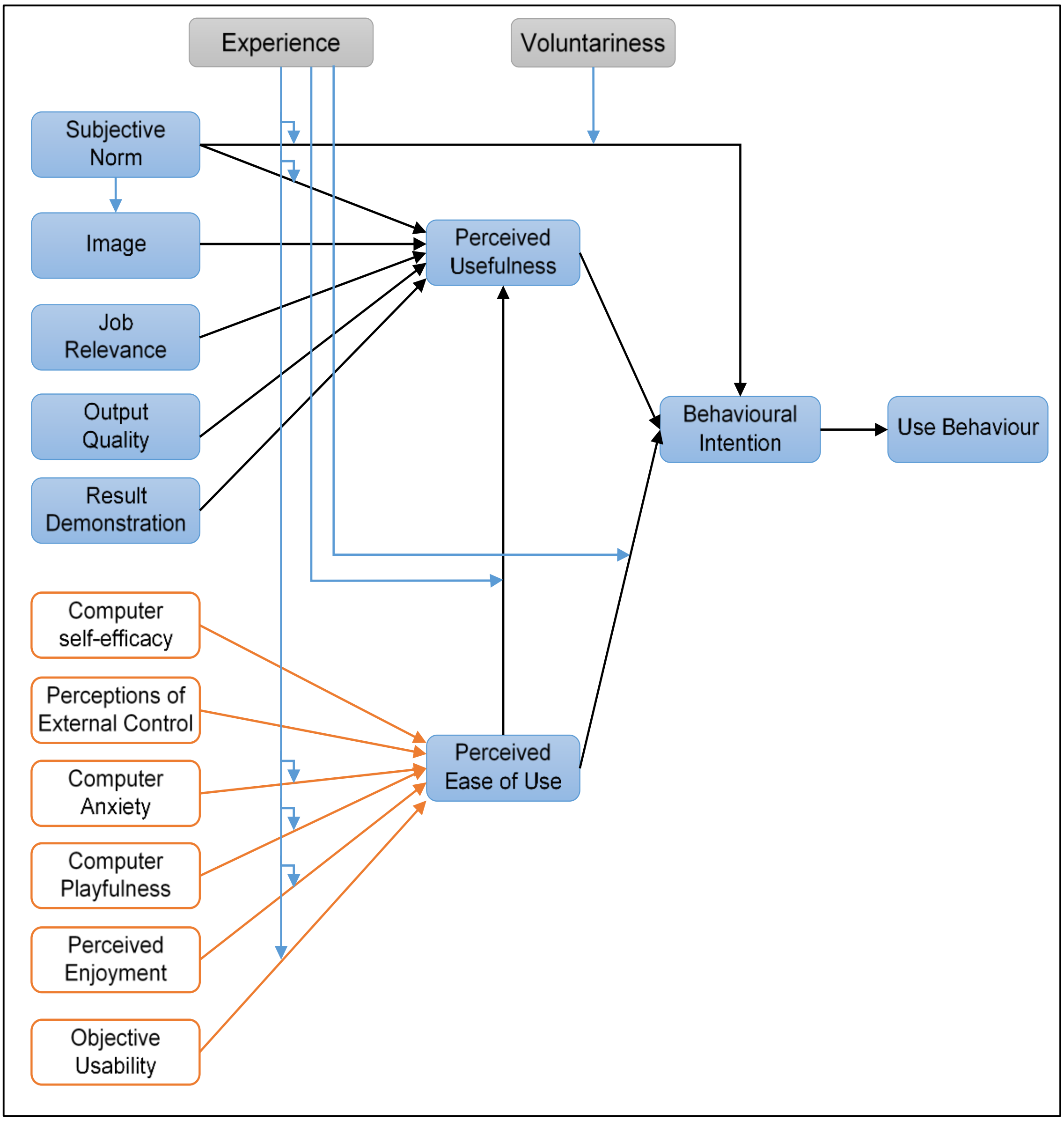


Figure 3.8: Technology Acceptance Model 3 (Venkatesh and Bala, 2008)

3.3.6 Model of Personal Computer Utilisation (MPCU)

The Model of Personal Computer Utilisation (MPCU) was developed by Thompson et al. (1991) in order to understand the determinants of use of personal computers (PC). As shown in Figure 3.9, the use of PCs is affected directly by the following factors: (1) complexity of PC use, which refers to "*the degree to which an innovation is perceived as relatively difficult to understand and use*" (Thompson et al., 1991, p.128); (2) social factors, which is defined as *"the individual's internalization of the reference groups' subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations*" (Thompson et al., 1991, p.126); (3) affect toward PC use, which refers to "*the feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act"* (Thompson et al., 1991, p.127); (4) Job-fit with PC use, which is defined as "*the extent to which an* *individual believes that using a PC can enhance the performance of his or her job*" (Thompson et al., 1991, p.129); (5) facilitating conditions for PC use, which refers to "*objective factors, 'out there' in the environment, that several judges or observers can agree make an act easy to do*" (Thompson et al., 1991, p.129); and (6) long-term consequences of PC utilisation, which refers to *"outcomes that have a pay-off in the future, such as increasing the flexibility to change jobs or increasing the opportunities for more meaningful work*" (Thompson et al., 1991, p.129). After validating the model, Thompson et al. (1991) found the affect toward PC use and facilitating conditions are not a statistically significant predictor of the PC utilisation. The MPCU was able to account for 24% of the variance in the PC use (Thompson et al., 1991).

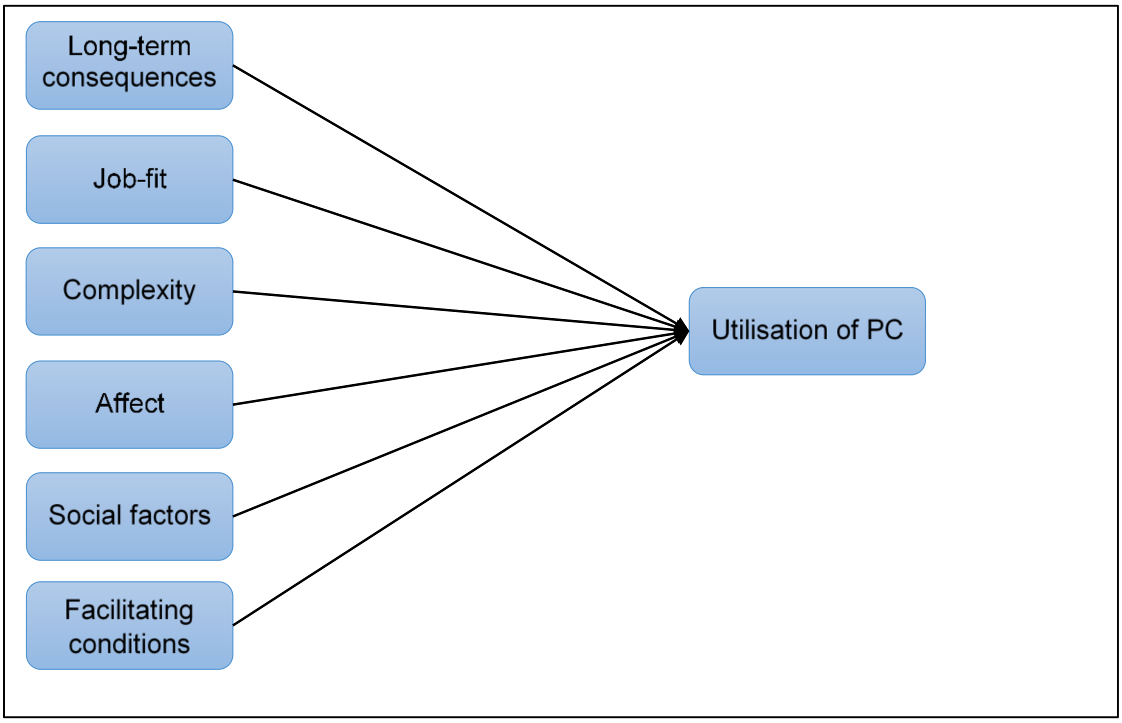


Figure 3.9: Model of Personal Computer Utilisation (Thompson et al., 1991)

A question regarding the applicability of MPCU to different contexts and technologies may be raised by opponents for several reasons. First, the model was developed with the intention to understand predictors of a specific technology (PC) (Thompson et al., 1991). Second, the purpose of MPCU was to help in predicting a volitional behaviour (Thompson et al., 1991), so, it may not be suitable to understand non-volitional behaviour. Third, the context targeted by this theory is a professional work context (Thompson et al., 1991), so, it includes constructs (e.g. job-fit) that may not be suitable to consumer contexts. Lastly, it disregards the effect of behavioural intention that is considered a very significant predictor in most theories (Bandura, 1986; Chang and Cheung, 2001; Compeau and Higgins, 1995; Venkatesh et al., 2003).

3.3.7 Motivational Model (MM)

The motivational model (MM) was developed by Davis et al. (1992) so as to investigate the determinants of computer adoption in place of work. Based on motivational theories, Davis et al. (1992) identified two main motivations of computer adoption: extrinsic motivation and intrinsic motivation. The extrinsic motivation was represented through perceived usefulness while the intrinsic motivation was represented through enjoyment (Davis et al., 1992). Davis et al. (1992, p.1113) defined enjoyment as "*extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated*". MM also postulates that both perceived usefulness and enjoyment affect indirectly the use of computers through behavioural intention (Davis et al., 1992). In addition, Davis et al. (1992) posited that perceived ease of use and perceived output quality influence directly both perceived usefulness and enjoyment. Perceived output quality refers to "*judged by observing intermediate or end products of using the system, such as documents, graphs, calculations, and the like*" (Davis et al., 1992, p.1115). As shown in Figure 3.10, the paths from the perceived ease of use and perceived output quality to perceived usefulness are moderated by task importance. Davis et al. (1992) validated MM through two studies and found that the model was able to account for up to 75% and 40% of the variance in behavioural intention and actual use, respectively.

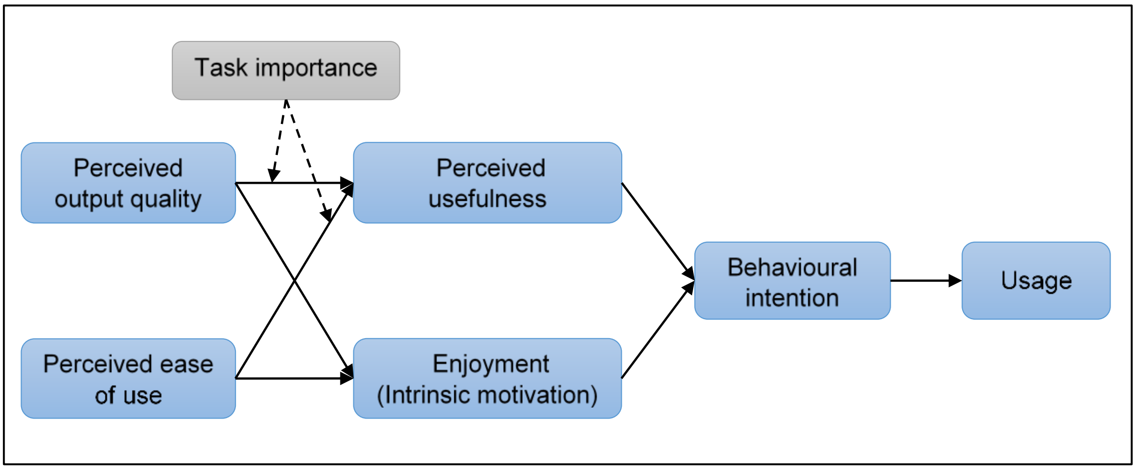


Figure 3.10: Motivational Model (Davis et al., 1992)

Although MM has a good predictive power, its applicability to other contexts was criticised since the aim of developing the model was to understand the determinants of computer adoption in workplaces, and this was clear through adding construct related to workplaces (i.e. task importance) (Davis et al., 1992). Wilson and Lankton (2004) omitted this construct from the model since they studied the adoption of a technology (ePHRs) in a non-professional setting. In addition, MM may not be suitable to investigate the predictors of non-voluntary behaviours since the purpose of the model was to examine the predictors of voluntary behaviours (Davis et al., 1992). Further, Davis et al. (1992) acknowledged that the model misses some important factors such as availability or accessibility of the technology. Davis et al. (1992) also admitted that their model might be affected by selective recall bias that resulted from measuring the actual use subjectively.

3.3.8 Combined TAM and TPB (C-TAM-TPB)

Taylor and Todd (1995a) combined TAM and TPB in order to overcome the shortcomings of TAM and TPB. According to the combined TAM and TBP model (C-TAM-TPB), both perceived usefulness and perceived ease of use were considered as direct predictors of attitude, and perceived ease of use is a direct determinant of perceived usefulness (Taylor and Todd, 1995a). Further, behavioural intention mediates the effect of attitude, subjective norms, perceived behaviour control, and perceived usefulness on behaviour. Perceived behaviour control also affects behaviour directly. Taylor and Todd (1995a) hypothesised that experience moderates all relationships between constructs (Figure 3.11). To validate the model, Taylor and Todd (1995a) used secondary data collected by Taylor and Todd (1995c) to examine the predictors of use of a computing resource centre (CRC) among business school students with and without a prior experience in using the system. They found that all proposed relationships were statistically significant for experienced users except associations between perceived behavioural control and behaviour, perceived ease of use and attitude, and attitude and behavioural intention (Taylor and Todd, 1995a). On the other hand, all proposed relationships were statistically significant for inexperienced users except the associations between attitude and behavioural intention (Taylor and Todd, 1995a). For the experienced group, the model explained 43% and 21% of the variance in behavioural intention and behaviour, respectively (Taylor and Todd, 1995a). For the inexperienced group, the model accounted for 60% and 17% of the variance in behavioural intention and behaviour, respectively (Taylor and Todd, 1995a).

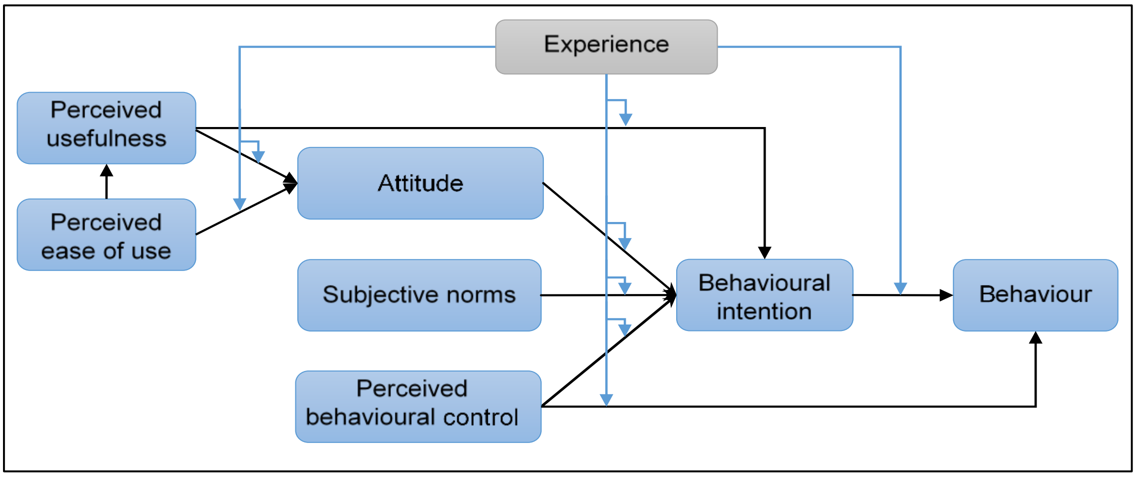


Figure 3.11: Combined TAM and TPB (Taylor and Todd, 1995a)

As outlined earlier, some paths in C-TAM-TPB model were not significant such as those from attitude to behavioural intention and from the perceived ease of use to attitude (Taylor and Todd, 1995a). Accordingly, this model may not be considered as a fully valid model. Applicability of C-TAM-TPB model over contexts where the behaviour is voluntary can be limited because the model includes constructs that are more suitable for predicting non-voluntary behaviour than voluntary behaviours such as perceived behavioural control (Ajzen, 1985). Further, this model was validated using secondary data which might affect the validity of the model because using such data introduces various problems such as poor internal validity, data errors, and biases (Bhattacherjee, 2012). Lastly, C-TAM-TPB model has been criticised because it misses some factors such as intrinsic motivation and other moderators (e.g. age and sex) (Taylor and Todd, 1995a; Venkatesh et al., 2012).

3.3.9 Unified Theory of Acceptance and Use of Technology

Given a multitude of models that could be used in studying technology acceptance, Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT) through reviewing and merging constructs of eight theories/models, which are: IDT, TRA, SCT, TPB, TAM, MPCU, MM, and C-TAM-TPB. Venkatesh et al. (2003) theorised that behavioural intention is affected directly by performance expectancy, effort expectancy, and social influence. Further, they hypothesised that both behavioural intention and facilitating conditions affect directly use behaviour (Venkatesh et al., 2003). Additionally, UTAUT proposes that most these relationships are moderated by age, sex, experience, and voluntariness (see Figure 3.12). Venkatesh et al. (2003) validated UTAUT and demonstrated that it accounted for 70% and 48% of the variance in behavioural intention and use behaviour, respectively.

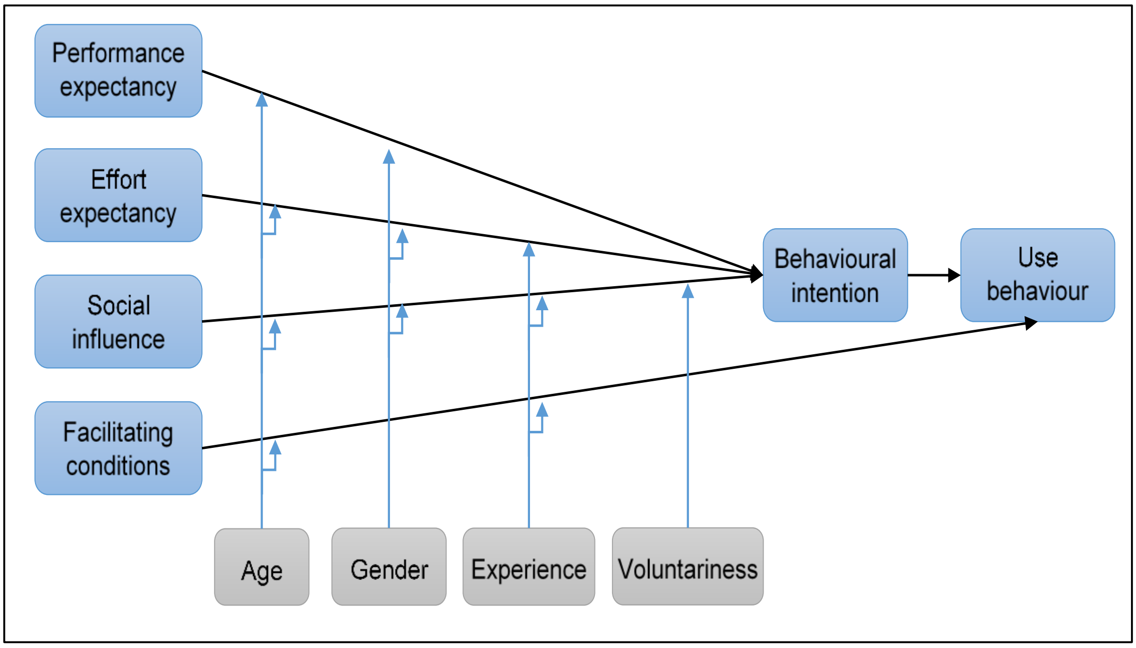


Figure 3.12: Unified Theory of Acceptance and Use of Technology

Several criticisms were pointed out by opponents of UTAUT, most notably: UTAUT is not suitable to explain the technology acceptance among consumers since it aims to understand the adoption of technology among employees (organisational contexts) (Tavares and Oliveira, 2016; Venkatesh et al., 2012). This may be attributed to the fact that UTAUT misses factors that are related to non-organisational contexts such as habit, perceived risk, and price (Dabholkar et al., 2003; Laukkanen et al., 2008; Lin and Hsieh, 2006; Venkatesh et al., 2012). Further, although Venkatesh et al. (2003) found a high predictive power of the model (70%), other studies demonstrated that the predictive power of UTAUT is almost equal to other models/ theories. Dwivedi et al. (2011) confirmed this flaw through a meta-analysis of 43 studies, which found that UTAUT was able to explain 39% and 40% of the variance in behavioural intention and use behaviour, respectively. Lastly, Venkatesh et al. (2003) excluded the construct "attitude" from UTAUT although it was the main predictor of behavioural intention in different theories such as TRA, TPB, and MM. Venkatesh et al. (2003) attributed this to the fact that attitude is a significant determinant of intention only when performance and effort expectancies do not exist in the model. However, a meta-analysis of 162 studies regarding IS acceptance and adoption found that attitude affects directly both behavioural intentions and use behaviour, and it is a mediator of the effects of performance expectancy, effort expectancy, social influence and facilitating conditions on behavioural intention (Dwivedi et al., 2017).

3.3.10 Unified Theory of Acceptance and Use of Technology 2

Venkatesh et al. (2012) extended UTAUT in order to overcome the inapplicability of UTAUT to a consumer context, and they called the new theory UTAUT 2. The extended model included three additional constructs: (1) hedonic motivations; which refers to "*the fun or pleasure derived from using a technology*"; (2) price value, which refers to "*consumers' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them*"; and (3) habit "*the extent to which people tend to perform behaviours automatically because of learning*" (Venkatesh et al., 2012, p.161). As depicted in Figure 3.13, behavioural intention is influenced directly by performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and habit. Further, behavioural intention, facilitating conditions, and habit affect directly use behaviour (Venkatesh et al., 2012). Most of those relationships are moderated by age, sex, and experience (Venkatesh et al., 2012). Venkatesh et al. (2012) tested the proposed model (UTAUT 2) by conducting a two-stage survey among 1512 current consumers of mobile internet technology in Hong Kong. Venkatesh et al. (2012) demonstrated that all relationships proposed in UTAUT 2 were significant except the effect of the moderator experience on the relationship between facilitating conditions and behavioural intention. UTAUT 2 explained 74% of the variance in behavioural intention and 52% of the variance in use behaviour.

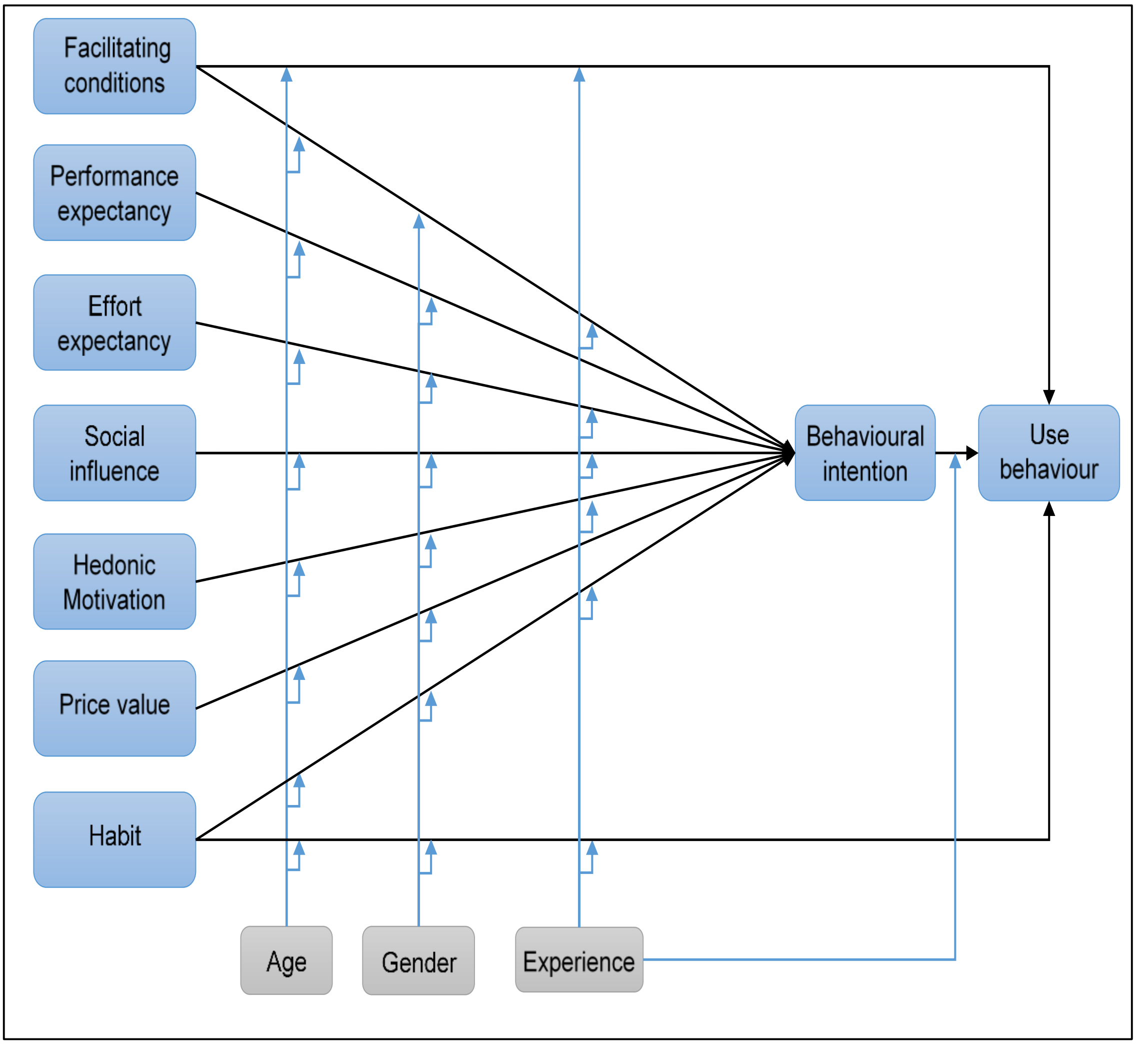


Figure 3.13: Unified Theory of Acceptance and Use of Technology 2

UTAUT 2 may be criticised because it missed the parsimony of UTAUT by adding three new constructs (Venkatesh et al., 2012). Further, opponents may doubt the reliability of validation process of the model for two reasons. First, use behaviour was assessed using a subjective measure that has been criticised by many researchers, as outlined in Section 1.3 (e.g. Burton-Jones and Gallivan, 2007; Karahanna et al., 2006; Lee et al., 2003; Podsakoff et al., 2003; Turner et al., 2010; Wade-Vuturo et al., 2013). Second, as online survey was used for collecting data, this study is prone for sample bias resulting from missing consumers who did not have a computer or internet access (Bhattacherjee, 2012). UTAUT 2 may not be suitable for assessing factors affecting the initial use of a technology as it has two constructs (i.e. experience and habit) that cannot be measured for individuals who have not already used the technology (i.e. nonusers). In addition, Venkatesh et al. (2012) had a concern regarding the generalisability of the findings since the model was validated in a highly advanced country (Hong Kong) in terms of the technology aspect.

3.4 Selecting the Suitable Theory

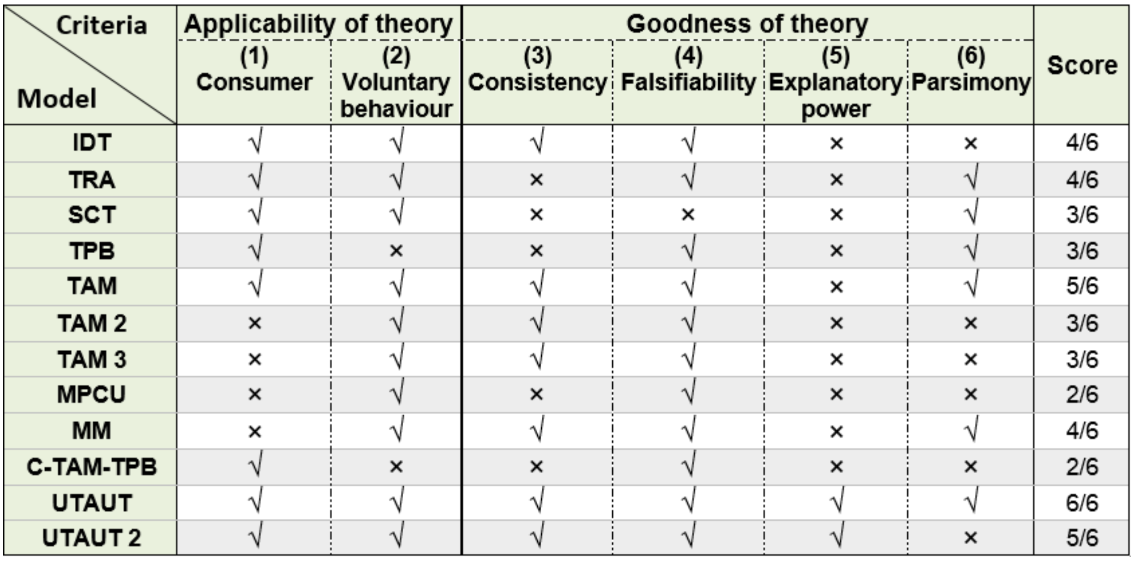
The second step of model development is the selection of a theory appropriate for the context of interest (Walker and Avant, 2011). In order to be objective in performing this step, the current study identified criteria for selecting an appropriate theory based on recommendations by Bhattacherjee (2012) and Taylor and Todd (1995c). Specifically, Bhattacherjee (2012) determined the following four criteria for assessing the goodness of the theory: logical consistency, explanatory power, falsifiability, and parsimony. Further, Taylor and Todd (1995c) suggested two criteria for selecting an appropriate theory: (1) the applicability of theory on the required phenomenon, (2) the degree of parsimony of theory (which is one of Bhattacherjee's criteria). All those criteria are discussed in the next paragraphs.

The criterion "applicability of theory on the required phenomenon" means that a theory must be suitable for understanding a phenomenon of interest (Taylor and Todd, 1995c). In order for a theory to meet this criterion, it must be applicable to the population and type of behaviour in the current study. To be more precise, the population in the present study is healthcare consumers (i.e. patients), therefore, the theory must be suitable for understanding consumer behaviour rather than other populations such as employees. Besides, the theory must be appropriate for studying voluntary behaviours but not compulsory behaviours as the behaviour of interest in the present study is voluntary (i.e. ePHRs use).

With respect to the four criteria reported by Bhattacherjee (2012), *logical consistency* refers to the degree to which proposed relationships are rational and logical; *explanatory power* refers to the ability of theory to account for reality; *falsifiability* refers to the possibility of disproving the theory through empirical tests (i.e. theory must have adequate explanations and measurable constructs); and *parsimony* refers to the ability of theory to examine a phenomenon using few numbers of variables.

To summarise, six criteria were used in the current study for selecting an appropriate theory. While two criteria are related to the applicability of the theory on the phenomena of interest (i.e. population and type of behaviour), the remaining four criteria are related to goodness of the theory (i.e. logical consistency, explanatory power, falsifiability, and parsimony). As shown in Table 3.1, UTAUT was the only theory that met all those criteria. Therefore, this study chose UTAUT as a theoretical lens to study factors that affect patients' use of ePHRs. More details about how the theories met or did not meet each criterion are discussed below.

Table 3.1: Criteria of Selection of Theory



Criteria / Model	Applicability of theory		Goodness of theory				Score
	(1) Consumer	(2) Voluntary behaviour	(3) Consistency	(4) Falsifiability	(5) Explanatory power	(6) Parsimony	
IDT	√	√	√	√	×	×	4/6
TRA	√	√	×	√	×	√	4/6
SCT	√	√	×	×	×	√	3/6
TPB	√	×	×	√	×	√	3/6
TAM	√	√	√	√	×	√	5/6
TAM 2	×	√	√	√	×	×	3/6
TAM 3	×	√	√	√	×	×	3/6
MPCU	×	√	×	√	×	×	2/6
MM	×	√	√	√	×	√	4/6
C-TAM-TPB	√	×	×	√	×	×	2/6
UTAUT	√	√	√	√	√	√	6/6
UTAUT 2	√	√	√	√	√	×	5/6

Starting with the first criterion (population), the following theories include constructs (e.g. job fit and output quality) that make these theories more suitable for explaining employees' behaviours; TAM 2, TAM 3, MPCU, and MM. Other theories do not consider the difference between the behaviour of employees and consumers; IDT, TRA, SCT, TPB, TAM, and C-TAM-TPB. However, they have been used widely used for explaining consumer adoption behaviour (e.g. Abramson et al., 2014; Baird, 2012; Emani et al., 2012; Lazard et al., 2016; Torres, 2011). One theory (UTAUT) aimed to understand the adoption of technology among employees. However, Venkatesh et al. (2012) confirmed that UTAUT can be suitable for investigating technology adoption among consumers as they demonstrated that UTAUT was able to account for 56 percent and 40 percent of the variance in behavioural intention and use behaviour, respectively. Lastly, UTAUT 2 was the only theory that was developed to understand technology adoption among consumers. Accordingly, only the following theories did not meet the first criterion as they include constructs suitable only for explaining employees' behaviours: TAM 2, TAM 3, MPCU, and MM.

With respect to the second criterion (type of behaviour), five theories are appropriate for understanding voluntary and non-voluntary behaviours; IDT, SCT, TAM 2, TAM 3, UTAUT. On the other hand, five theories are applicable only in voluntary contexts; TRA, TAM, MPCU, MM, and UTAUT 2. In contrast, TPB and C-TAM-TPB are more suitable for non-voluntary behaviours. Thus, all theories met this criterion, bar TPB and C-TAM-TPB (see Table 3.1).

With reference to the third criterion (logical consistency), TRA was criticised because it does not posit any relationship between subjective norms and attitudes while several studies found that social norms affect attitudes such as Greene et al. (1997), Park (2000), and Shepherd and O'keefe (1984). Besides, one of TRA's flaws is its assumption that attitude and subjective norms are the only predictors of a voluntary behaviour, and other external factors may affect the behaviour indirectly only through attitude and subjective norms (Davis, 1989; Hale et al., 2002). In SCT and MPCU, the behavioural intention was ignored although it has been considered as an essential part of most human behaviour theories (Bandura, 1986; Chang and Cheung, 2001; Compeau and Higgins, 1995; Venkatesh et al., 2003). The logical consistency of C-TAM-TPB is also weak since it posits that though some relationships were not significant (e.g. the relationship between perceived ease of use and attitude), they included in the model (Taylor and Todd, 1995a). Accordingly, IDT, TAM, TAM 2, TAM 3, MM, UTAUT, and UTAUT 2 have a logical consistency (see Table 3.1).

All theories met the fourth criterion (i.e. falsifiability) except SCT. Precisely, as mentioned before, constructs in SCT are difficult to be operationalised because they cover an extensive range of factors that are not clear from the theory (Compeau and Higgins, 1995; Munro et al., 2007). Consequently, SCT is the only theory that did not meet the fourth criterion (see Table 3.1).

With regard to the explanatory power of the theory (the fifth criterion), most of the abovementioned theories were not validated by their authors to assess the explanatory power (e.g. IDT, TRA, SCT, and TPB). Since Venkatesh et al. (2003) tested nine theories in one study (IDT, TRA, SCT, TPB, TAM, TAM 2, MPCT, MM, and C-TAM-TPB), it would be fair to use results of Venkatesh's study to compare nine theories in terms of the explanatory power. However, Venkatesh's study did not examine the explanatory power of TAM 3 and UTAUT 2. Fortunately, authors of both theories validated them and, thereby, explanatory powers resulted from these studies will be used to compare the theories. In short, Venkatesh et al. (2003) found that all nine models were able to explain between 17% and 42% of the variance in behavioural intention, and between 35% and 39% of the variance in use behaviour. TAM 3 accounted for 53% and 35% of the variance in behavioural intention and use behaviour, respectively (Venkatesh and Bala, 2008). UTAUT was able to predict 70% of the variance in behavioural intention, and 48% of variance in use behaviour (Venkatesh et al., 2003). UTAUT 2 explained 74% and 52% of the variance in behavioural intention and use behaviour, respectively (Venkatesh et al., 2012). It is clear that UTAUT and UTAUT 2 have stronger explanatory power than other theories, thereby, they met the fifth criterion (see Table 3.1).

As for the last criterion (parsimony), only six theories were considered parsimonious, which are: TRA, SCT, TPB, MM, TAM, and UTAUT (Assadi, 2013; Bagozzi, 2007; Gartrell, 2014; Holden and Karsh, 2010; Whetstone and Goldsmith, 2009).

In addition to that UTAUT met all criteria, it has the following pros. First, UTAUT does not focus only on human-technology factors (e.g. performance expectancy and effort expectancy) as some theories do (e.g. TAM), but it includes personal factors (e.g. age), organisational factors (facilitating conditions), and social factors (social influence) (Or, 2008). Second, UTAUT is one of few theories that use moderators in their model, and this enriches understanding of use behaviour of technology (Venkatesh et al., 2003). Last, UTAUT may be applicable to different technologies in different countries (Or and Karsh, 2009). This is because it has been validated extensively in different fields and contexts, and it showed that it is a suitable theory for investigating technology acceptance (Assadi, 2013; Cimperman et al., 2016; Or, 2008; Tavares and Oliveira, 2016). Further, it has been widely used by studies in the context of consumer health information technologies (CHITs) (e.g. Beenkens, 2011; Cimperman et al., 2016; de Veer et al., 2015; Mekawie, 2013; Or, 2008).

3.5 Tailoring the Selected Model

Although UTAUT is the most appropriate theory for the current study, it must be tailored to be more appropriate for the context of ePHRs, and this is the third step of model development. Venkatesh et al. (2003) recommended future research to investigate other factors relevant to the context under the study to enhance the applicability of UTAUT. Therefore, this section aims to tailor UTAUT to the context of ePHRs by mapping and selecting the most relevant and significant constructs to add them to the model. The findings of the systematic review (Chapter 2) were employed for performing this step.

As indicated previously, UTAUT consists of three determinants of behavioural intention; which are: performance expectancy, effort expectancy, and social influence. Further, use behaviour is affected directly by behavioural intention and facilitating conditions. Four factors were also proposed as moderators for most of these relationships; age, sex, experience, and voluntariness (Venkatesh et al., 2003). After a critical analysis of these relationships, it has been found that voluntariness is not suitable for the model of this study because the adoption of ePHRs in this study is voluntary, and this construct is applicable only in non-voluntary contexts (Venkatesh et al., 2012). Venkatesh et al. (2012) dropped this construct from UTAUT 2 to make it suitable for consumer contexts. Thus, the moderator “voluntariness” was dropped from the model in this study. As mentioned in Section 1.4, the current study focuses on factors that make nonusers become users of ePHRs (i.e. pre-usage stage), therefore, the sample must be composed of only nonusers of ePHRs (i.e. having no experience). For that reason, the moderator “experience” was dropped from the model in the current study.

According to the systematic review, definitive conclusions were drawn regarding 15 factors (see Figure 2.11). Of these, only three factors were mutual between the three groups (i.e. intention to use, subjectively-measured use, and objectively-measured use), which are: perceived usefulness, internet access, and privacy and security concerns. Only perceived usefulness of these three factors was captured by UTAUT constructs. Specifically, perceived usefulness is represented through the construct “performance expectancy” (Venkatesh et al., 2003). This confirms the importance of performance expectancy in the proposed model. The systematic review demonstrated that the factor “privacy and security concerns” is one of the most significant factors. Moreover, twelve of the theory-based studies that were not eligible for the systematic review contained this factor in their models, and 10 of them found that it negatively affects ePHRs adoption (see appendix 20). Yet, privacy and security concerns are not one of UTAUT constructs. Therefore, it is worthy to include this factor in the proposed model in order to make the model more appropriate for the context of ePHRs. In respect to internet access, it was concluded that it positively affects use of and intention to use ePHRs. But, it is not one of the constructs proposed in UTAUT. So, this factor was included in the model proposed in the current study.

In addition, of those 15 factors, two factors were common between subjective use studies and objective use studies. In particular, income and education level positively influence ePHRs use. However, none of them was included in UTAUT. Rodman (2015) recommended researchers to examine the effect of additional demographics such as education level and income on ePHRs adoption. Hence, both factors were added to the model in the current research.

Definitive conclusions regarding the effect of the following five factors only on intention to use were drawn in the systematic review: internet use, facilitating conditions, health status, sex, and ethnicity. With respect to internet access, it was found that it positively affects the intention to use ePHRs, but UTAUT does not include this construct. This factor was not included in the proposed model since it is largely related to the construct “internet access” that has already been added to the model. In other words, individuals who have internet access are more likely to be internet user, and vice versa. Facilitating conditions have been found as a significant positive predictor of intention to use. This construct is one of the main constructs of UTAUT. So, it was already introduced to the model proposed in this study. In respect to sex, it was concluded that sex is not associated with intention to use. In contrast, sex is a significant factor in UTAUT. The reason for these contradictory findings may be attributed to the fact that sex was assessed as a direct predictor of intention to use by studies in the systematic review while it is proposed as a moderator of the relationships in UTAUT. As sex has not been examined as a moderator in the context of ePHRs, it was kept in the model in the present study. The systematic review concluded that ethnicity and health status are not significant predictors of intention to use ePHRs, and they are not part of UTAUT. Consequently, ethnicity and health status were not added to the model in the present research.

It was concluded in the systematic review that awareness of ePHRs and perceived ease of use positively affect subjectively-measured use. The former factor is not suitable for the context of the study since the system is still new, thereby; patients are more likely to have no or very low awareness of the presence and functions of ePHRs. In regard to perceived ease of use, it is a very significant factor, and it is represented in UTAUT through the construct “effort expectancy” (Venkatesh et al., 2003). So, it was already included in the proposed model.

In the systematic review, it was concluded that objectively-measured use is affected by language, employment status, and computer access. These factors are not part of UTAUT. They were also not included in the model proposed in the current study for the following reasons. The sample in the current study must be English literate in order to be able to fill in the questionnaire by themselves, thus, the effect of language will not be prominent. The employment status is highly associated with income, which was already included in the model. Thereby, it is better not to include employment status in order to keep the parsimony of the model. Similarly, computer access is related to the internet access as internet access usually requires the presence of computer access. As internet access is one of the included factors in the model in the current study, computer access was not included in the model.

In summary, two constructs have been dropped from UTAUT; voluntariness and experience. On the other hand, four new constructs were added to the UTAUT model; internet access, privacy and security concerns, income, and education level. In this way, the model became more appropriate for the context of ePHRs.

3.6 The Proposed Hypotheses

This section is dedicated to carrying out the fourth and fifth steps of model development: defining the concepts of each construct in a way suitable for the phenomenon of interest, and specifying the relationships between constructs (Walker and Avant, 2011). Based on the factors selected earlier, this study proposed six direct effects, two mediating effects, and twenty moderating effects. The definition of each factor and the nature of these relationships are discussed in the following three subsections.

3.6.1 Hypotheses Regarding Direct Effects

Six direct relationships were hypothesised in this model: the effect of each of performance expectancy, effort expectancy, social influence, and perceived privacy and security on behavioural intention; and the effect of each of facilitating conditions and behavioural intention on use behaviour (see Table 3.2). The hypotheses regarding these relationships are discussed below.

Table 3.2: Hypotheses of Direct Effects

H	Independent variable	Dependent variable	Hypothesis
H1	Performance expectancy	Behavioural intention	Performance expectancy positively influences patients' intention to use Patient Online
H2	Effort expectancy	Behavioural intention	Effort expectancy positively influences patients' intention to use Patient Online
H3	Social influence	Behavioural intention	Social influence positively influences patients' intention to use Patient Online
H4	Perceived privacy & security	Behavioural intention	Perceived privacy and security positively influences patients' intention to use Patient Online
H5	Facilitating conditions	Use behaviour	Facilitating conditions positively influence patients' use of Patient Online
H6	Behavioural intention	Use behaviour	Behavioural intention positively influences patients' use of Patient Online

3.6.1.1 Effect of Performance Expectancy (PE)

Venkatesh et al. (2003, p.447) defined performance expectancy as "*the degree to which an individual believes that applying the technology will help him or her to attain gains in job performance*". In the ePHRs context, performance expectancy refers to patients' perceptions of the benefits and advantages gained from using ePHRs, such as increasing patient empowerment, saving time, saving efforts, enhancing knowledge, improving patient safety (Alyami and Song, 2016; Morton, 2012; Pagliari et al., 2007a). According to UTAUT, performance expectancy is one of the direct predictors of behavioural intention (Venkatesh et al., 2003). Specifically, people are more likely to intend to use a technology once they expect that adopting this technology is very useful and advantageous (Venkatesh et al., 2003). According to the systematic review in the previous chapter, this direct effect was assessed by 12 studies, and all of them supported this relationship (e.g. Abramson et al., 2014; Agarwal et al., 2013; Kim et al., 2009b; Lazard et al., 2016; Noblin et al., 2013). This means that patients are more likely to intend to use Patient Online when they perceive that it is useful for them. Consequently, this study hypothesises the following:

> ***H1: Performance expectancy positively influences patients' intention to use Patient Online.***

3.6.1.2 Effect of Effort Expectancy (EE)

The effort expectancy was defined by Venkatesh et al. (2003, p.450) as "*the degree of ease associated with the use of the system*". In the ePHRs context, effort expectancy refers to patients' perceptions about ease of use of ePHRs. Venkatesh et al. (2003) demonstrated that effort expectancy is an influential predictor of intention to use only in the pre-usage stage. Generally speaking, individuals are more likely to intend to use a technology when they perceive that using it is not difficult (Venkatesh et al., 2003). Several studies supported this relationship in the ePHRs context (e.g. Assadi, 2013; Emani et al., 2012; Noblin, 2010; Tavares and Oliveira, 2016; Wu, 2013). This means that patients who perceive that Patient Online is easy to use are more likely to intend to use it. Subsequently, the second hypothesis in the current study is as follows:

H2: Effort expectancy positively influences patients' intention to use Patient Online.

3.6.1.3 Effect of Social Influence (SI)

Venkatesh et al. (2003, p.451) defined social influence as "*the degree to which an individual perceives that important others believe he or she should use the new system*". In the case of ePHRs, social influence may be conceptualised as patient's perceptions that important individuals to him/her (e.g. physicians, nurses, caregivers, family, or friends) think he/she should utilise ePHRs (Or et al., 2011; Peek et al., 2014; Torres, 2011). Generally speaking, individual who perceives that using a technology is recommended by important people to him/her is more likely to use the technology (Venkatesh et al., 2003). This relationship was supported by numerous studies in the area of ePHRs (e.g. Torres, 2011; Wu, 2013). This refers that patients who perceive that using Patient Online is recommended by their doctors, caregivers, friends, or family members are more likely to intend to use it. Accordingly, this study claims the following:

H3: Social influence positively influences patients' intention to use Patient Online.

3.6.1.4 Effect of Perceived Privacy and Security (PPS)

Although privacy and security may cover two different aspects, they have been mixed together in many studies (Nasri et al., 2013). This may be attributed to the fact that they are highly correlated; security of a technology is required to keep individuals' privacy (Belanger et al., 2002). According to Parasuraman et al. (2005, p.7), privacy/ security of a website refers to "the *degree to which the customer believes the site is safe from intrusion and personal information is protected*". In the context of ePHRs, perceived privacy and security may be defined as the extent to which patients perceive that ePHRs are secure and able to keep their information private (Gartrell, 2014; Rao, 2014). Strictly speaking, individuals who have positive perception about the privacy and security of a technology are more likely to intend to adopt it (Featherman and Pavlou, 2003; Nicolaou and McKnight, 2006). As shown in the systematic review, many studies demonstrated this relationship (e.g. Ozok et al., 2017; Patel et al., 2011b; Patel et al., 2012; Rao, 2014; Whetstone and Goldsmith, 2009). This means that patients who believe that Patient Online is secure and maintain their privacy tend more to intend to use it. So, this study theorises the following:

H4: Perceived privacy and security positively influences patients' intention to use Patient Online.

3.6.1.5 Effect of Facilitating Conditions (FC)

Facilitating conditions was defined by Venkatesh et al. (2003, p.453) as "*the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system*". In the context of the current study, facilitating conditions refers to patients' perception of availability of resources (e.g. computers and internet access) and an organisational support (e.g. instructions, manuals, and technical assistance) that are necessary for using ePHRs (Or, 2008). Generally speaking, people are more likely to use a technology when they feel that there are facilitating conditions enough to enable them to use it (Venkatesh et al., 2003). It is noteworthy that UTAUT proposed the effect of facilitating conditions on use behaviour but not on behavioural intention since Venkatesh et al. (2003) demonstrated that the relationship between facilitating conditions and behavioural intention is not statistically significant. This association between facilitating conditions and use behaviour was demonstrated in several ePHRs studies (e.g. Luque et al., 2013; Mishuris et al., 2015; Patel et al., 2012). This indicates that patients who perceive that they have necessary resources, knowledge, and support to adopt Patient Online are more likely to use it. Therefore, this study postulates the following proposition:

H5: Facilitating conditions positively affects patients' use of Online Patient.

3.6.1.6 Effect of Behavioural Intention (BI)

According to Venkatesh et al. (2003), behavioural intention refers to the extent to which an individual has developed conscious willingness to perform or not perform a certain behaviour in the future. In the context of ePHRs, behavioural intention refers to the degree to which a patient plans to use or not use ePHRs. In general, individuals with higher intention to perform behaviour are more likely to perform it, and vice versa (Davis, 1989; Fishbein and Ajzen, 1975; Venkatesh et al., 2003; Venkatesh et al., 2012). This relationship was demonstrated by several studies in the context of ePHRs (e.g. Hsieh et al., 2016; Jian et al., 2012; Tavares and Oliveira, 2016). This means that patients with higher intention to use Patient Online are more likely to use it. Therefore, the sixth hypothesis in the current study is as follows:

H6: Behavioural intention positively affects patients' use of Patient Online.

3.6.2 Hypotheses Regarding Mediating Effects

Mediating effect refers to the situation where the association between an independent variable and dependent variable is affected by a third variable called "mediator" (Field, 2017). Figure 3.14 depicts the mediating effect.

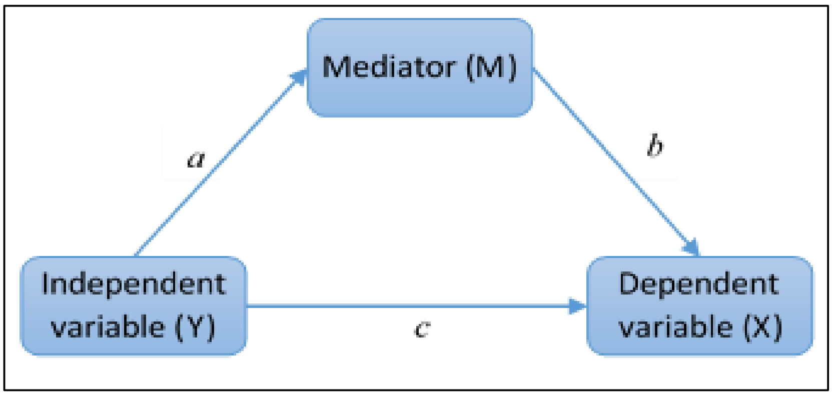


Figure 3.14: Mediating Effect

Two mediating effects were hypothesised in the model in the current study: the effect of performance expectancy on the relationship between effort expectancy and behavioural intention, and the effect of performance expectancy on the relationship between perceived privacy and security and behavioural intention (see Table 3.3). More discussion about these two relationships is presented below.

Table 3.3: Hypotheses of Mediating Effects

H	Independent variable	Dependent variable	Mediator	Hypothesis
H7	Effort expectancy	Behavioural intention	Performance expectancy	Performance expectancy positively mediates the positive relationship between effort expectancy and behavioural intention
H8	Perceived privacy & security	Behavioural intention	Performance expectancy	Performance expectancy positively mediates the positive relationship between perceived privacy and security and behavioural intention

The mediating effect of performance expectancy on the relationship between effort expectancy and behavioural intention was not proposed in UTAUT. However, Davis (1989) proposed this mediating effect in his well-known model (i.e. TAM). This indirect effect may be attributed to the fact that individuals' perceptions about usefulness of the system are influenced considerably by their perceptions about ease of use of that system (Goff, 2016; Lazard et al., 2016; Noblin, 2010; Rao, 2014; Richards, 2012). The mediating effect of performance expectancy was shown in two studies in the context of consumer health information technologies (CHITs) (Hsu et al., 2013; Or et al., 2011). This means that patients who perceive Patient Online as an easy to use system are more likely to perceive it as a useful system, thereby, they are more likely to intend to use it. In other words, for patients who perceive that Patient Online is easy to use, an increase of their perceived usefulness of Patient Online leads to an increase in their intention to use it. Therefore, this study theorises this mediating relationship as follows:

> ***H7: Performance expectancy positively mediates the positive relationship between effort expectancy and behavioural intention.***

Similarly, the mediating effect of performance expectancy on the relationship between perceived privacy and security and behavioural intention was not proposed in UTAUT. However, this mediating effect was proposed in the current study as patients' perceptions about the usefulness of the system are influenced considerably by their perceptions about privacy and security of their data in the system (Archer and Cocosila, 2014; Emani et al., 2012; Feistel, 2014; Mekawie, 2013; Rao, 2014). Accordingly, this means that patients who perceive that Patient Online is secure and able to maintain their privacy are more likely to perceive it as a useful system, thereby, they are more likely to intend to use it. To put it differently, for patients who perceive that Patient Online is secure, an increase of their perceived usefulness of Patient Online leads to an increase in their intention to use it. Thus, this study posits the following hypothesis:

> ***H8: Performance expectancy positively mediates the positive relationship between perceived privacy and security and behavioural intention.***

3.6.3 Hypotheses Regarding Moderating Effects

Moderating effect refers to the situation when the relationship between an independent variable and a dependent variable is affected by the level or group of a third variable called moderator (see Figure 3.15) (Field, 2017; Hair et al., 2010).

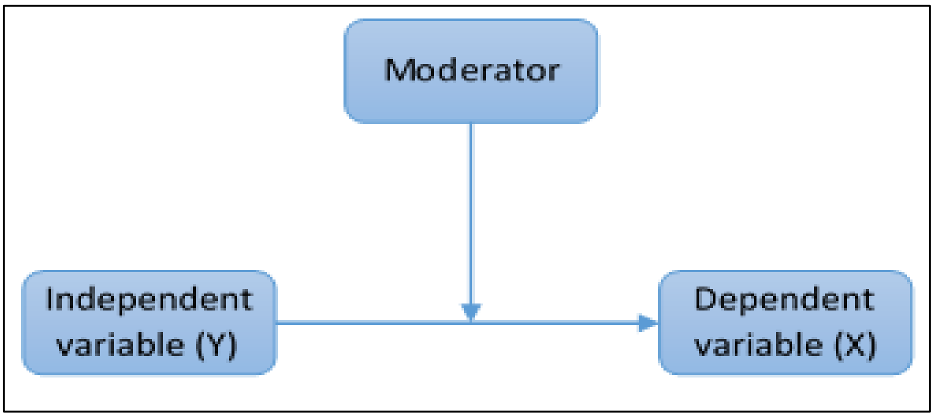


Figure 3.15: Moderating Effect

As indicated earlier, twenty moderating effects were hypothesised in the model in the current study. All direct relationships, except the association between behavioural intention and use behaviour, are affected by at least one of the following moderators: age, sex, income, education, and internet access (see Table 3.4). These moderating effects are discussed in the following five subsections.

Table 3.4: Hypotheses of Moderating Effects

H	Independent variable	Dependent variable	Moderator	Hypothesis
H9	Performance expectancy	Behavioural intention	Age	Age negatively moderates the positive relationship between performance expectancy and behavioural intention
H10	Effort expectancy	Behavioural intention	Age	Age positively moderates the positive relationship between effort expectancy and behavioural intention
H11	Social influence	Behavioural intention	Age	Age positively moderates the positive relationship between social influence and behavioural intention
H12	Perceived privacy & security	Behavioural intention	Age	Age positively moderates the positive relationship between perceived privacy & security and behavioural intention
H13	Facilitating conditions	Use behaviour	Age	Age positively moderates the positive relationship between facilitating conditions and use behaviour
H14	Performance expectancy	Behavioural intention	Sex	Sex moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for males
H15	Effort expectancy	Behavioural intention	Sex	Sex moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for females
H16	Social influence	Behavioural intention	Sex	Sex moderates the positive relationship between social influence and behavioural intention, such that the influence is stronger for females
H17	Perceived privacy & security	Behavioural intention	Sex	Sex moderates the positive relationship between perceived privacy & security and behavioural intention, such that the influence is stronger for females
H18	Facilitating conditions	Use Behaviour	Sex	Sex moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for females
H19	Performance expectancy	Behavioural intention	Education level	Education level negatively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for patients with lower level of education
H20	Effort expectancy	Behavioural intention	Education level	Education level negatively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients with lower level of education
H21	Perceived privacy & security	Behavioural intention	Education level	Education level positively moderates the positive relationship between perceived privacy & security and behavioural intention, such that the influence is stronger for patients with higher level of education

H22	Facilitating conditions	Use behaviour	Education level	Education level negatively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients with lower level of education
H23	Performance expectancy	Behavioural intention	Income	Income positively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for patients with higher income
H24	Effort expectancy	Behavioural intention	Income	Income negatively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients with lower income
H25	Perceived privacy & security	Behavioural intention	Income	Income negatively moderates the positive relationship between perceived privacy & security and behavioural intention, such that the influence is stronger for patients with lower income
H26	Facilitating conditions	Use behaviour	Income	Income negatively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients with lower income
H27	Effort expectancy	Behavioural intention	Internet access	Internet access moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients without internet access
H28	Facilitating conditions	Use behaviour	Internet access	Internet access moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients without internet access

3.6.3.1 Effect of Age

According to Venkatesh et al. (2003), age is a significant moderator of the relationship between performance expectancy and behavioural intention. Specifically, the effect of performance expectancy on intention to use is stronger among younger individuals (Venkatesh et al., 2003). This may be attributed to the fact that extrinsic motivation (e.g. usefulness) is more important for younger individuals (Hall and Mansfield, 1975; Porter, 1963). This moderating effect was also shown in the consumer context by Venkatesh et al. (2012). In the context of ePHRs, Emani et al. (2012) and Richards (2012) found a significant difference between older and younger patients in their perception of the usefulness of ePHRs. As a result, this study posits the following hypothesis:

> ***H9: Age negatively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for younger patients.***

Age is deemed as a significant moderator of the relationship between effort expectancy and behavioural intention according to UTAUT (Venkatesh et al., 2003). Precisely, the effect of effort expectancy on behavioural intention is stronger among older individuals (Venkatesh et al., 2003). This may be attributed to the fact that cognitive and physical abilities that are necessary to use technology decline gradually with increasing age (Hertzog and Hultsch, 2000; Rogers et al., 1998; Taylor et al., 2014; Venkatesh et al., 2003). Therefore, in comparison with younger individuals, older individuals are more likely to have more computer anxiety, less control over computers, and less computer self-efficacy (Chun and Patterson, 2012; Czaja et al., 2006; Majedi, 2014; Nägle and Schmidt, 2012; Rogers et al., 1998). This moderating effect of age was also supported in the consumer context by Venkatesh et al. (2012). In the context of ePHRs, Richards (2012) demonstrated a significant difference between older and younger patients in their perception of ease of use of ePHRs. Accordingly, this study theorises the following hypothesis:

> ***H10: Age positively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for older patients.***

According to UTAUT, age is considered an instrumental moderator for the relationship between social influence and behavioural intention (Venkatesh et al., 2003). Specifically, the effect of social influence on behavioural intention is stronger among older individuals (Venkatesh et al., 2003). This may be attributed to the fact that older people have more affiliation needs than younger people, thereby, they are more likely to be affected by social influence (Alaiad and Zhou, 2015; Rhodes, 1983). Moreover, psychological studies demonstrated that the need for autonomy is relatively lower among older individuals, and they tend more to conform to opinions of others (Cook and Wall, 1980; Evans et al., 1979). This moderating effect was also supported in the consumer context by Venkatesh et al. (2012). In the context of CHITs, the moderating effect of age on the relationship between social influence and behavioural intention to use home healthcare robot was demonstrated by Alaiad and Zhou (2015). Accordingly, this study proposes the following hypothesis:

> ***H11: Age positively moderates the positive relationship between social influence and behavioural intention, such that the influence is stronger for older patients.***

As the construct “perceived privacy and security” was not part of UTAUT, the moderating effect of age on the association between perceived privacy and security and behavioural intention was not tested by Venkatesh et al. (2003). However, Laric et al. (2009) argued that older individuals are more likely to concern about privacy of their data. They attributed this argument to the fact that older people are more likely to suffer from illnesses and diseases, thereby, they may be more worried about their privacy than younger people. Moreover, this effect of age on perceived privacy and security may reflect the fact that older people tend more to excessively doubt and not trust new technologies (Castle et al., 2012; Faqih and Jaradat, 2015; Peter and Valkenburg, 2011; Yao et al., 2007). In the context of ePHRs, this relationship was empirically supported by Baird (2012) and Richards (2012). In line with these findings, the following hypothesis is postulated:

> ***H12: Age positively moderates the positive relationship between perceived privacy & security and behavioural intention, such that the influence is stronger for older patients.***

In UTAUT, age is deemed as a significant moderator of the relationship between facilitating conditions and use behaviour (Venkatesh et al., 2003). In other words, the effect of facilitating conditions on use behaviour is stronger among older people (Venkatesh et al., 2003). As mentioned earlier, older people are more likely to have difficulty in learning how to use new information technologies due to age-related decline in their physical and cognitive abilities (Chin and Fu, 2010; Czaja et al., 2009; Hanson, 2009; Kim et al., 2009a; Seethamraju et al., 2018). This learning difficulty makes them more likely to have computer anxiety and less computer self-efficacy in comparison to younger individuals (Chun and Patterson, 2012; Czaja et al., 2006; Majedi, 2014; Nägle and Schmidt, 2012; Rogers et al., 1998). As a result, older people are more likely to place more importance on the presence of sufficient support and help on their job (Hall and Mansfield, 1975; Morris and Venkatesh, 2000). This moderating effect was also supported in a consumer context by Venkatesh et al. (2012). In the context of CHITs, Alaiad and Zhou (2015) demonstrated that the relationship between facilitating conditions and use behaviour of home healthcare robot is stronger among older patients. Accordingly, this study theorises the next hypothesis:

> ***H13: Age positively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for older patients.***

3.6.3.2 Effect of Sex

According to Venkatesh et al. (2003), sex is a significant moderator of the relationship between performance expectancy and behavioural intention. Specifically, the effect of performance expectancy on intention to use is stronger among males than females (Venkatesh et al., 2003). This may be attributed to the fact that males are more likely to be task oriented than females (Lynott and McCandless, 2000; Minton and Schneider, 1985), which means that they are concerned more with task accomplishment such as performance expectancy (Venkatesh and Morris, 2000; Venkatesh et al., 2003). This moderating effect was supported in the consumer context by Venkatesh et al. (2012). In the context of ePHRs, Richards (2012) demonstrated a significant difference between males and females in their perception of the usefulness of ePHRs. As a result, this study posits the following hypothesis:

> ***H14: Sex moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for males.***

Additionally, sex is considered as a significant moderator of the relationship between effort expectancy and behavioural intention in the UTAUT model (Venkatesh et al., 2003). Precisely, the effect of effort expectancy on behavioural intention is stronger among females (Venkatesh et al., 2003). This effect may be driven by the fact that females usually exhibit higher levels of computer/ technology anxiety in comparison with males (Frenkel, 1990; Gilroy and Desai, 1986; Lowe and Krahn, 1989; Morrow et al., 1986). However, it is likely that the level of computer/ technology anxiety among females may have reduced due to technology being more pervasive in 2018 than in the 1980s (Office for National Statistics, 2018). This moderating effect of sex was supported in the consumer context by Venkatesh et al. (2012). In the context of ePHRs, Richards (2012) showed a significant difference between males and females in their perception of ease of use of ePHRs. Accordingly, this study theorises the following hypothesis:

> ***H15: Sex moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for females.***

According to UTAUT, sex is considered an instrumental moderator for the relationship between social influence and behavioural intention (Venkatesh et al., 2003). Specifically, the effect of social influence on behavioural intention is stronger among females (Venkatesh et al., 2003). This may be attributed to the fact that females tend more to have deference to others' perceptions or opinions than males (Venkatesh and Morris, 2000). This moderating effect was shown in the consumer context by Venkatesh et al. (2012). In the context of ePHRs, Wu (2013) showed a significant difference between males and females in their perception of social influence of ePHRs. Accordingly, this study proposes the following hypothesis:

> ***H16: Sex moderates the positive relationship between social influence and behavioural intention, such that the influence is stronger for females.***

The moderating effect of sex on the association between perceived privacy and security and behavioural intention was not tested by Venkatesh et al. (2003) as the construct "perceived privacy and security" was not part of UTAUT. However, Laric et al. (2009) argued that females tend more to concern about the privacy of their data then females. This may reflect the fact that females tend more to excessively doubt and not trust technologies than males (Faqih and Jaradat, 2015). In the context of ePHRs, Richards (2012) found a significant difference between males and females in their perception of privacy and security of ePHRs. In line with this, the following hypothesis is postulated:

> ***H17: Sex moderates the positive relationship between perceived privacy & security and behavioural intention, such that the influence is stronger for females.***

According to Venkatesh et al. (2000), sex is deemed as a significant moderator of the relationship between facilitating conditions and use behaviour. In other words, the effect of facilitating conditions on use behaviour is stronger among females (Venkatesh et al., 2000). This may reflect the fact that while males tend more to exert effort to overcome issues and problems that may appear when achieving tasks, females are more likely to focus on the procedures and effort required for accomplishing the task (Venkatesh et al., 2000). In addition, females usually exhibit higher levels of computer/ technology anxiety in comparison with males (Frenkel, 1990; Gilroy and Desai, 1986; Lowe and Krahn, 1989; Morrow et al., 1986). As a result, females are more likely to place more emphasis on the presence of sufficient external support when adopting new technologies (Venkatesh et al., 2000; Venkatesh et al., 2012). Although this moderating effect of sex was demonstrated by Venkatesh et al. (2000), it has not been examined in the context of ePHRs. Hence, this study theorises the following hypothesis:

> ***H18: Sex moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for females.***

3.6.3.3 Effect of Education Level

Broadly speaking, individuals with higher level of education are more likely to be healthier and have no functional and mental limitations (Beenkens, 2011; Hoogendijk et al., 2008; Jacobsen et al., 2011). In addition, healthier people are less likely to perceive that ePHRs are useful for them (Beenkens, 2011; Liu et al., 2011; Rao, 2014). Consequently, it can be supposed that education level negatively moderates the effect of performance expectancy on intention to use (Beenkens, 2011). In the context of ePHRs, it has been demonstrated that patients with lower level of education perceive usefulness of ePHRs in a different way than those with higher level of education (Beenkens, 2011; Daglish, 2013; Richards, 2012). Accordingly, this study proposes the following:

> ***H19: Education level negatively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for patients with lower level of education.***

It has been demonstrated that effort expectancy is affected by education level (Agarwal and Prasad, 1999; Porter and Donthu, 2006). To be more precise, people with higher level of education are less likely to put into consideration the ease of use of a technology before adopting it. This effect of education may be attributed to several facts. Firstly, people with higher level of education generally are more likely to use the internet and have higher level of health literacy (Baker et al., 2003; Liebermann and Stashevsky, 2002; Paasche-Orlow et al., 2005; Rainie, 2010; Rhee and Kim, 2004; Scott et al., 2002). Secondly, people with higher level of education usually have less computer anxiety (Ellis and Allaire, 1999; Gutek and Bikson, 1985; Howard and Smith, 1986; Igbaria and Parasuraman, 1989), thereby, they are less likely to be worried about ease of use of new technology (Ellis and Allaire, 1999; Igbaria and Iivari, 1995; Lai et al., 2008; Torres, 2011; Venkatesh, 2000). Lastly, people with higher level of education have more ability to learn a new innovation (Agarwal and Prasad, 1999). In the context of ePHRs, this effect of education has been shown by Daglish (2013), Noblin (2010), and Richards (2012). As a consequence, this study hypothesises:

> ***H20: Education level negatively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients with lower level of education.***

According to Jian et al. (2012), people with high level of education are more likely to concern about their privacy. Reasonably, this may result from the fact that individuals with higher level of education have more awareness about threats of cyber attacks on breaching their privacy. In the context of ePHRs, this effect of education was found empirically by Richards (2012). Thus, this study proposes the following assumption:

> ***H21: Education level positively moderates the positive relationship between perceived privacy & security and behavioural intention, such that the influence is stronger for patients with higher level of education.***

By and large, people with lower level of education are less likely to use the internet and have lower level of health literacy (Baker et al., 2003; Liebermann and Stashevsky, 2002; Paasche-Orlow et al., 2005; Rainie, 2010; Rhee and Kim, 2004; Scott et al., 2002). Furthermore, people with lower level of education usually have more computer anxiety (Ellis and Allaire, 1999; Gutek and Bikson, 1985; Howard and Smith, 1986; Igbaria and Parasuraman, 1989). Consequently, it is reasonable to consider that people with lower level of education tend more to place emphasis on availability of sufficient external support when adopting new technologies. The moderating effect of education level on the association between facilitating conditions and use behaviour has not been tested in the context of ePHRs nor CHITs. Subsequently, this study proposes the following:

> ***H22: Education level negatively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients with lower level of education.***

3.6.3.4 Effect of Income

It has been shown that income level affects the perceived usefulness of technology (Chawla and Joshi, 2018; Porter and Donthu, 2006). As people with higher income are more likely to be busier, they tend more to concern about the usefulness of technology before using it (Chawla and Joshi, 2018). Thus, it can be thought that the association between performance expectancy and behavioural intention is stronger among people with higher income. This association was empirically shown in the ePHRs context by Daglish (2013) and Richards (2012). Therefore, this study posits the next hypothesis:

> ***H23: Income positively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for patients with higher income.***

Generally speaking, people with lower income are less likely to be able to afford internet access and latest technologies (Chawla and Joshi, 2018; Rainie, 2010; Rhee and Kim, 2004), and this may make those people having higher computer/ technology anxiety (Chawla and Joshi, 2018; Lee et al., 2010). Therefore, it can be inferred that people with low income are more likely to worry about ease of use of technology before using it. This effect of income was empirically demonstrated in the ePHRs context by Daglish (2013) and Richards (2012). Thus, this study claims the following:

> ***H24: Income negatively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients with lower income.***

It has been shown that people with lower income are more likely to concern about online information privacy (Chawla and Joshi, 2018; Hernández et al., 2011; Zukowski and Brown, 2007). This may result from the fact that individuals with low income are more likely to have health problems and illnesses (Beenkens, 2011; Jacobsen et al., 2011), thereby, they are more likely to concern about the privacy of their health information (Laric et al., 2009). Thus, it can be thought that the association between perceived privacy and security and behavioural intention is stronger among people with lower income. In the context of ePHR, this effect of income was demonstrated by Richards (2012). Consequently, this study hypothesises the next proposition:

> ***H25: Income negatively moderates the positive relationship between perceived privacy and security and behavioural intention, such that the influence is stronger for patients with lower income.***

As indicated previously, people with lower income are less likely to be able to afford internet access and latest technologies (Chawla and Joshi, 2018; Rainie, 2010; Rhee and Kim, 2004), and this may make those people having higher computer/ technology anxiety (Chawla and Joshi, 2018; Lee et al., 2010). Therefore, it can be inferred that people with low income are more likely to worry about availability of facilitating conditions before adopting a technology. This effect of income has not been assessed in the ePHRs contexts. Hence, this study posits the following hypothesis:

H26: Income negatively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients with lower income.

3.6.3.5 Effect of Internet Access

Reasonably, patients who have internet access are more likely to be internet users and, thereby, they are more likely to have less computer anxiety and higher self-efficacy. As mentioned before, individuals with less computer anxiety and higher self-efficacy are less likely to perceive technology easy to use (Ellis and Allaire, 1999; Igbaria and Iivari, 1995; Lai et al., 2008; Rao, 2014; Torres, 2011; Venkatesh, 2000; Venkatesh and Bala, 2008), thereby, they are less likely to worry about ease of use of technology before using it. This effect of internet access has not been examined in the ePHRs contexts. Accordingly, this study proposes the next hypothesis:

H27: Internet access moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients without internet access.

As mentioned above, patients without internet access are more likely to high computer anxiety and low computer self-efficacy, thereby, they may tend more to place emphasis on availability of sufficient external support when adopting new technologies. It is can be inferred that the relationship between facilitating conditions and use behaviour is stronger among patients without internet access. In the context of ePHRs, this moderating effect of internet access has not been studied. Subsequently, this study hypothesises the following proposition:

H28: Internet access moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients without internet access.

3.7 The Conceptual Model

The last step of model development requires researchers to present the proposed model graphically (Walker and Avant, 2011). Accordingly, Figure 3.16 shows the proposed model in the current study. In short, performance expectancy, effort expectancy, social influence, and privacy and security concerns affect behavioural intention directly. Facilitating conditions and behavioural intention are the only direct determinant of use behaviour. Effort expectancy and perceived privacy and security affect indirectly behavioural intention through performance expectancy. Age and sex moderate all direct relationships, except the path from behavioural intention to use behaviour. Education level and income moderates all direct relationships, except the path from social influence to behavioural intention and the path from behavioural intention to use behaviour. Lastly, internet access moderates the effect of effort expectancy on behavioural intention and the effect of facilitating conditions on use behaviour.

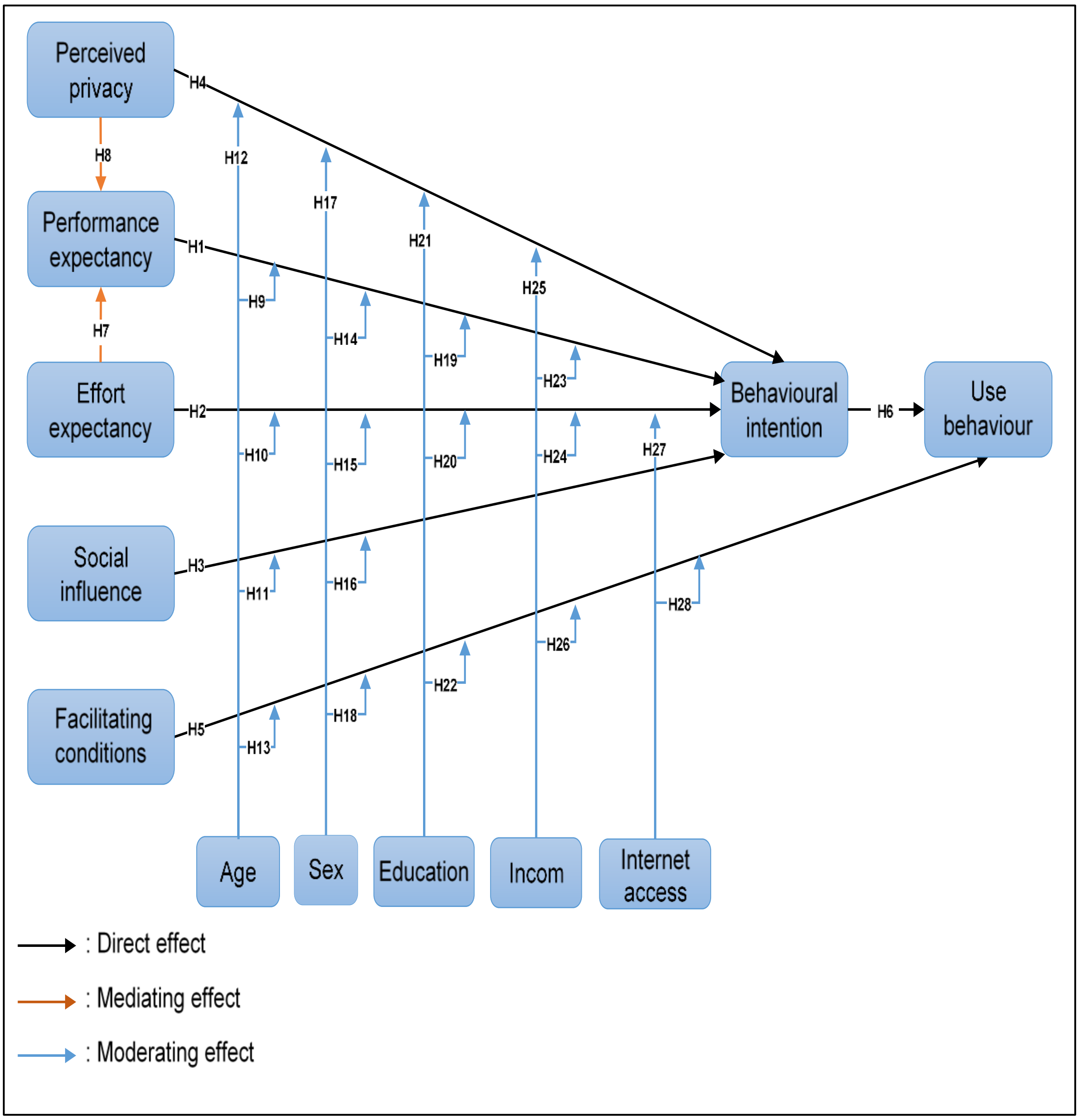


Figure 3.16: The Conceptual Model

3.8 Chapter Summary

The chapter aimed to develop a conceptual model for understanding the factors that affect patients' use of ePHRs. To this end, the researcher followed the six steps of model development recommended by Walker and Avant (2011). In line with the first step, 12 theories and models originated from various disciplines such as psychology, sociology, and information systems were reviewed. According to six criteria, UTAUT was identified as the most suitable theory for the context of ePHRs. In the third step, UTAUT was tailored to be more appropriate for the context of interest by dropping voluntariness and experience from the model and adding four new constructs; internet access, privacy and security concerns, income, and education level. The fourth step and fifth step were carried out simultaneously by defining the concepts of each construct determining the relationships between constructs. As a result, this study proposed six direct effects, two mediating effects, and twenty moderating effects. In the last step, the proposed model was presented graphically.

Chapter Four:

Research Methodology

Chapter 4 Research Methodology

4.1 Introduction

This chapter aims to outline and justify the research methods, techniques, and approaches that were used for conducting the empirical study. The empirical study aims to test the proposed model outlined in the previous chapter. In the first place, the research philosophy, purpose, approach, and methodology that this research follows are determined and justified in the next four sections, respectively. In Section 4.6, the researcher explains the reasons for choosing survey method rather than experimental or case study methods. Section 4.7 provides the justification for selecting the survey instrument and clarifies how it was developed. The process of sampling is explained in Section 4.8. In Section 4.9, research settings where the current study was carried out are identified and justified. Data collection process is described in details in Section 4.10. Data analysis techniques used in this study are defined and justified in Section 4.11. In the penultimate section, the main ethical considerations are discussed. The main points of this chapter are summarised in the last section.

4.2 Research Philosophy

Research philosophy is defined as a group of researcher's beliefs and perceptions about a certain phenomenon, the truth behind its existence, how knowledge about it can be attained, and which methods should be used to investigate it (Al-Azzam, 2016; Guba and Lincoln, 1994; Onyia, 2009). It is highly recommended that researchers identify the research philosophy that their studies follow before they embark upon them (Easterby-Smith et al., 2012; Guba and Lincoln, 1994; Saunders et al., 2015). This is because developing and selecting the appropriate research design and methods depends on the research philosophy followed (Easterby-Smith et al., 2012; Gray, 2018; Neuman, 2013; Saunders et al., 2015). Two philosophical areas of scientific research form the foundation of the main assumptions and principles of researchers; ontology and epistemology (Bhattacherjee, 2012; Neuman, 2013; Saunders et al., 2015).

Ontology refers to the philosophical assumptions regarding the nature of a reality and what exists (Creswell and Poth, 2017; Neuman, 2013; Saunders et al., 2015). That is, ontology is concerned with what is the entity that researchers are looking at, and how they perceive it (Bryman, 2015; Saunders et al., 2015; Walter, 2013).

Epistemology is defined by Neuman (2013, p.95) as "*an area of philosophy concerned with the creation of knowledge; focuses on how we know what we know or what are the most valid ways to reach truth*". In other words, Epistemology refers to how a researcher gains knowledge about a phenomenon of interest (Bryman, 2015; Gray, 2018; Saunders et al., 2015). Every research should start with identifying its ontological position, that then leads logically to the epistemological position and methods (Grix, 2002; Hay, 2002).

The two most common research philosophies that arise from the two abovementioned philosophical areas are positivism and interpretivism (Bryman, 2015; Grix, 2002; Tuli, 2010). Positivism is defined as a research philosophy derived from the natural sciences where the researcher believes that social reality is observable, measurable, fixed and external to the researcher (Bryman, 2015; Gray, 2018; Thomas, 2013). In contrast to positivism, interpretivism is a research philosophy where researchers believe that social reality is socially constructed and subjective, and researchers play an important role in interpreting it (Bryman, 2015; Gray, 2018; Neuman, 2013). The different assumptions and features of positivism and interpretivism are outlined in Table 4.1. Based on the nature and aim of the current study, positivist position appropriately reflects the philosophy behind the current study. Specifically, the positivist position is more in tune with the present research for the following reasons.

Firstly, as shown in Table 4.1, positivists usually aim to predict and control social phenomena and to come up with law-like generalisations about them (Bowling, 2014; Gray, 2018; Calnan, 2013), and this is in keeping with the aim of the current study which is to identify the factors that predict patients' use of ePHRs and generalise the findings from the sample to the population.

Secondly, positivists follow the deductive reasoning where theories and previous research are employed to formulate and test propositions and hypotheses (Table 4.1) (Bryman, 2015; Calnan, 2013; Saunders et al., 2015). As adoption of information systems is deemed as a mature field that has several well-validated theories and models (e.g. UTAUT, TAM, and TRA) (Venkatesh et al., 2003; Venkatesh et al., 2012), this study follows deductive reasoning through adopting the most appropriate theory (i.e. UTAUT) and formulating the research hypotheses accordingly.

Thirdly, positivists perceive any social phenomenon as a reality that is objective; that is, it is not affected by social actors who are concerned with its presence (Bryman, 2015; Neuman, 2013; Thomas, 2013). This position is more aligned with the present study because the researcher of the study believes that the reality (i.e. patients' adoption of Patient Online) is out there and exists independently of him. To be more precise, the researcher of this study perceives that he can investigate the phenomenon of interest objectively by not allowing his personal assumptions and beliefs to affect the reality. Hence, the researcher selected the factors in the proposed model based on theories and empirical studies and regardless of his beliefs, attitudes, and experiences. Further, the researcher considers all guidelines, recommendations, and criteria for objectively collecting, analysing, and reporting the data.

Fourthly, according to the positivist stance, knowledge can be gained through examining hypotheses empirically using objective and rigorous research methods, which are usually quantitative (Bowling, 2014; Calnan, 2013; Saunders et al., 2015), and this is in tune with this study in which the researcher perceives that the proposed model must be tested empirically by rigorous quantitative methods.

Fifthly, for generalisation purposes, positivists often collect highly structured quantitative data from a large sample size and analyse them using statistical analyses (Easterby-Smith et al., 2012; Saunders et al., 2015), and this is considered the best way to answer the question of the current study.

Lastly, positivism is the most used stance in social science research (Bowling, 2014; Calnan, 2013; Thomas, 2013). It also has been used by many researchers to investigate patients' adoption of ePHRs (e.g. Assadi, 2013; Klein, 2007a; Lazard et al., 2016; Morton, 2012; Tavares and Oliveira, 2016).

Table 4.1: Features of Research Philosophies

	Positivism	**Interpretivism**
Ontology assumptions	Single reality exists regardless of people perception, and it is observable, measurable, and fixed	Multiple realities exist and they are socially constructed by people interaction and interpretation
Epistemology assumptions	Reality is investigated objectively, and it is external to the researcher. Reality is studied through breaking it down into simplest elements. Concepts must be operationalised to be measured quantitatively.	Reality is investigated subjectively, and researchers play an important role in interpreting it. Concepts embody viewpoints of stakeholder.
Research aim	To explain causal relationships and to come up with law-like generalisations about them	To understand or describe how people create and make sense of a social reality from their point of view
Research approach	Deductive reasoning	Inductive reasoning
Research methodology	Quantitative, but they can use qualitative	Qualitative
Researcher's role	They must be independent and impartial	They must involve themselves in the settings in which they are interested
Sample size	Large	Small
Generalisability	From sample to population	From one setting to another

Source: Adapted from Easterby-Smith et al. (2012), Neuman (2013), Saunders et al. (2015)

4.3 Research Purpose

Studies can be classified into three groups based on their purposes: explanatory, exploratory, and descriptive (Bhattacherjee, 2012; Neuman, 2013; Saunders et al., 2015). The explanatory research attempts to explain causal relationships of phenomena and behaviours (Bhattacherjee, 2012; Neuman, 2013; Saunders et al., 2015). Exploratory research is typically carried out when investigating a new phenomenon, event, or behaviour that has not been explored yet, and researchers know little or nothing about it (Neuman, 2013; Saunders et al., 2015). Researchers normally conduct descriptive research when they have a good understanding of a phenomenon of interest, and they are interested in describing it instead of examining causal relationships (Blumberg et al., 2011; Neuman, 2013).

The current study can be considered as explanatory research because the aim of this study is in line with the purpose of explanatory research, which is to test a theory regarding a phenomenon of interest or extend a theory to new subjects and fields (Neuman, 2013). Moreover, explanatory studies usually adopt existing theories or models and previous literature to develop hypotheses, and then those hypotheses are tested using empirical research (Blumberg et al., 2011; Sekaran and Bougie, 2016). This is the case in the current study, which developed hypotheses based on a theory and previous studies, and those hypotheses were tested empirically.

4.4 Research Approach

Research approach refers to the scientific reasoning that researchers follow in conducting their studies (Bowling, 2014). There are two research approaches that researchers can follow; deductive and inductive (Bhattacherjee, 2012; Bowling, 2014; McInnes et al., 2013). The deductive approach depends on using existing theory (or theories) to develop the research hypotheses which are tested using empirical data, thus, it is called theory-testing approach (Bhattacherjee, 2012; Bowling, 2014). In other words, deductive research begins with general assumptions and thoughts of a phenomenon, then they are examined using specific observations (Gray, 2018; Wilson and MacLean, 2011). In contrast to the deductive approach, inductive approach depends on using empirical observations so as to build a theory or general inferences that can be tested in a further research, thus, it is called theory-building approach (Bhattacherjee, 2012; Bowling, 2014). To be more precise, inductive research starts with observing a given phenomenon and, then, constructing general propositions or theories based on the findings of the observations (Gray, 2018; Wilson and MacLean, 2011).

According to the features of those approaches outlined in Table 4.2, the deductive approach was more suitable for the present research than inductive approach. To be more precise, this study follows the deductive approach for the following reasons. Firstly, it is recommended to use this approach when the research subject is already well-investigated, thus, a theoretical framework and hypotheses can be generated based on the prior knowledge (Bhattacherjee, 2012; Creswell, 2013; Easterby-Smith et al., 2012). That is, this approach is suitable when there are plenty of explanations, studies, or theories about the phenomenon under the study. The phenomenon of interest in this study was investigated by numerous studies and theories, thereby; there is sufficient knowledge about it. Secondly, as mentioned earlier, the deductive approach is appropriate for examining causal relationships (Bhattacherjee, 2012; Saunders et al., 2015), and this is aligned with the aim of this research. Thirdly, the deductive approach is more compatible with the positivism (Bryman, 2015; Neuman, 2013; Saunders et al., 2015), which is the position that this study follows. Fourthly, the current study is restricted to time (as it is a part of an academic degree), thereby, the deductive approach is more appropriate as it is faster to complete and enables researchers to accurately expect time schedules of conducting the study (Creswell, 2013). Lastly, the deductive approach has low-risk of not achieving the aim of the study (Creswell, 2013).

Table 4.2: Features of Research Approaches

	Deductive	**Inductive**
Research aim	To explain causal relationships	To understand the meanings of a phenomenon from individuals' perspectives
Research methodology	More quantitative	More qualitative
Researcher's role	Researchers are independent of the phenomenon and impartial	Researchers are part of the phenomenon under the study
Data collection method	Highly structured	Flexible
Time to finish	Short time	Long time
Risk of not achieving the aim	Low risk	High risk
Sample size	Large	Small
Generalisability	More generalisable	Less generalisable

Source: Adapted from Bhattacherjee (2012); Bryman (2015), Creswell (2013), Neuman (2013), Zikmund et al. (2013)

4.5 Research Methodology

After identifying the research philosophy and approach that the researcher follows, it is necessary to determine the research methodology (Saunders et al., 2015). Researchers usually follow at least one of two main research methodologies; quantitative and qualitative (Bryman, 2015; Matthews and Ross, 2010). As shown in Table 4.3, those methodologies are different from each other in terms of numerous aspects. No methodology is superior to the other, rather the quantitative methodology is more appropriate than the qualitative approach for certain research questions, and vice versa (Dawson, 2002; Zikmund et al., 2013). The quantitative methodology is more appropriate for the current study for the following reasons.

Firstly, selecting the research methodology should be driven by research aims (Almohaimmeed, 2012; Dawson, 2002; Matthews and Ross, 2010). The aim of this study is to examine the factors that affect patients' use of ePHRs, and this aim is in line with the purpose of the quantitative research, which is usually to test a theory or determine cause-effect relationships between variables so as to explain a phenomenon (see Table 4.3) (Bryman, 2015; Neuman, 2013; Robson and McCartan, 2016).

Secondly, it is essential to take into consideration the research philosophy that a study follows when identifying the research methodology (Almohaimmeed, 2012; Matthews and Ross, 2010; Tuli, 2010). The current study adopted the positivist philosophy, which is the one that the quantitative methodology leans more toward (Bhattacherjee, 2012; Matthews and Ross, 2010; Neuman, 2013).

Thirdly, choosing the research methodology is also guided by the type of data that researchers require to answer the research question (Almohaimmeed, 2012). The present research needed more structured data in form of numbers to be able to statistically test the adopted theory, and quantitative studies usually deal with such data (Bowling, 2014; Gray, 2018; Matthews and Ross, 2010).

Fourthly, the research model proposed in this study requires to be tested by analysing the collected data statistically, and this is one of the main characteristics of the quantitative methodology (Creswell, 2013; Matthews and Ross, 2010; Neuman, 2013; Robson and McCartan, 2016).

Fifthly, the researcher of this study tries to be objective and neutral by keeping himself independent of the phenomenon and participants under study, and this is compatible with researchers' role in quantitative studies (Bowling, 2014; Gray, 2018; Neuman, 2013; Zikmund et al., 2013).

Sixthly, the researcher of this study endeavours to generalise the findings through collecting data via predefined, systematic, reliable measures and from a large sample size, and such aim is more likely to be achieved by quantitative methodology (Creswell, 2013; Matthews and Ross, 2010; Neuman, 2013).

Lastly, Bowling (2014) recommends researchers to use qualitative methodology when there is a lack of information regarding the phenomenon of interest, when the phenomenon is sensitive or complex, and when researchers need to explore the phenomenon in an inductive way. However, the current research does not meet these conditions because the phenomenon of interest is well-investigated, it is not sensitive or complex, the deductive approach was considered as an appropriate approach for this study.

Table 4.3: Features of Research Methodologies

	Quantitative	Qualitative
Philosophical position	Leans more to positivism	Leans more to interpretivism
Research aim	To explain causal relationships and test a theory	To in-depth explore phenomena and build a theory
Research Approach	Tends more to deductive	Tends more to inductive
Type of data	Structured data in form of numbers	Rich and in-depth data in form of words, texts, symbols, images, maps, or other visual media
Researchers' role	They are impartial and independent of the phenomenon or participants	They are subjective and immerse themselves in the phenomenon or participants
Study design	Structured, and specified before commencing the study	Relatively unstructured and evolutionary
Data Analysis	Analysed by statistical techniques and presented by tables, charts, and/or graphs	Analysed by coding data and extracting themes from it, then organising the themes in a coherent and consistent way
Data collection	Collected by predefined, systematic, more reliable measures	Collected by unstructured and free-form measures
Sample size	Large	Small
Generalisability	More generalisable and replicable	From one setting to another
Research methods	Experiment, survey, secondary data analysis, case study	Case study, action research, ethnography, grounded theory, and feminist research

Source: Adapted from Bryman (2015), Matthews and Ross (2010), Neuman (2013), Robson and McCartan (2016), Zikmund et al. (2013)

4.6 Research Methods

Research method is defined by Saunders et al. (2015) as a general strategy that a researcher follows to collect data required for answering research questions. The most used research methods in quantitative studies are as follows (Bhattacherjee, 2012; Saunders et al., 2015). (1) Survey, which refers to a systematic manner for collecting data regarding individuals so as to compare, describe, or explain their thoughts, preferences, knowledge, and behaviours (Bhattacherjee, 2012; Gray, 2018; Wilson and MacLean, 2011). (2) Experiments, which aim to examine causal relationships through separating the independent variable (cause) from the dependent variable (effect) in time. (Bhattacherjee, 2012; Bryman, 2015). It seems that the survey is the most appropriate research method for this study for the following reasons:

First, survey method is suitable for studies that endeavour to test causal relationships without controlling and manipulating the independent variables (Neuman, 2013; Saunders et al., 2015; Sekaran and Bougie, 2016). This is compatible with the aim of the current research, which is to examine the factors that affect patients' use of ePHRs, and those factors are difficult for the researcher to control and manipulate.

Second, survey method is suitable for studies where their units of analysis are individuals because it enables researchers to collect unobservable (i.e. self-reported) data such as people's attitudes, beliefs, opinions, preferences, behaviours, and intentions (Bowling, 2014; Neuman, 2013). This is the case in the current study, which is concerned with assessing patients' perceptions and intentions about the ePHRs.

Third, survey method enables researchers to examine relationships between more than two variables, and make comparisons between or within groups (Calnan, 2013; Howitt and Cramer, 2017; Neuman, 2013). This is compatible with the current study, which tests the effect of six independent variables on three dependent variables (PE, BI, and UB), and compares these relationships between groups to test the moderating effect of five variables (age, sex, education, income, and internet access).

Fourth, survey method is appropriate for collecting data from a very large sample in a wide area (Bhattacherjee, 2012; Neuman, 2013). As mentioned in Subsection 4.8.4, this study requires collecting data from a large sample (more than 600 participants) in a widespread area (West Yorkshire).

Fifth, survey studies have a high degree of generalisability (external validity) because their sample size is usually large and their data are commonly collected from the field context (Bhattacherjee, 2012; Neuman, 2013). The researcher endeavours to generalise the findings of this study to the population in England to enable the providers of Patient Online to consider these findings and improve the adoption rate of the system.

Sixth, in comparison with experiments, a survey is very efficient method in terms of time, cost, and effort; that is, it allows researchers to collect large data with less effort and money and within a short period of time (Bhattacherjee, 2012; Stangor, 2014; Zikmund et al., 2013). This feature of the survey method makes it suitable for the present study as it is conducted by a self-funded student who constrained by time, money, and human resources.

Lastly, the survey method has been widely used in technology acceptance research in general (e.g. Al Oraini, 2014; Alalwan, 2014; Pheeraphuttharangkoon, 2015; Tung and Rieck, 2005; Venkatesh et al., 2003; Venkatesh et al., 2012; Yu, 2012), and ePHRs adoption research in specific (e.g. Agarwal et al., 2013; Laugesen, 2013; Lazard et al., 2016; Patel et al., 2011a; Tavares and Oliveira, 2016; van der Vaart et al., 2014).

Surveys are divided into two main categories based on the temporal dimension: cross-sectional surveys, in which data are collected from participants only on one occasion at one particular time; and longitudinal surveys, in which data are gathered from participants on more than one occasion at separated times (Bowling, 2014; Neuman, 2013; Saunders et al., 2015). While cross-sectional studies usually aim to take a snapshot of the phenomenon of interest, longitudinal studies endeavour to monitor changes that occur on a certain phenomenon over a period of time (Collis and Hussey, 2014; Matthews and Ross, 2010; Zikmund et al., 2013). Although the internal validity (i.e. causality) typically is higher in longitudinal surveys than cross-sectional surveys (Bhattacherjee, 2012; Bowling, 2014; Collis and Hussey, 2014), this study adopted the cross-sectional survey method for the following reasons. Firstly, cross-sectional surveys are more appropriate for projects restricted with time and resources; such as research projects for obtaining academic degrees (Bowling, 2014; Collis and Hussey, 2014; Saunders et al., 2015). This is the case in the current study, which is carried out by a self-funded student, who has to undertake it by himself and within a specific period of time. Secondly, the internal validity of a cross-section study can be improved when there is an appropriate gap of time between collecting data regarding independent variables and dependent variables (Bhattacherjee, 2012), and this is the case in the current study because the dependent variable (actual use) was assessed after six months of assessing the independent variables (more details are available in Section 4.10). Lastly, results of cross-sectional surveys may be less biased than longitudinal surveys because there is high sample attrition over time in longitudinal studies (Bowling, 2014; Matthews and Ross, 2010). That is, participants are more likely to withdraw in longitudinal studies because several participants have passed away, they cannot be traced, or they are no longer interested in taking part (Bowling, 2014; Matthews and Ross, 2010).

4.7 Research Instruments

Research instruments are tools which are used for collecting data about a phenomenon under the study (Almohaimmeed, 2012; Matthews and Ross, 2010). Several research instruments can be used in social research, most notably; questionnaires, interviews, observations, narrative data, documents, and secondary sources (Bhattacherjee, 2012; Matthews and Ross, 2010). However, questionnaires and interviews (especially structured interview) are the most widely used instruments in survey studies (Bhattacherjee, 2012; Matthews and Ross, 2010; Saunders et al., 2015).

A Questionnaire is a data collection tool composed of a set of questions that must be answered by respondents in a structured manner (Bhattacherjee, 2012; Matthews & Ross, 2010). Questionnaires in each study are distributed exactly in the same form (e.g. questions, wording, order, and a set of answers to select from) for each participant (Gray, 2018; Matthews and Ross, 2010). On the other hand, interviews are defined as a data collection tool that enables researchers to obtain opinions, information and feelings from interviewees by using questions and interactive discussions either vis-à-vis or remotely (e.g. telephone) (Bhattacherjee, 2012; Matthews & Ross, 2010). In contrast to questionnaires, interviews enable researchers to easily ask probing or follow-up question (Bhattacherjee, 2012). The questionnaire instrument seems to be more suitable for this study than interviews for the following reasons.

Firstly, while questionnaires are typically used for collecting quantitative and structured data, interviews are usually used for gathering qualitative data (Matthews and Ross, 2010; Neuman, 2013; Bowling, 2014). Structured and standardised data enables researchers to easily analyse, interpret and generalise the data (Creswell, 2013; Gratton and Jones, 2010; Gray, 2018). This study follows the quantitative research approach, and it is pivotal to collect data in a standardised format in order to test the hypothesised model.

Secondly, questionnaires are more efficient than interviews in collecting data from a large number of participants in a widespread area (Gratton and Jones, 2010; Collis and Hussey, 2014; Bowling, 2014). This is the case in the current study, which endeavours to collect data from more than 600 patients in West Yorkshire.

Thirdly, in contrast to interviews, questionnaires are more suitable for collecting data from participants in very busy settings, such as shopping malls and public places (Bhattacherjee, 2012; Matthews and Ross, 2010). As outlined in Section 4.9, patients in waiting rooms in GP practices are the targeted sample in the current study, and such settings are often very busy and unsuitable for interviews.

Fourthly, questionnaires are able to reduce the bias resulted from interviewer-interviewee interactions (Gray, 2018; Connaway and Powell, 2010). To put it differently, questionnaires encourage participants to answer honestly due to the absence of researchers while filling out the questionnaire (Gray, 2018; Robson and McCartan, 2016). As the current research intends to generalise the findings, such sources of bias should be avoided as much as possible.

Fifthly, questionnaires are more convenient for respondents than interviews as they can be completed at a time and place suitable for respondents (Gratton and Jones, 2010; Gray, 2018), and they permit the respondents to take their time to read questions carefully and think about the answers (Clough and Nutbrown, 2012).

Lastly, questionnaires have been widely used in studies that examined factors affecting patients' adoption of ePHRs (e.g. Agarwal et al., 2013; Laugesen, 2013; Lazard et al., 2016; Patel et al., 2011a; Ruiz et al., 2016; Sanders et al., 2013; Tavares and Oliveira, 2016; Torres, 2011; van der Vaart et al., 2014).

4.7.1 Limitations of Questionnaires

Despite the aforementioned strengths of the questionnaire instrument, the researcher of this research acknowledges the following five main limitations of this instrument:

1. In contrast to interviews, questionnaires are not appropriate for investigating a given phenomenon in depth as standardised questions do not enable researchers to get rich and deep data (Matthews and Ross, 2010). However, this study does not aim to understand in depth the phenomenon of interest, rather it aims to test the factors that affect patients' use of ePHRs.
2. Questionnaires are inappropriate for individuals who are illiterate and have visual impairment (Marshall, 2005). But such individuals are not able to use Patient Online, thereby, they are excluded from the current study (more details about the eligibility criteria are presented in Subsection 4.8.1).
3. Low response rate is a common issue in questionnaire-based surveys, and this, in turn, may lead to a biased sample (Matthews and Ross, 2010; Marshall, 2005; Robson and McCartan, 2016). This study attempts to reduce non-response bias as much as possible through careful development and design of the questionnaire, the non-response bias is also examined to check if there are any differences between respondents and non-respondents (more details about the non-response bias are available in Subsection 4.7.4.2).
4. In contrary to interviews, it is usually difficult for respondents to ask for further clarifications from the researcher if they found any confusion in questions (Marshall, 2005; Robson and McCartan, 2016). To alleviate this issue, the researcher was

around the participants during the completion of the questionnaires, and the contact details of the researcher were provided in the questionnaire just in case participants would like to complete it at home and send it by post (more details about this is found in Section 4.10).

5. Questionnaires are less flexible than interviews in allowing participants to express their own thoughts or ideas (Marshall, 2005). One open-ended question was added at the end of the questionnaire in order to minimise this issue (more details about the open-ended question are explained in the Subsection 4.7.3.2).

4.7.2 Ways of Delivering Questionnaires

Self-administrated questionnaires are classified into three main types based on the way they are delivered to the participants. The first type is a delivery and collection questionnaire, where the researcher delivers the questionnaires by hand to each participant, then the researcher returns to collect questionnaires from the participants (Gray, 2018; Saunders et al., 2015). The second type is the mail or postal questionnaire, where the researcher sends questionnaires to eligible participants via mail, and participants, in turn, complete them and send them back to the researcher using prepaid envelops bounded to the questionnaires (Bhattacherjee, 2012; Bowling, 2014; Wilson and MacLean, 2011). The third type is the internet questionnaire, where participants complete questionnaires over the internet using interactive tools (Bhattacherjee, 2012; Gray, 2018; Wilson and MacLean, 2011). Researchers either send the questionnaire as an attachment or embedded link (URL) in the participants' emails, or they post the questionnaire on a website where it can be completed (Bhattacherjee, 2012; Gray, 2018).

The delivery and collection questionnaire was selected as the main instrument to collect data in the current research for the following reasons. The delivery and collection questionnaire has usually a high response rate (Bhattacherjee, 2012; Gray, 2018), thereby, this enables the researcher to reach the required sample size (more than 600) in a short period of time. Further, it enables participants to ask the researcher to clarify any ambiguous questions (Bhattacherjee, 2012), and this was important for the current study in order to enhance the reliability of participants' answers. Moreover, it makes researchers more confident that the questionnaire is completed by the right person but not anyone else (Saunders et al., 2015). Although this type of questionnaires needs much time and effort to deliver and collect the questionnaires (Gray, 2018), this issue is less problematic when participants are gathered in the same place and time (Bhattacherjee, 2012). Participants in the current study are patients who visit one of four predetermined GP practices during data collection, thus, using this method does not need much time and effort.

Bhattacherjee (2012) recommends researchers to use different types of questionnaires to allow participants to choose the preferred instrument. Accordingly, the present study used mail and internet questionnaires as a complementary instrument for collecting data. To be more precise, if participants wanted to take part in the study but they preferred to complete the questionnaire at home instead of the GP practice, the researcher offered two choices to them: a link to the internet questionnaire and a questionnaire with a pre-paid envelope (more information about these methods is described in Section 4.10). This enabled the researcher to gain the advantages of the mail and internet questionnaires while avoiding their disadvantages.

4.7.3 Questionnaire Development

This section illustrates the development of the questionnaire that was used for collecting data in this study. Developing questionnaires is considered as a mix of science and art (Bhattacherjee, 2012; Neuman, 2013). The process of questionnaire development has been described in many published guidelines, but it can be summarised in seven main steps: identifying the required information to answer the research question, specifying the content of each question, determining the response formats to each question, wording each question, ordering the questions, designing the layout and presentation of the questionnaire, and validating the questionnaires (Gray, 2018; Iacobucci and Churchill, 2010; Wilson and MacLean, 2011). The current study follows these steps to develop the questionnaire. More details about each step are explained in the following subsections.

4.7.3.1 The Required Information

It is essential that researchers identify the information required for answering the research question as this affects the content and structure of the questionnaire (Shaughnessey et al., 2014; Wilson and MacLean, 2011; Zikmund et al., 2013). In the current research, the answer to the research question depended on testing the theoretical model that was developed in the previous chapter. Thus, the required information for answering the research question was related to the constructs of the model, which were: performance expectancy, effort expectancy, social influence, facilitating conditions, perceived privacy and security, behavioural intention, use behaviour, age, sex, education, income, and internet access. In addition, the researcher endeavoured to identify other important factors by asking participants about why they would use or not use Patient Online. Then, the factors stated by respondents are compared to the factors resulted from testing the proposed model.

4.7.3.2 Content of Question

The content of the questionnaire depends on the measures of the constructs in the theoretical model (Bhattacherjee, 2012). To measure a construct, two main processes should be performed; conceptualisation and operationalisation (Bhattacherjee, 2012; Neuman, 2013).

Conceptualisation refers to the process of defining an abstract construct using a clear, accurate, systematic theoretical statement (Neuman, 2013). Neuman (2013) acknowledged that there is no specific method to conceptualise a construct (i.e. to give it a conceptual definition), but he recommends researchers to reflect carefully, monitor directly, seek advice from others, and review the literature to conceptualise a construct. In line with this advice, the researcher of this study developed a conceptual definition for each construct in the model. To be more precise, the conceptual definitions of constructs were developed through first reviewing the literature. More than one definition was adopted for some constructs in this stage. Then, the researcher checked the appropriateness of the definitions adopted from literature for the context of this study. After that, the adopted definitions were shown to a panel of three experts in the School of Medicine at the University of Leeds, who were asked to check the suitability of those definitions for the constructs. This panel consisted of Dr Hamish Fraser, Dr Peter Gardner, and Prof Hilary Bekker who are expert in eHealth systems, human factors and human-computer interaction, and decision making, respectively. The conceptual definitions were modified according to experts' suggestions regarding the wording of some of those definitions. Table 4.4 shows the conceptual definitions of the constructs.

Table 4.4: Conceptual Definitions of the Constructs

Constructs	Conceptual definitions
Performance expectancy	The degree to which patients believe that using Patient Online will enable them to attain several gains
Effort expectancy	The degree to which patients perceive that using Patient Online is easy to use
Social influence	The degree to which a patient perceives that important people believe he/she should use Patient Online
Facilitating conditions	The degree to which patients believe that an organisational and technical infrastructure exists to support the use of Patient Online
Perceived privacy and security	The degree to which patients believe that Patient Online is safe from intrusion and personal information is protected
Behavioural intention	The degree to which patients plan to use or not use Patient Online
Use behaviour	Number of times a patient logged in to Patient Online during six months after completing the questionnaire

Age	The period of time (in years) that a patient has lived when completing the questionnaire
Sex	The patient’s state of being either male or female
Educational level	The highest level of education a patient has achieved or been studying when completing the questionnaire
Income	The amount of money that a whole patient’s household earns per year
Ethnicity	The patient’s state of belonging to a social group that has a common national, racial, or cultural origin
Internet access	The patient’s state of having internet access in his/her house.

After conceptualising the constructs, researchers should operationalise them (Bhattacherjee, 2012; Neuman, 2013). Operationalisation is defined as a process of moving from a conceptual definition to an operational definition of a construct through developing a set of indicators or measurement procedures for measuring that construct empirically (Bhattacherjee, 2012; Neuman, 2013; Zikmund et al., 2013). Simply, it is a process of developing accurate measures for constructs (Bhattacherjee, 2012). Authors recommend researchers to review the literature to find well-validated measures that match their constructs, then, they can be modified or utilised directly to measure those constructs (Bhattacherjee, 2012; Neuman, 2013; Saunders et al., 2015). Using well-validated measures of previous studies is very useful for three reasons: it enables researchers to develop more reliable research instrument (Bryman, 2015; Saunders et al., 2015); it allows researchers to compare the findings of their studies with other studies that the measures were adopted from (Bryman, 2015); and it saves the researcher’s time and effort in developing new measures (Bhattacherjee, 2012). However, if previous studies do not contain measures that match the constructs of interest or they have poor measures, then, researchers should develop their own measures (Bhattacherjee, 2012; Neuman, 2013; Saunders et al., 2015).

In line with the recommendations mentioned above, the researcher reviewed the literature and extracted all measures relevant to the constructs of interest. Then, those measures were classified into groups based on the construct that they measure. Lastly, the researcher and the panel of three experts selected the questions that were well-validated and matched most closely constructs of interest.

As shown in Table 4.5, ten questions were adapted from Venkatesh et al. (2012) to measure performance expectancy (3 questions), effort expectancy (4 questions), and social influence (3 questions). Facilitating conditions were measured using 5 questions; four of them were adapted from Venkatesh et al. (2012) and the remaining question was adapted from Or (2008). Five questions were adapted to measure the construct perceived privacy and security; three of them were adapted from Whetstone and

Goldsmith (2009), and the remaining two questions were adapted from Rao (2014). The construct “behavioural intention” was assessed using three questions developed by Venkatesh et al. (2003). All of the unobserved constructs (latent variables) mentioned above were measured using at least three questions, and this is highly recommended by many authors (Blunch, 2012; Haenlein and Kaplan, 2004; Hair et al., 2010; Kline, 2015). Kenny (1979, p.143) emphasised on the importance of using multiple indicators (questions) for each construct by stating *“two might be fine, three is better, four is best, and anything more is gravy”*. This is attributed for several reasons: (1) increasing the number of indicators of each construct increases the chance of obtaining proper solutions for the model, thereby, getting over-identified measurement model (more details about model identification are explained in Section 4.11.3) (Anderson and Gerbing, 1984; Blunch, 2012; Kline, 2015); (2) parameter estimates are more stable and accurate when employing more indicators for each construct (Bowling, 2014; Marsh et al., 1998; Nasser and Wisenbaker, 2003); (3) increasing the number of indicators per factor increases the construct reliability (Kline, 2015; Marsh et al., 1998).

In respect to the construct “use behaviour” (system usage), it can be measured subjectively or objectively (Straub et al., 1995; Turner et al., 2010; Walldén et al., 2016). Subjective measures of use are gathered by asking subjects of interest to estimate their use of the system, thus, they are also called self-reported measures (Straub et al., 1995; Walldén et al., 2016; Wu and Du, 2012). On the other hand, objective measures of use are usually collected by checking system logs or tracking tools, thus, they are also called computer-recorded measures (Straub et al., 1995; Wu and Du, 2012). Subjective measures of use may introduce bias since they mostly do not reflect the actual use (Burton-Jones and Gallivan, 2007; Karahanna et al., 2006; Lee et al., 2003; Straub et al., 1995; Turner et al., 2010; Venkatesh et al., 2012; Wade-Vuturo et al., 2013). This is because light users may overestimate their use of a system, and vice versa (Collopy, 1996). Another explanation is that it is difficult for users to recall their previous uses, thereby, they are very error-prone in reporting their use (Devaraj and Kohli, 2003). Therefore, researchers recommend using objective measures of usage (Straub et al., 1995; Wu and Du, 2012). In keeping with this advice, the current research measured patients’ use of Patient Online through checking the system logs. Specifically, the system logs were checked to identify the number of times that each participant logged into the system and used one of its services during six months after completing the questionnaire.

Table 4.5: Measures of Constructs and their Sources

Constructs	Measures/ Indicators		Sources
Performance Expectancy	PE1	I think Patient Online will be useful in managing my health care.	Venkatesh et al. (2012)
	PE2	I think using Patient Online would help me do things (e.g. booking appointments and ordering repeat prescriptions) less quickly.	Venkatesh et al. (2012)
	PE3	I believe using Patient Online would enhance my effectiveness in managing my health care.	Venkatesh et al. (2012)
Effort Expectancy	EE1	I think learning how to use Patient Online would be difficult for me.	Venkatesh et al. (2012)
	EE2	I expect my interaction with Patient Online would be clear and understandable.	Venkatesh et al. (2012)
	EE3	I believe I would find Patient Online easy to use.	Venkatesh et al. (2012)
	EE4	I believe it would be difficult for me to become skilful at using Patient Online.	Venkatesh et al. (2012)
Social Influence	SI1	People who are important to me would think that I should use Patient Online.	Venkatesh et al. (2012)
	SI2	People whose opinions that I value would prefer that I use Patient Online.	Venkatesh et al. (2012)
	SI3	People who influence my behaviour would think that I should use Patient Online.	Venkatesh et al. (2012)
Facilitating Conditions	FC1	I think I have the resources necessary to use Patient Online.	Venkatesh et al. (2012)
	FC2	I think I have the knowledge necessary to use Patient Online.	Venkatesh et al. (2012)
	FC3	Patient Online is compatible with other web-based services I use (e.g. Amazon, eBay, or Internet banking).	Venkatesh et al. (2012)
	FC4	I can get help from others when I have difficulties using Patient Online.	Venkatesh et al. (2012)
	FC5	I believe there is always a helpdesk for help in solving problems with the Patient Online website.	Or (2008)

Perceived Privacy & Security	PPS1	I would feel that Patient Online is vulnerable.	Whetstone & Goldsmith (2009)
	PPS2	I would feel that health information maintained in my Patient Online would be protected.	Whetstone & Goldsmith (2009)
	PPS3	I would feel that my health record will be kept private.	Whetstone & Goldsmith (2009)
	PPS4	I am worried about privacy issues when using Patient Online.	Rao (2014)
	PPS5	I believe Patient Online can ensure my personal security if it is password protected.	Rao (2014)
Behavioural Intention	BI1	I intend to use Patient Online in the next 6 months.	Venkatesh et al. (2003)
	BI2	I predict I would use Patient Online in the next 6 months.	Venkatesh et al. (2003)
	BI3	I plan to use Patient Online in the next 6 months.	Venkatesh et al. (2003)
Age	Ag	What is your age?	Richards (2012)
Sex	Sx	What is your sex?	Richards (2012)
Ethnicity	Ethn	What is your ethnicity?	Noblin (2010)
Income	Inc	What is your household income level?	Richards (2012)
Education	Edu	What is the highest level of education that you have completed?	Rao (2014)
Internet Access	Int	Do you have internet access where you live?	Logue (2011)

In respect to the remaining constructs, one question was employed to measure each one of them (see Table 4.5). To be more precise, three questions were adapted from Richards (2012) to measure sex, age, and income. Education level was measured using one question that was developed by Rao (2014). One question used by Noblin (2010) was adapted in this study to assess ethnicity. Based on a question developed by Logue (2011), the construct “internet access” was measured.

It was mentioned in the previous subsection that the researcher endeavoured to identify other expected factors and compare them with the factors proposed in the model. Open-ended questions are usually used to collect rich qualitative data that may enable researchers to catch unexpected answers (Bowling, 2014; Gray, 2018; Matthews and Ross, 2010). In addition, such questions make participants feel that their views are important and valued (Matthews and Ross, 2010). Therefore, it is highly recommended that researchers add few open-ended questions to their closed-ended questionnaires (Bhattacherjee, 2012; Zikmund et al., 2013). This advice has been followed by numerous studies in the health information technology adoption field (e.g. Assadi, 2013; Daglish, 2013; Gartrell, 2014; Laugesen, 2013; Mohamadali, 2013; Morton, 2012; Torres, 2011; Wu, 2013). In line with the recommendation mentioned above, the following question was developed by the researcher and the three experts to obtain rich data about the factors affecting patients’ use of Patient Online: “If you have any other comments to help us understand more about why people may or may not use Patient Online, please would you add them here?”.

4.7.3.3 Response Formats

After determining the content of the questions, it is important to identify the response format for each of them (Iacobucci and Churchill, 2010; Matthews and Ross, 2010; Zikmund et al., 2013). The response format of a question depends on the type of question; open-ended or closed-ended (Neuman, 2013; Wilson and MacLean, 2011).

With open-ended questions, participants can freely answer with what they like (Gray, 2018; Neuman, 2013; Wilson and MacLean, 2011). As mentioned in the previous subsection, the questionnaire contained only one open-ended question. Thus, the researcher added a free-text box below this question to enable participants to express freely their opinion about factors affecting them to use Patient Online.

With closed-ended questions, participants select the answer from structured responses that are developed by the researcher (Neuman, 2013). There are different types of closed-ended questions based on response formats: list, category, ranking, scale, and quantity (Gray, 2018; Zikmund et al., 2013). Scale, category, and quantity questions were used for measuring all constructs in the current study (see Table 4.6).

More specifically, the following constructs were measured using scale questions: performance expectancy, effort expectancy, social influence, facilitating conditions, perceived privacy and security, and behavioural intention (see Table 4.6). Different scales can be used to answer scale questions; Likert scale, Guttman scale, Thurstone scale, and semantic-differential scale (Bowling, 2014; Saunders et al., 2015; Wilson and MacLean, 2011). Questionnaires that use Likert scale provide participants with statements, and those participants have to identify the degree to which they agree or disagree with them (Bowling, 2014; Saunders et al., 2015). This study employed Likert scale to measure those abovementioned constructs for the following reasons: (1) it is appropriate for collecting data about participants' opinions, perceptions, and attitudes (Saunders et al., 2015; Wilson and MacLean, 2011); (2) it is the most widely used scale in sociology and psychology (Bhattacherjee, 2012; Bowling, 2014; Saunders et al., 2015); (3) it is very efficient in terms of saving participants' time and effort (Bowling, 2014; Frazer and Lawley, 2001; Iacobucci and Churchill, 2010); (3) it was used in studies that the questions of this study were adopted from (Venkatesh et al., 2003; Venkatesh et al., 2012; Whetstone and Goldsmith, 2009); and (4) it has been also used by many studies in the context of ePHRs adoption (e.g. Assadi, 2013; Klein, 2007b; Laugesen, 2013; Majedi, 2014; Mohamadali, 2013; Morton, 2012; Or, 2008; Richards, 2012; Tavares and Oliveira, 2016; Torres, 2011). Likert scales usually consist of five or seven anchors although it may be composed of more or less number of anchors (Bhattacherjee, 2012; Wilson and MacLean, 2011). The current study used a seven-point Likert scale because giving more response options enables respondents to accurately identify the degree to which they agree or disagree with given statements (De Vaus, 2002), thereby, it collects more reliable data than those collected by the five-point Likert scale (Oppenheim, 2005; Preston and Colman, 2000). Moreover, seven-point Likert scales were used in the studies that the questions of this study were adopted from (Venkatesh et al., 2003; Venkatesh et al., 2012). It has been also used by several studies in the context of ePHRs adoption (e.g. Agarwal et al., 2013; Assadi, 2013; Daglish, 2013; Laugesen, 2013; Majedi, 2014; Or, 2008; Richards, 2012; Tavares and Oliveira, 2016; Torres, 2011; Wu, 2013). However, seven-point Likert scales have the following three limitations (Dolnicara et al., 2011). First, one point on the scale (e.g. “7”) may not indicate the same actual level of agreement between respondents. Second, studies that use seven-point Likert scales are more likely to suffer from response style bias, which defined by Paulhus (1991, p.17) as “a systematic tendency to respond to a range of questionnaire items on some basis other than the specific item content (i.e., what the items were designed to measure)”. Third, participants spend a longer time to fill in questionnaires with seven-point Likert scales in comparison with questionnaires with fewer responses of Likert scales (Dolnicara et al., 2011).

Category questions were employed in this study to measure the following constructs: sex, education, income, ethnicity, and internet access (see Table 4.6). To be more precise, participants could select one of two responses to identify their sex; male or female. This response format was adopted from the study that this question was taken from (Richards, 2012), it also was used in numerous studies in the context of ePHRs (e.g. Gartrell, 2014; Logue, 2011; Laugesen, 2013). Seven groups of household income level (GBP/year) were provided to participants to select one of them; Less than 20,000, 20,000-29,999, 30,000-39,999, 40,000-49,999, 50,000-59,999, 60,000 or more, and prefer not to say. These groups were adapted from Assadi (2013). The current study did not use a quantity question to measure the income because many people do not prefer to disclose exactly their income, thereby, using a category question may encourage them to disclose the band into which their income falls (Saunders et al., 2015). In respect to education, participants could choose one of six responses that were adopted from Assadi (2013); up to secondary school, secondary school, college degree, bachelor degree, master degree, and doctoral degree. Five responses regarding ethnicity were offered to participants to choose one of them; White, Asian or Asian British, Black or Black British, mixed or multiple, and others. These responses were adopted from NHS reports about demographics of patients who registered in each GP practice in England. With regard to having internet access, participants could choose one of two responses that were adopted from Morton (2012); yes and no.

Last but not least, a quantity question was used for measuring two constructs in this study; age and use behaviour (see Table 4.6). This is because of the fact that this question type enables researchers to obtain more accurate data than using a category question when the data are numerical (Bhattacherjee, 2012).

Table 4.6: Response Formats

Variable	Question type	Responses
Performance Expectancy, Effort expectancy, Social influence, Facilitating conditions, Perceived privacy & security	Seven-point Likert scale	(1) Strongly disagree, (2) Disagree, (3) Slightly disagree, (4) Neutral, (5) Slightly agree, (6) Agree, (7) Strongly agree.
Use behaviour	Quantity	Number
Age	Quantity	Number
Sex	Category	(1) Male, (2) Female
Ethnicity	Category	(1) White, (2) Asian or Asian British, (3) Black or Black British, (4) Mixed or multiple, (5) Others

Income	Category	(1) Less than 20,000, (2) 20,000-29,999, (3) 30,000-39,999, (4) 40,000-49,999, (5) 50,000-59,999, (6) 60,000 or more, (7) prefer not to say
Education	Category	(1) Up to secondary school, (2) Secondary school, (3) College degree, (4) Bachelor degree, (5) Master degree, (6) Doctoral degree
Internet access	Category	(1) Yes, (2) No
General question	Open-ended	Free-text answer

4.7.3.4 Wording of Questions

After identifying the content of questions and their responses, it is necessary that they are phrased in a way suitable for participants and the research context in order to collect valid data (Matthews and Ross, 2010; Saunders et al., 2015). Poorly phrased questions can lead to meaningless answers, thereby, this affects the reliability and validity of the findings (Bhattacherjee, 2012). Although this study adopted well-established questions, it was necessary to check that their wording suited the context of this study and followed the general guidelines for developing research questions.

With reference to the appropriateness of wording of questions for the context of this study, several words in the original questions (i.e. those were adopted from other studies) were replaced with other words suitable for the context of this study. For example, many questions included the words mobile internet to refer to the system that a researcher is interested in, so, these words were replaced with Patient Online which is the system that the current study focuses on.

Questions were also checked in order to confirm that their wording is compatible with general guidelines recommended by many authors. The first guideline is that questions should be short, clear, and understandable (Bhattacherjee, 2012; Saunders et al., 2015). Thus, researchers should use a very simple language and avoid complex words, jargon, technical terms, slang, and abbreviations (Matthews and Ross, 2010; Neuman, 2013). All questions in this study fulfilled this guideline as they were simple, clear, and did not include any difficult terms. The readability of the questions was also assessed using an online tool (Readable.io), and the average grade level of five readability indices was about 7. This score means that the questions can be easily read and understood by 12 to 13-year-olds. Moreover, the longest question in this study contained 18 words, which is within the acceptable number of words in a question (≤20) according to Shaughnessey et al. (2014).

Another guideline is that questions should not be ambiguous and vague through using words that can be interpreted differently by participants (Bhattacherjee, 2012; Neuman, 2013; Saunders et al., 2015). In this study, the question “what is your household income?” was slightly ambiguous as it did not specify whether it is weekly, monthly, or yearly, and what the currency. Thus, the question was modified through adding (GBP/year) to the end of the question. Also, the question “I think using Patient Online would help me do things less quickly” had the word “things”, which may be a vague word for participants. Therefore, this word was clarified more to participants through adding the following clarification after that word: (e.g. booking appointments and ordering repeat prescriptions).

Additionally, questions should not include negatives, especially double negatives, as they may confuse participants, thereby, they may result in invalid answers (Bhattacherjee, 2012; Matthews and Ross, 2010; Neuman, 2013). After checking the questions, only one question was worded in a negative manner, which is “I am not worried about privacy issues when using Patient Online”. Thus, this question was rephrased through removing the negative “not”.

In addition, researchers should phrase some questions in the opposite direction in order to avoid issues regarding with response bias (Shaughnessey et al., 2014; Wilson and MacLean, 2011) (more details about response bias are presented in Subsection 4.7.4.1). Accordingly, the current study switched the direction of five questions: “I think using Patient Online would help me do things (e.g. booking appointments and ordering repeat prescriptions) less quickly”, “I think learning how to use Patient Online would be difficult for me”, “I believe it would be difficult for me to become skilful at using Patient Online”, “I would feel that Patient Online is vulnerable”, and “I am worried about privacy issues when using Patient Online”.

Researchers should also make sure that participants have the knowledge needed to answer the questions (Bhattacherjee, 2012; Matthews and Ross, 2010; Saunders et al., 2015). Thus, it is recommended to provide participants with background information when the topic is new (Gray, 2018). As the current study focused on people who had not used Patient Online before (non-users), they were less likely to have knowledge about it. Therefore, an introduction about Patient Online was added at the top of the questionnaire in order for participants to acquire an initial knowledge necessary to answer the questions. Many studies similar to the current research have added such definition at the beginning of their questionnaires (e.g. Daulby, 2015; Gartrell, 2014; Nguyen, 2011; Richards, 2012; Tavares and Oliveira, 2016; Torres, 2011; Wu, 2013).

Researchers should also avoid offensive, double-barrelled, leading, and built-in-assumption questions (Gray, 2018; Shaughnessey et al., 2014; Zikmund et al., 2013). After checking all questions in this study, the questionnaire did not include offensive, double-barrelled, leading, or built-in-assumption questions.

4.7.3.5 Sequence of Questions

It is essential that researchers carefully order the questions in a questionnaire as this may affect the response rate and participants' responses (Bhattacherjee, 2012; Bowling, 2014). The current study followed all subsequent guidelines and tips about sequence of questions suggested by several scholars. Firstly, questionnaires should start with the following types of questions: the most interesting and easy to answer questions; questions measuring dependent variables; factual and behavioural questions; least sensitive questions; and general questions (Bowling, 2014; Matthews and Ross, 2010; Neuman, 2013; Podsakoff et al., 2012). Secondly, questions assessing the same construct should be mixed with other questions in order to minimise the risk of common method bias (Podsakoff et al., 2003; Podsakoff et al., 2012) (More information about common method bias is provided in Subsection 4.7.4.3). Thirdly, open-ended and demographic questions should be presented at the end of the questionnaire (Bowling, 2014; Matthews and Ross, 2010; Shaughnessey et al., 2014).

To summarise, the questionnaire consists of three main sections. The first section of the questionnaire contains questions that measure the main constructs in the model (i.e. PE, EE, SI, FC, PPS, and BI). In this section, questions that measure behavioural intention were placed at the beginning, and questions that measure the same construct were mixed with other questions. Moreover, questions that are more general, easy to answer, interesting, and less sensitive were positioned at the beginning of this section. The second section of this questionnaire is composed of the open-ended question. The last section includes demographic questions.

4.7.3.6 Layout and Presentation of the Questionnaire

The layout and presentation of a questionnaire is another important aspect that researchers should consider when developing a questionnaire (Neuman, 2013; Saunders et al., 2015). An attractive questionnaire can encourage participants to participate and, thereby, increase the response rate (Saunders et al., 2015). Many useful instructions have been suggested by authors to develop an attractive questionnaire. One of the most important instructions is that questionnaire should be short (Matthews and Ross, 2010; Saunders et al., 2015; Zikmund et al., 2013). Neuman (2013) stated that a 3-A4-page questionnaire is suitable for general population. In terms of time, Bhattacherjee (2012) recommends that a good questionnaire should be completed within 10-15 minutes. In the same time, authors warned researchers to squash questions to make the questionnaire looks short (Gray, 2018; Neuman, 2013; Saunders et al., 2015). In keeping with this advice, the researcher developed a short questionnaire (3 A4 pages), where there were enough spaces between questions.

It is also advised that the font size of questions should be between 10-12 points and using a plain font (Saunders et al., 2015). Moreover, researchers should avoid CAPITALS, *italics* and shaded backgrounds as this make the questions difficult to read (Bowling, 2014; Saunders et al., 2015). In addition, all font features should be consistent for all questions (Saunders et al., 2015). Researchers should also assign a number for each question (Gray, 2018; Saunders et al., 2015). Further, researchers should avoid splitting questions, where a question starts on one page and ends on another (Bowling, 2014; Zikmund et al., 2013). In view of those instructions, all questions were consistent in terms of font type (Arial) and font size (12 points), and they did not include any CAPITALS, *italics* and shaded backgrounds. Besides, questions were numbered in each section. The researcher also ensured that questions are not split between pages.

In respect to the layout of responses, scholars pointed out that the clearest layouts of responses of closed-ended questions are numbers (to be circled) and boxes or brackets (to be checked) (Gray, 2018; Neuman, 2013). In regard to open-ended questions, free-text boxes or lines are the most appropriate layout of responses (Gray, 2018). When a questionnaire contains numerous questions that have the same response format, researchers should use a multiple-grid layout, where the questions and their responses are presented in a grid format (Neuman, 2013; Saunders et al., 2015; Zikmund et al., 2013). Following the guidelines above, numbers from 1 to 7 were used as response alternatives for scale questions (questions in the first section of the questionnaire) while boxes were used as response alternatives for category questions (questions in the last section of the questionnaire). Participants were provided with a free-text box for answering the open-ended question. Moreover, as the questionnaire has 23 questions with same response alternatives (i.e. seven-point Likert scale), the multiple-grid layout was used to present the questions and their responses.

Additionally, questionnaires should have instructions that inform respondents how to answer questions (Bhattacherjee, 2012; Matthews and Ross, 2010; Saunders et al., 2015). These instructions should be clear and distinguishable from questions (Neuman, 2013; Zikmund et al., 2013). Thus, an instruction was added before each section of the questionnaire. These instructions were typed using 14-point-font size and bolded font to be different from the questions.

Further, researchers should consider adding identifying information on questionnaires (Neuman, 2013). In line with this advice, the header of the questionnaire included the logo of University of Leeds, the general practice name where that data collected from, and participant identification number that were given for each participant in order to match their questionnaires with their data regarding actual use (more information is explained in Section 4.10). Besides, the footer of the questionnaire contained information about the ethical application number (IRAS), the name of the document, the version, and date of developing that version. These details were requested by NHS Research Ethics Committee (REC).

With regard to questionnaire printing, researchers should print questionnaires on one side of the paper and avoid landscape orientation (Gray, 2018; Saunders et al., 2015). Further, a good-quality paper should be used for printing questionnaires (Saunders et al., 2015). Researchers also should avoid printing questionnaires on fluorescent-colour papers, instead, white colour is an acceptable choice (Saunders et al., 2015). The questionnaire in this study was printed on one side of a good-quality white paper and using portrait orientation.

Questionnaires should also include a professional cover sheet (i.e. participant information sheet), which contains information about the study such as purpose of the study, who is eligible, benefits and harms of taking part, confidentiality of data (Matthews and Ross, 2010; Neuman, 2013; Saunders et al., 2015). In addition, researchers should conclude the questionnaire by thanking participants for taking part in the study (Bhattacherjee, 2012; Bowling, 2014; Saunders et al., 2015). It is essential that questionnaires contain the researcher’s contact details to enable participants to ask the researcher for more information, if any (Matthews and Ross, 2010; Neuman, 2013). In line with these guidelines, participants were provided with a participant information sheet before distributing the questionnaire (more details about the participant information sheet are available in Subsection 4.12.1). The end of the questionnaire contained a statement of thanks and the researcher’s phone number and email address.

The internet questionnaire was created using Bristol Online Survey that is recommended by the University of Leeds. The internet survey is exactly the same the paper-based questionnaire in terms of the content, the response formats, the wording, the sequence of questions, and the layout.

4.7.3.7 Questionnaire Validation

After developing a questionnaire, it is very important that the researcher validates it (Matthews and Ross, 2010; Neuman, 2013; Saunders et al., 2015). The current study validated the questionnaire using two main steps: expert evaluation and pilot testing (Bhattacherjee, 2012; Neuman, 2013; Saunders et al., 2015). The next two subsections explain these steps.

4.7.3.7.1 Expert Evaluation

It is recommended that a draft of the questionnaire is sent to a panel of experts in order for it to be critically evaluated (Neuman, 2013). The experts should be asked to assess the face validity and content validity of the questions (Bhattacherjee, 2012; Hair et al., 2010). In other words, they should check that the proposed questions measure what they are supposed to measure and nothing else (Bhattacherjee, 2012; Saunders et al., 2015). In addition to checking question validity, they should examine the structure of the questionnaire (e.g. question ordering, and layout of the questionnaire) (Saunders et al., 2015).

In accordance with that advice, the researcher had a focus group meeting with the three experts in the School of Medicine at University of Leeds and another focus group meeting with two experts in West Yorkshire Research and Development (R&D). In addition, the questionnaire was sent to an associate professor at Al-Balqa Applied University in Jordan, who is an expert in technology acceptance. The researcher discussed with all of them the following aspects of the questionnaire: (1) the appropriateness and representativeness of the questions for measuring the constructs of interest; (2) the appropriateness of the language used and how much it is simple and comprehensible to patients; (3) the suitability of the response formats, sequence of questions, and layout of the questionnaire; and (4) the length of the questionnaire.

In respect to the first aspect (i.e. the appropriateness and representativeness of the questions), only two issues regarding the validity of the questions were spotted. The first is the similarity of some questions, such as questions measuring behavioural intention. This issue was not considered in amending the questionnaire as these questions were adopted from well-validated studies (see Subsection 4.7.3.2), and it is highly recommended to include more than one question to measure a construct (Blunch, 2012; Haenlein and Kaplan, 2004; Hair et al., 2010; Kline, 2015). The second issue is the inappropriateness of asking patients about their income. Similar to the first issue, the questionnaire was not amended because the income is considered as an important factor in adopting ePHRs. Moreover, there was a response option that enables participants to not reveal their income (i.e. prefer not to say).

With reference to the second aspect, many wording issues were detected by experts. They recommended the researcher to rephrase the question “I find Patient Online will be useful in managing my health” to be suitable for the participants in this study (i.e. patients who did not use Patient Online). This question was reworded by replacing the word “find” with the word “think” to be “I think Patient Online will be useful in managing my health care”. Further, the word “technologies” in the question “Patient Online is compatible with other technologies I use” should be better to be replaced by another word suitable for the context of this study. Accordingly, that question was rephrased to become “Patient Online is compatible with other web-based services I use (e.g. Amazon, eBay, or Internet banking)”. In addition, the word “productivity” in the question “I believe using Patient Online would increase my productivity” is not suitable for the context of this study. Thus, it was reworded to become “I believe using Patient Online would enhance my effectiveness in managing my health care”. The definition of Patient Online at the top of the questionnaire included a service that has not been provided by Patient Online (i.e. sending messages to doctors). Thus, this service was deleted from the definition of Patient Online.

Experts also found several issues regarding the response formats, the sequence of questions, and the layout of the questionnaire. Specifically, the question regarding age was originally categorical (i.e. it had response alternatives). It was converted to quantity question (i.e. continuous variable) as recommended by experts. Another issue was found by experts is that while titles of response alternatives of scale questions (i.e. strongly agree, agree, slightly agree, etc.) were shown on the first page, they were not shown on the next page. These titles were added to responses on the next page. The free-text box for the open-ended question was criticised due to its small size. Hence, that box was replaced with a larger one. Experts noticed that pages of the questionnaire were not numbered. Therefore, the pages were numbered.

In regard to the length of the questionnaire, all experts agreed that the questionnaire was not long and could be completed in short period of time (10-15 minutes).

4.7.3.7.2 Pilot Testing

After modifying the questionnaire according to experts’ recommendations, it should be pilot tested by sending it to a small group of the target population (Bhattacherjee, 2012; Saunders et al., 2015). At first, participants in the pilot testing should be asked to fill in the questionnaire, then, they should be interviewed or provided with a feedback form to obtain their comments about the questionnaire (Saunders et al., 2015). The feedback form should obtain the following information: clarity or ambiguity of questions, clarity of instructions to answer questions, difficulty to answer questions, time needed to complete the questionnaire, clarity and attractiveness of the layout, missing of major topics, sequence of questions, and any other comments (Bell, 2014; Zikmund et al., 2013). In keeping with the abovementioned recommendations, the modified questionnaire was sent to members of Patient/Carer Community (PCC) by the coordinator of this community via email. The PPC was developed and is run by a team based at the Leeds Institute of Medical Education in order to engage patients and their carer in the teaching of medical students. This community is composed of more than 170 patients and carers. A short questionnaire was attached to emails, which contained the seven questions mentioned above. Appendix 21 and Appendix 22 show the invitation letter and the feedback form, respectively.

Several issues about the questionnaire were reported by 37 respondents. The issue regarding the similarity of some questions was also mentioned here by a number of respondents. As this issue was very prominent, the researcher added the following statement at the beginning of the questionnaire to alleviate this issue: "*Before starting the survey, you should note that some questions may look similar. So, please read them carefully and answer all the questions*". As with experts, several respondents considered the question about income is intrusive. However, the researcher did not amend this questionnaire for the same reasons discussed before. Further, two respondents indicated that the abbreviation "GBP" in the question "what is your household income level (GBP/year)" may not be understood by many people. Hence, this abbreviation was replaced with the sign "£". In addition, the question "I think I have the resources necessary to use Patient Online" was ambiguous for some respondents due to the exact meaning of the word "resources". So, the question was clarified more by some examples of the resources (e.g. internet, computer, and IPad). Although other respondents recommended the researcher to arrange questions into themes, the researcher had intentionally mixed the questions in order to reduce the risk of common method bias (more details are explained in Subsection 4.7.4.3). The respondents found that the length of the questionnaire was appropriate, and it did not take much time to complete.

After amending the questionnaire according to the most of the comments provided by experts and patients, the questionnaire was ready to be distributed to participants. The final version of the questionnaire is presented in Appendix 23.

4.7.4 Biases in Survey Method

Although the survey method has several advantages and strengths, it is usually affected by several biases, such as response bias, non-response bias, and common method bias (Bhattacherjee, 2012; Zikmund et al., 2013). Such biases may reduce the validity of findings resulted from survey studies (Bhattacherjee, 2012). So, it is very important that researchers endeavour to avoid these biases as much as possible (Bhattacherjee, 2012). The following three subsections discuss how the current study tried to avoid the most common biases of survey method: response bias, non-response bias, and common method bias, respectively.

4.7.4.1 Response Bias

Response bias refers to the situation wherein participants' answers to questions do not intentionally or unintentionally represent the truth (Neuman, 2013; Zikmund et al., 2013). Response bias includes five types: acquiescence bias, extremity bias, social desirability bias, recall bias, and interviewer bias (Beins and McCarthy, 2017; Bhattacherjee, 2012; Zikmund et al., 2013). While the former four biases are more likely to happen in questionnaire studies, the latter bias is more likely to occur in qualitative studies (Al-Sabawy, 2013). Thus, the interviewer bias is less likely to affect the current study as it is not qualitative study. Recall bias is less likely to occur in this study as it does not ask respondents about past events or behaviours (Bhattacherjee, 2012). In general, the response bias may be avoided by making the questions understandable, interpretable, and readable (Sharpe et al., 2015). Thus, this study adopted a widely used questionnaire from a well-developed theory (UTAUT), and the adopted questionnaire was also pilot tested to identify any misunderstanding and confusion as discussed above. The acquiescence and social desirability biases can be minimised by assuring participants about confidentiality of their responses (Podsakoff et al., 2003; Podsakoff et al., 2012). Hence, respondents in this study were assured regarding the confidentiality of their questionnaires through participant information sheets distributed to them. The questionnaire included five questions that were worded in the opposite direction in order to reduce the effect of acquiescence and extremity biases (Emani et al., 2012; Lindell and Whitney, 2001).

4.7.4.2 Non-Response Bias

Non-response bias occurs when respondents to the survey are different from non-respondents owing to systematic reasons (Bhattacherjee, 2012; Price et al., 2015). Undoubtedly, such bias affects the validity of the results (Bhattacherjee, 2012; Neuman, 2013). Non-respondents can belong to one of two groups: the first contains people who refuse to participate, and the second includes people who cannot be reached or contacted (Denscombe, 2014; Matthews and Ross, 2010; Zikmund et al., 2013).

The best method for decreasing non-response bias is to maximise the response rate (Bhattacherjee, 2012; Neuman, 2013; Price et al., 2015). Several techniques recommended by studies were used so as to maximise response rate in the current study, namely: (1) the questionnaires were handed out in person to eligible patients because face-to-face surveys usually have the highest response rates in comparison with other methods such as mail, phone, and online surveys (Denscombe, 2014; Price et al., 2015; Zikmund et al., 2013). In order to minimise the impact of having the researcher present when collecting data, the researcher left the participants alone after handing out the questionnaire. In addition, he assured participants that their responses would be kept confidential. A locked box was provided at the reception in each GP practice to enable participants to return completed questionnaire. (2) Posters were put on walls of the four general practices at least one week before data collection in order to inform patients about the study and improve their tendency to participate (Bhattacherjee, 2012; Price et al., 2015). (3) As mentioned earlier, the questionnaire was developed to be participant-friendly through making it short, simple, clear, and easy to answer, and this may improve the response rate (Bhattacherjee, 2012; Neuman, 2013; Price et al., 2015). (4) The researcher did not leave the waiting room in the practice while participants were filling in the questionnaires so as to answer participants' enquires regarding any unclear questions and to remind or motivate them to complete the questionnaires (Bhattacherjee, 2012; Matthews and Ross, 2010; Saunders et al., 2015). (5) Potential participants were assured that the confidentiality and privacy of their responses were protected (Bhattacherjee, 2012; Dawson, 2002).

It is highly recommended that researchers inspect the presence of non-response bias in the study through comparing characteristics of respondents with non-respondents (Baird, 2012; Compeau et al., 1999; Sivo et al., 2006). If the difference between respondents and non-respondents is not significant, it can be concluded that there is a low risk of non-response bias (Sivo et al., 2006). Various characteristics can be compared between respondents with non-respondents: age, sex, ethnicity, income, health status, and so forth (Bowling, 2014; Sivo et al., 2006). In line with this advice, the current study assessed the presence of non-response bias by comparing age, sex, and ethnicity of respondents with non-respondents. Data regarding characteristics of non-respondents were obtained from the practices from where the participants were recruited. As data regarding other characteristics rather than age, sex, and ethnicity could not be extracted, the respondents and non-respondents were compared based only on these characteristics. Significant tests can be used to identify whether the difference between respondents and non-respondents is significant (Bowling, 2014). Therefore, the significance of the difference between respondent and non-respondents was tested using the chi-square test. The significant difference ($p<0.05$) between respondents and non-respondents indicates a high risk of non-response bias (Assadi, 2013; Meyers et al., 2016). The results of the assessment of non-response bias were presented in the results chapter (Subsection 5.4.1).

4.7.4.3 Common Method Bias

Common method bias (CMB) is defined as the amount of spurious variance caused by the data collection method rather than the associations between indicators and its latent constructs or between latent constructs themselves (Bhattacherjee, 2012; Podsakoff et al., 2003; Straub et al., 2004). Data collection methods may cause such bias when dependent and independent variables are assessed at the same time and/or using the same data collection instrument (questionnaires) (Bhattacherjee, 2012; Campbell and Fiske, 1959). CMB inflates the results of analysis and, thereby, it can lead to invalid conclusions (Podsakoff et al., 2003; Straub et al., 2004). Thus, the following guidelines have been suggested to avoid CMB:

Firstly, researchers should use different instruments to measure the dependent and independent variables (Bhattacherjee, 2012; Podsakoff et al., 2003). In line with this guideline, this study measured the main dependent variable (use behaviour) using system logs whereas all independent variables were assessed using self-administered questionnaires. Two independent variables (i.e. performance expectancy and behavioural intention) were also proposed as dependent variables for other variables, but they could not be measured using different methods.

Secondly, dependent and independent variables should be measured at different points in times (Bhattacherjee, 2012; Podsakoff et al., 2003; Podsakoff et al., 2012). In light of this advice, the dependent variable (use behaviour) was measured after 6 months of assessing the independent variables.

Thirdly, questions should be ordered in a way where questions assessing the same construct are mixed with other questions, and questions assessing the dependent variables should be at the beginning of the questionnaire (Podsakoff et al., 2003; Podsakoff et al., 2012). The current study applied this guideline by mixing questions and moving behavioural intention items to the beginning of the questionnaire.

Lastly, researchers should include reversely-worded questions (i.e. questions worded in the opposite direction) (Lindell and Whitney, 2001). As mentioned in Subsection 4.7.3.4, five reversely-worded questions were included in the questionnaire.

In spite of applying guidelines to reduce the risk of CMB, it is very important that researchers check statistically the presence of CMB in their studies (Podsakoff et al., 2003; Podsakoff et al., 2012). One of the most widely used techniques for detecting

CMB is Harman's single-factor test (Podsakoff et al., 2003; Mohamadali, 2013; Laugesen, 2013). By this technique, all items are loaded into an exploratory factor analysis, and the unrotated factor solution is examined with a view to identifying the number of constructs required to explain the variance in all variables (Podsakoff et al., 2003). It can be concluded that there is a substantial amount of CMB if either the exploratory factor analysis produces a single factor that all items load on, or the majority of the variance among items is explained by a single factor (Podsakoff et al., 2003). This method has been adopted by several studies related to the adoption of health information technologies (e.g. Assadi, 2013; Mohamadali, 2013; Klein, 2007b; Laugesen, 2013; Rahman, 2015). Thus, the current study used Harman's single-factor test to detect CMB using Statistical Package for the Social Sciences (SPSS) version 22.

Although Harman's single-factor test is a very common method, it has some limitations (Podsakoff et al., 2003). Basically, it cannot be used as a remedy for the detected CMB, if any. Further, it is an insensitive test as it is very rare to achieve the first condition, which is the emergence of a single factor from the exploratory factor analysis. Therefore, studies have used additional statistical techniques so as to confirm findings resulting from Harman's single-factor test (e.g. Assadi, 2013; Laugesen, 2013). Examples of such statistical techniques are unmeasured latent method factor technique, directly measured latent factor technique, measured response style technique, and CFA marker techniques (Podsakoff et al., 2012; Richardson et al., 2009). Podsakoff et al. (2012, p.564) recommended researchers to use unmeasured latent method factor technique "*if the specific source of the method bias is unknown or valid measures of the source of bias are not available*". As the current study did not specify a source of method bias and the questionnaire did not include items to assess a certain method bias, the unmeasured latent method factor technique was used to detect CMB and to confirm the conclusion drawn from Harman's single-factor test. This method entails adding a latent variable (so-called common method factor) to the model (Podsakoff et al., 2012). All items in the model load on the common method factor in addition to their underlying constructs (Podsakoff et al., 2003). Thus, the variance of each item is explained by its underlying construct, common method factor, and random error (Chin et al., 2012; Liang et al., 2007). In order to conclude that CMB is not likely to be a serious issue, two conditions must be achieved (Liang et al., 2007; Podsakoff et al., 2003; Williams et al., 2012). First, factor loadings (i.e. standardised regression weights) of the common method factor are not significant. Second, by obtaining squared values of standardised estimates of factor loadings (i.e. R^2), the variance of each indicator explained by its theoretical construct must be higher than the variance interpreted by the common method factor. The unmeasured latent method factor technique was carried using

Analysis Moment of Structures Software (AMOS) version 24. The results of Harman’s single-factor test and unmeasured latent method factor technique are presented in the results chapter (Subsection 5.5.1.4).

4.8 Research Sampling Process

After identifying the appropriate research method and developing a data collection tool, the next step is the research sampling process (Zikmund et al., 2013). Sampling refers to the process of choosing an adequate subgroup of population under study in order to make observations and draw conclusions about that population (Bhattacherjee, 2012; Saunders et al., 2015). The sampling process usually consists of four main steps: defining the population of interest, determining the sampling frame, selecting sampling technique, and determining the sample size (Malhotra et al., 2017; Saunders et al., 2015; Zikmund et al., 2013). These four steps of sampling process were followed in this study. More details about each step were presented in the subsequent four subsections.

4.8.1 Population

Population is defined as the entire set of cases or elements that share particular characteristics and a researcher wishes to investigate (Bhattacherjee, 2012; Neuman, 2013; Zikmund et al., 2013). Researchers should commence the sampling process by defining precisely the characteristics of the population of interest (Malhotra et al., 2017; Zikmund et al., 2013).

Characteristics of the population in the current study are as follows. (1) Patients who live in England and registered at a GP practice. (2) Patients who are aged 18 or older, this is because those who are younger than 18 years are not allowed to use Patient Online. (3) Patients who have not used Patient Online before (non-users), this is because this study aimed to examine factors that make potential users become users of Patient Online (pre-usage phase), and including users may bias the results as the factors before using the system may differ after using it (Han, 2003; Peek et al., 2014; Venkatesh et al., 2003). (4) Patients who are able to understand verbal explanations or written information, this is because they must be able to give written consent and complete the questionnaire independently. (5) For the same previous reason, patients who are English-language literate. There are no restrictions regarding other sociodemographic characteristics such as sex, ethnicity, and education level.

4.8.2 Sampling Frame

The second step of sampling process is determining the sampling frame (Bhattacherjee, 2012; Malhotra et al., 2017). Sampling frame refers to a list of all cases or elements of population from which researchers draw the sample, such as the telephone book, mailing lists, a customer database, and city directory (Malhotra et al., 2017; Saunders et al., 2015; Zikmund et al., 2013). It is highly recommended that the sampling frame is precise, comprehensive, and up-to-date (Bhattacherjee, 2012; Saunders et al., 2015).

In many cases, sampling frame cannot be determined for two reasons. First, a list of all cases in the population does not exist. Second, although such a list exists, a researcher cannot access it because it is confidential and protected by legislation, or the owner of the data refuses to give the researcher access due to the lack of time or interest in the research (Matthews and Ross, 2010). In the current study, it was very difficult to get a list of all individuals in the target population due to the confidentiality of such data and the large volume of work and time needed to get a list of such large population. Consequently, the sampling frame in this study could not be defined.

4.8.3 Sampling Techniques

The third step of the sampling process is the selection of a sample using an appropriate sampling technique (Bhattacherjee, 2012; Malhotra et al., 2017). The sample is defined as a small group of cases or elements that a researcher draws from the population (Neuman, 2013; Zikmund et al., 2013). Sampling techniques that are used to draw a sample are categorised into two main groups; probability sampling techniques and non-probability sampling techniques (Bowling, 2014; Gray, 2018; Neuman, 2013). Although probability sampling techniques are more appropriate than non-probability sampling techniques in producing representative samples (Bhattacherjee, 2012; Matthews and Ross, 2010; Shaughnessey et al., 2014), the current study used one of the non-probability sampling techniques instead of probability sampling techniques for the following two reasons. First, researchers must have a well-defined sampling frame to be able to use any probability sampling technique (Bowling, 2014; Matthews and Ross, 2010; Zikmund et al., 2013). That is, researchers need an accurate, comprehensive, up-to-date list of all cases in the target population in order to randomly select the sample and have a non-zero probability of selecting each case (Gray, 2018; Saunders et al., 2015). However, the sampling frame could not be identified in the present study for the reasons mentioned in the previous subsection. Second, even if the sampling frame could be identified in this study, it would be impractical to use probability sampling techniques. This is because the population is very large and spreads over a very wide area, and the required sample is large, thereby, data collection would be time consuming and too costly. In such cases, scholars recommend researchers to use one of the non-probability sampling techniques (Matthews and Ross, 2010; Saunders et al., 2015; Zikmund et al., 2013).

The most commonly used non-probability sampling techniques are convenience sampling, quota sampling, purposive sampling, and snowball sampling (Matthews and Ross, 2010; Saunders et al., 2015). The convenience sampling was the most appropriate for this study. The reasons for using convenience sampling and non-using the other non-probability sampling techniques are discussed below.

Convenience sampling is a technique that researchers use to select the most accessible, convenient, and reachable cases of the target population (Bhattacherjee, 2012; Wilson and MacLean, 2011). Convenience sampling was used in this study for the following reasons. Firstly, it is very suitable for researchers who are constrained with time, money, and human resources (Denscombe, 2014; Neuman, 2013; Zikmund et al., 2013), and this is the case for the researcher in this study. Secondly, convenience sampling is appropriate for studies that investigate consumer behaviour (Bryman, 2015; Zikmund et al., 2013), which is the aim of this study. Thirdly, it is used more frequently than other non-probability techniques in social research contexts (Matthews and Ross, 2010; Neuman, 2013; Zikmund et al., 2013). Moreover, it has been used by many studies in the context of ePHRs adoption (e.g. Baird, 2012; Majedi, 2014; Morton, 2012; Noblin et al., 2013; Patel et al., 2012; Sanders et al., 2013; Torres, 2011; Wakefield et al., 2012). Lastly, although the generalisability of findings from such samples is limited (Bhattacherjee, 2012; Saunders et al., 2015), this issue may be alleviated if the researcher proves the representativeness of the sample (Matthews and Ross, 2010; Shaughnessey et al., 2014). As mentioned in Subsection 4.7.4.1, this research compared characteristics of the respondents with the non-respondents to test the representativeness of the sample. Section 4.10 explains in details how the participants in this study were recruited using convince sampling technique.

Quota sampling was not used in this study due to the following reasons. It is suitable when the researcher highly anticipates that a certain subgroup of interest is less likely to accept to take part in the study (Zikmund et al., 2013). The researcher of this study did not anticipate that a subgroup would be more likely to refuse to participate in the study than others as the questionnaire in this study is suitable for all subgroups and does not contain sensitive or private questions. Further, it is very difficult to use quota sampling when the researcher is concerned with several characteristics of the population (e.g. age, sex, and income level) (Neuman, 2013; Wilson and MacLean, 2011), and this the case in the current study where the researcher wishes to select participants with numerous characteristics (i.e. age, sex, ethnicity, income level, education level, and having internet access). Lastly, quota sampling is not practical when the researcher is concerned with unobservable characteristics (e.g. social class) because this requires the researcher to interact with the case first to identify whether it is eligible to the study or not (Matthews and Ross, 2010). In the current study, several characteristics that the researcher is interested in are unobservable (i.e. income level, education level, and having internet access).

Although snowball sampling is very economical technique (Zikmund et al., 2013), it was not used in the current study for two reasons. First, it is appropriate for recruiting participants of a rare or hard-to-reach population (Bhattacherjee, 2012; Matthews and Ross, 2010; Zikmund et al., 2013). However, the population in the study is not rare and it is easy to reach. Second, although it enables the researcher to locate participants with the desired characteristics, it is more likely that the sample is not representative of the population as the initial group of participants are most likely to refer to others who have similar characteristics to themselves, leading to homogenous sample. (Bowling, 2014; Saunders et al., 2015; Zikmund et al., 2013).

Purposive sampling was not used in the current research for the following reasons. Purposive sampling is more appropriate for studies that aim to recruit only individuals with enough knowledge and experience regarding the phenomenon of interest (Bhattacherjee, 2012; Saunders et al., 2015). But, the current study did not aim to select participants with particular experience or knowledge to participate in the survey. Additionally, it is usually appropriate for small qualitative studies so as to explore or interpret individuals’ experiences and perceptions in depth (Bowling, 2014; Matthews and Ross, 2010; Saunders et al., 2015). Yet, the current research is a quantitative study that did not endeavour to understand participants’ perception in depth.

4.8.4 Sample Size

Identifying the sample size is a crucial step that the research should carefully take into account (Malhotra et al., 2017; Saunders et al., 2015). When using non-probability sampling techniques, it is difficult to identify the sample size owing to the lack of rules (Saunders et al., 2015).

One of the most crucial considerations that researchers should take into account before identifying the sample size is the data analysis method used (Hair et al., 2010; Kline, 2015; Zikmund et al., 2013). This is because complex analyses need large samples (Malhotra et al., 2017; Wilson and MacLean, 2011). As outlined in Section 4.11, this study employed structural equation modelling technique (SEM) in order to validate the proposed model and test the research hypotheses. When using SEM, it is highly advised that researchers select a large sample size so as to attain stable estimations of covariance and correlations and maintain the power of statistical tests (Blunch, 2012; Kline, 2015; Tabachnick and Fidell, 2013). However, there is no consensus on how large the sample should be in order to conduct the analysis using SEM (Kline, 2015; Muthén and Muthén, 2002). For instance, while Bentler and Chou (1987) recommend researchers to recruit at least five individuals for each observed variable (item) on condition that data meet the normal distribution assumption and constructs have multiple variables, Kline (2015) considered the findings resulted from such samples are less trustworthy. Further, other researchers suggested a rule of thumb of at least 10 individuals per an observed variable (Bentler and Chou, 1987; Blunch, 2012; Jackson, 2003). Costello and Osborne (2005) and Jackson (2003) suggested a more restricted rule, which is a minimum of 20 individuals per observed variable. A sample of a minimum of 200 participants was also identified as a rule of thumb (Blunch, 2012; Kline, 2015).

Hair et al. (2010) offered four suggestions for minimum sample sizes based on the complexity of the model, number of indicators for each construct, and communalities (i.e. average error variance of indicators). The first sample size is ≥ 100, which is suitable when the model is made up of ≤5 constructs, each construct is measured by more than three observed variables, and the average error variance of each indicator is high (≥0.6). The second sample size is ≥150, which is appropriate when the model consists of ≤7 constructs, the average error variance of each indicator is modest (0.5), and each construct is measured by three or more observed variables. The third sample is ≥300, which is suitable when the model includes ≤7 constructs, the average error variance of each indicator is low (<0.45), and/or multiple constructs are measured by less than 3 observed variables. The fourth sample is ≥500, which is suitable when the model is composed of >7 constructs, the average error variance of some indicators is low, and/or all constructs are measured by less than 3 observed variables.

The current study followed the rule proposed by Hair et al. (2010) as it considers more aspects of the model to identify the sample size (i.e. complexity of the model, number of indicators for each construct, and communalities) than other rules. The model in the current study is composed of seven main variables in addition to other six moderating variables. Therefore, the fourth sample size (i.e. ≥500) suggested by Hair et al. (2010) was suitable for this study. However, Hair et al. (2010) indicated that sample sizes should be increased in the following situations: variables are not multivariate normal, missing data are higher than 10%, and/or asymptotically distribution-free (ADF) estimation technique is used rather than maximum likelihood (ML) or generalized least squares (GLS) (more details about these techniques are discussed in Subsection 4.11.3). While the former two situations were possible in the current study, the latter situation was not possible as maximum likelihood (ML) was used in the current study.

Therefore, the target sample size in this study was increased to 600 in order to counter the two potential issues (i.e. multivariate abnormal and missing data) if they appeared.

4.9 Research Settings

After identifying the sampling technique and sample size, it is very important that researchers locate the settings from where the sample will be recruited (Biggam, 2015; Gray, 2018). Selection of inappropriate setting may result in incorrect inferences (Bhattacherjee, 2012). Researchers should select research settings based on the research questions rather than arbitrary selection (Bhattacherjee, 2012). Further, Dawson (2002) recommends researchers to take into account the available resources (i.e. time and budget) before determining the research settings.

According to those recommendations, the researcher in the current study identified the following characteristics of the required settings. (1) Settings must be GP practices for the following reasons: the system under the study (Patient Online) is implemented only in GP practices, the practices enable the researcher to reach the target individuals at the same time in one place, they are safe settings for participants and the researcher, they enable the researcher to easily gather data regarding the actual use of the system, and they are convenient for participants as they can complete the questionnaire while they are waiting for their turn to see the GP. (2) Settings should offer all the system services to their patients (i.e. viewing health records, booking appointments, and ordering repeat prescriptions). This allows the researcher to control the effect of the available services on the actual use as patients' use of the system may result from the presence of a certain service rather than another. (3) They should have a large number of registered patients as this may increase the number of the patients' visits per day, thereby, the researcher can reach the required sample size in short period. (4) They should have a small percentage of system users as the target sample in this study is non-users, and this enables the researcher to recruit the required sample size as soon as possible. (5) They should be located in West Yorkshire since the researcher has limited time and budget. (6) More than two GP practices should be selected and they should be dissimilar in terms of their patients' demographics to increase the variance in observations which is important for testing theories.

The process of determining the GP practices was performed by West Yorkshire Research and Development (R&D) as it is responsible for research taking place in GP practices in West Yorkshire. West Yorkshire R&D was informed about the characteristics of the required GP practices. Several GP practices were invited to participate in the study. Four GP practices accepted to take part in the current study.

As shown in Table 4.7, the selected GP practices met the required characteristics mentioned earlier. To be more precise, all practices have a system that provides all services predefined by the researcher. Further, the number of registered patients who are 18 years and older was large in all practices and ranged between 6193 and 9762 patients. The adoption rate of Patient Online was also low in all practices and ranged between 10% and 22%. Additionally, all practices are located in West Yorkshire (3 in Bradford and 1 in Leeds), where they are easy to reach. Moreover, there were differences between practices in terms of their patients' demographics. For example, while patients who are younger than 35 years formed about 30% of the registered patients in Practice 1, that age group formed 58% of the registered patients in Practice 4. In addition, whereas proportion of females was higher than males in Practice 1 and Practice 2, the proportion of males was higher than females in Practice 4, and both proportions were almost equal in Practice 3.

Table 4.7: Characteristics of the GP Practices

Features	Groups	Practice 1	Practice 2	Practice3	Practice 4
Registered patients[1]	-	6193	6552	9235	9762
Online services[2]	-	All services	All services	All services	All services
Adoption rate	-	15%	22%	11%	10%
Location	-	Bradford	Bradford	Bradford	Leeds
Age	18-24	867 (14%)	1068 (16.3%)	1199 (13%)	2716 (27.8%)
	25-34	1012 (16.3%)	1323 (20.2%)	1741 (19%)	2955 (30.3%)
	35-44	883 (14.3%)	1077 (16.4%)	1694 (18.3%)	1376 (14.1%)
	45-54	1045 (16.9%)	1162 (17.7%)	1530 (16.6%)	919 (9.4%)
	55-64	940 (15%)	922 (14.1%)	1343 (14.5%)	739 (7.6%)
	65-74	670 (11%)	583 (8.9%)	971 (10.5%)	589 (6%)
	74+	776 (12.5%)	417 (6.4%)	757 (8.1%)	468 (4.8%)
Sex	Male	2962 (47.8%)	3161 (48.2%)	4607 (49.9%)	5367 (55%)
	Female	3231 (52.2%)	3391 (51.8)	4628 (50.1%)	4395 (45%)
Ethnicity	White	85.3%	77.7%	78.2%	76.2%
	Asian	7.3%	17.6%	16.3%	10.9%
	Black	3.6%	1.1%	1.4%	6.3%
	Mixed	3.4%	2.6%	2.7%	4.4%
	Others	0.4%	1%	1.1%	2.2%

[1] **:** *All figures in the table represent patients who aged 18 years and older.*

[2] **:** *Online services include viewing records, booking appointments, ordering prescription.*

4.10 Data Collection Procedure

By developing the data collection tool, identifying sampling technique, and selecting the research setting, researchers should describe in details how the data are collected. Thus, this section is devoted to describing the data collection process.

The process of questionnaire distribution was not carried out in all practices at the same time as the researcher was the only one who was responsible for distributing the questionnaires. Questionnaire distribution started in Practice 1 on 21st August 2017, and it ended in Practice 4 on 26th September 2017. Data regarding participants' use of Patient Online were extracted from the system logs after six months of questionnaire distribution. To be more precise, data extraction process started in 21st February 2018 and ended in 26th March 2018. The data collection process was systematic and consisted of the following eight main steps.

First, the data collection process started with publicising the study one week before distributing the questionnaire in the GP practice. This is important in order to give patients enough time to decide whether to participate or not, and such step can improve their propensity to participate (Bhattacherjee, 2012; Saunders et al., 2015; Zikmund et al., 2013). Four channels were used to publicise the study: practice's newsletter, practice's website, posters on walls of waiting room in each practice, and participant information sheets that were handed out by a receptionist to patients when they book an appointment in person (more information about the content of the publicity is presented in Subsection 4.12.1).

Second, when patients arrived at the reception in the GP practice, the receptionist invited them to talk with the researcher. The role of the receptionist was useful as this made the study more formal and, thereby, might increase the response rate (Neuman, 2013; Zikmund et al., 2013). Some practices allowed patients to check-in independently using the electronic system at the entrance of the GP practice. Patients who used this service were approached directly by the researcher.

Third, the researcher introduced himself and handed out the participant information sheet to the patients who have accepted to talk with him. Although many patients were already informed about the study through one of the four channels, it was still necessary to make sure that all participants were aware enough of the study. In this step, the researcher left the patient alone for 5-10 minutes to read the participant information sheet carefully and to decide independently whether to take part or not. Appendix 24 shows the participant information sheet.

Fourth, after reading the participant information sheet, the researcher handed out the consent form to patients who showed an interest in participation in the study. The consent form consisted of two identical copies, one copy was returned to the researcher and the other copy remained with the participant. The consent form required patients to write their full name and signature (see Appendix 25). In this step, the researcher made sure that patients wrote their full names, which were important for carrying out the seventh step of the data collection process.

Fifth, the researcher handed out the questionnaire to patients who gave a written consent. Participants completed the questionnaire in the waiting room while they were waiting for the turn to get into the GP office. In this step, the researcher left the participants alone in order to not affect their answers, he also stayed in the waiting room to answer any questions from participants. If patients wanted to participate but they were unable to complete the questionnaire in the GP practice, the researcher offered two options to them for completing the questionnaire: a prepaid envelope to send the completed questionnaire back to the researcher, or the address (URL) of the internet questionnaire. The researcher’s address at the University of Leeds was printed on the prepaid envelops to ensure questionnaires were sent back to the correct destination. For those who selected the internet questionnaire, they had to complete the consent form before they were provided with a piece of paper containing the address of the internet questionnaire and their study identification number. Patients had to use their study identification number to be able to access the internet questionnaire. This is important in order to prevent anyone who was not registered to any of the four GP practices to complete the questionnaire, and the identification number is useful for performing the seventh step of the data collection process.

Sixth, the researcher returned to patients to collect the completed questionnaires and thank them for their participation in the study. Also, participants could drop their completed questionnaire in a locked box available at the reception in each GP practice when the researcher was not available or they were worried about the confidentiality of their data.

Seventh, after six months of distributing the questionnaire, a list of participants’ names and their study identification numbers was sent to a member of West Yorkshire R&D via an encrypted email. This member accessed the system logs of Patient Online in order to extract data about participants’ use of the system. Then, she sent the extracted data with only participants’ identification numbers to the researcher via an encrypted email. The researcher matched the data collected via questionnaires with data extracted from the system logs using the participants’ identification numbers. This 6-month period was determined for the following reasons: (1) it increases the possibility that participants have a need to use Patient Online (e.g. a need for booking appointment) (Assadi and Hassanein, 2009), (2) it is not practical to determine a period longer than 6 months as this study is restricted to time, and (3) participants' perceptions collected by the questionnaire might alter if the period was longer than 6 months, thus, they might not be the actual factors affecting their use or non-use of the system (Assadi, 2013).

4.11 Data Analysis

It is highly recommended that collected data are prepared before starting the analysis (Bhattacherjee, 2012; Bowling, 2014; Bryman, 2015). The following subsection outlines steps carried out by the researcher to prepare data for analysis. Quantitative data can be analysed in two different ways: descriptive analysis that is used to statistically summarise and describe characteristics of participants and variables; and inferential analysis that is utilised to statistically test hypotheses and validate theories (Bhattacherjee, 2012). The data in the current study were analysed using descriptive and inferential analyses. Further details regarding descriptive and inferential analyses are presented in Subsections 4.11.2 and 4.11.3, respectively. After analysing the quantitative data, the qualitative data collected by the open-ended question were analysed using thematic analysis. More information regarding the thematic analysis is explained in Subsection 4.11.4.

4.11.1 Data Preparation

The current research followed the subsequent steps of data preparation recommended by scholars: data entry, data coding, treatment of missing values, treatment of unengaged responses, checking normality, treatment of outliers, checking linearity, assessing homoscedasticity, and checking multicollinearity (Bhattacherjee, 2012; Bowling, 2014; Gray, 2018). More discussion about each step is presented in the following nine subsections.

4.11.1.1 Data Entry

In order to execute an analysis using a statistical software, data collected via paper-based questionnaires must be entered into a computer (Bowling, 2014). Bhattacherjee (2012) recommends researchers to use a spreadsheet such as Microsoft Excel when they have small data sets (less than 65,000 cases and 256 items). Thus, the data in the current study were entered into Microsoft Excel.

As data entry must be accurate in order to execute a correct analysis (Gray, 2018), the researcher compared the data entered into an Excel sheet with the data in questionnaires after completing the data entry. Only 26 of 20584 entries were incorrect in the Excel sheet. Those 26 entries were corrected by reviewing the corresponding questionnaires and entering the correct data.

4.11.1.2 Data Coding

Data coding for a quantitative analysis refers simply to the process of assigning numbers for data (Bhattacherjee, 2012). The coding process should be guided by a code book developed by the researcher (Bhattacherjee, 2012; Gray, 2018). Accordingly, data in the current study were coded using a code book presented in Appendix 26.

It is highly recommended that researchers check the coded data to find errors that resulted from the coding process (Bowling, 2014). The current study used two ways suggested by Bowling (2014) to find errors resulted from the coding process. The first is range checks where researchers try to find data that are out of a predefined range for each variable. The second is the consistency checks where researchers try to find impossible combinations of values of different variables (e.g. pregnant male or children treated in geriatric wards). No errors were found due to the coding process.

4.11.1.3 Treatment of Missing Values

Various methods can be used for treating the missing data: listwise deletion, pairwise deletion, mean imputation, regression imputation, pattern-matching imputation, and model-based methods (Byrne, 2016; Hair et al., 2010; Kline, 2015). Selecting the suitable method for treating missing data depends basically on the extent of missing data (i.e. the amount of missing values of all data set) (Byrne, 2016; Hair et al., 2010). If the missing data are less than 5%, researchers can select any method for treating missing data because there is not much difference in using any method (Hair et al., 2010; Kline, 2015; Roth, 1994). By using “Missing Values Analysis” option in SPSS v.22, the amount of missing data in the current study was very small (0.77%), therefore, any method could be used for treating the missing data. In the current study, missing data were treated using model-based methods for the following reasons. Firstly, model-based methods are considered the least biased methods, thereby, the generalisability of the results can be ensured (Hair et al., 2010; Byrne, 2016; Bhattacherjee, 2012). Secondly, they are appropriate for both patterns of missing data (i.e. missing completely at random & missing at random) (Hair et al., 2010; Kline, 2015). Thirdly, they have become easy to apply as several statistical software programs support it such as SPSS (Bhattacherjee, 2012; Hair et al., 2010).

There are two main model-based methods; expectation maximisation (EM) and full information maximum likelihood (FIML) (Hair et al., 2010; Byrne, 2016; Kline, 2015). Although EM and FIML methods are statistically efficient (Byrne, 2016), EM was used in the current study as it can be easily applied using “Missing Values Analysis” option in SPSS (Hair et al., 2010).

4.11.1.4 Treatment of Unengaged Responses

Bhattacherjee (2012) recommends researchers to watch out for unengaged responses where participants select one response for all questions regardless of the content, or they answer the questions in the same pattern (e.g. 1, 2, 3, 4,1, 2, 3, 4... or 1, 1, 1, 2, 2, 2, 3, 3, 3…). Such cases should not be included in the analysis (Bhattacherjee, 2012). There is no special technique for assessing unengaged responses, but the best way to do so is observing data during data entry process (Bhattacherjee, 2012). In the current study, data were screened for unengaged responses while entering and coding data. Unengaged responses were found in eight cases in this study. Those eight cases were removed from the dataset. The eight cases had different demographic characteristics.

4.11.1.5 Treatment of Outliers

Outliers are defined as values that are extremely higher or lower than the other values in the data set (Kline, 2015). There are two main types of outliers; univariate and multivariate (Hair et al., 2010; Kline, 2015). While the univariate outliers refer to extreme values on an individual variable, the multivariate outliers refer to unusually high or low values on two or more variables (Hair et al., 2010; Kline, 2015). Both types of outliers were assessed in the present study.

Univariate outliers were spotted in the current study using z-scores and boxplots, which are recommended by Aguinis et al. (2013), Field (2017), Hair et al. (2010), and Kline (2015). According to Hair et al. (2010), the cut-off point of standard values (z-scores) depends on sample size. Specifically, if the sample size is less than 80, the suitable cut-off point is 2.5 or more (Hair et al., 2010). For sample size larger than 80, the cut-off point is ≥4 (Hair et al., 2010). As the sample size in this study is larger than 80, the cut-off point of ≥4 indicates presence of outlier. As univariate outliers are checked for only continuous variables (Field, 2017; Hair et al., 2010), the current study assessed univariate outliers for age and use behaviour, which were the only continuous variables.

For detecting multivariate outliers, a significant test was carried out for values resulted from dividing Mahalanobis distance (D^2) values on the degree of freedom (i.e. number of variables) (D^2/df) (Byrne, 2016; Hair et al., 2010; Kline, 2015). As a thumb of rule, if the level of significance is less than 0.001, the case is designated as an outlier (Hair et al., 2010; Kline, 2015). It is worth mentioning that SPSS v.22 was used for detecting univariate and multivariate variables. The results regarding outliers are presented in the next chapter (Subsection 5.3.1).

4.11.1.6 Checking Normality

One of the main assumptions in the inferential analysis is normality (Hair et al., 2010; Schumacker and Lomax, 2010). In other words, it is prerequisite that data of each metric variable (i.e. continuous variable) are normally distributed in order to carry out an inferential analysis (Byrne, 2016; Hair et al., 2010). There are two types of normality; univariate and multivariate (Byrne, 2016; Hair et al., 2010). While the univariate normality is related to the distribution for each individual variable, multivariate normality is regarding the distribution of the joint effect of any two variables (Hair et al., 2010; Kline, 2015).

Univariate normality was examined in the current study through assessing skewness (i.e. how asymmetrical the distribution around the mean) and kurtosis (i.e. how flat a distribution in comparison with the normal distribution) (Hair et al., 2010; Kline, 2015). As it is recommended to use both graphics and statistical tests to assess skewness and kurtosis (Hair et al., 2010; Blunch, 2012), the current study assessed them through presenting a histogram for each variable, then, checking values of skewness and kurtosis. Kline (2015) considered variables as severely skewed when the absolute value of skewness is larger than three. Further, he determined the absolute value larger than 10 as an indication of high kurtosis. The above-mentioned thresholds were used in assessing the univariate normality in the current study. SPSS v.22 was used for checking univariate normality. The results regarding univariate normality are presented in the next chapter (Subsection 5.3.2).

Multivariate normality was not checked in the current study, and the univariate normality was considered as an acceptable indicator for multivariate normality. This is because assessing all aspects of multivariate normality is deemed very hard because it needs to examine the joint distribution of each two variables (Kline, 2015), and there is no direct assessment for it (Hair et al., 2010). Although multivariate normality can be examined using significant tests such as Mardia's test, these tests are not quite useful as they are very sensitive to large samples (Kline, 2015). Therefore, most studies examine the univariate normality as an indicator for multivariate normality (Hair et al., 2010; Kline, 2015). Blunch (2012, p.107) supported this approach by commenting "*I am well aware that in theory normality of marginal distributions does not guarantee multivariate normality. However, in my experience, in practice you can in general assume multivariate normality if all marginal distributions are normal*".

As outlined earlier, normality is checked for continuous variables (Byrne, 2016; Hair et al., 2010). The present research contained only two continuous variables; age and use behaviour. However, there is an ongoing debate about treating Likert scales as continuous variables rather than ordinal variables, and using parametric statistics for analysing them rather than non-parametric statistics (Carifio and Perla, 2008; Pell, 2005; Sullivan and Artino Jr, 2013). Many studies showed that parametric statistics can be used for analysing Likert scale data, especially when the Likert scale is five-point or greater (e.g. Akaike, 1987; Beauducel and Herzberg, 2006; Bentler and Chou, 1987; DiStefano, 2002; Muthén and Kaplan, 1985; Norman, 2010; Rhemtulla et al., 2012). According to Norman (2010), about 75% of studies in education and healthcare fields have used parametric statistics to analyse Likert scale data. In the context of ePHRs, several studies treated Likert scales as continuous variables and used parametric statistics for analysing them (e.g. Agarwal et al., 2013; Klein, 2007a; Lazard et al., 2016; Majedi, 2014; Morton, 2012; Noblin, 2010; Richards, 2012; Tavares and Oliveira, 2016; Torres, 2011; Whetstone and Goldsmith, 2009). Accordingly, Likert scale data in the current research were treated as continuous variables and analysed using parametric statistics.

4.11.1.7 Checking Linearity

Linearity is another critical assumption in any correlational multivariate analysis (Hair et al., 2010). Linearity implies that the relationship between an independent variable and dependent variable is linear (Field, 2017; Schumacker and Lomax, 2010). As the most commonly used method for checking linearity is scatterplot graphs (Hair et al., 2010) and Curve Estimation procedure (Alanazi, 2015; Gaskin, 2013), the current study checked the linearity between each proposed relationship using both techniques. Curve Estimation procedure estimates regression statistics for 10 different nonlinear models in addition to a linear model (Gaskin, 2013). In order to conclude that a relationship between two variables is linear, the F value for the linear model must be higher than other F values for other models, in addition, this value must be statistically significant ($p < .001$) (Gaskin, 2013). SPSS v.22 was used for checking linearity. The results regarding linearity are shown in the next chapter (Subsection 5.3.3).

4.11.1.8 Assessing the Homoscedasticity

The third important assumption in the inferential analysis is homoscedasticity, which indicates that different groups/ levels of an independent variable explain equal amounts of the variance of a dependent variable (Hair et al., 2010; Field, 2017; Kline, 2015). Gaskin (2013) recommends researchers to do not check homoscedasticity when models contain moderators as heteroscedasticity is expected in such models. Since moderators are part of the proposed model, homoscedasticity was not assessed in the current study.

4.11.1.9 Checking Multicollinearity

The last assumption in the inferential analysis is multicollinearity (Field, 2017; Hair et al., 2010). Multicollinearity refers to the situation where at least two independent variables are highly correlated (Field, 2017; Hair et al., 2010). Ideally, independent variables should be highly associated with the dependent variable, but there is no or weak correlation between the independent variables themselves (Hair et al., 2010). Multicollinearity was assessed in this study using two relevant measures: tolerance, which refers to the proportion of variability of one predictor that is unexplained by other predictors; and variance inflation factor (VIF), which refers to how strong the linear relationship between an independent variable and the other independent variables (Field, 2017; Hair et al., 2010; Kline, 2015). VIF value is estimated by dividing 1 by tolerance value (1/tolerance value) (Field, 2017; Hair et al., 2010; Kline, 2015). Extreme multicollinearity between independent variables can be concluded when VIF estimations are above 10 or tolerance estimations are below 0.10 (Hair et al., 2010; Kline, 2015). SPSS v.22 was used to check multicollinearity. The results regarding multicollinearity are outlined in Subsection 5.3.4.

4.11.2 Descriptive Analysis

After preparing data and checking multivariate assumptions, it is very important to summarise and describe characteristics of participants and their responses using univariate statistics (e.g. frequency distribution, mean, and standard deviation) and bivariate statistics (e.g. bivariate correlation) (Bhattacherjee, 2012). Accordingly, all characteristics of participants, except age, were summarised in a table using frequency distributions (numbers and percentages) because they are categorical variables (Field, 2017; Gray, 2018). Since age is a continuous variable in the current study, it was summarised using mean and standard deviation (Field, 2017; Gray, 2018). In addition, frequency distributions, mean, and standard deviation of the participants' responses for each item were estimated. All descriptive analyses were executed using SPSS v.22. The results of the descriptive analyses are presented in Section 5.4.

4.11.3 Inferential Analysis

The current study selected structural equation modeling (SEM) as an appropriate method for testing the theoretical model. Structural equation modeling (SEM) is defined as a set of multivariate statistical techniques that helps researchers to test theoretical models through examining simultaneously the relationships between observed variables and latent variables and the relationships between latent variables themselves (Hair et al., 2010). The current study used SEM for the following reasons.

Firstly, in contrast to first-generation techniques (e.g. analysis of variance and logistic regression), it is suitable for testing and validating hypotheses and conceptual models through examining simultaneously complicated relationships between latent variables and observable variables, and the relationship between many latent constructs (Byrne, 2016; Kline, 2015; Schumacker and Lomax, 2010). The theoretical model of the current study contains 23 observed variables which measure six latent variables, thus, it is necessary to assess the ability of observed variables to measure their corresponding latent variables, then to examine the relationships between latent variables.

Secondly, in contrast to first-generation techniques, SEM enables researchers to assess complex models that contain moderators and mediators (Hair et al., 2010; Schumacker and Lomax, 2010). The current study proposed 20 moderating effects and two mediating effects. This made SEM an appropriate approach for testing this model.

Thirdly, in contrast to first-generation techniques, the measurement errors could be taken into account when executing the analysis using SEM (Byrne, 2016; Hair et al., 2010; Schumacker and Lomax, 2010). Thus, the reliability and validity of the observed values measured by data collection instruments will increase (Byrne, 2016; Crockett, 2012; Schumacker and Lomax, 2010). It was necessary to add measurement errors to the proposed model in the current study as 23 observed variables were collected using questionnaires.

Fourthly, in contrast to most multivariate techniques that are exploratory by nature, SEM is deemed as a confirmatory approach more than exploratory approach though the latter can be addressed using SEM (Anderson and Gerbing, 1988; Byrne, 2016; Kline, 2015). Therefore, it is more suitable than other multivariate techniques for testing hypotheses (Byrne, 2016). As the model in the current study was developed based on a well-developed theory (UTAUT), the confirmatory approach was needed to validate the model, thereby, SEM was more suitable for achieving this purpose.

Lastly, SEM helps researchers to assess the extent to which a proposed model fits with the collected data, and it provides several statistical indicators to improve the model fit (Blunch, 2012; Hair et al., 2010; Kline, 2015).

The current study followed the main five steps of SEM: model specification, model identification, model estimation, model testing, and model modification (Crockett, 2012; Schumacker and Lomax, 2010). These steps are not straightforward but iterative as it is required to return to an earlier step when a problem happens at certain step (Kline, 2015). These steps are explained next and presented in Figure 4.1.

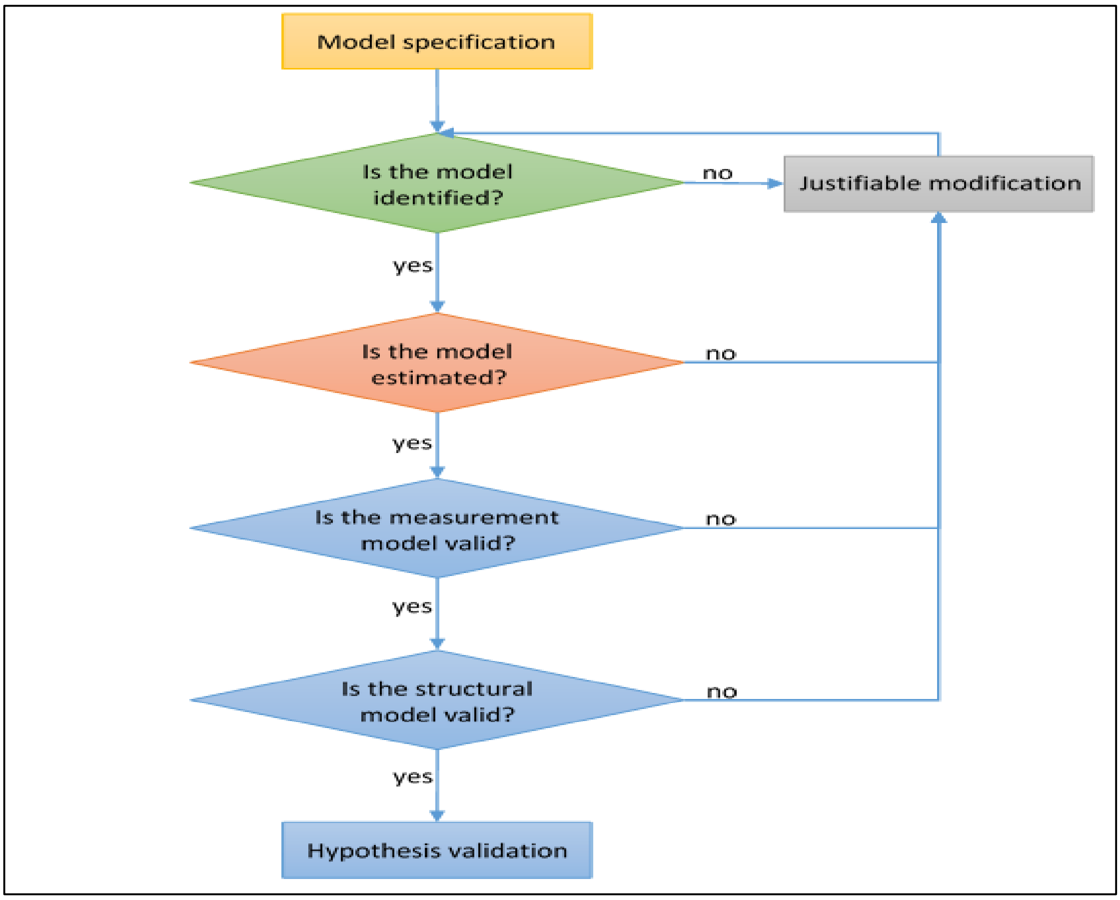


Figure 4.1: Structural Equation Model Steps

Starting with the model specification, a theoretical model was developed and presented based on relevant theories and empirical studies, as discussed in Chapter 3. Further, the measures of variables were identified in Subsection 4.7.3. This step is deemed as the most important and difficult step because it is the base of the subsequent process (Kline, 2015).

Following the model specification step, the model must theoretically be able to produce a unique solution of each parameter, and this is a so-called model identification (Kline, 2015; Schumacker and Lomax, 2010). The current study used the t-rule and the recursive rule for assessing the model identification. In respect to t-rule, the number of unique elements in the sample matrix should be equal to or larger than the number of free parameters (i.e. unknown and need to be estimated) in order for a model to be identified (Bollen, 1989; Crockett, 2012; Schumacker and Lomax, 2010). In other words, known elements should be equal to or more than unknown elements to assign a model as identified (Bollen, 1989; Crockett, 2012). With regard to recursive rule, the model is identified if it is recursive (i.e. no reciprocal relationships between any pair of variables) (Bollen, 1989; Schumacker and Lomax, 2010). In order for a model to be recursive, two conditions should be achieved: errors of endogenous variables (i.e. dependent variables) are not correlated, and relationships between latent variables are not reciprocal or feedback loops (Bollen, 1989; Schumacker and Lomax, 2010).

In the third step (i.e. model estimation), parameters of the population need to be estimated in order to generate a population covariance matrix ($\sum$) that is very close to the observed covariance matrix (S) (Crockett, 2012; Schumacker and Lomax, 2010). The estimation process depends on an iterative procedure, so-called fitting function, so as to reduce the differences between the estimated population covariance matrix ($\sum$) and observed sample covariance matrix. Statistical programs offer various fitting functions, notably: maximum likelihood (ML), generalized least squares (GLS), unweighted least squares (OLS), scale-free least squares (SLS), and asymptotically distribution-free (ADF) estimation (Blunch, 2012; Crockett, 2012; Schumacker and Lomax, 2010). The current study used maximum likelihood (ML) for model estimation due to the following reasons. Firstly, it is highly recommended to use ML if observed variables are multivariate normal (Blunch, 2012; Byrne, 2016; Kline, 2015), and this was the case in the current study. Secondly, ML estimates are consistent, which means that the estimates become closer to the population parameter when the sample size increases (Blunch, 2012; Byrne, 2016; Kline, 2015; Schumacker and Lomax, 2010). Thirdly, ML is asymptotically unbiased, which means that its bias reaches zero as the sample size increases to infinity (Byrne, 2016; Kline, 2015; Schumacker and Lomax, 2010). Fourthly, ML generates normally distributed estimations when the observed variables are multivariate normal (Blunch, 2012; Schumacker and Lomax, 2010). Fifthly, ML can be used for categorical variables if they are multivariate normal (Crockett, 2012; Schumacker and Lomax, 2010), and this was the case in the current study. Lastly, ML has been utilised in most studies that used SEM (Blunch, 2012; Kline, 2015).

After estimating the population covariance matrix, the model must be tested in terms of its fit to the collected data, and this is the fourth step (Schumacker and Lomax, 2010). Models in SEM consist of two components: measurement model in which the relationships between observed variables and the latent variables are examined; and structural model in which the relationships proposed between latent variables are assessed (Byrne, 2016; Hair et al., 2010; Schumacker and Lomax, 2010). The current study tested both measurement and structural models. There are two main approaches for testing measurement and structural models: the one-step approach, where the measurement model and structural model are examined simultaneously; and two-step approach, where the structural model is tested after the measurement model (Anderson and Gerbing, 1988). The present research used the two-step approach for the following reasons. Basically, many researchers argued that achieving a good fit of a model is very difficult using one-step approach (Anderson and Gerbing, 1992; Byrne, 2016; James et al., 1982; Koufteros, 1999). In addition, researchers can test the significance of all patterns of coefficients using the two-step approach rather than the one-step approach

(Anderson and Gerbing, 1988). Furthermore, the two-step approach prevents having a good model fit by masking poor fit of the other models, as the case in the one-step approach (Anderson and Gerbing, 1988). Lastly, as examining the relationships proposed in structural models depends on correct, reliable measurement models, the measurement models must be well-specified and examined first (Anderson and Gerbing, 1988). Testing measurement models and structural models include several processes that need extensive explanations. Hence, this study explained all processes for testing measurement model and structural model in the following two subsections, respectively.

Lastly, the model modification is a necessary step for managing the issues appear in any step mentioned above, such as an unidentified model and a poor fit model. (Byrne, 2016; Hair et al., 2010; Schumacker and Lomax, 2010). To perform an appropriate modification, the current study checked factor loadings, the statistical significance of estimated parameters, standardised residual matrix, and modification indices, which are recommended by Byrne (2016), Hair et al. (2010), Kline (2015), and Schumacker and Lomax (2010). Specifically, an item with a factor loading of 0.70 or less was taken into consideration for deleting (Barclay et al., 1995; Chin, 1998; Hair et al., 2010). Further, the researcher considered eliminating parameters that were not statistically significant ($p> 0.05$) (Crockett, 2012; Schumacker and Lomax, 2010). The researcher also checked standardised residual matrix (standardised differences between the estimated covariance matrix and the sample covariance matrix) to find absolute values larger than two, which indicates that the model does not explain a certain covariance very well (Hair et al., 2010; Kline, 2015; Schumacker and Lomax, 2010). Thus, such covariance was taken into consideration to be deleted (Hair et al., 2010; Kline, 2015; Schumacker and Lomax, 2010). Lastly, the researcher checked modification indices, which show the minimum amount of the discrepancy (chi-square value) that will be decreased by defining a certain parameter as free (Byrne, 2016; Hair et al., 2010; Kline, 2015). Authors warned researchers to modify models depending only on the above-mentioned statistics without theoretical basis and plausible justification (Byrne, 2016; Hair et al., 2010; Kline, 2015). Therefore, the model modifications in the current study were performed based on theoretical and statistical considerations.

There are several statistical programs for executing SEM, such as AMOS, EQS, LISREL, SMART PLS, and STATA (Kline, 2015; Schumacker and Lomax, 2010). A specialised statistical software tool for SEM called Analysis of Moment Structures (AMOS v.24) was used for conducting the inferential analysis in the current study.

4.11.3.1 Measurement Model

Researchers need to ensure that the measurement model is valid, which means that the observed variables (indicators) actually measure their underlying latent variables (Crockett, 2012; Hair et al., 2010). The validity of the measurement model can be assessed by confirmatory factor analysis (Crockett, 2012). Confirmatory factor analysis examines the validity of measurement model using three measures: model fit, construct reliability, and construct validity (Hair et al., 2010; Kline, 2015). The current research used these three measures to assess the validity of the measurement model. More details about these measures are explained in the following three subsections. Figure 4.2 summarises the whole measurement model validation process in the current study.

4.11.3.1.1 Model Fit

Model fit is a measure that assesses the extent to which a model is consistent with the collected data (Hair et al., 2010). To put it differently, model fit refers to the degree to which the covariance matrix estimated by the model is similar to the one that observed among the collected data (Hair et al., 2010). Model fit can be assessed using numerous indices, which are categorised into three groups: absolute, incremental, and parsimonious fit indices (Hair et al., 2010; Kline, 2015; Schumacker and Lomax, 2010). The current study used several indices for assessing the model fit. More discussion regarding the selected indices in each group is presented in the following subsections.

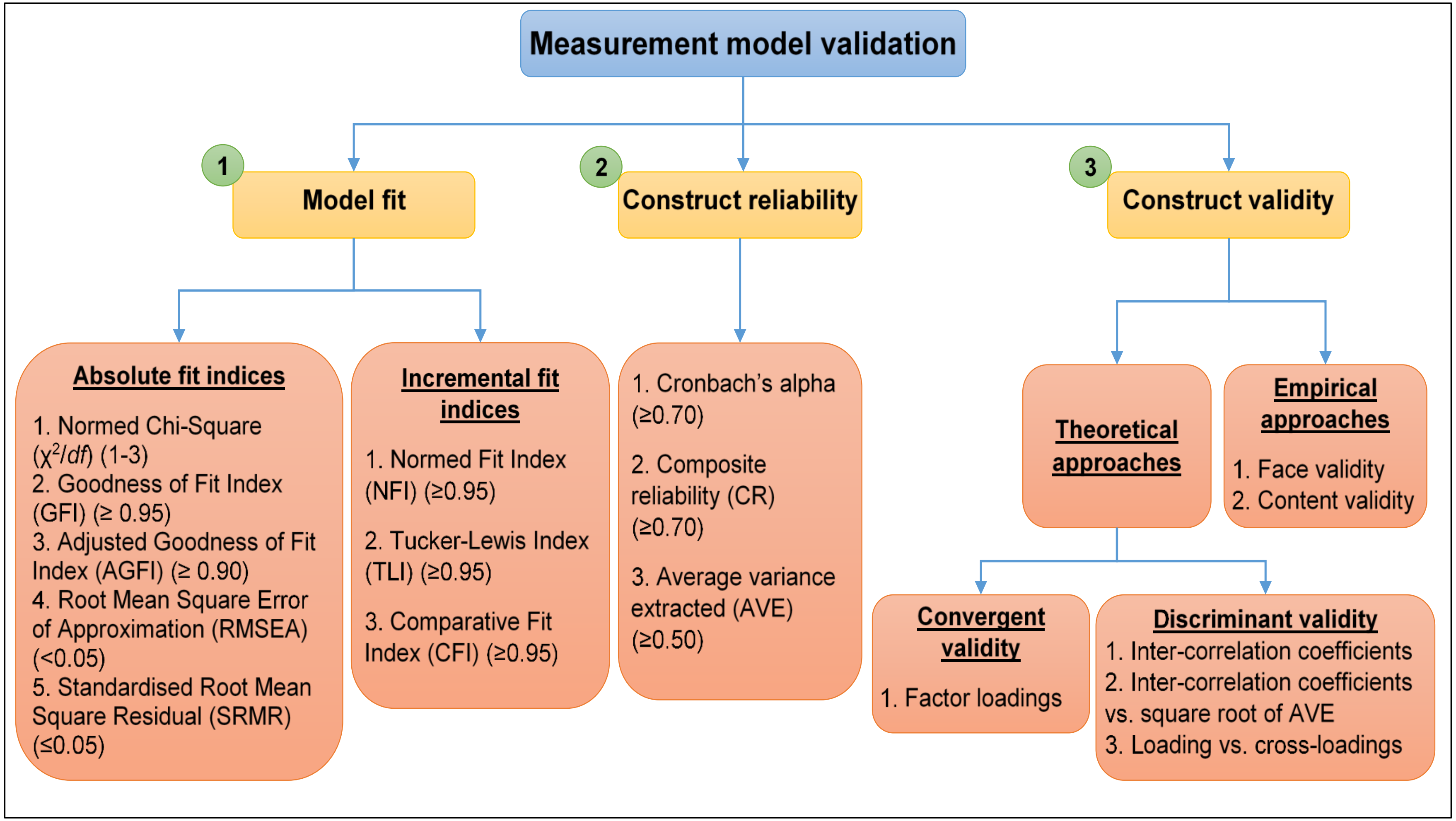


Figure 4.2: Measurement Model Validation

Absolute Fit Indices

Absolute fit indices assess fit of a specified model without comparing that fit of the model with other alternative models (Hair et al., 2010; Kline, 2015). The current study used the following absolute fit indices:

1. Chi-Square Statistic (χ^2): it measures the discrepancy between the covariance matrix estimated by the model and the covariance matrix calculated from the sample data (Hu and Bentler, 1999). When the χ^2 value is not statistically significant (i.e. $p>0.05$), the model fit is considered good (Hair et al., 2010; Hu and Bentler, 1998). It is known that χ^2 is not an appropriate index for studies with large samples (Byrne, 2016; Hair et al., 2010; Kline, 2015; Tabachnick and Fidell, 2013). In order to deal with this issue, Wheaton et al. (1977) developed a new fit index by dividing the value of χ^2 on the degree of freedom (*df*), and they called it as relative chi-square (χ^2/df). As the current study recruited a large sample (624 patients), the relative chi-square (χ^2/df) was used instead of chi-square. Hair et al. (2010) identified the cut-off value between 1and 3 as an indicator of a good model fit. The current study used this cut-off level as it is the most restricted level suggested by in the literature.
2. Goodness-of-Fit Index (GFI): it measures the proportion of covariance matrix in the sample data that is explained by the hypothesised model (Byrne, 2016; Kline, 2015). The current study used this index with a cut-off point of 0.95 and greater to indicate a good fit model, which is the most restricted threshold and recommended by Kamarulzaman (2006) and Schumacker and Lomax (2010).
3. Adjusted Goodness-of-Fit Index (AGFI): GFI was adjusted using degrees of freedom and number of parameters in order to take into consideration the model complexity (Blunch, 2012; Hair et al., 2010). In other words, the more complex the model is the lower the AGFI value (Byrne, 2016; Hair et al., 2010). For that reason, AGFI can be considered as one of the parsimonious fit indices which are discussed later (Byrne, 2016; Hair et al., 2010). As the AGFI value is usually less than the GFI value (Hair et al., 2010), and some researchers suggested a cut-off point of 0.90 and above to refer to a good model fit (Hooper et al., 2008; Kamarulzaman, 2006; Schumacker and Lomax, 2010), the current study used the cut-off level of ≥ 0.90.
4. Root Mean Square Error of Approximation (RMSEA): it measures the extent to which a model fits the covariance matrix for the population if it is obtainable (Browne and Cudeck, 1993; Hu and Bentler, 1999). The RMSEA is deemed as a badness-of-fit index since the larger RMSEA values indicate a poor model fit (Hair et al., 2010; Kline, 2015). As a rule of thumb, a value of less than 0.05 indicates close model fit, a value between 0.05 and 0.08 points to adequate model fit, and a value of higher than 0.10 refers to bad model fit (Browne and Cudeck, 1993; Hair et al.,

2010; Kamarulzaman, 2006; MacCallum and Hong, 1996). The current study followed the above-mentioned rule of thumb. Further, this study used 90% confidence interval (CI) of the estimated RMSEA value in order to assess its precision (Byrne, 2016; Kline, 2015). When the upper bound of 90% CI for RMSEA value is higher than the predefined RMSEA cut-off point (e.g. 0.11), the model fit will be assessed as bad (Byrne, 2016; Kline, 2015). The current study also used a statistical test called PCLOSE to test the proposed assumption that the RMSEA value is less than 0.05 (Browne and Cudeck, 1993). A PCLOSE value of <0.05 indicates that the model fit is poor even though the RMSEA value is less than 0.05 as it is likely that the RMSEA value is due to chance (Browne and Cudeck, 1993; Kline, 2015).

5. Standardised Root Mean Square Residual (SRMR): it measures the average of the absolute differences between the predicted and observed matrices (residuals) (Hair et al., 2010; Kline, 2015). A lower SRMR value indicates a better model fit, thus, it is considered as a badness-of-fit index (Hair et al., 2010; Kline, 2015). The current study selected the most stringent cut-off value of SRMR (≤0.05) to indicate a good model fit, which is recommended by Schumacker and Lomax (2010).

Incremental Fit Indices

Incremental fit indices, which are also called comparative or relative fit indices, examine how well a proposed model fits the collected data in comparison with an alternative null model, which assumes no correlations between all observed variables (Hair et al., 2010; Kline, 2015). Specifically, these indices assess the proportion of improvement in fit of the hypothesised model over that of a null model (Kline, 2015). The current study used the following incremental fit indices:

1. Normed Fit Index (NFI): it is the outcome of dividing the difference between chi-square values for the proposed model and a null model by the chi-square value for the null model (Hair et al., 2010; Tabachnick and Fidell, 2013). Values of NFI ranges from 0 to 1, where the higher NFI value is the better model fit (Hair et al., 2010; Tabachnick and Fidell, 2013). The current study used the cut-off level of 0.95 and above as it is the most stringent and highly recommended threshold (Blunch, 2012; Hu and Bentler, 1999; Tabachnick and Fidell, 2013).
2. Tucker-Lewis Index (TLI): it is similar to NFI but it puts into consideration the model complexity by controlling the degree of freedoms from the proposed model and the null model, thus it is called non-normed fit index (NNFI) (Hair et al., 2010; Kline, 2015). Similar to NFI, a threshold of ≥ 0.95 was used in the current research to refer to a good model fit (Byrne, 2016; Hu and Bentler, 1999).

3. Comparative Fit Index (CFI): it measures the extent of departure from good fit for the proposed model in comparison with that for the null model (Kline, 2015). As TLI and NFI, the most recommended cut-off point for CFI to indicate a good fit is ≥ 0.95 (Blunch, 2012; Hu and Bentler, 1999; Kamarulzaman, 2006). The current study used the cut-off point of ≥ 0.95.

Parsimonious Fit Indices

Parsimonious fit indices enable researchers to identify the most appropriate model of a set of competing models in terms of both the model fit and complexity (Byrne, 2016; Hair et al., 2010). The current study did not use parsimonious fit indices for two reasons. First, they are not useful for studies that have only one model as their values are meaningless without comparing them with values of other model/s (Byrne, 2016; Hair et al., 2010; Schumacker and Lomax, 2010). The current study proposed only one model, and it did not intend to compare it with competing models. Second, those indices can be deemed as redundant because comparing values of incremental fit indices for competing models provides comparable evidence (Hair et al., 2010). Therefore, Hair et al. (2010, p. 699) reported that "*the use of parsimony fit indices remains somewhat controversial*".

To summarise, the current study used five absolute fit indices and three incremental fit indices. Those indices and their cut-off points are summarised in Table 4.8. The current study used AMOS v.24 to assess the measurement model fit.

Table 4.8: Model Fit Indices and their Acceptance Levels

4.11.3.1.2 Construct Reliability

Group	Fit Indices	Acceptable level
Absolute fit indices	Normed Chi-Square (χ^2/df)	1-3
	Goodness-of-Fit Index (GFI)	≥ 0.95
	Adjusted Goodness-of-Fit Index (AGFI)	≥ 0.90
	Root Mean Square Error of Approximation (RMSEA)	RMSEA: -Close fit (<0.05) -Adequate fit (0.05-0.08) -Inadequate fit (>0.10) PCLOSE: ≥0.05
	Standardised Root Mean Square Residual (SRMR)	≤0.05
Incremental fit indices	Normed Fit Index (NFI)	≥0.95
	Tucker-Lewis Index (TLI)	≥0.95
	Comparative Fit Index (CFI)	≥0.95

Construct reliability refers to the consistency or reproducibility of an observed variable in measuring what it is assumed to measure (Bhattacherjee, 2012; Hair et al., 2010). To put it differently, a measure (indicator) of a construct should produce almost the same results when it is repeated under constant conditions (Blunch, 2012). The most commonly used measures for assessing construct reliability are Cronbach's alpha, the composite reliability (CR), and the average variance extracted (AVE) (Assadi, 2013; Hair et al., 2010; Kamarulzaman, 2006). These three measures were used in the current study, and more details about them are provided below.

Cronbach's alpha is a measure of internal consistency reliability (Cronbach, 1951). Cronbach's alpha measures "*the degree to which responses are consistent across the items within a measure*" (Kline, 2015, p. 91). As a rule of thumb, Cronbach's alpha values of ≥0.90, ≥0.80, ≥0.70, ≥ 0.60, ≥0.50, and <0.50 are considered as an indication of excellent, very good, acceptable, questionable, poor, unacceptable internal consistency reliability, respectively (George and Mallery, 2016; Kline, 2015). Cronbach's alpha for each latent variable in this study was examined using SPSS v.22.

As Cronbach's alpha, the composite reliability (CR) is a measure of internal consistency reliability (Assadi, 2013; Majedi, 2014). However, while Cronbach's alpha assesses the reliability of a latent variable without a comparison with other latent variables in the model, the CR examines the reliability of a latent variable in relation to other latent variables in the model (Majedi, 2014; Werts et al., 1974). The cut-off points for the CR are similar to those for Cronbach's alpha (Hair et al., 2010). The CR for each construct in this study was measured using a new plugin (so-called Master Validity) in AMOS v.24 developed by Gaskin and Lim (2016).

The average variance extracted (AVE) measures the percentage of variance that a construct captures in relative to the percentage of variance owing to measurement errors (Fornell and Larcker, 1981). The highly recommended cut-off level for AVE is ≥0.50 to indicate a good reliability (Fornell and Larcker, 1981; Hair et al., 2010). This study measured AVE for each latent variable using the plugin "Master Validity" in AMOS v.24. Table 4.9 summarises the construct reliability measures used in this study and their acceptable cut-off points.

Table 4.9: Reliability Measures and their Acceptable Cut-off Points

Reliability Measures	**Cut-off levels**
Cronbach's alpha	≥0.70
Composite reliability (CR)	≥0.70
Average variance extracted (AVE)	≥0.50

4.11.3.1.3 Construct Validity

Construct validity refers to the degree to which a group of scales (items) of a latent variable adequately measures that latent variable and nothing else (Bhattacherjee, 2012; Hair et al., 2010). The current study used two groups of approaches to assess the construct validity: theoretical and empirical approaches (Bhattacherjee, 2012). More discussion regarding those groups is provided in the following subsections.

Theoretical approaches

Theoretical approaches examine "*how well the idea of a theoretical construct is translated into or represented in an operational measure*" (Bhattacherjee, 2012, p. 58). The current study used two theoretical approaches to assess the construct validity: face validity, which assesses how reasonable a scale (item) measures the underlying latent variable "on its face"; and content validity, which examines the extent to which a group of scales represents the domain of the latent variable that they are hypothesised to measure (Bhattacherjee, 2012; Kline, 2015; Litwin and Fink, 1995). Face and content validity were examined by sending the questionnaire to an expert panel to assess its face and content validity. This process was described in details in Subsection 4.7.3.7.1.

Empirical approaches

Empirical approaches assess "*how well a given measure relates to one or more external criterion, based on empirical observations*" (Bhattacherjee, 2012, p. 58). The current study utilised the most widely used empirical approaches to assess the construct validity: convergent validity and discriminant validity (Gefen and Straub, 2005; Hair et al., 2010; Kline, 2015).

Convergent validity refers to how close a scale relates to its latent variable that it is assumed to measure (Bhattacherjee, 2012; Hair et al., 2010). The convergent validity was assessed in this study using the standardised regression weights (i.e. factor loadings) (Anderson and Gerbing, 1988; Hair et al., 2010; Richards, 2012). Factor loadings are an indicator of the strength of the relationship between scales and their target constructs (Majedi, 2014; Schumacker and Lomax, 2010). Although a cut-off point of 0.50 or more can be acceptable for indicating a good convergent validity for an item, the ideal cut-off point is 0.70 or higher (Barclay et al., 1995; Chin, 1998; Hair et al., 2010). Factor loadings of all items in the current study were measured using AMOS 24. It is noteworthy that AVE can be regarded as a measure for convergent validity, in addition to the construct reliability (Chang et al., 2015; Hair et al., 2010; Kamarulzaman, 2006).

In contrast to convergent validity, the discriminant validity refers to the extent to which a scale of one latent variable does not relate to other latent variables that it is not postulated to measure (Bhattacherjee, 2012; Hair et al., 2010). Discriminant validity was examined in this study using three approaches. The first is inter-correlation coefficients, which refers to the correlations between each pair of constructs (Brown, 2014; Kline, 2015). In order to say that a good discriminant validity has been achieved, inter-correlation values should be less than 0.85 (Brown, 2014). Inter-correlation coefficients of each pair of constructs were assessed in the present research using the plugin “Master Validity” in AMOS v.24 (Gaskin and Lim, 2016).

In the second approach, the square root of AVE for a construct is compared with the inter-correlation coefficients between that construct and each of other constructs (Chin, 1998; Fornell and Larcker, 1981; Hair et al., 2010). To reach good discriminant validity for a construct, the value of square root of AVE for a construct need to be higher than inter-correlation coefficients between that construct and each of other constructs (Fornell and Larcker, 1981; Gefen and Straub, 2005; Hair et al., 2010). Values of the square root of AVE and inter-correlation coefficients were summarised in one table, where the diagonal of the table presents square root of AVE and the off-diagonal of the table contains inter-correlation coefficients of each pair of constructs. This table was produced using the “Master Validity” Plugin in AMOS v.24 (Gaskin and Lim, 2016).

In the third approach, the factor loading of each item on their underlying construct is compared with the factor loading of that item on other constructs (cross-loadings) (Chin, 1998; Chin, 2010). It can be concluded that an item has acceptable discriminant validity when its loading on its construct is higher than its loading on other constructs (Chin, 1998). Factor loadings and cross-loadings were summarised using a table, where rows contain items, and columns represent constructs (Chin, 2010). This table was created automatically by AMOS v.24. When the loading of the item is greater than cross-loadings in one row, this indicates that this item sufficiently discriminates its underlying latent variable from other latent variables (Chin, 2010). On the other hand, when the loading of the item is greater than cross-loadings in one column, this means that the construct in that column associates with its own items than with other items (Chin, 2010).

4.11.3.2 Structural Model

After assuring the validity of the measurement model, it is necessary to assess the structural model. Researchers should assess three main aspects of the structural model: model fit, predictive power, and strength of relationships (Byrne, 2016; Kamarulzaman, 2006; Kline, 2015). All three aspects were assessed in the present study (see Figure 4.3), and more details are outlined in the following subsections.

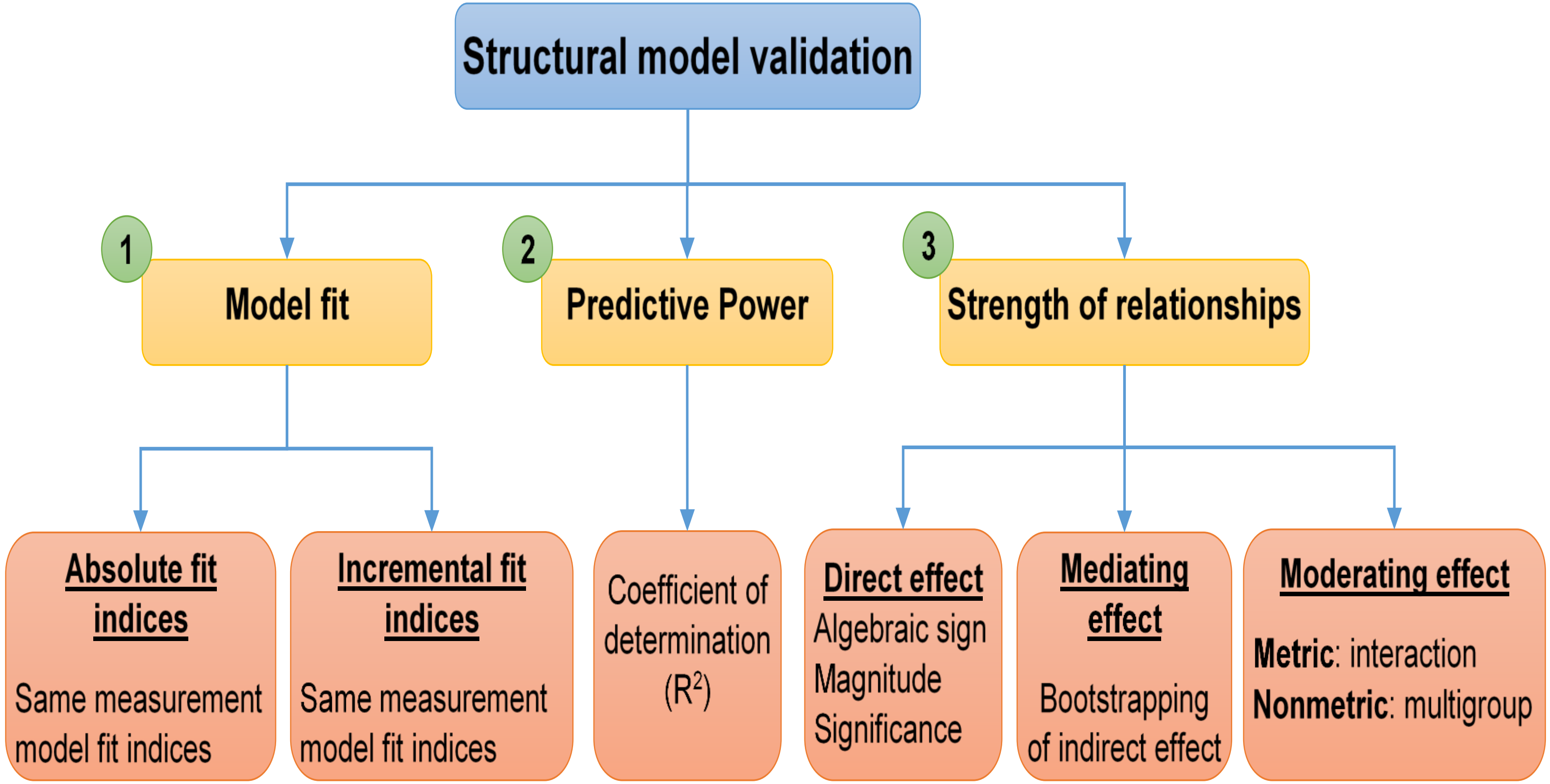


Figure 4.3: Structural Model Validation Process

4.11.3.2.1 Model Fit

The fit of the structural model was examined in this study using the same fit indices used for assessing the measurement model fit, which are: χ^2/df, GFI, AGFI, RMSEA, SRMR, NFI, TLI, and CFI. The current study used AMOS v.24 to assess the structural model fit.

4.11.3.2.2 Predictive Power

After assuring the fit of the structural model, the current study assessed the predictive power of the proposed model by examining the coefficient of determination (R^2) for three endogenous variables (dependent variables); use behaviour (UB), behavioural intention (BI), and performance expectancy (PE) (Byrne, 2016; Chin, 1998; Urbach and Ahlemann, 2010). The coefficient of determination (R^2) measures the proportion of the variance of the endogenous variable (dependent variable) that is predicted by exogenous variables (independent variables) (Hair et al., 2010). Values of R^2 ranges between 0 and 1, where the higher values indicate a higher predictive power (Hair et al., 2010; Urbach and Ahlemann, 2010). According to Chin (1998), R^2 values of around 0.67, 0.33, and 0.19 indicate substantial, moderate, and week prediction powers, respectively. AMOS v.24 was used in this study for assessing the predictive power

4.11.3.2.3 Strength of Relationships

The assessment of the effect of a factor on another depends on the type of the effect (i.e. direct, mediating, or moderating) (Field, 2017; Hair et al., 2010). As the model proposed in this study included direct, mediating, and moderating effects, different methods were used to assess each effect. More information about these methods is presented in the following the subsections.

Direct Effect

The direct effects of exogenous variables on endogenous variables were tested in this study by checking path coefficients (Chin, 1998). Path coefficient measures the amount of increase in the endogenous variable value when the exogenous value increases or decreases one unit (Kline, 2015). Three main elements of path coefficients were checked; algebraic sign, magnitude, and significance (Hair et al., 2010; Schumacker and Lomax, 2010; Urbach and Ahlemann, 2010). The algebraic sign must be in the same direction proposed in the hypothesis (Chin, 1998; Schumacker and Lomax, 2010; Urbach and Ahlemann, 2010). In respect to the magnitude of path coefficients, Cohen (1988) considered that values of less than 0.2 indicate week relationships, values ranging from 0.2 to 0.5 reflect moderate relationship, values of greater than 0.5 refer to strong relationships. Lastly, the path coefficients need to be statistically significant ($p \le 0.05$) in order for the relationships to be significant (Schumacker and Lomax, 2010; Urbach and Ahlemann, 2010). In order for a hypothesis to not be rejected, all these elements should be achieved (Hair et al., 2010; Schumacker and Lomax, 2010; Urbach and Ahlemann, 2010). It is worth mentioning that this study reported 95% confidence interval (CI) of the path coefficients in order to show the precision of estimates. The strength of direct effects was assessed using AMOS v.24.

Mediating Effect

Mediating effect refers to the situation where the association between an independent variable and dependent variable is affected by a third variable called “mediator” (Field, 2017). The two mediating effects in this study were assessed through assessing the indirect effects and their confidence interval and significance using bootstrapping method (Field, 2017; Gaskin, 2017; MacKinnon et al., 2004). In order to infer that there is mediating effect, the indirect effect of the independent variable on the dependent variable needs to be statistically significant (Field, 2017; Gaskin, 2017). Gaskin (2017) developed a special tool in AMOS for assessing the indirect effect using bootstrapping. This tool was used in the current study for assessing the mediating effects.

Moderating Effect

Moderating effect refers to the situation when a relationship between an independent variable and a dependent variable is affected by the level/group of a third variable called moderator (Field, 2017; Hair et al., 2010). Methods for testing moderating effects depend on types of moderators; nonmetric and metric (Field, 2017; Hair et al., 2010; Schumacker and Lomax, 2010). Nonmetric moderators are categorical variables while metric moderators are continuous variables (Field, 2017; Hair et al., 2010). As the current study had metric moderators (i.e. age) and nonmetric moderators (i.e. sex, education, income, and internet access), different methods were used for assessing the moderating effects.

In respect to nonmetric moderators, the current study assessed their effects using multigroup SEM (Field, 2017; Hair et al., 2010; Schumacker and Lomax, 2010). In this method, the chi-square difference test is estimated for the difference between a fully unconstrained group model and another group model in which the path of interest is constrained to be equal between the groups (Hair et al., 2010). The moderating effect can be inferred if the chi-square difference between models is statistically significant ($p \leq 0.05$) (Hair et al., 2010). AMOS v.24 was used in this study for assessing this type of moderation.

With reference to the metric moderator, the present research assessed its effect using the interaction effect method (Field, 2017; Gaskin, 2017; Hair et al., 2010). In this method, firstly, the interaction effect between the moderator and the independent variable needs to be estimated (Field, 2017; Gaskin, 2017). Then, this interaction effect and the moderator should be added to the model as a predictor of the dependent variable (Field, 2017; Gaskin, 2017). If the relationship between the interaction effect and dependent variable is statistically significant, it can be concluded that the moderating effect occurs (Field, 2017; Gaskin, 2017). The current study used AMOS v.24 for assessing this type of moderation.

4.11.4 Qualitative Analysis

As mentioned in Section 4.7.3, the questionnaire contained an open-ended question to enable participants to express their opinions and thoughts about factors affecting their use of Patient Online. The main aim of this question was to identify other possible factors that were not examined by the proposed model. To this end, the qualitative data gathered by the open-ended question were analysed using thematic analysis. Reasons for selecting thematic analysis rather than other techniques (e.g. content analysis, grounded theory analysis, and discourse analysis) were outlined in the following subsection.

4.11.4.1 Selecting the Appropriate Qualitative Analysis Approach

Thematic analysis is defined by Braun and Clarke (2013, p.175) as "*a method for identifying themes and patterns of meaning across a dataset in relation to a research question*". Thematic analysis was utilised in the current research for the following reasons. Thematic analysis is regarded a flexible and versatile approach because it is not tied to or based on a certain theoretical or epistemological stance as most other qualitative analysis approaches, thereby, it can be used in all studies regardless of their theoretical and epistemological stances (Braun and Clarke, 2006; Howitt and Cramer, 2017; Wilson and MacLean, 2011). Further, thematic analysis is accessible and easy to apply as it does not need thorough theoretical and technological knowledge of approaches and methods as grounded theory (Braun and Clarke, 2006; Wilson and MacLean, 2011). Additionally, it offers a rich and detailed description of data as it depends on the manifest and latent meaning of data for creating themes (Braun and Clarke, 2006; Joffe and Yardley, 2004). Moreover, it is the most commonly used approach for analysing qualitative data in the health field (Green and Thorogood, 2018; Howitt and Cramer, 2017).

Content analysis is defined as a systematic approach that groups data into categories in order to determine patterns, relationships, and frequencies among those categories (Bhattacherjee, 2012; Joffe and Yardley, 2004; Wilson and MacLean, 2011). As the content analysis is concerned with frequencies of instances of certain categories, it tends more toward the quantitative end of the qualitative data continuum (Dawson, 2002; Joffe and Yardley, 2004; Vaismoradi et al., 2013). This approach was not selected for analysing the qualitative data in the current study because it is appropriate for exploratory research where there is little known about the phenomenon of interest (Vaismoradi et al., 2013). However, as mentioned at the beginning of this chapter, this study is explanatory research. Moreover, content analysis relies merely on the manifest meanings of data for developing a theme but not on latent meanings (Denscombe, 2014; Joffe and Yardley, 2004; Vaismoradi et al., 2013). Therefore, it may generate trivial results (Joffe and Yardley, 2004). Furthermore, the researchers who employ content analysis tend to eliminate the meaning of the data from the context, thereby, it may not reflect the complexity and details of the data (Denscombe, 2014; Joffe and Yardley, 2004; Wilson and MacLean, 2011).

The grounded theory technique, which originated from a sociological perspective, is defined as a systematic analysis of qualitative data which aims to build a theory about a social phenomenon using an inductive technique (Bhattacherjee, 2012; Green and Thorogood, 2018; Starks and Trinidad, 2007). The inductive technique refers that data analysis is based only on the collected data rather theories (Denscombe, 2014; Howitt and Cramer, 2017; Joffe and Yardley, 2004). This technique is a cyclical (or iterative) process; that is, data are analysed at the beginning of data collection in order to develop initial coding scheme which is used to guide the next interview or observations, then another analysis is carried out to check whether theory emerges, and this process continues until reaching the saturation point where no new concepts emerge (Corbin and Strauss, 1990; Green and Thorogood, 2018; Starks and Trinidad, 2007). The grounded theory is not suitable for this study as the qualitative data was collected at one point in time and no more data will be collected, thereby, the analysis process cannot be iterative. Moreover, the aim of grounded theory (i.e. building a theory) is not compatible with the aim of the current study (i.e. testing a theory).

Discourse analysis was developed from linguistic studies, semiotics, and literary criticism (Starks and Trinidad, 2007). Wilson and MacLean (2011, p.559) defined it as "*qualitative data analysis approach which focuses on how language constructs social reality*". That is, researchers who use this approach are concerned with the type of language is being used, kinds of ideas lie behind that language, and the way those ideas are constructed through the language (Dawson, 2002; Denscombe, 2014; Matthews and Ross, 2010). The discourse analysis is an inappropriate approach for the current study for the following reasons. Firstly, it depends on large chunks of the conversation instead of words or sentences (Howitt and Cramer, 2017; Wilson and MacLean, 2011), but most of the participants' responses to the open-ended question in this study consisted of only one or two sentences. Secondly, it is a suitable approach merely for studies that are concerned with language as a social action or an active thing (Howitt and Cramer, 2017), and this is not the case in the current study. Thirdly, guidelines for conducting discourse analysis are unclear and inconsistent (Denscombe, 2014; Howitt and Cramer, 2017; Wilson and MacLean, 2011).

Lastly, the phenomenological analysis was evolved from a psychological perspective, and it aims to explore a phenomenon of interest through understanding the experience of individuals of it (Howitt and Cramer, 2017; Wilson and MacLean, 2011). This technique was not used to analyse data in the current study for three reasons. First, it is more appropriate for studies that follow the phenomenological philosophy, which is a popular qualitative philosophy (Howitt and Cramer, 2017; Wertz, 2011; Wilson and MacLean, 2011). However, the current study does not follow this philosophy. Second, the phenomenological analysis is suitable for studies that aim to describe individuals' experiences of a phenomenon of interest (Howitt and Cramer, 2017; Starks and Trinidad, 2007). But, this study aims to explain a phenomenon rather than describe it. Third, phenomenological analysis entails that the sample is composed of individuals who have experienced the phenomenon of interest (Howitt and Cramer, 2017; Starks and Trinidad, 2007). However, the sample in this study is not compatible with the abovementioned condition because it consisted of patients who have not used ePHRs.

4.11.4.2 Thematic Analysis

Braun and Clarke's guidelines are considered the most systematic guide for conducting thematic analysis to date (Howitt and Cramer, 2017; Wilson and MacLean, 2011). Therefore, the thematic analysis of the qualitative data in this study was carried out according to those guidelines reported by Braun and Clarke (2006).

Specifically, the researcher started the analysis by familiarising himself with the collected data through scrutinising and re-scrutinising it and making notes on any initial thoughts. Then, comments that consist of more than one idea were broken down into utterances according to the number of the ideas. This phase was followed by assigning systematically codes to all utterances relevant to the research question in this study. After having a list of all codes, they were grouped into themes or sub-themes according to their relevance to each other. An initial thematic map was drawn to present those themes and sub-themes. After checking the fit of those themes and sub-themes to the original utterances, an inappropriate grouping of some codes was found, thereby, this problem was solved out by merging and renaming some themes, and re-grouping some codes into other themes. Lastly, the themes and sub-themes were named precisely in order to reflect what it represents. The analysis process was managed using Microsoft Excel.

4.12 Ethical Considerations

The ethics of research is defined by Gray (2018, p.68) as "*the appropriateness of the researcher's behaviour in relation to the subjects of the research or those who are affected by it*". Researchers must follow a moral and responsible way in all research stages from identifying the research question to reporting the findings (Saunders et al., 2015). The current study took into consideration the main five ethical principles, which are: obtaining informed consent, ensuring the privacy of participants, avoiding harm to participants, avoiding deception, and maintaining objectivity (Bhattacherjee, 2012; Gray, 2018; Matthews and Ross, 2010). The current study needed Health Research Authority (HRA) Approval as it involved NHS organisations (i.e. GP practices). The HRA approval for this study was granted before starting data collection (REC reference: 17/SC/0323). The approval is presented in Appendix 27.

4.12.1 Obtaining Informed Consent

Informed consent refers to a voluntary agreement to participate that researchers obtain from participants after providing them with sufficient information about the study (Neuman, 2013; Wilson and MacLean, 2011). Three conditions must be achieved in order to obtain both legal and ethical consent:

First, it must be obtained from a person who has been sufficiently informed about the study (Gray, 2018; Matthews and Ross, 2010; Wilson and MacLean, 2011). To achieve this condition, the current study informed participants about the study using four channels: practice newsletter, practice website, posters on walls of the waiting room in each practice, and participant information sheets. Appendix 24 shows the participant information sheet which contained all information recommended by many scholars (Gray, 2018; Matthews and Ross, 2010; Wilson and MacLean, 2011). All channels have exactly the same information presented in the participant information sheet. The channels were available for patients before one week of data collection in order to give the patients enough time to decide whether to participate or not (Gray, 2018). As mentioned earlier, participant information sheet was handed out to people before they sign the consent form in order to make sure that they are fully informed about the study.

Second, the consent must be voluntarily given (Bhattacherjee, 2012; Gray, 2018; Matthews and Ross, 2010). In keeping with this condition, patients were informed that their participation in the study is entirely up to them, and they can withdraw from the study at any time before reporting the findings without any consequences. In order to withdraw from the study, a participant needs to contact the researcher using the contact details provided at the end of the participant information sheet. Information about the voluntariness of participation and the ability to withdraw were provided via the four channels. The researcher did not coerce or pressure individuals to participate in the present study through providing inducements (e.g. financial payments).

Third, the consent must be given by an individual with capacity (Matthews and Ross, 2010). The current study recruited only patients who are aged 18 or older, able to understand verbal explanations or written information, and English-language literate.

4.12.2 Ensuring Privacy of Participants

Although this research did not ask participants sensitive questions (e.g. sexual behaviour, drug abuse, or family violence), it is still important to ensure the privacy of participants. The privacy of participants can be protected using two principles; anonymity and confidentiality (Bhattacherjee, 2012; Neuman, 2013).

Anonymity implies that the identity of participants cannot be connected with their responses by the researcher or the readers of the study report (Bhattacherjee, 2012). The best way to protect participants' anonymity is that the researcher does not collect personal data (e.g. name, telephone number, or address) (Gray, 2018; Wilson and MacLean, 2011). It was difficult to not collect personal data in the current study because participants' names were needed to match the data collected by questionnaire with the data extracted from the system. In order to alleviate this issue, names of participants were the only personal data that were collected from them. Moreover, participants' names and their responses were collected using different forms that were stored in different places. An instruction at the beginning of the questionnaire was added to notify participants to not write their names on the questionnaire. Participants' names and their responses can be only matched using participant identification numbers available in each questionnaire and consent form. Additionally, only the researcher and the member of West Yorkshire R&D could access participants' name on the consent form, and both of them are aware of their responsibilities in dealing with personal data as stated by Data Protection Act 1998. Lastly, participants' names stored in consent forms and the computer were permanently shredded/ deleted after matching the data collected by the questionnaire with the data collected from the system logs.

In respect to confidentiality, researchers may be able to link personal data with participants' responses, but they should protect participants' privacy from the public by not disclosing information in any way that enables others to link certain participants with certain responses (Bhattacherjee, 2012; Neuman, 2013). This study protected the data confidentiality in several ways. (1) The study reported only aggregated results in the final research paper. (2) The collected data were not used for any purpose other than the purpose of this study. (3) The data were not disclosed to any third parties. (4) Questionnaires and consent forms were stored in two different cabinets within a locked office in a secure building at the University of Leeds. (5) Data extracted from the system logs were encrypted before sending them to the researcher. (6) These electronic data were stored on a password-protected computer within a secure server at the University of Leeds. (7) The researcher will dispose of all collected data (whether paper-based or electronic data) after two years of completing the study. All these procedures were mentioned in the participant information sheet so as to reassure participants.

4.12.3 Avoiding Harm to Participants

One of the fundamental ethical principles is that researchers must protect participants from harm that may be resulted from their participation in research (Gray, 2018; Neuman, 2013). Researcher must avoid physical harm (e.g. diseases and injuries), psychological harm (e.g. stress, embarrassment, loss of self-esteem, and anxiety), legal harm (e.g. being arrested), and economic harm (e.g. losing job and affecting income) (Gray, 2018; Matthews and Ross, 2010; Wilson and MacLean, 2011).

In this study, the researcher performed the fieldwork risk assessment provided by the University of Leeds. According to this risk assessment, the risk of harm to patients due to their participation or non-participation in this study is very minimal. Specifically, physical harms are not anticipated as the data were collected in very safe and secure settings (GP practices) during daylight hours, and this study is not a medical or physical experiment which may expose participants to a physical harm (Matthews and Ross, 2010). Further, the researcher does not expect any psychological harms to participants because the study does not collect clinical or sensitive information at all, and their participation or non-participation does not affect the care that they receive in any way. Additionally, participants are not exposed to legal harms since this study does not investigate illegal, immoral, or harmful behaviours nor political activities, where their perpetrators may be followed by authorities, and their data are treated in a confidential way and not disclosed to any third parties. Lastly, economical harms are unlikely to happen in this study as it does not ask questions that may affect their jobs or income.

4.12.4 Avoiding Deception

Researchers should avoid deceiving participants through either withholding some information about the study or deliberately misinforming them about any part of it (Gray, 2018; Shaughnessey et al., 2014; Wilson and MacLean, 2011). The current study did not deceive participants at all, and adequate, correct information about the study was provided to them using four channels.

4.12.5 Maintaining Objectivity

Researchers should be objective throughout the research (Neuman, 2013; Zikmund et al., 2013). The researcher took into consideration his objectivity in all stages of the current research. Specifically, each step in this research was well-justified and performed according to scholars' guidelines and previous literature.

4.13 Chapter Summary

To summarise, this chapter provided extensive discussions and justifications of all methods, procedures, or approaches were used for conducting this empirical study. To begin with, the epistemological and ontological philosophies were critically reviewed, and, accordingly, the positivist position was more in tune with the philosophical basis of the present research. After that, the types of research based on their purposes were explained, then, the explanatory research was identified and rationalised as a suitable type of this study. Further, inclusive explanations of research approaches (i.e. deductive and inductive) were introduced, and it was justified that deductive approach is more aligned with the purpose of this study. The quantitative methodology was adopted and rationalised. This chapter discussed the main quantitative methods (i.e. survey, experiments, case study), and rational reasons for selecting the survey method were given.

After that, questionnaires were identified as an appropriate survey instrument for this study for reasonable reasons. The process of developing the questionnaire was described starting with identifying the required information and ending with pilot testing it. Then, the researcher explained how main biases associated with the questionnaire were minimised. The process of sampling was described in details. Specifically, the characteristics of the population were determined in the first place, but the sampling frame could not be identified. Following that, the sampling techniques were explained, and convenience sampling was selected as the most appropriate technique. The sampling process ended with identifying the sample size of at least 600 patients. In this chapter, the researcher located four GP practices from where the participants were recruited. Then, the process of data collection was described in details.

The process of data analysis was also explained in this chapter. The process started with preparing data for analysis through conducting several steps: data entry, data coding, treatment of missing values and unengaged responses, checking normality, and treatment of outliers. After that, descriptive analysis techniques were used to summarise characteristics of participants and their responses. Subsequently, structural equation modeling (SEM) was adopted to validate the proposed model and test the hypotheses. Thematic analysis was used in this study to analyse the qualitative data. This chapter was concluded with identifying the main ethical principles that this study put into consideration throughout the research process.

Chapter Five:

Results

Chapter 5 Results

5.1 Introduction

The aim of this chapter is to present the results of each statistical analysis identified in the methodology chapter. The chapter starts with outlining the response rate in Section 5.2. Section 5.3 presents the findings of data screening related to missing values, outliers, normality, linearity, and multicollinearity. Section 5.4 presents the descriptive analysis for characteristics of respondents and non-respondents, and participants' responses. In Section 5.5, results of the inferential analysis for the measurement model and structural model are reported. This is followed by Section 5.6 which contains the results of the thematic analysis of the qualitative data collected through the open-ended question. This chapter is concluded by summarising the main results in Section 5.7.

5.2 Response Rate

Data collection process started on 21st of August 2017 and ended on 26th of September 2017. As mentioned in the previous chapter, the sample was recruited from four general practices. As shown in Figure 5.1, 800 eligible patients were invited to take part in the survey. Of those 800 patients, 731 (91%) patients accepted to participate. Of those 731, 693 (95%) patients returned the questionnaire back to the researcher. Sixty-nine of the returned questionnaires were invalid for the following reasons: participants were not registered at any of the four GP practices (n=29), participant's name was missing or illegible (n=15), participants have already used the system (n=10), participants provided unengaged responses (n=8), participants moved to other practices (n=3), participants have passed away (n=2), and participants answered less than 50% of the questionnaire (n=2). After excluding those 69 invalid questionnaires, 624 valid questionnaires were eligible for statistical analyses in the current study. Response rate is defined as the proportion of respondents who returned a valid questionnaire among all eligible people who were invited to participate in the study (Zikmund et al., 2013; Shaughnessey et al., 2014). Accordingly, the response rate in this study was 78% (624/800). This response rate is deemed good according to Neuman (2013), who stated that the response rates for academic organisations range between 68% and 75%.

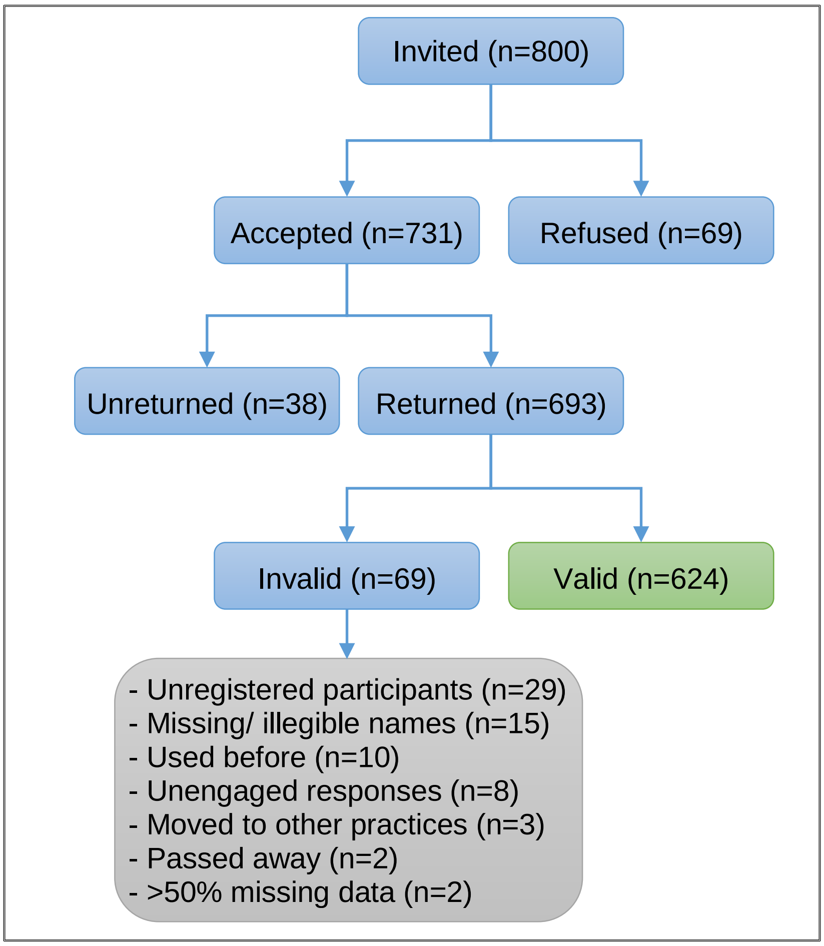


Figure 5.1: Response Rate

5.3 Data Screening

Several assumptions regarding data should be achieved before conducting any analysis, especially, multivariate analyses (Kline, 2015; Hair et al., 2010). These assumptions are (1) data do not contain missing values, (2) data do not include outliers, (3) data are normally distributed, (4) the relationships between independent variables and dependent variables are linear, and (5) the independent variables are not highly correlated (Kline, 2015; Hair et al., 2010). Checking and treating missing data were presented in the previous chapter (Subsection 4.11.1.3). The remaining four assumptions are examined in the following four subsections.

5.3.1 Treating Outliers

As mentioned in the previous chapter, the continuous variables in the present study (i.e. age and use behaviour) were checked for detecting univariate and multivariate outliers. Z-scores and boxplots were used to spot univariate outliers. Standard values were less than the predefined cut-off level (i.e. <4) for age, but there were five outliers for use behaviour (see Table 5.1). These results were confirmed using boxplots as presented in Figure 5.2. However, these values were retained in the current study for the following reasons. Firstly, there are only 5 of 624 cases, thereby, their effect will likely be trivial. Secondly, standard values for four of those outliers were very slightly above the cut-off level. Thirdly, although deleting outliers may enhance the results of multivariate analysis, it limits the generalizability of the findings (Hair et al., 2010). Fourthly, Hair et al. (2010) and Kline (2015) recommend researchers to keep outliers if they truly belong to the population from which the data are collected; since it is reasonable that patients use the system 6 or 8 times over six months, these outliers can belong to the population of interest in this study.

Table 5.1: Univariate Outliers

Case number	Standard values (z-scores)
408	5.704
20	4.091
238	4.091
494	4.091
634	4.091

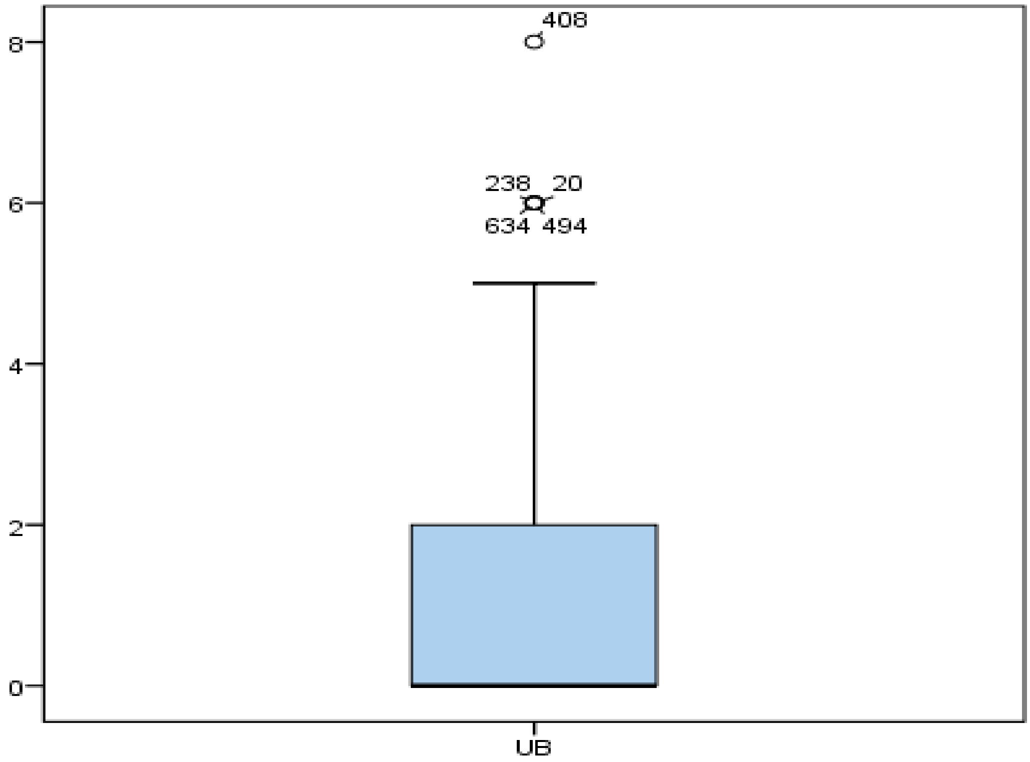


Figure 5.2: Univariate Outliers on Use Behaviour Variable

In relation to multivariate outliers, Mahalanobis distance (D^2) for each case was measured, and the significance test was calculated for D^2/df values for each case. D^2/df values were statistically significant (p<0.001) for only seven cases, which can be considered as outliers. Table 5.2 presents the highest 20 D^2 values in the dataset. As univariate outliers, these seven cases were not deleted for the same reasons mentioned above and the following reason. Blunch (2012) and Byrne (2016) indicated that a case should be designated as an outlier when the gap between D^2 values for this case and a case next to it, given that all cases are sorted in descending order, is very large regardless of the corresponding p-value. In accordance with this recommendation, no multivariate outliers were found in the current study as the difference between D^2 values for each case and the one next to it is not very large (see Table 5.2).

In order to be sure that retaining those univariate and multivariate outliers was an appropriate decision, the measurement model and structural model were assessed using the data with outliers and without outliers. The results showed a very trivial difference in all analyses (i.e. measurement and structural model fits, construct reliability and validity, coefficient of determination, and path coefficients).

Table 5.2: The Highest 20 Mahalanobis D^2 Values

Case number	Mahalanobis D^2	P-value
269	50.84	.000
414	50.41	.000
408	50.21	.000
355	49.94	.000
364	49.05	.000
137	47.62	.000
270	46.92	.000
74	43.17	.001
372	42.60	.001
69	42.57	.001
142	42.20	.001
285	41.15	.002
494	40.97	.002
258	40.06	.002
19	39.99	.002
96	39.71	.002
394	39.66	.002
438	39.40	.002
37	39.28	.003
117	39.02	.003

5.3.2 Checking Normality

Assessing normality of the data is prerequisite in the inferential analysis (Hair et al., 2010; Schumacker and Lomax, 2010). Univariate normality was examined in the current study through assessing skewness and kurtosis. To do so, data distribution for each item was presented using histograms, then values of skewness and kurtosis for each item were summarised using tables. As shown in Appendix 28, there is no severe skewness and kurtosis on all items. This finding was confirmed by results of the statistical analysis presented in Table 5.3. Specifically, the absolute values of skewness and kurtosis were considerably less than their cut-off points of 3 and 10, respectively (Kline, 2015). Accordingly, it can be concluded that the distribution is within the acceptable level of skewness and kurtosis, thereby, it is mildly non-normal.

Table 5.3: Values of Skewness and Kurtosis

Variables	Items	Skewness	Kurtosis
Performance expectancy	PE1	-0.10	-0.79
	PE2	-0.04	-0.92
	PE3	0.05	-0.82
Effort expectancy	EE1	-0.60	-0.68
	EE2	-0.52	-0.61
	EE3	-0.57	-0.61
	EE4	-0.55	-0.63
Social influence	SI1	-0.13	-0.15
	SI2	-0.09	-0.19
	SI3	0.05	-0.56
Facilitating condition	FC1	-0.65	-0.75
	FC2	-0.64	-0.71
	FC3	-0.50	-0.61
	FC4	-0.45	-0.54
	FC5	-0.18	-0.65
Perceived privacy and security	PPS1	-0.14	-0.91
	PPS2	-0.15	-0.96
	PPS3	-0.37	-0.63
	PPS4	-0.01	-0.98
	PPS5	-0.58	-0.52
Behavioural intention	BI1	0.11	-0.81
	BI2	0.10	-0.68
	BI3	0.20	-0.54
Use Behaviour	UB	2.59	6.53

5.3.3 Checking Linearity

The linearity of the proposed relationships was assessed using scatterplot graphs and the Curve Estimation procedure. By screening scatterplots shown in Appendix 29, there was indication of possible non-linearity for only two relationships (BI-UB & FC-UB). However, results of the Curve Estimation procedure showed that all proposed relationships between variables are linear (see Table 5.4). Specifically, F values for all proposed relationships in the linear model were significant and higher than F values of the proposed relationships in the 10 non-linear models. Consequently, it can be concluded that all relationships proposed in the current study's model are linear.

Table 5.4: Results of Curve Estimation Procedure

Relationship	R Square	F	Sig.	Linearity?
PE-BI	0.738	1864.213	.000	linear
EE-BI	0.409	458.916	.000	linear
SI-BI	0.274	250.135	.000	linear
PPS-BI	0.526	733.540	.000	linear
EE-PE	0.350	355.983	.000	linear
PPS-PE	0.450	541.960	.000	linear
BI-UB	0.438	515.135	.000	linear
FC-UB	0.299	282.937	.000	linear

5.3.4 Checking Multicollinearity

Multicollinearity between the independent variables was assessed using tolerance and variance inflation factor (VIF) measures. As shown in Table 5.5, all values are within the predetermined cut-off points of tolerance (≥0.10) and VIF (≤10) (Hair et al., 2010; Kline, 2015). Those values even are within more stringent cut-off points of more than 0.2 for tolerance and less than 5 for VIF that are suggested by Menard (1995). Thus, it can be concluded that there is no serious multicollinearity between independent variables.

Table 5.5: Tolerance and VIF Values

Dependent variable	Independent variables	Collinearity Statistics	
		Tolerance	VIF
UB	BI	0.661	1.514
	FC	0.661	1.514
BI	PE	0.450	2.223
	EE	0.600	1.666
	SI	0.658	1.520
	PPS	0.505	1.979
PE	EE	0.737	1.357
	PPS	0.737	1.357

5.4 Descriptive Analysis Results

As mentioned in the previous chapter, descriptive analysis was carried out to summarise characteristics of participants and their responses. The next two subsections show the results of this analysis.

5.4.1 Characteristics of Participants and Non-participants

The current study included 624 participants in the analysis. As depicted in Table 5.6, the mean age of respondents is 44.6 years (SD=18.9). More than half of participants were females (53.1%). In regard to ethnicity, whites formed the largest proportion of respondents (79.8%). About half of the sample (45.5%) had income level of less than £20,000 per year. Percentage of respondents who preferred not to reveal their income was 18.2%. In reference to the education level, the three most prominent education levels among respondents were bachelor degree (27.9%), college/ diploma (26.4%), and secondary school (23.6%). The majority of respondents (84.6%) reported that they had access to the internet.

The non-response bias was assessed by comparing characteristics of participants with non-participants (i.e. who rejected to participate in the survey or could not be contacted). As shown in Table 5.6, all groups in each variable are comparable between participants with non-participants. The chi-square test was calculated in order to test the significance of the difference between participants with non-participants. As depicted in Table 5.6, the differences between participants with non-participants in terms of age, sex, and ethnicity were not significant (p=0.213, 0.063, 0.643, respectively). Accordingly, it can be concluded that the risk of non-response bias is minimal in the current study.

Table 5.6: Characteristics of Participants and Non-participants

Variable	**Groups**	**Participants (n=624)**		**Non-participants[1] (n=31742)**		**Diff[2]**	**P-Value[3]**
		n	**%**	**n**	**%**	**%**	
Age, year mean (SD)	-	44.6 (18.9)		-		-	-
Age	18-24	107	17.1	5850	18.4	1.3	0.213
	25-34	148	23.7	7031	22.2	1.5	
	35-44	116	18.6	5030	15.8	2.8	
	45-54	98	15.7	4656	14.7	1.0	
	55-64	65	10.4	3944	12.4	2.0	
	65-74	46	7.4	2813	8.90	1.5	
	75+	44	7.1	2418	7.60	0.5	
Sex	Male	293	46.9	16097	50.7	3.8	0.063
	Female	331	53.1	15645	49.3	3.8	
Ethnicity	White	498	79.8	25099	79.1	0.7	0.643
	Asian	73	11.7	4203	13.2	1.5	
	Black	20	3.2	1013	3.2	0.0	
	Mixed	26	4.1	1051	3.3	0.8	
	Others	7	1.2	376	1.2	0.0	
Income	< 20,000	284	45.5	-	-	-	-
	20,000-29,999	80	12.8	-	-	-	-
	30,000-39,999	65	10.4	-	-	-	-
	40,000-49,999	43	7	-	-	-	-
	50,000-59,999	26	4.2	-	-	-	
	60,000 or more	12	1.9	-	-	-	-
	Prefer not to say	114	18.2	-	-	-	
Education	Up to secondary school	69	11.1	-	-	-	-
	Secondary school	147	23.6	-	-	-	-
	College/ Diploma	165	26.4	-	-	-	-
	Bachelor Degree	174	27.9	-	-	-	-
	Master Degree	47	7.5	-	-	-	-
	Doctoral Degree	22	3.5	-	-	-	-
Internet access	Yes	528	84.6	-	-	-	-
	No	96	15.4	-	-	-	-

[1]: *Those who rejected to participate in the survey or could not be contacted*
[2]: *Absolute difference between respondents and non-respondents (percentage)*
[3]: *Chi-square was used*

5.4.2 Participants’ Responses and Use of Patient Online

The questionnaire in the current study contains 23 items measuring six constructs; performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC), perceived privacy and security (PPS), and behavioural intention (BI). The response to each item ranged from 1 to 7; where 1 refers to strongly disagree and 7 indicates strongly disagree. Table 5.7 presents descriptive statistics of responses for each item and construct. According to these statistics, the following findings were inferred in the current study: (1) participants are almost neutral about their perceptions of the usefulness of Patient Online, (2) participants perceive the system is slightly easy to use, (3) participants are almost neutral about their perceptions that people who are important to them would prefer them to use the system, (4) participants slightly perceive that they have facilitating conditions for using the system, (5) participants have almost neutral perceptions regarding the privacy and security of Patient Online, and (6) participants are almost neutral about their intention to use Patient Online.

Table 5.7: Descriptive Statistics of Participants’ Responses

Construct	Items	Response*, n (%)							Mean	SD
		1	2	3	4	5	6	7		
PE	PE1	36 (5.8)	75 (12)	95 (15.2)	135 (21.6)	130 (20.8)	92 (14.8)	61 (9.8)	4.18	1.66
	PE2	24 (3.8)	82 (13.1)	91 (14.6)	125 (20)	131 (21)	91 (14.6)	80 (12.8)	4.28	1.70
	PE3	35 (5.6)	96 (15.4)	109 (17.5)	152 (24.4)	105 (16.8)	83 (13.3)	44 (7)	3.99	1.64
	All	**95 (5.1)**	**253 (13.5)**	**295 (15.8)**	**412 (22)**	**366 (19.5)**	**266 (14.2)**	**185 (9.9)**	**4.15**	**1.67**
EE	EE1	30 (4.8)	55 (8.8)	62 (10)	82 (13.1)	112 (18)	173 (27.7)	110 (17.6)	4.84	1.75
	EE2	15 (2.4)	65 (10.4)	55 (8.8)	120 (19.2)	131 (21)	176 (28.2)	62 (10)	4.72	1.58
	EE3	23 (3.7)	57 (9.1)	57 (9.1)	102 (16.4)	119 (19.1)	168 (26.9)	98 (15.7)	4.81	1.68
	EE4	31 (5)	47 (7.5)	76 (12.1)	96 (15.4)	122 (19.6)	176 (28.2)	76 (12.2)	4.71	1.69
	All	**99 (4)**	**224 (9)**	**250 (10)**	**400 (16)**	**484 (19.4)**	**693 (27.8)**	**346 (13.8)**	**4.77**	**1.68**
SI	SI1	29 (4.7)	75 (12)	81 (13)	254 (40.7)	115 (18.4)	51 (8.2)	19 (3)	3.92	1.38
	SI2	31 (5)	96 (15.4)	74 (11.9)	250 (40)	122 (19.6)	37 (5.9)	14 (2.2)	3.83	1.38
	SI3	49 (7.8)	116 (18.6)	93 (14.9)	205 (32.9)	101 (16.2)	43 (6.9)	17 (2.7)	3.63	1.49
	All	**109 (5.8)**	**287 (15.3)**	**248 (13.2)**	**709 (37.9)**	**338 (18.1)**	**131 (7)**	**50 (2.7)**	**3.79**	**1.41**

FC	FC1	24 (3.8)	71 (11.4)	52 (8.3)	66 (10.6)	101 (16.2)	195 (31.3)	115 (18.4)	4.87	1.78
	FC2	26 (4.2)	62 (10)	65 (10.4)	60 (9.6)	115 (18.4)	200 (32)	96 (15.4)	4.81	1.75
	FC3	21 (3.4)	63 (10.1)	59 (9.5)	115 (18.4)	140 (22.4)	164 (26.3)	62 (9.9)	4.63	1.62
	FC4	18 (2.9)	46 (7.4)	63 (10.1)	159 (25.5)	102 (16.3)	181 (29)	55 (8.8)	4.63	1.55
	FC5	36 (5.8)	77 (12.3)	75 (12)	190 (30.5)	116 (18.6)	101 (16.2)	29 (4.6)	4.11	1.58
	All	**125 (4)**	**319 (10.2)**	**314 (10.1)**	**590 (18.9)**	**574 (18.4)**	**841 (27)**	**357 (11.4)**	**4.61**	**1.66**
PPS	PPS1	40 (6.4)	77 (12.4)	96 (15.4)	133 (21.3)	110 (17.6)	116 (18.6)	52 (8.3)	4.20	1.70
	PPS2	32 (5.1)	91 (14.6)	99 (15.9)	124 (19.9)	114 (18.3)	125 (20)	39 (6.2)	4.17	1.66
	PPS3	27 (4.3)	48 (7.7)	77 (12.4)	158 (25.3)	107 (17.2)	155 (24.8)	52 (8.3)	4.48	1.61
	PPS4	20 (3.2)	98 (15.7)	106 (17)	141 (22.6)	98 (15.7)	117 (18.8)	44 (7)	4.16	1.63
	PPS5	16 (2.6)	45 (7.2)	52 (8.3)	128 (20.5)	98 (15.7)	200 (32.1)	85 (13.6)	4.85	1.60
	All	**135 (4.3)**	**359 (11.5)**	**430 (13.8)**	**684 (21.9)**	**527 (16.9)**	**713 (22.9)**	**272 (8.7)**	**4.37**	**1.64**
BI	BI1	45 (7.2)	95 (15.2)	124 (20)	145 (23.2)	93 (14.9)	82 (13.1)	40 (6.4)	3.89	1.65
	BI2	37 (5.9)	90 (14.4)	130 (20.8)	142 (22.8)	126 (20.2)	58 (9.3)	41 (6.6)	3.92	1.59
	BI3	62 (9.9)	99 (15.9)	161 (25.8)	140 (22.4)	104 (16.7)	42 (6.7)	16 (2.6)	3.55	1.53
	All	**144 (7.7)**	**284 (15.2)**	**415 (22.2)**	**427 (22.8)**	**323 (17.2)**	**182 (9.7)**	**97 (5.2)**	**3.79**	**1.59**

*****: **(1)** Strongly disagree, **(2)** Slightly disagree, **(3)** Disagree, **(4)** Neutral, **(5)** Agree, **(6)** Slightly agree, **(7)** Strongly agree

As mentioned earlier, one construct (i.e. use behaviour) was assessed using system logs. This construct was described using numbers, percentages, mean, median, standard deviation (SD), and interquartile range (IQR). As outlined in Table 5.8, the number of participants who used Patient Online over the 6 month-period is 130 (20.8%). Of those, 49 patients used the system to book 95 appointments, and 101 patients used it to request 243 medications. However, none of the 130 users accessed the system to view their records. While the mean use of the system was 0.27 times per person (SD=0.86), the median of use was zero (IQR=0). It is worth mentioning that the extracted data showed that only 22 participants did not use any of the GP services whether by Patient Online, phone, or face-to-face visits. Therefore, this indicates that choosing the six-month period between the data collection methods (i.e. questionnaires and system logs) was an appropriate decision as most participants (96.5%) had a need to use

Patient Online. Those 22 participants were not excluded from this study because it was found that the results of inferential analyses (i.e. SEM) were not affected considerably when those participants were excluded.

Table 5.8: Descriptive Statistics of Patients' Use of Patient Online

Construct	Service	Users, n (%)[1]	Use, n (%)[2]	Use per person, mean (SD)	Use per person, median (IQR)
Use Behaviour	**Booking appointment**	49 (9.1)	95 (28.1)	0.15 (0.60)	0 (0)
	Requesting medication	101 (15.4)	243 (71.9)	0.39 (1.04)	0 (0)
	Viewing records	0 (0)	0 (0)	0 (0)	0 (0)
	Any service	**130 (20.8)**	**338 (100)**	**0.27 (0.86)**	**0 (0)**

[1]: percentage of users to all participants
[2]: percentage of uses of a certain service to the sum of all uses

5.5 Inferential Analysis Results

As mentioned in the previous chapter, structural equation modeling (SEM) was used for testing the proposed model in this study. Starting with the first step of SEM, the model was well specified in Chapter 3 based on a solid theoretical basis and the systematic review results. In brief, this model contains four exogenous variables (i.e. EE, PPS, SI, and FC), three endogenous variables (i.e. PE, BI, and UB), and five moderators (age, sex, income, education, and internet access).

The identification of the model (the second step) was assessed using the t-rule and the recursive rule. Based on the t-rule, the model was identified because the number of known elements is considerably larger than the number of unknown parameters that need to be estimated (276 vs. 61). Also, it could be inferred that the model is identified because it does not contain reciprocal relationships between any pair of variables.

In the third step, the population covariance matrix (∑) was estimated based on maximum likelihood (ML) in AMOS v.24. As indicated earlier, the model testing (the fourth step) was performed for measurement model in the first place, then for structural model. The results of testing both models and the subsequent model modifications are explained in the next subsections.

5.5.1 Measurement Model

The initial measurement model was developed as shown in Figure 5.3. This model consisted of six main constructs (PE, EE, PPS, SI, FC, and BI). These constructs were measured using 23 items. Measurement error was added to each item. The confirmatory factor analysis was used in this study for testing the validity of this model based on three aspects: model fit, construct reliability, and construct validity (Hair et al., 2010; Kline, 2015). Results of measurement validity in terms of these three aspects are explained in the following three subsections.

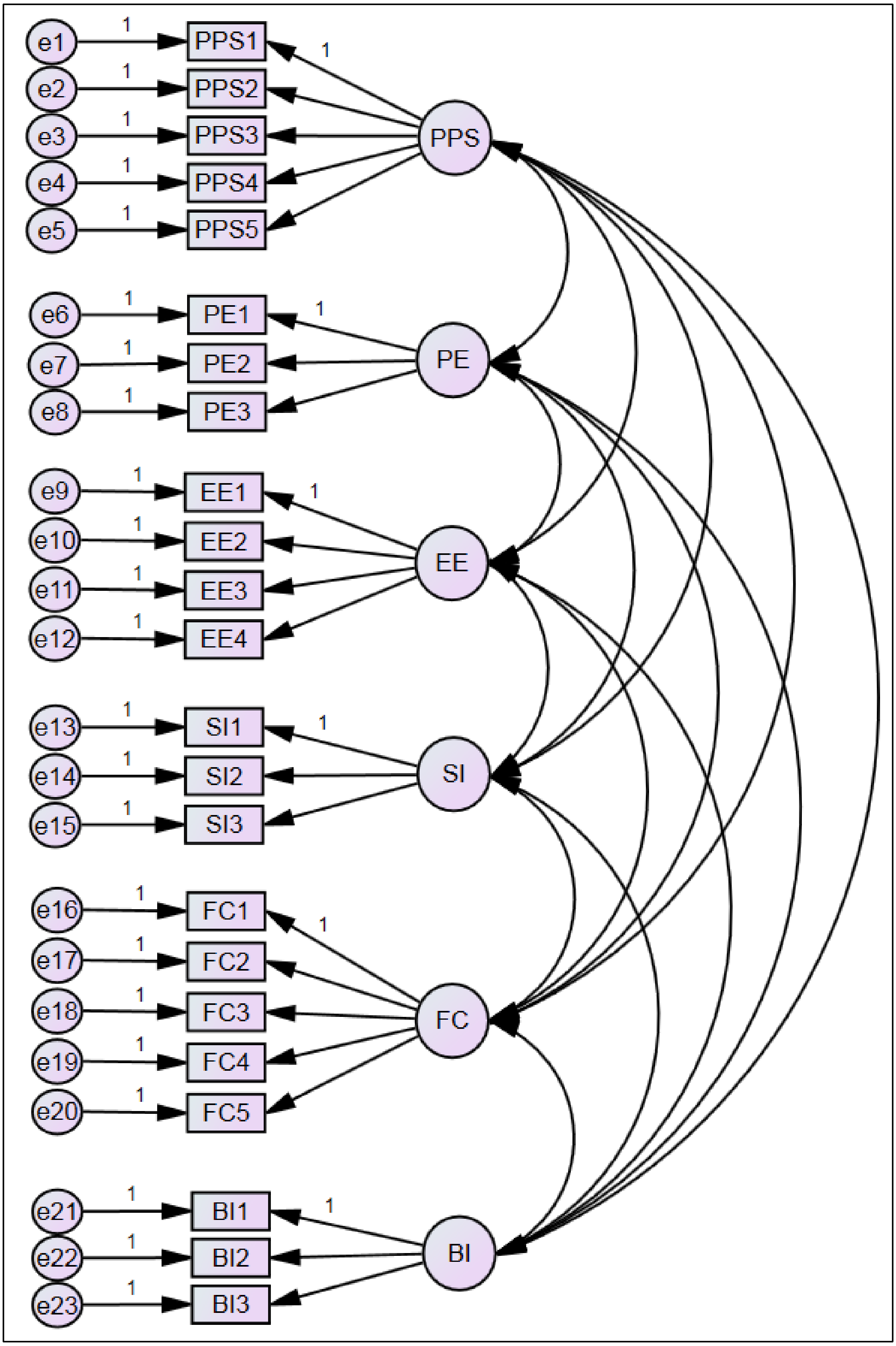


Figure 5.3: Initial Measurement Model

5.5.1.1 Model fit

Five indices were adopted for testing the absolute model fit (χ^2/df, GFI, AGFI, RMSEA, and SRMR), and three indices were used for assessing incremental fit (NFI, CFI, and TLI). As shown in Table 5.9, values of the following indices indicate good fit of the initial model as they within the cut-off levels; χ^2/df (2.829), AGFI (0.902), NFI (0.964), CFI (0.977), and TLI (0.972). However, the remaining indices found poor model fit; GFI (0.923), RMSEA (0.053), and SRMR (0.057). According to the results of the latter indices, model modification (the fifth step of SEM) was required to improve the measurement model fit (Byrne, 2016; Hair et al., 2010; Kline, 2015).

Table 5.9: Results of Fit Indices of Initial and Modified Measurement Model

Fit indices	Cut-off point	Initial measurement model	Modified measurement model
χ^2/df	1-3	2.829	1.448
GFI	≥ 0.95	0.923	0.969
AGFI	≥ 0.90	0.902	0.957
RMSEA	< 0.05	0.053	0.026
PCLOSE	≥ 0.05	0.194	1.000
SRMR	≤ 0.05	0.057	0.017
NFI	≥ 0.95	0.964	0.988
CFI	≥ 0.95	0.977	0.995
TLI	≥ 0.95	0.972	0.996

In order to modify the model, it is highly recommended to check factor loadings, significance and magnitude of estimated parameters, standardised residual matrix, and modification indices looking for abnormal values that reduce the model fit (Byrne, 2016; Hair et al., 2010; Schumacker and Lomax, 2010; Kline, 2015). By inspecting the factor loadings (i.e. standardised regression weights) for each item, it was clear that four items were less than the ideal factor loading values (>70), which are FC4 (0.56), FC5 (0.36), PPS3 (0.49), and PPS5 (0.58). The first two items (FC4 and FC5) were not adopted from the same theory (UTAUT) that the remaining three factors (FC1, FC2, FC3) were adopted from, thereby, they have lower factor loadings. Also, it was expected to find low factor loadings among items that measure perceived privacy and security because they were adopted from two different studies (i.e. Rao, 2014; Whetstone and Goldsmith, 2009) but not from well-developed theories. Therefore, the four items (FC4, FC5, PPS3, and PPS5) were eliminated from the model.

By scrutinising parameter estimates, it was found that magnitude of three parameter estimates exceeds the value of 1 which indicates misspecification of the reference variables (Schumacker and Lomax, 2010; Byrne, 2016). Those parameters are PE→PE2 (1.007), SI→SI2 (1.020), and SI→SI3 (1.015). This issue could be treated by specifying a reference variable to another item measuring the same construct (Schumacker and Lomax, 2010; Byrne, 2016). Therefore, the reference variable became PE2 in the construct PE, and SI2 in the construct SI.

When standardised residual matrix was checked, absolute values of 12 residual covariances were higher than the cut-off point of >2; 5 covariances between FC4 and other 5 variables, 7 covariances between PPS5 and other 7 variables. As it was already decided to exclude FC4 and PPS5 due to their low factor loadings, it is plausible that such abnormal values would disappear.

Lastly, modification indices showed that most suggested modifications are related to PPS5 and PPS3. In particular, specifying a covariance between e3 and e5, which are connected with item PPS3 and PPS5 respectively, will decrease the discrepancy (χ^2) by at least 141.612. Because it was already decided to exclude PPS3 and PPS5 due to their low factor loadings, these suggested modifications would not appear.

Since it is highly advised to apply one modification each time and to assess the model fit after each modification (Byrne, 2016; Kline, 2015; Schumacker and Lomax, 2010), the four items were deleted one each time, and the two reference variables were changed in the same way.

As shown in Figure 5.4, the modified measurement model consisted of six main constructs, which were measured using 19 items. The fit of the modified measurement model was tested again. As presented in Table 5.9, all fit indices improved and existed within their acceptable levels: χ^2/df =1.448, GFI=0.969, AGFI=0.957, RMSEA=0.026 and its PCLOSE=1.000, SRMR=0.017, NFI=0.988, CFI=0.995, and TLI=0.996. These results indicate a good fit of the modified measurement model.

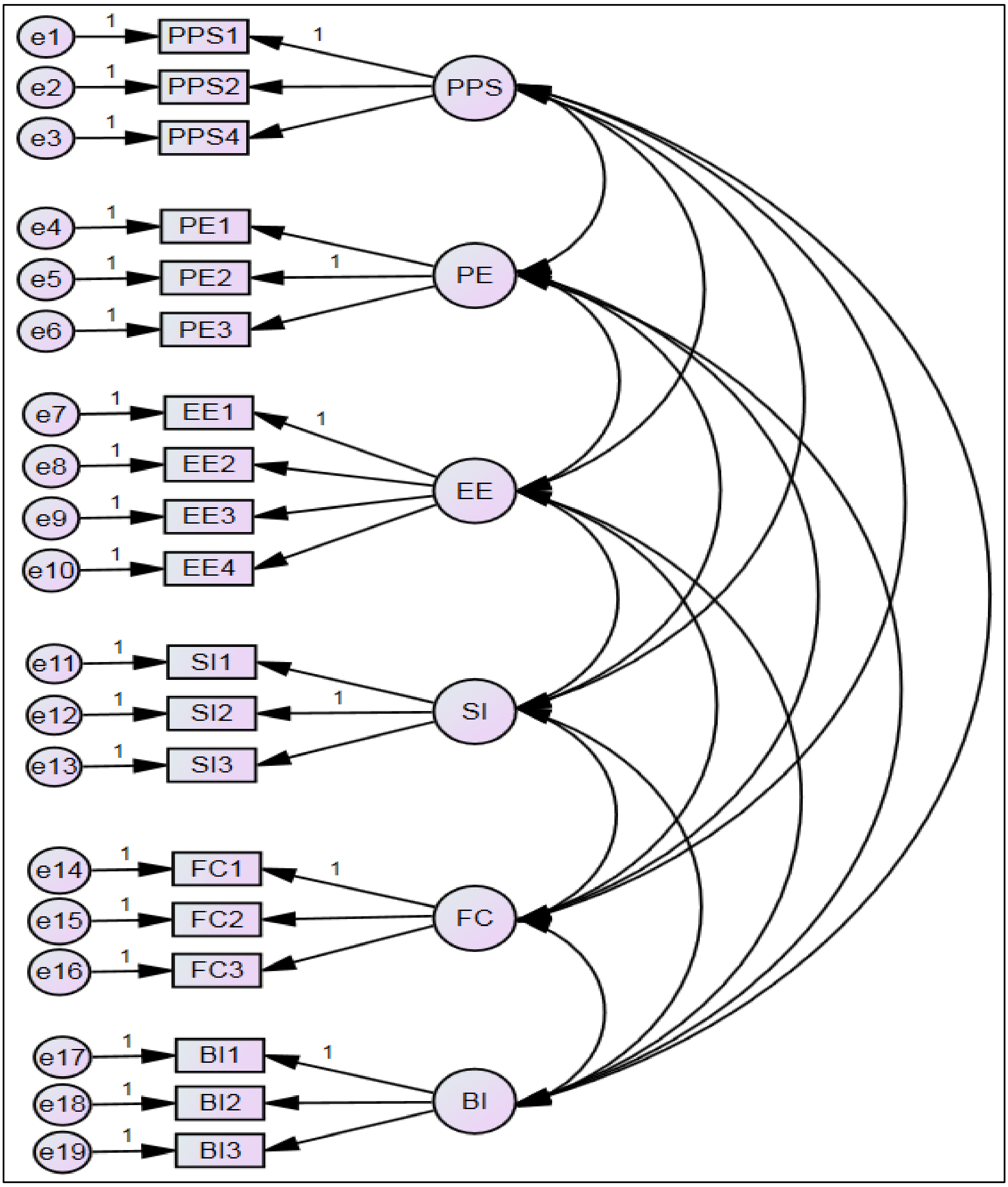


Figure 5.4: Modified Measurement Model

In order to make sure that no modifications were needed, factor loadings, significance and magnitude of estimated parameters, standardised residual matrix, and modification indices were checked again. All estimates were within the acceptable levels. More specifically, all factor loadings were substantially higher than the cut-off of 0.70. Parameter estimates were significant and their magnitudes were between -1 and 1. In regard to the standardised residual matrix, all absolute values were less than 2 (as shown in Appendix 30). Lastly, modification indices suggested some implausible modifications with a small amount of discrepancy expected to be decreased (M.I. less than 11.336). It can be concluded that the model is adequately fit, thereby, it could be moved to test the next aspect of the measurement model, which is construct reliability.

5.5.1.2 Construct Reliability

As discussed in Chapter 4, construct reliability was tested in the current study in order to assess the consistency or reproducibility of an observed variable in measuring what it is assumed to measure (Bhattacherjee, 2012; Hair et al., 2010). Construct reliability were tested using three measures: Cronbach's alpha, the composite reliability (CR), and the average variance extracted (AVE) (Hair et al., 2010; Assadi, 2013).

As summarised in Table 5.10, values of Cronbach's alpha for each construct was considerably higher than the cut-off point of 0.70. More precisely, values of Cronbach's alpha ranged from 0.940 (for FC) to 0.962 (for PE and BI) indicating excellent internal consistency reliability (Kline, 2015; George and Mallery, 2016). This excellent internal consistency reliability was supported by results of composite reliability (CR), which were almost equal to the results of Cronbach's alpha (see Table 5.10). Specifically, the lowest value of composite reliability was 0.942 for FC and PPS whereas BI had the highest value of 0.963. By looking at the results of AVE in Table 5.10, all values were substantially higher than the threshold of ≥0.50 (Hair et al., 2010; Fornell and Larcker, 1981). The value of AVE for FC was the lowest (0.843) while the value of AVE for BI was the highest (0.898). Thus, these AVE values confirmed the construct reliability. In summary, all three measures of construct reliability proved that the measurement items are consistent and reproducible in measuring what it is assumed to measure.

Table 5.10: Results of Construct Reliability

Constructs	Cronbach's alpha (α)	Composite Reliability (CR)	Average Variance Extracted (AVE)
PE	0.962	0.962	0.895
EE	0.961	0.962	0.863
SI	0.946	0.948	0.858
FC	0.940	0.942	0.843
PPS	0.941	0.942	0.845
BI	0.962	0.963	0.898

5.5.1.3 Construct Validity

Two components of construct validity were examined in the current study; convergent validity and discriminant validity (Kline, 2015; Hair et al., 2010; Majedi, 2014). The former component, which refers to how close a scale relates to its latent variable that it is assumed to measure (Bhattacherjee, 2012; Hair et al., 2010), was tested by checking the standardised regression weights (factor loadings) (Hair et al., 2010; Anderson and Gerbing, 1988). As seen in Table 5.11, all items considerably exceeded the threshold of 0.70. The lowest factor loading was 0.86 for FC3 and PPS4 while the factor loading for PE1, FC1, and BI was the highest (0.97). AVE can be regarded as a measure of convergent validity, in addition to the construct reliability (Hair et al., 2010; Chang et al., 2015). As found in the previous subsection, all AVE values were within the acceptable level (≥0.50). Accordingly, it can be inferred that items of each construct relate strongly to their constructs that it is assumed to measure.

Table 5.11: Results of Convergent Validity

Latent Constructs	Items	Factor Loading	AVE
Performance Expectancy	PE1	0.97	0.895
	PE2	0.95	
	PE3	0.92	
Effort Expectancy	EE1	0.95	0.863
	EE2	0.92	
	EE3	0.95	
	EE4	0.90	
Social Influence	SI1	0.94	0.858
	SI2	0.96	
	SI3	0.88	
Facilitating Conditions	FC1	0.97	0.843
	FC2	0.93	
	FC3	0.86	
Perceived Privacy & Security	PPS1	0.95	0.845
	PPS2	0.94	
	PPS4	0.86	
Behavioural Intention	BI1	0.97	0.898
	BI2	0.95	
	BI3	0.91	

The discriminant validity, which assesses the extent to which an item of one latent variable does not relate to other latent variables that it is not proposed to measure (Bhattacherjee, 2012; Hair et al., 2010), was tested in this study using inter-correlation coefficients, comparing the square root of AVE with the inter-correlation coefficients, and comparing loadings and cross-loadings. Off-diagonal values presented in Table 5.12 represent inter-correlation coefficients. It is obvious that all values located within the acceptable ranges (<0.85) (Brown, 2014). In particular, inter-correlation coefficients ranged between 0.454 and 0.837.

In respect to the second measure, each value of square root of AVE for a construct, which is presented by the diagonal of the table, is higher than all inter-correlation coefficients between that construct and each other construct. For example, the square root of AVE for PE (0.946) is higher than all inter-correlation coefficients between PE and EE (0.454), SI (0.647), and so forth.

As shown in Table 5.13, the loading of each item on its construct was higher than cross-loadings in rows. To be more precise, the loading of PE1 on its construct (PE) is higher than the loadings of this item on other constructs in the raw. This indicates that each item sufficiently discriminates its underlying latent variable from other latent variables (Chin, 2010). Similarly, the loading of each item on its construct was higher than cross-loadings in columns. For example, the loading of the item EE1 (0.949) on its construct (EE) was higher than the loadings of other items (SI1, FC2, PPS4, etc.) on that construct (EE). This means that the construct in that column associates with its own items than with other items (Chin, 2010). According to the results of all three measures, it can be concluded that items of each construct are not related to the other constructs that it is not postulated to measure.

To summarise, the results of convergent and discriminant validity indicated that the items are valid enough to measure what they are assumed to measure and not anything else. Thus, it can be moved to the next step, which is the assessment of common method bias.

Table 5.12: Inter-Correlation Coefficients and Squared Roots of AVE

Latent constructs	PE	EE	SI	FC	PPS	BI
PE	**0.946**					
EE	0.454	**0.929**				
SI	0.647	0.501	**0.926**			
FC	0.563	0.837	0.530	**0.918**		
PPS	0.538	0.525	0.701	0.541	**0.919**	
BI	0.493	0.506	0.484	0.573	0.621	**0.947**
Note	- Values on the off-diagonal are inter-correlation coefficients. - Values on the diagonal are squared roots of AVE.					

Table 5.13: Item Loadings and Cross-Loadings

Constructs Items	PE	EE	SI	FC	PPS	BI
PE1	**0.969**	0.555	0.485	0.524	0.627	0.811
PE2	**0.953**	0.545	0.477	0.515	0.616	0.797
PE3	**0.916**	0.524	0.458	0.495	0.592	0.766
EE1	0.543	**0.949**	0.431	0.503	0.468	0.589
EE2	0.526	**0.918**	0.417	0.486	0.453	0.57
EE3	0.542	**0.947**	0.43	0.502	0.467	0.588
EE4	0.516	**0.901**	0.409	0.477	0.444	0.559
SI1	0.469	0.426	**0.938**	0.493	0.454	0.474
SI2	0.479	0.435	**0.958**	0.503	0.464	0.484
SI3	0.441	0.4	**0.881**	0.463	0.427	0.446
FC1	0.522	0.511	0.507	**0.965**	0.519	0.543
FC2	0.502	0.492	0.488	**0.928**	0.499	0.522
FC3	0.465	0.455	0.451	**0.859**	0.462	0.484
PPS1	0.616	0.47	0.461	0.513	**0.953**	0.667
PPS2	0.611	0.466	0.458	0.508	**0.945**	0.662
PPS4	0.555	0.423	0.416	0.462	**0.858**	0.601
BI1	0.814	0.604	0.492	0.548	0.682	**0.973**
BI2	0.798	0.592	0.482	0.537	0.668	**0.954**
BI3	0.765	0.567	0.462	0.514	0.64	**0.914**

5.5.1.4 Common Method Bias

The common method bias (CMB) was examined in the current study using two techniques; Harman's single-factor test and unmeasured latent method factor. In the former technique, 19 items were loaded into an exploratory factor analysis, and the unrotated factor solution was examined. As shown in Table 5.14, five factors emerged from the analysis, and a single factor was able to explain less than half of the variance (47.3%). As more than one factor emerged and a single factor did not explain the majority of variance, it can be concluded that there are no concerns regarding the presence of CMB in this study.

Table 5.14: Results of Harman's Single-Factor Test

Item	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.739	**47.344**	**47.344**	10.739	47.344	47.344
2	1.810	12.529	59.873	1.810	12.529	59.873
3	1.786	11.402	71.275	1.786	11.402	71.275
4	1.343	9.070	80.345	1.343	9.070	80.345
5	1.078	7.850	88.195	1.078	7.850	88.195
6	.526	2.767	90.961			
7	.233	1.228	92.190			
8	.200	1.051	93.241			
9	.183	.961	94.202			
10	.166	.874	95.076			
11	.156	.822	95.898			
12	.136	.717	96.616			
13	.116	.612	97.227			
14	.107	.564	97.791			
15	.101	.533	98.324			
16	.096	.507	98.831			
17	.088	.463	99.294			
18	.070	.371	99.664			
19	.064	.336	100.000			

In order to confirm the conclusion drawn from Harman's single-factor test, unmeasured latent method factor technique was performed as described in the previous chapter. As seen in Table 5.15, all factor loadings of the common method factor are not significant ($p>0.05$). In addition, the variance of each indicator explained by its theoretical construct was higher than the variance explained by the common method factor. By comparing the average of those variances, it was found that the average explained by the theoretical constructs was substantially higher than the average explained by the common method factor (0.838 vs. 0.002), and the ratio of both averages reached 381:1. Therefore, these results confirmed that CMB is not a serious problem in this study, thereby, the second step of SEM "structural model" can be performed.

Table 5.15: Results of Unmeasured Latent Method Factor Technique

	Theoretical Construct			Common Method Factor		
Items	**Factor Loading**	**Significance**	**Variance (R^2)**	**Factor Loading**	**Significance**	**Variance (R^2)**
PE1	0.966	***	0.933	0.065	0.716	0.004
PE2	0.954	***	0.910	0.037	0.836	0.001
PE3	0.907	***	0.823	0.176	0.290	0.031
EE1	0.933	***	0.870	0.174	0.235	0.030
EE2	0.905	***	0.819	0.156	0.247	0.024
EE3	0.931	***	0.867	0.172	0.226	0.030
EE4	0.888	***	0.789	0.154	0.258	0.024
SI1	0.906	***	0.821	0.243	0.095	0.059
SI2	0.932	***	0.869	0.218	0.077	0.048
SI3	0.868	***	0.753	0.165	0.129	0.027
FC1	0.89	***	0.792	0.152	0.063	0.023
FC2	0.854	***	0.729	0.175	0.065	0.031
FC3	0.742	***	0.551	0.203	0.070	0.041
PPS1	0.946	***	0.895	0.113	0.417	0.013
PPS2	0.935	***	0.874	0.137	0.318	0.019
PPS3	0.857	***	0.734	0.066	0.614	0.004
BI1	0.97	***	0.941	0.006	0.975	0.000
BI2	0.96	***	0.922	-0.068	0.708	0.005
BI3	0.915	***	0.837	0.146	0.384	0.021
Average			**0.838**			**0.002**

***: *$p < 0.001$*

5.5.2 Structural Model

After ensuring the validity of the measurement model and the absence of serious concerns pertaining to common method bias, the structural model was specified and validated. As mentioned in the previous chapter, the structural model represents the hypothesised relationships between constructs (Hair et al., 2010; Schumacker and Lomax, 2010; Byrne, 2016). The structural model shown in Figure 5.5 was tested in terms of three main aspects: model fit, predictive power, and strength of relationships (Byrne, 2016; Kline, 2015; Hair et al., 2010). The results of testing these aspects are reported in the next three subsections.

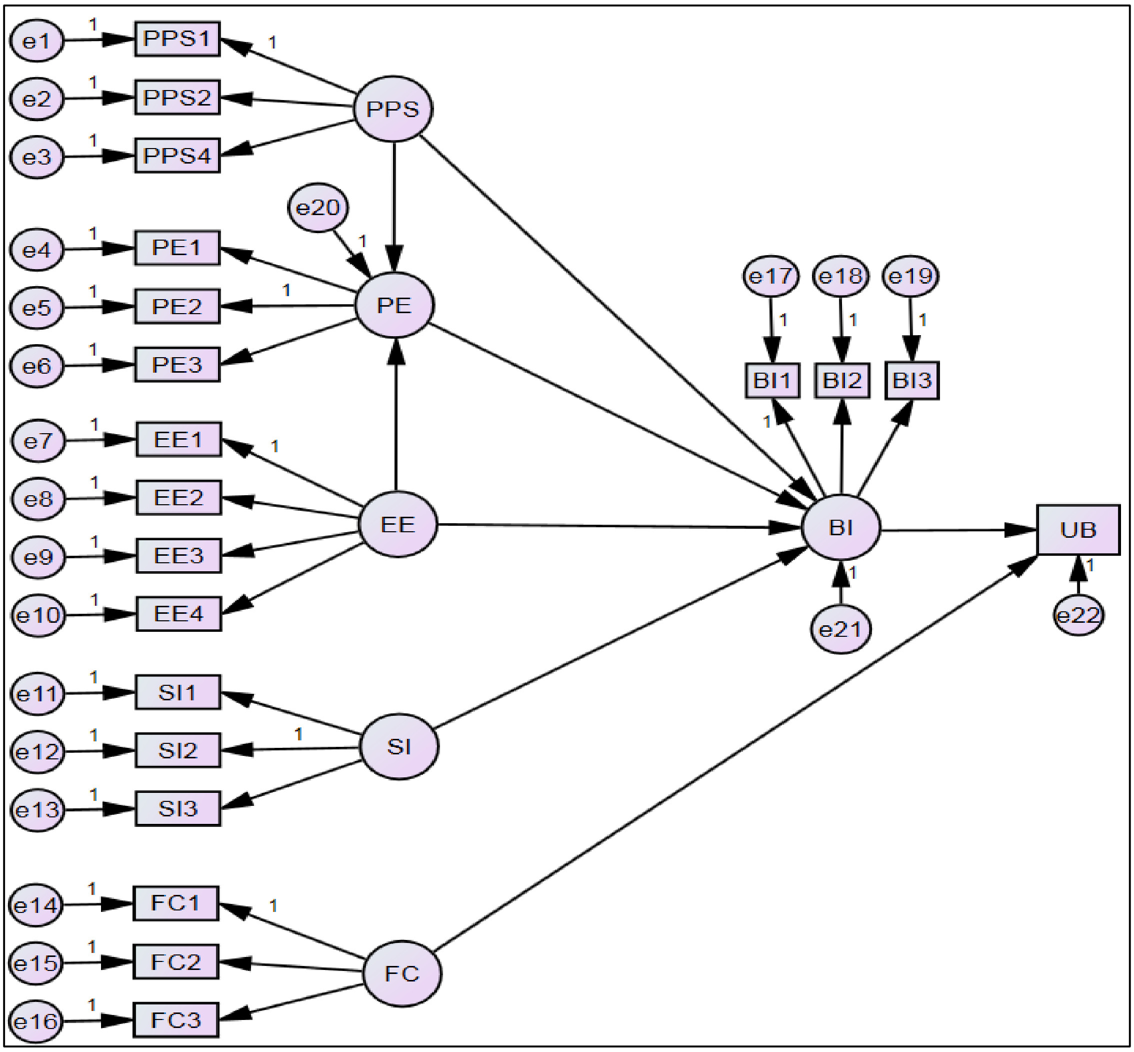


Figure 5.5: Initial Structural Model

5.5.2.1 Model Fit

The indices that were used to measure the fit of the measurement model were used again for assessing the fit of the structural model. All these indices showed a good fit of the structural model. As shown in Table 5.16, indices were within their cut-off levels: χ^2/*df*=1.673, GFI=0.962, AGFI=0.949, RMSEA=0.032 and its PCLOSE=1.000, SRMR=0.036, NFI=0.984, CFI=0.993, and TLI=0.992. According to these results, no model modification is needed so far.

Table 5.16: Results of Fit Indices of Initial Structural Model

Fit indices	Cut-off point	Initial Structural Model
χ^2/*df*	1-3	1.673
GFI	≥ 0.95	0.962
AGFI	≥ 0.90	0.949
RMSEA	< 0.05	0.032
PCLOSE	≥ 0.05	1.000
SRMR	≤ 0.05	0.036
NFI	≥ 0.95	0.984
CFI	≥ 0.95	0.993
TLI	≥ 0.95	0.992

5.5.2.2 Predictive Power

The predictive power of the proposed model was tested by checking the coefficient of determination (R^2) of each endogenous variable. As shown in Figure 5.6, the structural model accounted for 51% of the variance in performance expectancy (PE), 76% of the variance in behavioural intention (BI), and 48% of the variance in use behaviour (UB). According to Chin (1998), the predictive power of the model can be considered as moderate for PE and UB while it is substantial for BI.

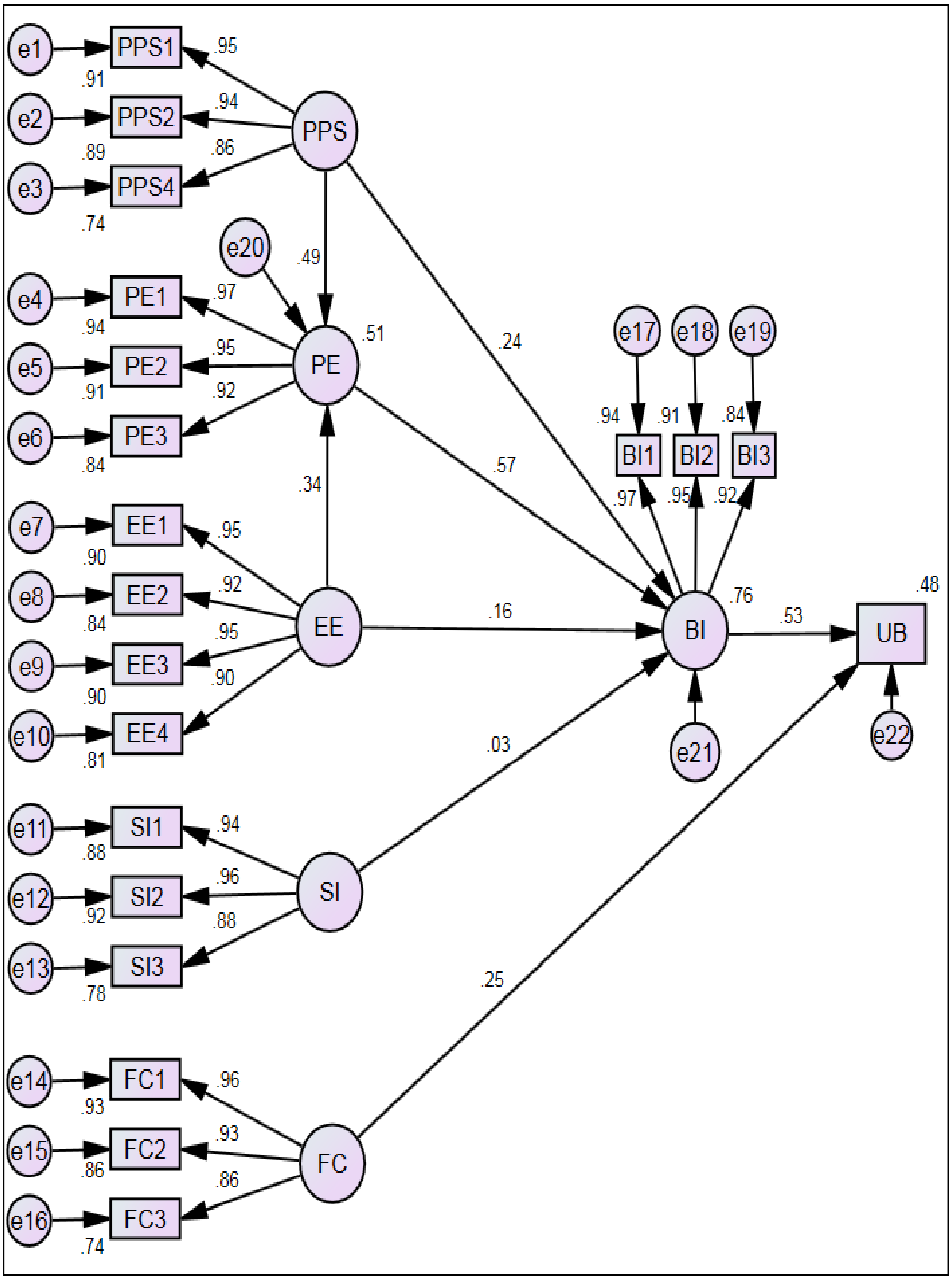


Figure 5.6: Coefficient of Determination (R^2) & Path Coefficients

5.5.2.3 Strength of Relationships

Assessing the strength of relationships refers to testing the proposed hypotheses. As discussed before, examining the strength of relationships depends on the type of proposed effect between variables; direct, mediating, and moderating.

Starting with direct effects, the strength of associations was tested by checking algebraic sign, magnitude, and significance of path coefficients. As summarised in Table 5.17, behavioural intention was affected significantly by performance expectancy (β=0.57, p<0.001), effort expectancy (β=0.16, p<0.001), and perceived privacy and security (β=0.24, p<0.001). However, the path from social influence to behavioural intention was not significant (β=0.03, p=0.183). Lastly, both facilitating conditions and behavioural intention influenced significantly use behaviour (β=0.25, p<0.001; β=0.53, p<0.001, respectively).

Table 5.17: Results of Path Coefficients of Direct Effects

Hypothesised path	Standardised estimate (β)	Z-value	95% Confidence Interval	P-value
PE→BI	0.57	17.81	0.51-0.64	***
EE→BI	0.16	5.91	0.11-0.21	***
SI→BI	0.03	1.33	-0.03-0.10	0.183
PPS→BI	0.24	7.84	0.18-0.29	***
FC→UB	0.25	7.12	0.20-0.30	***
BI →UB	0.53	15.00	0.48-0.58	***

***: *p<0.001*

In respect to mediating effects, it was assessed by testing the indirect effect (i.e. the effect of the independent variable on the dependent variable through the mediator) using bootstrapping method (Field, 2017; Gaskin, 2017; Shrout and Bolger, 2002). Performance expectancy was the only mediator proposed in the model, and it was hypothesised that it mediates the effect of each of effort expectancy and perceived privacy and security on behavioural intention. Results of bootstrapping indicate that performance expectancy mediated significantly the effect of effort expectancy and perceived privacy and security on behavioural intention (β=0.20, p<0.001; β=0.28, p<0.001, respectively) (see Table 5.18). As it is necessary to check the model fit when modifying the model or testing a new hypothesis (Schumacker and Lomax, 2010; Byrne, 2016; Gaskin, 2017), the model fit was examined again when the hypotheses were tested, and all model fit indices showed a good model fit.

Table 5.18: Results of Mediating Effects

Indirect Effect	Estimate (β)	95% Confidence Interval	*P*-value
EE→PE→ BI	0.20	0.15-0.25	< 0.001
PPS→PE→ BI	0.28	0.23-0.33	< 0.001

With reference to moderating effects, interaction effect approach was adopted to examine the effect of metric moderators (i.e. age) while multigroup approach was used to assess the effect of nonmetric moderators (i.e. sex, income, education, ethnicity, and internet access).

Starting with age, the interaction effect analysis showed that age moderated significantly three paths; PE→BI (β=-0.10, p<0.001), EE→BI (β=0.06, p=0.028), and FC→UB (β=0.16, p<0.001) (see Table 5.19). As seen in Figure 5.7, the relationship between performance expectancy and behavioural intention dampened with increasing age. In contrast, when age increased, the relationship between effort expectancy and behavioural intention increased (see Figure 5.8). Similarly, the effect of facilitating conditions on use behaviour increased by increasing age (Figure 5.9). All model fit indices were within acceptable levels for each model at each time the interaction effect analysis was conducted.

Table 5.19: Results of Moderating Effect of Age

Hypothesised interaction effect	**Standardised estimate (β)**	**Z-value**	***P*-value**
PE*Age→BI	-0.10	-4.32	***
EE*Age→BI	0.06	2.20	**0.028**
SI*Age→BI	0.01	1.88	0.063
PPS*Age→BI	-0.03	-1.23	0.217
FC*Age→UB	0.16	4.91	***

****: p<0.001*

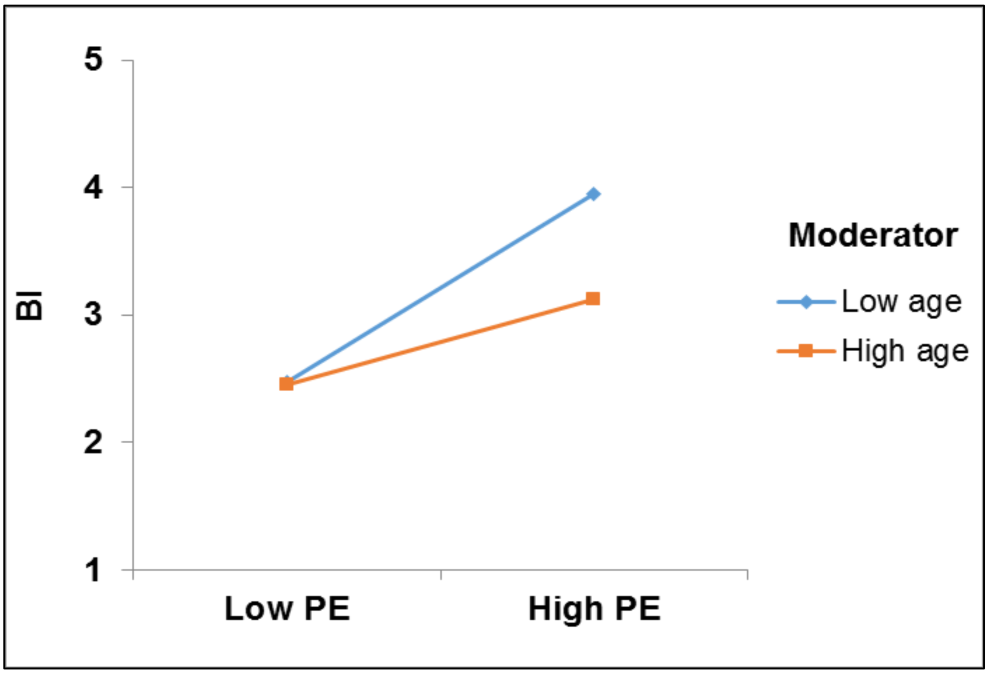


Figure 5.7: Moderating Effect of Age on the Path PE-BI

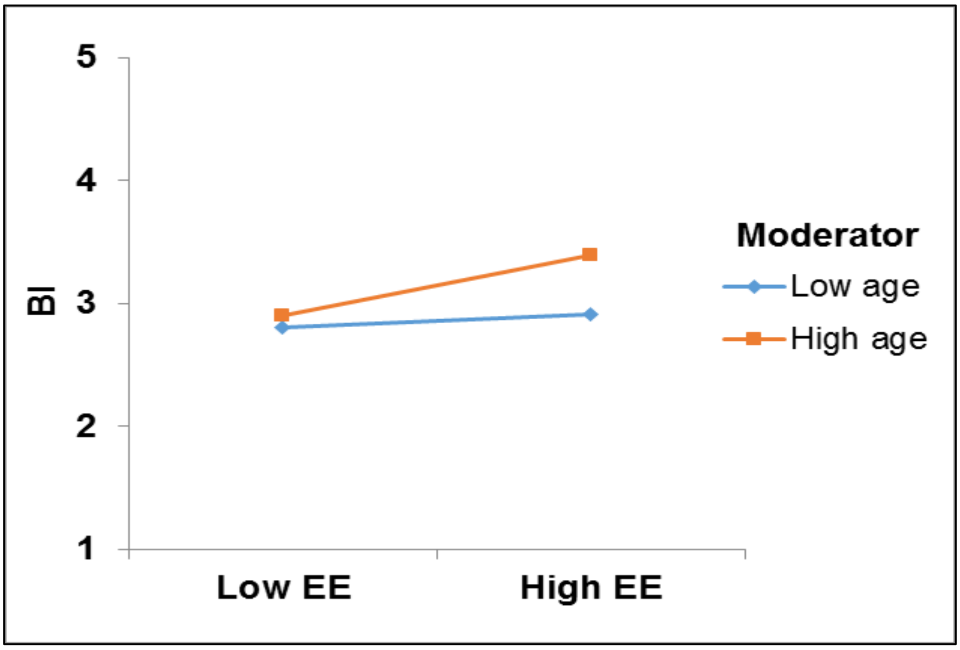


Figure 5.8: Moderating Effect of Age on the Path EE-BI

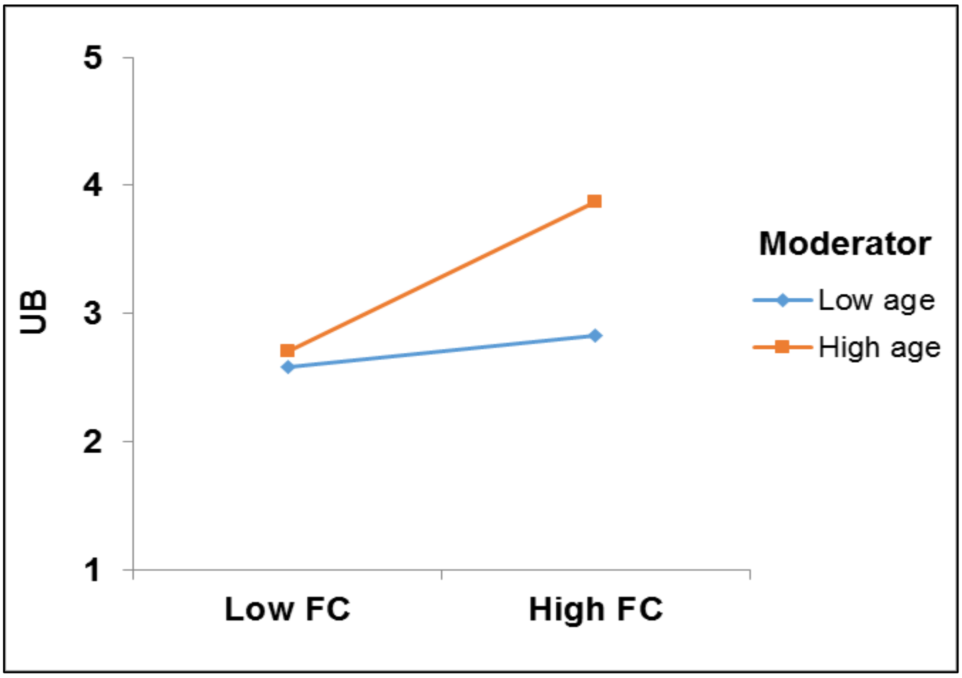


Figure 5.9: Moderating Effect of Age on the Path FC-UB

With reference to sex, a chi-square difference test showed that sex moderated significantly the relationship between performance expectancy and behavioural intention (p=0.009). Specifically, this relationship was stronger for males than females (β=0.59 vs. β=0.51, respectively). As shown in Table 5.20, sex neither moderates the associations between behavioural intention and effort expectancy (p=0.320), social influence (p=0.068), and perceived privacy and security (p=0.645), nor the relationship between facilitating conditions and use behaviour (p=0.318). It should be noted that the fit indices showed a good model fit at each time multigroup analysis was carried out.

Table 5.20: Results of Moderating Effect of Sex

Hypothesised path	Male		Female		Chi-square difference test
	Standardised estimate (β)	P-value	Standardised estimate (β)	P-value	
PE→BI	0.59	***	0.51	***	**0.009**
EE→BI	0.17	***	0.19	***	0.320
SI→BI	-0.03	0.530	0.06	0.054	0.068
PPS→BI	0.27	***	0.20	***	0.645
FC→UB	0.35	***	0.28	***	0.318

****: $p<0.001$*

In respect to education, the numbers of participants were substantially incomparable among the six groups. Hence, the first two groups (up to secondary school and secondary school) were merged, and the last three groups (bachelor degree, master degree, and doctoral degree) were also combined in order to make a balance between groups. This process produced three groups; secondary school or lower, college, and bachelor or higher. The multigroup analysis was performed between only two groups at each time. By comparing the first two groups, the only path that was affected significantly by education level was the one between facilitating conditions and use behaviour (p=0.003) (Table 5.21). Specifically, this path was stronger for "secondary school or lower" group than college group (β=0.39 vs. β=0.30). In the second comparison between "secondary school or lower" group and "bachelor or higher" group (Table 5.21), three paths were moderated significantly by education level; EE→BI (p=0.027), SI→BI (p=0.020), and FC→UB (p=0.022). The first path was significant for "secondary school or lower" group (β=0.14, p< 0.05), but it was not significant for "bachelor or higher" group (β=0.01; p=0.161). Conversely, the second path (SI→BI) was not significant for "secondary school or lower" group (β=-0.05, p=0.401), but it was significant for "bachelor or higher" group (β=0.14; p< 0.05). The last path (FC→UB) was stronger for "secondary school or lower" group than "bachelor or higher" group (β=0.39 vs. β=0.21). In the last comparison between college group and "bachelor or higher" group (Table 5.21), the level of education moderated significantly two paths; EE→BI (p=0.008) and SI→BI (p=0.041). While the first path was significant for college group (β=0.13, p<0.01), it was not significant for "bachelor or higher" group (β=0.01, p<0.161). In contrast, the second path was not significant for college group (β=0.00, p=0.969), but it was significant for "bachelor or higher" group (β=0.14, p<0.05). The fit of the model was good at each time multigroup analysis was performed.

Table 5.21: Results of Moderating Effect of Education Level

Hypothesised path	Secondary school or lower		College/Diploma		Chi-square difference test
	Standardised estimate (β)	P-value	Standardised estimate (β)	P-value	
PE→BI	0.57	***	0.62	***	0.379
EE→BI	0.14	*	0.13	**	0.377
SI→BI	-0.05	0.401	0.00	0.969	0.572
PPS→BI	0.17	**	0.29	***	0.224
FC→UB	0.39	***	0.30	***	**0.003**

Hypothesised path	Secondary school or lower		Bachelor or higher		Chi-square difference test
	Standardised estimate (β)	P-value	Standardised estimate (β)	P-value	
PE→BI	0.57	***	0.57	***	0.496
EE→BI	0.14	*	0.01	0.161	**0.027**
SI→BI	-0.05	0.401	0.14	*	**0.020**
PPS→BI	0.17	**	0.24	***	0.144
FC→UB	0.39	***	0.21	***	**0.022**

Hypothesised path	College/Diploma		Bachelor or higher		Chi-square difference test
	Standardised estimate (β)	P-value	Standardised estimate (β)	P-value	
PE→BI	0.62	***	0.57	***	0.097
EE→BI	0.13	**	0.01	0.161	**0.008**
SI→BI	0.00	0.969	0.14	*	**0.041**
PPS→BI	0.29	***	0.24	***	0.539
FC→UB	0.30	***	0.21	***	0.232

**: p<0.05; **: p< 0.01; ***: p<0.001*

As with education, the numbers of participants were substantially unequal among seven groups regarding income. In order to make a balance between groups, four groups were formed by combining the second group (£20,000-29,999) with the third group (£30,000-39,999), and merging the fourth group (£40,000-49,999), the fifth group (£50,000-59,999), and the sixth group (£60,000 or more). The new groups are as follows: low income (less than £20,000), middle income (£20,000-39,999), high income (£40,000 or more), and "prefer not to say" group. However, the fourth group was not included in the analysis as it is similar to missing data (Field, 2017; Bhattacherjee, 2012). The multigroup analysis was carried out between only two groups at each time. By comparing low income with middle income, the relationship between facilitating conditions and use behaviour was moderated significantly by income (p=0.048). Precisely, the relationship was stronger among low income participants than middle income participants (β=0.43 vs. β=0.25). However, all remaining paths were not moderated significantly by income (Table 5.22). By comparing low income with high income groups, it was found that income level moderated significantly the path between facilitating conditions and use behaviour (p=0.033). This path was stronger among low income group than high income group (β=0.43 vs. β=0.10). The rest of paths were not moderated by income level as shown in Table 5.22. In the last comparison between middle and high-income groups, the relationship between facilitating conditions and use behaviour was influenced significantly by income level (p=0.024), where this relationship was stronger for the middle-income group than the high-income group (β=0.25 vs. β=0.10). As outlined in Table 5.22, the remaining paths were not moderated by income level. The model showed an acceptable fit at each time multigroup analysis was conducted.

Table 5.22: Results of Moderating Effect of Income

Hypothesised path	**Low income**		**Middle income**		**Chi-square difference test**
	Standardised estimate (β)	**P-value**	**Standardised estimate (β)**	**P-value**	
PE→BI	0.54	***	0.52	***	0.425
EE→BI	0.14	***	0.22	***	0.386
SI→BI	0.07	0.101	0.01	0.918	0.368
PPS→BI	0.26	***	0.28	***	0.987
FC→UB	0.43	***	0.25	***	**0.048**
Hypothesised path	**Low income**		**High income**		**Chi-square difference test**
	Standardised estimate (β)	**P-value**	**Standardised estimate (β)**	**P-value**	
PE→BI	0.54	***	0.68	***	0.089
EE→BI	0.14	***	0.12	*	0.673
SI→BI	0.07	0.101	-0.07	0.201	0.059
PPS→BI	0.26	***	0.25	***	0.873
FC→UB	0.43	***	0.10	*	**0.033**
Hypothesised path	**Middle income**		**High income**		**Chi-square difference test**
	Standardised estimate (β)	**P-value**	**Standardised estimate (β)**	**P-value**	
PE→BI	0.52	***	0.68	***	0.055
EE→BI	0.22	***	0.12	*	0.267
SI→BI	0.01	0.918	-0.07	0.201	0.271
PPS→BI	0.28	***	0.25	***	0.875
FC→UB	0.25	***	0.10	*	**0.024**

**: p< 0.01; ***: p<0.001

With regard to internet access, the chi-square difference test showed that only two paths were moderated significantly by internet access; EE→BI (p=0.011) and FC→UB (p<0.001). As shown in Table 5.23, the former path was stronger for participants without internet access (β=0.59) than those with internet access (β=0.41). Similarly, the latter path was stronger for participants without internet access (β=0.44) than those with internet access (β=0.18). Although this study did not hypothesise moderating effect of internet access on the paths PE→BI, SI→BI and PPS→BI, it was tested here to make sure that this was an appropriate decision. Indeed, those paths were not influenced significantly by the moderator "internet access". The model fit indices showed a good model fit at each time multigroup analysis was carried out.

Table 5.23: Results of Moderating Effect of Internet Access

Hypothesised path	Internet access		No internet access		Chi-square difference test
	Standardised estimate (β)	P-value	Standardised estimate (β)	P-value	
PE→BI	0.55	***	0.48	**	0.556
EE→BI	0.12	***	0.28	***	**0.011**
SI→BI	0.06	0.061	-0.03	0.394	0.103
PPS→BI	0.21	***	0.34	***	0.583
FC→UB	0.18	***	0.44	***	**0.000**

***: p<0.01;   ***: p<0.001*

Although ethnicity was not included in the proposed model, its moderating effect was examined. The numbers of participants were noticeably incomparable among five groups related to ethnicity. So as to make a balance between groups, two groups were formed by merging four groups (Asian, Black, Mixed, and others). The resulted groups are white and non-white. By conducting multigroup analysis, the results showed that ethnicity affected significantly the relationship between performance expectancy and behavioural intention (p=0.016). This relationship was stronger among white participants than non-white participants (β=0.59 vs. β=0.44). As shown in Table 5.24, ethnicity did not moderate the other relationships. The model showed an acceptable fit at each time multigroup analysis was conducted.

Table 5.24: Results of the Moderating Effect of Ethnicity

Hypothesised path	White		Non-White		Chi-square difference test
	Standardised estimate (β)	P-value	Standardised estimate (β)	P-value	
PE→BI	0.59	***	0.44	***	**0.016**
EE→BI	0.15	***	0.25	***	0.551
SI→BI	0.03	0.238	0.00	0.963	0.619
PPS→BI	0.23	***	0.25	***	0.908
FC→UB	0.21	***	0.49	***	0.284

****: p<0.001*

To sum up, this subsection tested the 28 hypotheses proposed in this study. The first six hypotheses (H1-H6) represented the direct effects of factors. All these hypotheses were supported except hypothesis 3 (H3), which is related to the effect of social influence on intention to use (Table 5.25). The next two hypotheses (H7 & H8) were related to the mediating effects, both of them were also supported by the results (Table 5.26). The rest of hypotheses (H9-H28) were pertaining to moderating effects. Only nine of those hypotheses were supported by the results, which are: H9, H10, H13, H14, H20, H22, H26, H27, and H28. These results of all hypotheses ensured extensive discussion in the next chapter.

Table 5.25: Hypotheses Testing Related to Direct Effects

H	Paths	Hypotheses	Results
H1	PE→BI	Performance expectancy positively influences behavioural intention	Supported
H2	EE→BI	Effort expectancy positively influences behavioural intention	Supported
H3	SI→BI	Social influence positively influences behavioural intention	Rejected
H4	PPS→BI	Perceived privacy and security positively influences behavioural intention	Supported
H5	FC→UB	Facilitating conditions positively influence use behaviour	Supported
H6	BI→UB	Behavioural intention positively influences use behaviour	Supported

Table 5.26: Hypotheses Testing Related to Mediating Effects

H	Path	Mediator	Hypotheses	Results
H7	EE→BI	PE	Performance expectancy positively mediates the positive relationship between effort expectancy and behavioural intention	Supported
H8	PPS→BI	PE	Performance expectancy positively mediates the positive relationship between perceived privacy and security and behavioural intention	Supported

Table 5.27: Hypotheses Testing Related to Moderating Effects

H	Path	Moderator	Hypotheses	Results
H9	PE→BI	Age	Age negatively moderates the positive relationship between performance expectancy and behavioural intention	Supported
H10	EE→BI	Age	Age positively moderates the positive relationship between effort expectancy and behavioural intention	Supported
H11	SI→BI	Age	Age positively moderates the positive relationship between social influence and behavioural intention	Rejected
H12	PPS→BI	Age	Age positively moderates the positive relationship between perceived privacy & security and behavioural intention	Rejected
H13	FC→UB	Age	Age positively moderates the positive relationship between facilitating conditions and use behaviour	Supported
H14	PE→BI	Sex	Sex moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for males	Supported
H15	EE→BI	Sex	Sex moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for females	Rejected
H16	SI→BI	Sex	Sex moderates the positive relationship between social influence and behavioural intention, such that the influence is stronger for females	Rejected
H17	PPS→BI	Sex	Sex moderates the positive relationship between perceived privacy & security and behavioural	Rejected

			intention, such that the influence is stronger for females	
H18	FC→UB	Sex	Sex moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for females	Rejected
H19	PE→BI	Education level	Education level negatively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for patients with lower level of education	Rejected
H20	EE→BI	Education level	Education level negatively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients with lower level of education	Supported
H21	PPS→BI	Education level	Education level positively moderates the positive relationship between perceived privacy & security and behavioural intention, such that the influence is stronger for patients with higher level of education	Rejected
H22	FC→UB	Education level	Education level negatively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients with lower level of education	Supported
H23	PE→BI	Income	Income positively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for patients with higher income	Rejected
H24	EE→BI	Income	Income negatively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients with lower income	Rejected
H25	PPS→BI	Income	Income negatively moderates the positive relationship between perceived privacy & security and behavioural intention, such that the influence is stronger for patients with lower income	Rejected
H26	FC→UB	Income	Income negatively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients with lower income	Supported
H27	EE→BI	Internet access	Internet access moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients without internet access	Supported
H28	FC→UB	Internet access	Internet access moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients without internet access	Supported

5.5.2.4 Modification of the Structural Model

Although the initial structural model achieved a good fit and predictive power, there is room to improve the model because some proposed relationships were not supported. The model fit and parsimony may be improved by dropping non-significant paths (Byrne, 2016; Schumacker and Lomax, 2010). Based on the results in the previous subsection, the path extended from social influence to behavioural intention was the only one of direct effects which was not significant. Thus, this path was dropped from the model. While the two mediating effects proposed in the initial model were supported, only 9 of 20 moderating effects were supported. Therefore, those 11 rejected effects were dropped out from the model. Two moderating effects were not proposed in the model but they were statistically significant. The first is the moderating effect of ethnicity on the relationship between performance expectancy and behavioural intention. Thus, this effect was added to the model. The second is the moderating effect of education level on the relationship between social influence and behavioural intention. However, this moderating effect was not included in the model because the construct social influence was dropped out of the model. Figure 5.10 shows the modified structural model.

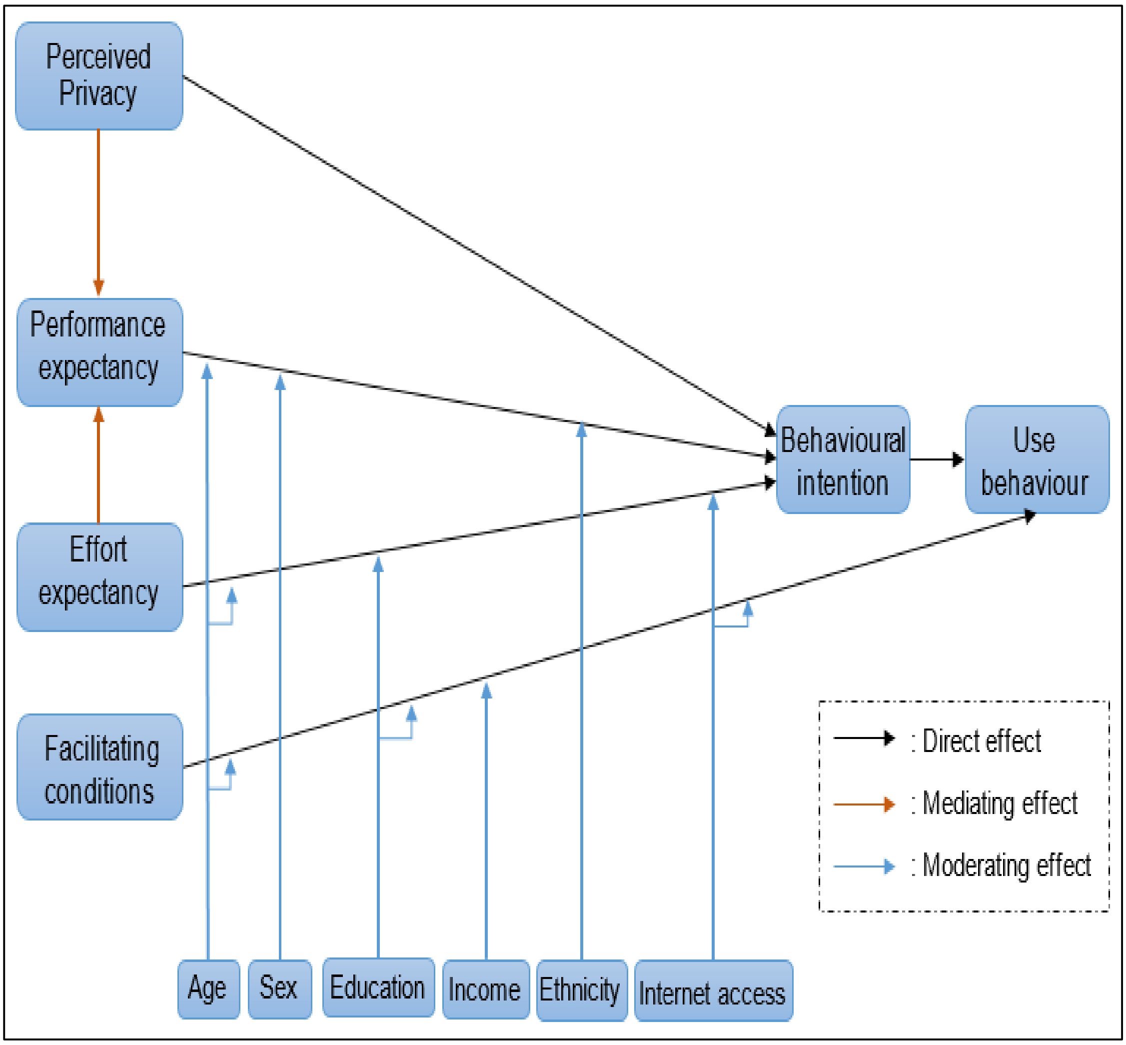


Figure 5.10: The Modified Structural Model

As the model was modified, it was necessary to assess the model again (Byrne, 2016; Gaskin, 2017; Schumacker and Lomax, 2010). Starting with model fit assessment, Table 5.28 shows that all model fit indices achieved a good model fit. As seen in Table 5.29, the values of R^2 for the modified model were equal to those for the initial model. Further, the strength of relationships in the modified model was almost comparable to those in the initial structural model (see Table 5.29). Lastly, modification indices were checked to ensure that the model does not need further modifications. As shown in Table 5.30, modification indices suggested only some unreasonable modifications, and applying these modifications may slightly decrease the discrepancy. Therefore, those modifications were not applied, thus, the modified structural model was not amended.

Table 5.28: Results of Fit Indices of Modified Structural Model

Fit indices	Cut-off point	Modified Structural Model
χ^2/df	1-3	1.931
GFI	≥ 0.95	0.963
AGFI	≥ 0.90	0.949
RMSEA	< 0.05	0.037
PCLOSE	≥0.05	0.997
SRMR	≤0.05	0.032
NFI	≥ 0.95	0.985
CFI	≥ 0.95	0.993
TLI	≥ 0.95	0.991

Table 5.29: Predictive Power and Strength of Relationships

Hypothesised path	Explained variance (R^2)	Standardised estimate (β)	Z-value	P-value
EE→PE	0.51	0.34	9.77	***
PPS→PE		0.49	13.90	***
PE→BI	0.76	0.58	18.28	***
EE→BI		0.17	6.30	***
PPS→BI		0.24	8.33	***
FC→UB	0.48	0.25	7.14	***
BI →UB		0.53	15.02	***

***: *p<0.001*

Table 5.30: Modification Indices for the Modified Structural Model

Suggested paths	M.I.	Par change
e19 ←→ FC	10.661	.118
e19 ←→ e22	17.416	.096
e6 ←→ e18	10.407	-.050
FC → BI3	15.437	.060
UB → BI3	15.506	.082
FC1 → BI3	13.717	.053
FC2 → BI3	12.576	.052
FC3 → BI3	18.898	.069

M.I.: The amount of discrepancy that is expected to fall down when the corresponding path is assigned as a free parameter.
Par change: The expected increase of estimate of the corresponding parameter when it is assigned as a free parameter.

5.6 Thematic Analysis

Thematic analysis was carried out to analyse the qualitative data collected by the open-ended question. That question asked participants about their perception of why people may or may not use Patient Online. Of 624 participants who completed and returned the questionnaires, 136 participants (21.8%) answered the optional open-ended question. Those 136 comments were broken down into 221 utterances. Three utterances were excluded due to handwriting being illegible (2 utterances) or the intended meaning of the utterance being unclear (1 utterance). Thus, 218 utterances were included in the thematic analysis. The number of respondents remained 136 in spite of excluding three utterances; this is because these three excluded utterances were only part of three large comments. The characteristics of the respondents and non-respondents to the open-ended question and the findings of the thematic analysis are presented in the next two subsections, respectively.

5.6.1 Characteristics of Respondents and Non-Respondents

While 136 participants answered the open-ended question, 488 participants did not. Table 5.31 shows the characteristics of both respondents and non-respondents. The mean age of respondents is 43.7 years (SD=18.3). About 60% of respondents were female. In regard to ethnicity, the majority of respondents were white (78.7%). Around 70% of respondents had income of less than £40,000 per year. Approximately 40% of respondents have Bachelor degree or higher. The respondents who have internet access formed 82.4% of all respondents.

In order to check the non-response bias, characteristics of respondents and non-respondents were compared. As shown in Table 5.31, the differences between respondents and non-respondents were very small for most of the characteristics. The chi-square test was carried out in order to test the significance of the differences between respondents and non-respondents. The differences between respondents and non-respondents in terms of age, sex, ethnicity, income, education, and internet access were not significant (p=0.816, 0.127, 0.791, 0.236, 0.838, and 0.408 respectively). Accordingly, it can be concluded that the risk of non-response bias is minimal in the current study.

Table 5.31: Characteristics of Respondents and Non-Respondents

Variable	Groups	Respondents (n=136)	Non-respondents[1] (n=488)	Diff[2]	P-Value[3]
		n (%)	n (%)	%	
Age, year mean (SD)	-	43.7 (18.3)	44.6 (18.7)	0.9	0.618[4]
Age	18-24	19 (14)	88 (18)	4	0.816
	25-34	35 (25.7)	113 (23.1)	2.6	
	35-44	23 (16.9)	93 (19.1)	2.2	
	45-54	20 (14.7)	78 (16)	1.3	
	55-64	17 (12.5)	48 (9.8)	2.7	
	65-74	12 (8.8)	34 (7)	1.8	
	75+	10 (7.4)	34 (7)	0.4	
Sex	Male	56 (41.2)	237 (48.6)	7.4	0.127
	Female	80 (59.8)	251 (51.4)		
Ethnicity	White	107 (78.7)	391 (80.1)	1.4	0.791
	Asian	14 (10.3)	59 (12.1)	1.8	
	Black	6 (4.4)	14 (2.9)	1.5	
	Mixed	7 (5.1)	19 (3.9)	1.2	
	Others	2 (1.5)	5 (1)	0.5	
Income	< 20,000	55 (40.4)	229 (46.9)	6.5	0.236
	20,000-29,999	24 (17.6)	56 (11.5)	6.1	
	30,000-39,999	16 (11.8)	49 (10)	1.8	
	40,000-49,999	9 (6.6)	34 (7)	0.4	
	50,000-59,999	6 (4.4)	20 (4.1)	0.3	
	60,000 or more	5 (3.8)	7 (1.4)	2.4	
	Prefer not to say	21 (15.4)	93 (19.1)	3.7	
Education	Up to secondary school	13 (9.6)	63 (12.9)	3.3	0.838
	Secondary school	31 (22.8)	118 (24.2)	1.4	
	College/ Diploma	38 (27.9)	132 (27)	0.9	
	Bachelor Degree	38 (27.9)	129 (26.4)	1.5	
	Master Degree	10 (7.4)	32 (6.6)	0.8	
	Doctoral Degree	6 (4.4)	14 (2.9)	1.5	
Internet access	Yes	112 (82.4)	416 (85.2)	2.8	0.408
	No	24 (17.6)	72 (14.8)		

[1]: *Those who participated in the survey but did not answer the open-ended question*

[2]: *Absolute difference between respondents and non-respondents (percentage)*

[3]: *Chi-square was used*

[4]: *t-test was used*

5.6.2 Findings of Thematic Analysis

The thematic analysis produced two meta-themes. The first meta-theme pertains to utterances about why patients do not use Patient Online. As shown in Table 5.32 and Figure 5.11, this meta-theme is made up of five themes, which are: concerns about using patient online, lack of awareness of patient online, challenges regarding internet and computers, perceived characteristics of non-users, and preferring personal contact. The second meta-theme summarises utterances about why patient use Patient Online, and it contains only one theme; encouraging features of patient online. More details regarding these themes are explained next.

Table 5.32: Numbers and Percentages of Utterances and Respondents for each Theme and Sub-theme

Themes	Sub-Themes	Utterances n (%)[a]	Respondents n (%)[b]
Concerns about using Patient Online	Concerns about privacy and security	41 (19%)	35 (26%)
	Difficulty accessing Patient Online	13 (6%)	11 (8%)
	Difficulty using Patient Online	10 (5%)	9 (7%)
	Lack of trust in Patient Online	6 (3%)	6 (4%)
	Difficulty to register	3 (1%)	3 (2%)
	Technical concerns	3 (1%)	3 (2%)
	Inability of Patient Online to save money/ time	3 (1%)	2 (1%)
	Total	**79 (36%)**	**58**[c] (43%)
Issues about awareness of Patient Online	Lack of awareness	25 (11%)	21(15%)
	Advertising about Patient Online	8 (4%)	8 (6%)
	Total	**33 (15%)**	**24**[c] (18%)
Challenges regarding internet and computers	No internet/computer access	19 (9%)	16 (12%)
	Limited internet/computer skills	10 (4%)	9 (7%)
	Lack of internet/computer use	4 (2%)	4 (3%)
	Total	**32 (15%)**	**23**[c] (17%)
Perceived characteristics of non-users	Elderly	19 (9%)	17 (13%)
	People who rarely use GP services	4 (2%)	3 (2%)
	People with low income	3 (1%)	3 (2%)
	Others	4 (2%)	4 (3%)
	Total	**30 (14%)**	**26**[c] (19%)
Preferring personal contact	-	22 (10%)	22 (16%)
Encouraging features of Patient Online	-	22 (10%)	20 (15%)

[a]: *Percentage of utterances in each theme to all utterances (218)*

[b]: *Percentage of respondents in each theme to all respondents (136)*

[c]: *The total of respondents in each meta-theme does not equal to the sum of respondents in the corresponding themes because some participants have utterances in more than one theme*.

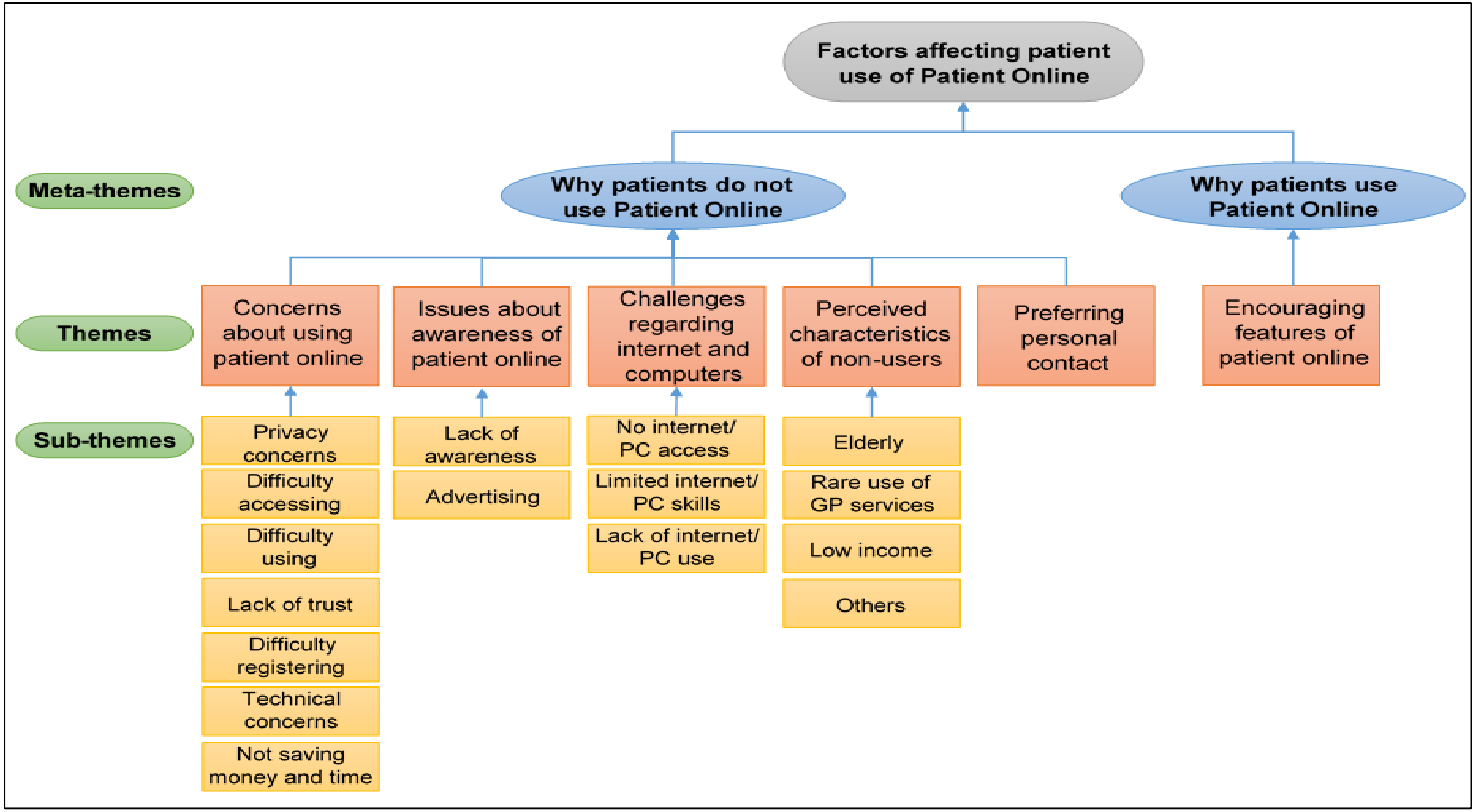


Figure 5.11: Thematic Map

5.6.2.1 Theme 1: Concerns about Using Patient Online

The first theme contains utterances from 43% of respondents, who were worried or concerned about using Patient Online (see Table 5.32). This theme is made up of seven sub-themes: (1) concerns about privacy and security, (2) difficulty accessing patient online, (3) difficulty using patient online, (4) lack of trust in Patient Online, (5) difficulty to register, (6) technical concerns, and (7) the inability of Patient Online to save money and time (see Figure 5.11).

The most commonly mentioned concern was regarding privacy and security of Patient Online (41 utterances). Several respondents attributed their privacy and security concerns to the recent NHS hack attacks, accessing their data by third parties or unknown people, and uncertainty about the security measures of Patient Online.

> *"I believe that patient online has/ will have too many privacy issues….look what happened when the NHS was hacked" (Participant #9).*
>
> *"Only concern is confidentiality of System One as I am aware CIAs are now using the system" (Participant #30).*
>
> *"Programmers are not clever enough to have written the perfect secure program for 100% full online security" (Participant #48).*

In the second sub-theme, utterances revealed that difficulty accessing (i.e. logging in) Patient Online could be a barrier to use it. The main reasons given for difficulties accessing Patient Online were finding its URL link and forgetting passwords and login details.

> *"I tried to use the system but I can never find the correct link…." (Participant #120).*
>
> *"….I always forget my password" (Participant #35).*
>
> *"I would use the online services more if I do not keep forgetting my login details" (Participant #52).*

The third sub-theme encompasses respondents' comments about difficulty using Patient Online. While respondents in the previous sub-theme concerned only about logging in to Patient Online, respondents in this sub-theme were worried about using the system after logging in to it (i.e. ordering prescriptions, managing appointments, and checking their records). Some respondents showed more concerns about difficulty using Patient Online when there is lack of help from others.

> *"I don't know if this would be easy to use" (Participant #5).*
>
> *"If people experience a difficulty and do not know where to find help, or who to ask, they may give up trying" (Participant #49).*
>
> *"....Nobody close contact to help in using it" (Participant #10).*

Within the fourth sub-theme, some respondents did not trust Patient Online in doing what they want. For example, they may feel uncertain that an appointment has been booked for them if the booking is done via Patient Online.

> *"....I don't trust the service" (Participant #9).*
>
> *"….I am not sure I would entirely trust it…." (Participant #123).*

The fifth sub-theme brought together utterances concerned with difficulty registering with Patient Online. Some respondents attributed this concern to the fact that they have to visit the practice in person with their identity document (ID) to be able to register to use the system. One respondent suggested a way to encourage patients to sign up for Patient Online by making the signing up procedure as a part of patient registration in the practice.

> *"You also have to make a trip to the surgery with ID to be able to use the service" (Participant #28).*
>
> *"I think more effort should be made to encourage patients to sign up for this, and the process should be more streamlined-perhaps done as a matter of course when registering" (Participant #7).*

In respect to the sixth sub-theme, respondents showed their concerns regarding technical issues of Patient Online. Technical issues here refer to technical errors that people face when using Patient Online.

> *"Technical concerns about using online services" (Participant #89).*
>
> *"…technology goes wrong and does not tell you why (Participant #58).*

The last sub-theme encapsulates comments from some respondents who were worried about the inability of Patient Online to save money and time. To be more precise, respondents, especially those live near the practice, doubted that using Patient Online saves money and time.

> *"In my experience many of these things do not end up saving people's time and money. So I don't think I'll be using this except infrequently" (Participant #38).*
>
> *"It would not save travel costs because I live next to it" (Participant #85).*

5.6.2.2 Theme 2: Issues about Awareness of Patient Online

This theme summarises respondents' comments about their awareness of many aspects of Patient Online. Many respondents acknowledged that if they were aware/ had knowledge about Patient Online, they would use it. As depicted in Figure 5.11, this theme consists of two sub-themes: lack of awareness of Patient Online and advertising about Patient Online. In the former sub-theme, respondents attributed their non-use of Patient Online to the lack of knowledge about different aspects of the system, which are: its presence, what it is about, how to use it, and how to access it.

> *"To be honest, I've never heard of Patient online before and that may be why people haven't used it" (Participant #88).*
>
> *"Not been shown what it is about and how to use it" (Participant #80).*
>
> *"Don't have any information on what it is, and how to access it, so I wouldn't use it" (Participant #99).*

Within the second sub-theme "advertising about Patient Online", respondents felt that the reason behind the lack of awareness of Patient Online is the lack of advertising about it. Thus, several respondents stressed the importance of improving the publicity of Patient Online so as to increase people awareness of it.

> *"It is not openly advertised in the surgery that patient online is available" (Participant #28).*
>
> *"…may not be enough advertisement" (Participant #62).*
>
> *"More publicity about it would be helpful. More advertising is needed" (Participant #76).*

5.6.2.3 Theme 3: Challenges Regarding Internet and Computers

The third theme refers to issues regarding prerequisites for using Patient Online (i.e. computers and internet). Respondents identified three challenges regarding internet and computers, which form three sub-themes within this theme. The first challenge is lack of internet or computer access. Many respondents attributed non-use of Patient Online to not having internet or computer access.

> *"I don't have a computer or internet" (Participant #20).*
>
> *"Those who don't have access to the internet may not use it" (Participant #57).*

The second challenge is the limited skills in using internet or computers. In other words, although the lack of internet or computer access might not be an issue for several respondents, they were concerned about their ability to use Patient Online due to their limited skills in using internet or computers.

> *"I can't use a computer so I can't use online" (Participant #2).*
>
> *"I do not have computer skills or knowledge which would be hard" (Participant #27).*

The last challenge is lack of use internet or computers. Respondents within this sub-theme might have internet, computers, and skills to use them, but they rarely use them, and this is the main reason for not using Patient Online.

> *"I do not use the internet and I have no intention of ever doing so" (Participant #60).*
>
> *"I do not use computers of any kind" (Participant #75).*

5.6.2.4 Theme 4: Perceived Characteristics of Non-Users

The fourth theme brings together utterances about who is less likely to use Patient Online. Respondents mentioned frequently three characteristics of non-users; elderly people, people who rarely use GP services, and people with low income. Thus, these characteristics formed three sub-themes within this theme. Other characteristics were reported infrequently by some respondents and they are less common, therefore, they were grouped into additional subtheme called "others".

The most commonly reported characteristic of non-users was elderly people. Several respondents doubted the ability of old people to use Patient Online for different reasons; lack of computers and internet skills, lack of internet access, lack of awareness of how to use it, lack of confidence in using it, preferring face-to-face contact, and lack of technology use.

> *"Elderly people may have no understanding or knowledge of how to use a computer or the internet" (Participant #69).*
>
> *"Older people may not use it as they don't have access to internet or know how to use services" (Participant #116).*
>
> *"Confidence in using online technology, e.g. older generation may struggle" (Participant #112).*
>
> *"Older people would maybe prefer face to face services" (Participant #96).*
>
> *"Elderly people who don't use the technology available would not be able to use the service" (Participant #129).*

The second characteristic of non-users was people who rarely use GP services. To be more precise, several respondents attributed their lack of use of Patient online to rare visits to the practice and rare use of prescriptions.

> *"I've never used it as it's rare that I attend the surgery and I'm not on any medication" (Participant #132).*
>
> *"I don't need regular appointments or prescriptions, only come to doctors around once a year" (Participant #135).*

People with low income were identified by respondents as the third characteristic of non-users. Some respondents indicated that people need enough income to have internet access or to get training to be able to use computers and internet.

> *"I do not have enough income/benefits…." (Participant #20).*
>
> *"….people that can't afford the internet" (Participant #130).*
>
> *"Homeless" (Participant #105).*

The last sub-theme encompasses characteristics of other people who are more likely to be non-users for Patient Online, and those are: people who live near the practice, illiterate people, people who cannot read in English, and people who forget to use Patient Online.

> *"I would use patient online more often if I lived further away from the surgery" (Participant #15).*
>
> *"I am not good at reading or spelling so online would not be good for me" (Participant #70).*
>
> *"….cannot read in English" (Participant #71).*
>
> *"I know about it but I forgot to use it" (Participant #117).*

5.6.2.5 Theme 5: Preferring Personal Contact

Utterances in this theme revealed that preferring personal contact was the main justification for not using Patient Online. Several respondents determined the reasons behind their preference of personal contact, which are: more reliable, easier, getting an instant reply, and important in urgent conditions.

> *"Personally I prefer to speak to someone rather than go online" (Participant #64).*
>
> *"It is more reliable to speak to someone directly about their medical records rather than using online" (Participant #29).*
>
> *"Picking up the phone and speaking to someone is easier" (Participant #135).*
>
> *"I like talking to people and you can get answers to questions instantly" (Participant #43).*
>
> *"Personal contact is important especially if urgency is required or an earlier visit or advice needed" (Participant #61).*

5.6.2.6 Theme 6: Encouraging Features of Patient Online

Within this theme, respondents identified features of Patient Online that may encourage them to use the system. One of the main features of Patient Online is that it is useful for different people, such as students, people with mobility needs, people who cannot reach the practice, and busy people.

> *"I feel that it would be particularly useful for students" (Participant #63).*
>
> *"I believe this would be a useful service to have as I can't always get the doctors to order repeat prescriptions due to my mobility needs" (Participant #84).*
>
> *"I think it is useful for people who cannot make it to the doctors don't have transport/or means of a way to set to the doctors" (Participant #98).*
>
> *"Much easier for people with busier lifestyle" (Participant #103).*

Another feature mentioned by respondents is ease of access. Some respondents thought that Patient Online could be more accessible if it was a mobile app.

> *"A mobile application would be more accessible…." (Participant #95).*
>
> *"For ease of access, a mobile phone app would make this effective and widespread" (Participant #102).*

Respondents reported other features of Patient Online, which may encourage people to use it, namely: secure, quick, friendly user interface, convenient, and less stressful.

> *"If it is secure and fast then people will use it, I suppose" (Participant #68).*
>
> *"If the interface is not user-friendly people might not be encouraged to use Patient Online" (Participant #82).*
>
> *"It is convenient, no waiting in telephone queue" (Participant #16).*
>
> *"Less stressful than coming into surgery for medication or ringing for appointment as this is stressful for me" (Participant #22).*

5.7 Chapter Summary

This chapter aimed to present the results of analysis of the data that were collected for assessing patients' intention to use and actual use of ePHRs. The chapter began with showing the response rate of the survey, which reached a good level (78%). Following this, z-scores and Boxplots were used for finding univariate outliers, and they found only five cases as univariate outliers. Further, multivariate outliers were assessed using Mahalanobis distance (D^2), which found 7 cases as multivariate outliers. Those univariate and multivariate outliers were not deleted for well-justified reasons. The univariate normality of the data was checked using histograms and by computing skewness and kurtosis. The results indicate a negligible non-normal distribution. The linearity of the relationships between two variables was assessed using scatterplot graphs and the Curve Estimation procedure, and both methods showed that all relationships are linear. Multicollinearity between the independent variables was assessed using tolerance and variance inflation factor (VIF) measures, which showed unserious multicollinearity between the independent variables.

After ensuring that the data met multivariate analysis assumptions, descriptive analysis was performed in order to describe the characteristics of participants and non-participants and assess the non-response bias, which was not an issue in this study. Then, participants' responses were summarised using descriptive statistics.

The descriptive analysis was followed by inferential analysis (SEM) which included assessments of measurement model and structural model. The measurement model was assessed in terms of goodness of fit, construct reliability, and construct validity. The goodness of fit of the initial measurement model was not proved by some of the indices (GFI, RMSEA, and SRMR). So, it was modified and reassessed. All fit indices showed a good fit of the modified measurement model. In respect to the construct reliability, results of Cronbach's alpha, the composite reliability (CR), and the average variance extracted (AVE) indicated that measurement items are consistent and reproducible in measuring what they are assumed to measure. All measures of convergent validity (factor loadings and AVE) and discriminant validity (inter-correlation coefficients, √AVE vs. the inter-correlation coefficients, and loadings vs. cross-loadings) proved that the items are valid enough to measure what they are assumed to measure and not anything else. Before assessing the structural model, the common method bias (CMB) was examined using Harman's single-factor test and unmeasured latent method factor, and the results of both methods showed that CMB is an unserious problem in this study.

With reference to the structural model assessment, the same fit indices that were used in the measurement model assessment showed a good fit for the structural model. Further, the structural model had a good predictive power according to values of coefficient of determination (R^2). All hypothesised direct relationships in the structural model were statistically significant, except for the relationship between social influence and behavioural intention. The two proposed mediating effects (EE→PE→BI and PPS→PE→BI) were statistically significant. Pertaining to moderating effects, only 11 relationships were affected significantly by moderators; which are age (on PE→BI, EE→BI, and FC→UB), sex (on PE→BI), income (on FC→UB), education (on EE→BI, SI→BI, and FC→UB), ethnicity (on PE→BI), and internet access (on PE→BI and FC→UB). Due to the presence of the non-significant direct and moderating effects, the initial structural model was modified by dropping non-significant paths and, then, it was examined again. All assessments of the modified structural model showed a good model fit, acceptable predictive power, and significant relationships.

Last but not least, the results of the thematic analysis of the qualitative data were demonstrated in Section 5.6. Six themes emerged from 16 sub-themes. Five of the themes were about why patients do not use Patient Online, and those themes are: concerns about using patient online, issues about awareness of Patient Online, challenges regarding internet and computers, perceived characteristics of non-users, and preferring personal contact. The remaining theme pertained to why patients use Patient Online, and this theme is encouraging features of Patient Online.

Chapter Six:

Discussion and Conclusion

Chapter 6 Discussion and Conclusion

6.1 Introduction

This chapter is dedicated to achieving the fourth objective of the current research, which is to formulate practical and theoretical implications by discussing the research results presented in the previous chapter. In the following section, the results of the current research are summarised, interpreted, and compared with findings of previous relevant studies. Section 6.3 outlines the theoretical and practical contributions of the current study. The main strengths and limitations of the present study are presented in Section 6.4. In Section 6.5, recommendations for future research are suggested. The main conclusions of this research are presented in the last section.

6.2 Summary of Main Results

The current project aimed to examine the factors that affect patients' use of electronic personal health records (ePHRs) in England. This aim was achieved by accomplishing four objectives. The first objective was to systematically review the evidence regarding factors that influence patients' acceptance and adoption of ePHRs. More than 120 exclusive factors were explored by 79 studies included in the systematic review. From this large number of factors, conclusions could be drawn regarding the impact of only 15. Eleven of these 15 factors had a positive impact: perceived usefulness, internet access, income, education level, facilitating conditions, internet use, perceived ease of use, awareness of ePHRs, language, employment status, and computer access. One factor had a negative impact (i.e. privacy and security concerns) while the remaining three factors had no influence (i.e. health status, ethnicity, and sex).

The second objective was to develop a conceptual model suitable for the study context. After reviewing well-established theories and models related to the adoption of technology and human behaviour, the Unified Theory of Acceptance and Use of Technology (UTAUT) was selected based on pre-specified criteria. Then, the most influential factors found by the systematic review were added to UTAUT model (i.e. perceived privacy and security, education level, income, and internet access). By doing so, UTAUT became more suitable for the context of ePHRs.

The third objective was to empirically examine the proposed conceptual model. To this end, data were collected by surveying 624 patients and accessing system logs at four GP practices in England. The data were analysed using structural equation model (SEM). The initial measurement model had a poor fit of the observed data because values of some fit indices (GFI, RMSEA and its PCLOSE, and SRMR) did not exist within their acceptable levels. The initial measurement model was modified by dropping four items (FC4, FC5, PPS3, and PPS5) from the model. The modified measurement model showed a good fit of the observed data. All three measures of construct reliability (Cronbach's alpha, CR, and AVE) demonstrated that the measurement items are consistent and reproducible in measuring what it is assumed to measure. The results of convergent and discriminant validity indicated that the items are valid enough to measure what they are assumed to measure and not anything else. The results confirmed that common method bias is not a serious problem in this study. All fit indices showed a good fit of the structural model. The results showed that performance expectancy, effort expectancy, and perceived privacy and security are significant positive predictors of behavioural intention. The relationship between social influence and behavioural intention was not statistically significant. Both facilitating conditions and behavioural intention positively affected use behaviour. Performance expectancy was also a significant mediator of the effect of both effort expectancy and perceived privacy and security on behavioural intention. Moderators influenced eleven relationships: age moderated PE→BI, EE→BI, and FC→UB; sex moderated PE→BI; income moderated FC→UB; education moderated EE→BI, SI→BI, and FC→UB; ethnicity moderated PE→BI; and internet access moderated PE→BI and FC→UB. The proposed model accounted for 48% of the variance in use behaviour (UB). The following two subsections discuss these results in more details.

The last objective is to formulate practical and theoretical implications for general practice, policy makers, system developers, and researchers. This objective is achieved by discussing the abovementioned findings in this chapter.

6.2.1 Model Predictive Power

The structural model accounted for 51% of the variance in performance expectancy (PE), 76% of the variance in behavioural intention (BI), and 48% of the variance in use behaviour (UB). According to Chin (1998) guidelines, the predictive power of the model can be considered as moderate for PE and UB while it is substantial for BI.

While the model in this study outweighs the original UTAUT model in explaining the variance in behavioural intention (76% vs 70%), it accounted for the same amount of variance in use behaviour (48%) (Venkatesh et al., 2003). This increase of the predictive power of behavioural intention may be attributed to adding the construct "perceived privacy and security" to the current model. Venkatesh et al. (2012) tested the original UTAUT model in a consumer context. They demonstrated that the original UTAUT model was able to explain 56% and 40% of the variance in behavioural intention and use behaviour, respectively. Accordingly, it can be said that tailoring the UTAUT model to the ePHRs context enhanced its predictive power.

By comparing the predictive power of the model in this study with models in previous theory-based studies investigating the adoption of ePHRs, it was found that the current model is superior to models proposed by those studies. Specifically, to the best of the researcher's knowledge, no study has proposed a model that could explain more than 51%, 76%, and 48% of the variance in performance expectancy, behavioural intention, and use behaviour, respectively. For example, the models proposed in the following ePHR studies accounted for less than 76% of variance in behavioural intention: Agarwal et al. (2013) (42%), Archer and Cocosila (2014) (61%), Assadi (2013) (65%), Feistel (2014) (35%), Hsieh et al. (2016) (29%), Lazard et al. (2016) (29%), Majedi (2014) (68.2%), Noblin (2010) (49.6%), and Tavares and Oliveira (2016) (49.7%). Similarly, the models hypothesised by the next studies explained less than 48% of the variance in use behaviour: Hsieh et al. (2016) (42.7%) and Tavares and Oliveira (2016) (26.8%). In addition, the models proposed by the subsequent ePHR studies explained less than 51% of variance in performance expectancy: Assadi (2013) (25%), Feistel (2014) (39%), Hsieh et al. (2016) (21.2%), Klein (2007a) (40%), Lazard et al. (2016) (48%), Liu et al. (2013) (15.4%), Majedi (2014) (33%), and Noblin (2010) (7.5%). It can be inferred that the model in the current study is more suitable for investigating the adoption of ePHRs than the models proposed by other relevant studies.

6.2.2 Research Hypotheses

The current research proposed 28 hypotheses. While six hypotheses are related to direct effect of variables, two hypotheses pertain to mediating effect of variables, and the remaining 20 hypotheses are related to moderating effect of variables. Findings of these three groups of hypotheses are summarised and discussed in the next three subsections.

6.2.2.1 Direct Effect Hypotheses

In this subsection, the direct effect of the following six variables are discussed: performance expectancy, effort expectancy, social influence, perceived privacy and security, facilitating conditions, and behavioural intention.

6.2.2.1.1 Direct Effect of Performance Expectancy

The first hypothesis in this study is that performance expectancy positively influences patients' intention to use ePHRs. The empirical study found that the relationship between performance expectancy and behavioural intention is strong and statistically significant (β=0.57, p<0.001), thereby, the hypothesis was supported. Further, the qualitative data collected by the open-ended question supported this relationship. Specifically, three sub-themes were associated with this hypothesis: usefulness for different people (e.g. students, people with mobility needs, people who cannot reach the practice, and busy people), inability of Patient Online to save money and time, and having encouraging features of Patient Online (i.e. quick, convenient, and less stressful). Accordingly, these findings mean that patients are more likely to intend to use Patient Online when they perceive that it is very useful and advantageous.

This may be attributed to the fact that Patient Online can be useful and convenient for patients by easily accessing the GP services anytime and anywhere (e.g. booking appointments & requesting repeat prescriptions) (Morton, 2012; Pagliari et al., 2007a).

These results are consistent with the results of previous research on ePHRs adoption. For example, in the Canadian context, Archer and Cocosila (2014), Assadi (2013), Daglish (2013), and Majedi (2014) found that the path coefficient for the relationship between performance expectancy and intention to use ePHRs was significant (p<0.001) and reached 0.57, 0.72, 0.54, and 0.49, respectively. This relationship was also shown by six ePHRs studies conducted in the United States of America (USA): Baird (2012) (β=0.36, p<0.001), Emani et al. (2012) (β=0.51, p<0.001), Klein (2007a) (β=0.48, p<0.001), Lazard et al. (2016) (β=0.40, p<0.001), Noblin (2010) (β=0.67, p<0.001), and Whetstone and Goldsmith (2009) (β=0.51, p<0.001). In Portugal, Tavares and Oliveira (2016) supported this relationship between performance expectancy and behavioural intention (β=0.20, p<0.05). Another study carried out in Taiwan showed that the path coefficient of this relationship is statistically significant (β=0.47, p<0.001) (Liu et al., 2013). The performance expectancy was the strongest predictor of behavioural intention in the current study and the abovementioned studies. Accordingly, the results discussed above support the findings of the current study regarding the effect of performance expectancy on patients' intention to use ePHRs.

6.2.2.1.2 Direct Effect of Effort Expectancy

The second hypothesis in this study is that effort expectancy positively influences patients' intention to use ePHRs. The structural model assessment showed that the relationship between effort expectancy and behavioural intention is weak but statistically significant (β=0.16, p<0.001), thereby, the hypothesis was supported. This hypothesis was also supported by the qualitative data collected by the open-ended question. Specifically, four sub-themes were associated with this hypothesis: difficulty using Patient Online, difficulty accessing Patient Online, technical concerns, and having a friendly user interface. According to these findings, it can be concluded that patients are more likely to intend to use Patient Online when they perceive that it is easy to use.

This may be attributed to the fact that patients need adequate computer and internet skills to use Patient Online. They may also need to access it without any help from others to protect their privacy, thereby, the ease of use of the system may be very crucial in forming patients' intention to use it.

These findings are consistent with findings of existing literature in the context of ePHRs. In particular, the following studies supported the relationship between effort expectancy and behavioural intention in the American context; Emani et al. (2012) (β=0.14, p<0.001), Noblin (2010) (β=0.08, p=0.045), and Wu (2013) (β=0.16, p=0.026). Further, Assadi (2013) demonstrated that the association between effort expectancy and behavioural intention is statistically significant in Canada (β=0.16, p<0.01). In Portugal, this relationship was also supported by Tavares and Oliveira (2016) (β=0.185, p=0.045). Thus, these results support the findings of the current study regarding the effect of effort expectancy on patients' intention to use ePHRs.

Although this relationship was statistically significant in the current study and other studies discussed above, it was weak (<0.20) in all of them, and it is weaker than the relationship between performance expectancy and behavioural intention. This weak relationship may be attributed to two reasons. First, people have become more computer and internet literate in the last two decades due to the widespread availability of computers and internet access, thereby, they have fewer concerns about using web-based services and technologies. For example, the percentage of households with internet access in the UK was about 25% in 2000 and by 2017 had increased to 90% (Office for National Statistics, 2017). The percentage of households with computers in the UK was 44% in 2000 and it had doubled (88%) by 2017 (Office for National Statistics, 2018). Second, in addition to the direct effect, effort expectancy has an indirect effect on the behavioural intention through performance expectancy, therefore, the strength of its direct effect reduces when performance expectancy is taken into account (Davis et al., 1989). This argument was supported by numerous studies in the context of ePHRs (e.g. Beenkens, 2011; Klein, 2007a; Lazard et al., 2016; Liu et al., 2013; Noblin et al., 2013; Rao, 2014; Richards, 2012). This indirect effect of effort expectancy is discussed in details in Subsection 6.2.2.2.1.

6.2.2.1.3 Direct Effect of Social Influence

The third hypothesis in this study is that social influence positively affects patients' intention to use ePHRs. The coefficient value indicated a very weak and statistically non-significant relationship between social influence and behavioural intention (β=0.03, p=0.183), thus, the hypothesis was rejected. This relationship was not supported by the qualitative data as none of the respondents identified social influence as an influential factor in using Patient Online. Consequently, it can be concluded that opinions and beliefs of people who are important to the patient do not affect his/her intention to utilise ePHRs. The non-significant relationship between social influence and behavioural intention can be attributed to the following four reasons:

First, this relationship is significant in contexts where using the technology is mandatory but not voluntary (Davis, 1989; Mathieson, 1991; Venkatesh et al., 2003; Venkatesh and Davis, 2000). In other words, an individual is more likely to comply with expectations of people when they are capable to reward or punish him/her for following or not following those expectations (Hartwick and Barki, 1994; Warshaw, 1980). In the current study, using Patient Online is voluntary, and patients were not rewarded or punished for using or not using it. Thus, the social influence did not appear to play a crucial role in forming the patients' intention to use Patient Online.

Second, nature of technology (individual vs. group) affects the relationship between social influence and behavioural intention (Davis, 1989; Lou et al., 2000; Sun and Zhang, 2006). Individual technologies are those designed for enhancing personal efficiency and productivity, such as word processing software (Sun and Zhang, 2006). Group technologies are those developed to facilitate collective working by a number of different users such as emails (Sun and Zhang, 2006). Users of a group technology are keener to promote it through providing support to or sharing their experience with potential users, thereby, this may convince them to use it (Lou et al., 2000; Sun and Zhang, 2006). In other words, the effect of social influence on behavioural intention is stronger for group technologies than for individual technologies (Davis, 1989; Lou et al., 2000; Sun and Zhang, 2006). Patient Online tends to be seen as a personal technology than group technology, therefore, the effect of social influence was not significant.

Thirdly, the presence of performance expectancy in a model makes the effect of social influence on behavioural intention weak and non-significant (Carlsson et al., 2006; de Veer et al., 2015) as social influence affects behavioural intention indirectly through performance expectancy (Or et al., 2011; Venkatesh and Davis, 2000). In the current research, the performance expectancy is a main construct in the model and it may mediate the relationship between social influence and behavioural intention, thereby, this relationship is reduced.

Fourthly, the effect of the social influence increases when the popularity and publicity of the technology increases, and vice versa (Jewer, 2018; Majedi, 2014). In other words, an individual may be more likely to be affected by others' opinions and expectations regarding using technology when those people widely use it or know about it (Tan and Teo, 2000). As discussed in Chapter 1, the adoption rate of Patient Online in England is very low (NHS Choices, 2017), and the lack of awareness of Patient Online was one of the main themes emerging from participants' responses of the open-ended question. Thus, social influence did not affect behavioural intention significantly.

In the context of ePHRs, two previous studies supported the findings of the current study. Specifically, Majedi (2014) showed a non-significant relationship between social influence and intention to use ePHRs in Canada ($\beta=0.16$, $p=0.167$), and Tavares and Oliveira (2016) found that this relationship is not significant in Portugal ($\beta=0.08$, $p=0.081$). Across the area of CHITs, several studies supported the finding in this study. For example, de Veer et al. (2015) conducted a study in the Netherlands to assess patients' intention to use e-health applications, and they showed that social influence is not statistically associated with behavioural intention. Likewise, a study was carried out in Slovenia to examine the factors influencing patients' acceptance of home telehealth services, and it rejected the hypothesis supposing an association between social influence and behavioural intention ($\beta=-0.03$, $p>0.05$) (Cimperman et al., 2016). Or et al. (2011) and Yuan et al. (2015) conducted their studies in the USA to examine the adoption of an interactive web-based health information system and health and fitness mobile apps among patients, respectively. Both studies found a non-significant relationship between social influence and behavioural intention. As a result, the findings of the current study are in line with findings of the existing literature in relation to the effect of social influence on behavioural intention.

6.2.2.1.4 Direct Effect of Perceived Privacy and Security

The fourth hypothesis in the current research is that perceived privacy and security positively influences patients' intention to use ePHRs. The results demonstrated that the relationship between perceived privacy and security and behavioural intention is moderate and statistically significant ($\beta=0.24$, $p<0.001$), thereby, the hypothesis was supported. This hypothesis was also strongly supported by the qualitative data collected by the open-ended question. Specifically, two sub-themes were associated with this hypothesis: concerns about the privacy and security of Patient Online and encouraging features of Patient Online (e.g. secure). The findings from the quantitative and qualitative data allow this study to conclude that patients are more likely to intend to use Patient Online when they perceive that it is secure and able to maintain their privacy.

This conclusion may be attributed to the fact that ePHRs typically contain personal and sensitive information, and patients have previously been shown to be concerned about the accessibility of these data (Daglish, 2013; Howell et al., 2016). According to responses to the open-ended question, patients attributed their privacy and security concerns to the recent NHS hack attacks (which happened two months before the data collection), accessing their data by third parties or unknown people, and uncertainty about the security measures of Patient Online.

This relationship between perceived privacy and security and behavioural intention was supported by several studies in the area of ePHRs adoption. For example, a Canadian study conducted by Daglish (2013) demonstrated a significant effect of privacy and security concerns on behavioural intention ($\beta=-0.16$, $p<0.001$). Another study examined the relationship between perceived privacy and security and behavioural intention among elderly Americans, and it found a significant moderate relationship ($\beta=0.32$, $p<0.001$) (Rao, 2014). Similarly, Whetstone and Goldsmith (2009) supported this relationship by surveying US college students ($\beta=0.17$, $p<0.001$). Further, among non-users of ePHRs, the correlation between perceived privacy and security and behavioural intention was statistically significant ($r=0.50$, $p<0.001$) according to an American study conducted by Ozok et al. (2017). In addition to those quantitative studies, numerous qualitative studies have supported this relationship (e.g. Arauwou, 2017; Dontje et al., 2014; Luque et al., 2013; Mishuris et al., 2015; Nguyen et al., 2016; Patel et al., 2011a; Patel et al., 2011b; Patel et al., 2012; Tieu et al., 2015; Turner et al., 2015). It can be inferred that the results of the current study and previous studies on ePHRs adoption are consistent regarding the relationship between perceived privacy and security and behavioural intention. This result also supports the justifications and decision of adding this construct to the model.

6.2.2.1.5 Direct Effect of Facilitating Conditions

The fifth hypothesis in the current research is that facilitating conditions positively influence patients' use of ePHRs. The statistical analysis showed that the relationship between facilitating conditions and use behaviour is moderate and statistically significant ($\beta=0.25$, $p<0.001$), thus, the hypothesis was supported. This hypothesis was also supported by the qualitative data collected by the open-ended question. Specifically, three sub-themes were associated with this hypothesis: lack of awareness of Patient Online (i.e. its presence, what it is about, how to use it, and how to access it), advertising about Patient Online, and lack of internet or computer access. While the former two sub-themes are related to lack of the knowledge necessary to use Patient Online, the latter sub-theme is related to the lack of resources necessary to use Patient Online. According to the findings indicated above, this study concluded that patients are more likely to use

Patient Online when they feel that they have the resources and knowledge enough to use it.

This relationship may be attributed to the fact that using Patient Online requires internet and computer access which are not provided for free to patients. In addition, patients need to be computer and internet literate to be able to use Patient Online. Moreover, they need to know about the presence of Patient Online, what services it includes, how they can book appointments or order prescriptions through it.

This effect of facilitating conditions was supported by several studies in the context of ePHRs. For instance, an American study demonstrated that the perceived technical support and patients' use of ePHRs are significantly correlated (Patel et al., 2012). In another American study, Luque et al. (2013) found that patients with human immunodeficiency virus (HIV) are more likely to use the system if they are taught how to use it. In addition, a qualitative study showed that American patients desire personal assistance and training to use ePHRs (Mishuris et al., 2015). This relationship has been also demonstrated by several studies in the area of CHITs. For example, a Slovenian study found that the association between facilitating conditions and patients' use of home telehealth services is statistically significant ($\beta=0.13$, $p<0.001$) (Cimperman et al., 2016). Similarly, Chen and Chan (2014) examined the relationship between facilitating conditions and use of gerontechnology by older Hong Kong Chinese patients, and they showed that this relationship is statistically significant ($\beta=0.16$, $p<0.001$). Consequently, it could be said that the findings in the current study are consistent with findings of prior studies in relation to the effect of facilitating conditions on use behaviour.

6.2.2.1.6 Direct Effect of Behavioural Intention

The sixth hypothesis in the current study is that behavioural intention positively influences patients' use of ePHRs. The empirical results demonstrated that the relationship between behavioural intention and use behaviour is strong and statistically significant ($\beta=0.53$, $p<0.001$), thus, the hypothesis was supported. Consequently, it was concluded that patients are more likely to use Patient Online when they intend to use it.

Three studies in the context of ePHRs supported the positive relationship between behavioural intention and use behaviour. A Portuguese study showed that the coefficient value of this relationship is statistically significant ($p<0.05$) and reached 0.26 (Tavares and Oliveira, 2016). In another study, Hsieh et al. (2016) found that the relationship between behavioural intention and use behaviour among Taiwanese patients is strong and statistically significant ($\beta=0.65$, $p<0.001$). The third study found that Taiwanese patients with higher intention to use ePHRs are more likely to use them (OR=9.43, 95%CI=5.87-15.16) (Jian et al., 2012). In the field of CHITs, Or et al. (2011)

found that behavioural intention affects significantly Americans' use of a web-based interactive self-management technology (β=0.46, p<0.001). In addition, elderly Bengalese patients are more likely to use mobile health services when they have higher intention to use them (β=0.41, p<0.001) (Hoque and Sorwar, 2017). Equally, Klein (2007b) found that behavioural intention affects significantly use behaviour of an internet-based patient-physician communication application among American patients (β=0.41, p<0.001). Accordingly, this effect of behavioural intention in the current study is consistent with the findings of previous studies.

6.2.2.2 Mediating Effect Hypotheses

This subsection discusses the indirect effect of effort expectancy and perceived privacy and security on behavioural intention through performance expectancy.

6.2.2.2.1 Indirect Effect of Effort Expectancy

The seventh hypothesis in this study is that performance expectancy positively mediates the positive relationship between effort expectancy and behavioural intention. Results indicated that effort expectancy affects indirectly behavioural intention through performance expectancy (β=0.20, p<0.001, CI=0.15-0.25), therefore, the hypothesis was supported. This study concluded that patients who perceive Patient Online as easy to use are more likely to perceive it as a useful system, thereby, they are more likely to intend to use it. In other words, for patients who perceive that Patient Online is easy to use, an increase of their perceived usefulness of Patient Online leads to an increase in their intention to use it.

This indirect effect may be attributed to the fact that patients' perceptions about the usefulness of the system are influenced considerably by their perceptions about the ease of use of that system. This influence was shown in this study, where it was found that effort expectancy affects significantly performance expectancy (β=0.34, p<0.001). Moreover, this relationship has been supported by numerous studies in the context of ePHRs: Goff (2016) (β=0.57, p<0.001), Lazard et al. (2016) (β=0.64, p<0.001), Liu et al. (2013) (β=0.39, p<0.01), Noblin (2010) (β=0.27, p<0.001), Rao (2014) (*r*=0.71, p<0.001), and Richards (2012) (β=0.23, p<0.001).

Although this indirect effect of effort expectancy was shown by Davis (1989) in his well-known theory (i.e. TAM), to the best of the researcher's knowledge, it has not been examined in the contexts of ePHRs adoption. Some ePHRs studies concluded that there is an indirect effect of effort expectancy on behavioural intention based only on the presence of a significant relationship between performance expectancy and effort expectancy (e.g. Lazard et al., 2016; Liu et al., 2013). However, such a conclusion may be incorrect as it is not necessary that the presence of a significant relationship between effort expectancy and performance expectancy refers to the presence of the indirect effect of effort expectancy on behavioural intention. As mentioned in Chapter 4, mediating effects can be examined by testing the indirect effect ($a*b$) using bootstrapping method (Gaskin, 2017; MacKinnon et al., 2004; Shrout and Bolger, 2002). Thus, the current research may be the first study to assess this indirect effect of effort expectancy in the context of ePHRs.

To the best of the researcher's knowledge, the indirect effect was assessed by only two studies in the area of the CHITs. In the first study, Or et al. (2011) demonstrated that effort expectancy affects indirectly patients' intention to use a web-based health technology through performance expectancy (β=0.41, p<0.001). In respect to the second study, Hsu et al. (2013) found this indirect effect of effort expectancy on intention to use health information systems (β=0.15, p<0.001). Accordingly, it can be inferred that the results of the current study are in line with previous CHITs studies regarding this mediating effect.

6.2.2.2.2 Indirect Effect of Perceived Privacy and Security

The eighth hypothesis in this study is that performance expectancy positively mediates the positive relationship between perceived privacy and security and behavioural intention. According to results of bootstrapping, perceived privacy and security influences indirectly behavioural intention through performance expectancy (β=0.28, p<0.001, CI=0.23-0.33), therefore, the hypothesis was supported. This study concluded that patients who perceive that Patient Online is secure and able to maintain their privacy are more likely to perceive it as a useful system, therefore, they are more likely to intend to use it. To put it differently, for patients who perceive that Patient Online is secure, an increase of their perceived usefulness of Patient Online leads to an increase in their intention to use it.

This indirect effect may be attributed to the fact that patients' perceptions about the usefulness of the system are influenced considerably by their perceptions about privacy and security of their data in the system. This effect was shown in this study, where it was found that perceived privacy and security affects significantly performance expectancy (β=0.49, p<0.001). This effect of perceived privacy and security on performance expectancy has been shown by several studies in the context of ePHRs and CHITs, such as: Archer and Cocosila (2014) (β=0.44, p<0.001), Cimperman et al. (2016) (β=0.21, p<0.001), Emani et al. (2012) (β=not reported, p<0.001), Feistel (2014) (β=0.21, p<0.001), Hsu et al. (2013) (β=0.32, p<0.001), Rao (2014) (β=0.33, p<0.001), and Whetstone and Goldsmith (2009) (r=0.16, p<0.001).

Although many studies in the context of ePHRs and CHITs examined the direct influence of perceived privacy and security on performance expectancy and on behavioural intention, to the best of the researcher's knowledge, none of them tested the mediating effect of performance expectancy on the relationship between perceived privacy and security on behavioural intention. Accordingly, the current research may be the first study to examine this mediating effect in the context of ePHRs and CHITs.

6.2.2.3 Moderating Effect Hypotheses

This subsection discusses the effect of the next moderators on the direct relationships proposed in the model: age, sex, education, income, and internet access.

6.2.2.3.1 Moderating Effect of Age

Of five hypotheses regarding the moderating effect of age, three were supported in this study: age moderated the effect of each of performance expectancy and effort expectancy on behavioural intention and the effect of facilitating conditions on use behaviour. These findings are discussed below.

Performance Expectancy

The ninth hypothesis in this study is that age negatively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for younger patients. The results of the current study supported this moderating effect ($\beta=-0.10$, $p<0.001$), thus, the hypothesis was supported. Accordingly, this study concluded that the relationship between performance expectancy and behavioural intention to use Patient Online increases with decreasing patients' age. This moderating effect may be attributed to the fact that extrinsic motivation (i.e. usefulness) is more important for younger individuals (Hall and Mansfield, 1975; Porter, 1963). This means that younger individuals need to perceive a behaviour as useful to intend to use it.

In the context of ePHRs, this moderating effect of age was not examined by prior studies. Two ePHRs studies examined only the direct effect of age on performance expectancy and demonstrated a significant difference between older and younger patients in their perception of usefulness of ePHRs (Emani et al., 2012; Richards, 2012). Accordingly, the current research may be the first study to test the moderating effect of age on the relationship between performance expectancy and behavioural intention in the context of ePHRs.

In the context of CHITs, two studies supported this moderating effect of age. In the first study, Alaiad and Zhou (2015) demonstrated that the effect of performance expectancy on patients' intention to use home healthcare robots is stronger among younger patients. Likewise, the second study supported this moderating effect among diabetic patients in the context of telemedicine (Rho et al., 2015). Therefore, it can be said that the results of the current study are consistent with previous CHITs studies regarding the moderating effect of age.

Effort Expectancy

The tenth hypothesis in this study is that age positively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for older patients. The empirical results in the current research demonstrated this moderating effect ($\beta=0.06$, $p=0.028$), thus, the hypothesis was supported. Accordingly, this study concluded that the relationship between effort expectancy and behavioural intention to use Patient Online increases with increasing patients' age. This moderating effect of age may be attributed to the following facts: (1) older people usually have less experience, knowledge, and skills of using information technologies than young people who have grown up in the recent technology revolution (Chin and Fu, 2010; Czaja et al., 2009; Hanson, 2009; Kim et al., 2009a); (2) older people are more likely to have a difficulty to learn how to use new information technologies due to age-related decline in their physical and cognitive abilities (Chin and Fu, 2010; Czaja et al., 2009; Hanson, 2009; Seethamraju et al., 2018); and (3) older people are more likely to have technophobia (i.e. computer anxiety) (Chun and Patterson, 2012; Czaja et al., 2006; Kim et al., 2009a; Nägle and Schmidt, 2012).

Although this moderating effect of age was also shown in a consumer context by Venkatesh et al. (2012), it has not been tested in existing literature in the area of ePHRs. One ePHRs study assessed only the direct effect of age on effort expectancy and demonstrated a significant difference between older and younger patients in their perception of ease of use of ePHRs (Richards, 2012). Thus, the current study may be the first study to examine the moderating effect of age on the relationship between effort expectancy and behavioural intention.

To the best of the researcher's knowledge, this moderating effect was examined by only one study in the field of CHITs adoption. Alaiad and Zhou (2015) supported this moderating effect when they concluded that the relationship between effort expectancy and behavioural intention of using home healthcare robot increases with increasing patients' age. Accordingly, it can be inferred that the results of the current study are in line with findings of previous CHITs study regarding this moderating effect.

Social Influence

The eleventh hypothesis in this study is that age positively moderates the positive relationship between social influence and behavioural intention, such that the influence is stronger for older patients. The empirical results in the current research showed that this moderating effect of age is not significant (β=0.01, p=0.063), thereby, the hypothesis was rejected. Accordingly, this study concluded that the relationship between social influence and behavioural intention to use Patient Online is not affected by patients' age. This finding may be attributed to the fact that older patients are more likely to ignore the effect of social status, image, and societal pressure, and they endeavour to achieve more emotionally meaningful goals (Carstensen et al., 2003).

This moderating effect of age was not examined by prior ePHRs studies. One ePHRs study examined only the direct effect of age on social influence, and it demonstrated a non-significant difference between older and younger patients in their perception of social influence of ePHRs (Wu, 2013). Hence, the current research may be the first study to examine the moderating effect of age on the relationship between social influence and behavioural intention.

In the context of CHITs, two studies demonstrated that the effect of social influence on patients' intention to use mobile health is not moderated by age (Faqih and Jaradat, 2015; Seethamraju et al., 2018). Likewise, a third study showed that this moderating effect is not statistically significant when using telemedicine among diabetic patients (Rho et al., 2015). Consequently, it can be said that the results of the current study are consistent with results of previous CHITs studies regarding the non-significant moderating effect of age on the relationship between social influence and behavioural intention.

Perceived Privacy and Security

The twelfth hypothesis in this study is that age positively moderates the positive relationship between perceived privacy and security and behavioural intention, such that the influence is stronger for older patients. The empirical results in the current research showed that this moderating effect of age is not significant (β=-0.03, p=0.217), thereby, the hypothesis was rejected. As a result, this study concluded that the relationship between perceived privacy and security and behavioural intention to use Patient Online is not affected by patients' age. This finding may be attributed to the fact that the recent NHS hack attacks might increase the concerns about the privacy and security of Patient Online for both young and old patients. This attribution was supported by patients' responses to the open-ended question, where concerns about the privacy and security were reported by young and old respondents.

This moderating effect of age was not examined by previous studies in the area of ePHRs. One ePHRs study tested only the direct effect of age on perceived privacy and security, and it found a non-significant relationship between them (Wu, 2013). To the best of the researcher's knowledge, this moderating effect has not been tested by studies in the context of CHITs. Accordingly, the current study may be the first study to test the moderating effect of age on the relationship between perceived privacy and security and behavioural intention in the context of ePHRs and CHITs.

Facilitating Conditions

The thirteenth hypothesis in this study is that age positively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for older patients. The statistical analysis in the current research approved this moderating effect ($\beta=0.16$, $p<0.001$), thus, the hypothesis was supported. Consequently, this study concluded that the effect of facilitating conditions on use behaviour of Patient Online increases with increasing patients' age. This moderating effect of age may reflect the fact that older people are more likely to have a difficulty to learn how to use new information technology due to age-related decline in their physical and cognitive abilities (Chin and Fu, 2010; Czaja et al., 2009; Hanson, 2009; Kim et al., 2009a). This makes them more likely to have computer anxiety and less computer self-efficacy in comparison to younger individuals (Chun and Patterson, 2012; Czaja et al., 2006; Nägle and Schmidt, 2012; Rogers et al., 1998). As a result, older people are more likely to place more importance on the presence of sufficient support and help on their job (Hall and Mansfield, 1975; Morris and Venkatesh, 2000).

Although this moderating effect of age was also shown in a consumer context by Venkatesh et al. (2012), it was not examined by previous studies in the area of ePHRs. Hence, the present study may be the first study to test the moderating effect of age on the relationship between facilitating conditions and use behaviour in the context of ePHRs.

In respect of the area of CHITs, one study examined this moderating effect and showed that the relationship between facilitating conditions and use behaviour of home healthcare robot is stronger among older patients (Alaiad and Zhou, 2015). Thus, the results of the current study and the abovementioned study are consistent.

6.2.2.3.2 Moderating Effect of Sex

Of five hypotheses regarding the moderating effect of sex, only one was supported in this study: sex moderated the effect of performance expectancy on behavioural intention. These findings are discussed below.

Performance Expectancy

The fourteenth hypothesis in this study is that sex moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for males than females. The results of the current study found that this moderating effect is significant (p=0.009), thus, the hypothesis was supported. Accordingly, the current research concluded that the relationship between performance expectancy and behavioural intention to use Patient Online is stronger among males than females. This moderating effect may be attributed to the fact that males are more likely to be task oriented than females (Lynott and McCandless, 2000; Minton and Schneider, 1985), which means that they are concerned more with task accomplishment such as performance expectancy (Venkatesh and Morris, 2000; Venkatesh et al., 2003). Moreover, males are reported to be more pragmatic, objective, and logical than females (Rosenkrantz et al., 1968; Sun and Zhang, 2006), which means that males need to perceive a behaviour as useful to perform it.

In the context of ePHRs, this moderating effect of sex was not examined by previous studies. One ePHRs study examined only the direct effect of sex on performance expectancy, and it found a significant difference between males and females in their perception of the usefulness of ePHRs (Richards, 2012). Accordingly, the current research may be the first study to examine the moderating effect of sex on the relationship between performance expectancy and behavioural intention in the context of ePHRs.

One study examined the moderating effect of sex in the context of CHITs. Alaiad and Zhou (2015) concluded that the relationship between performance expectancy and patients’ intention to use home healthcare robot is stronger for males. The finding supports the finding in the current study.

Effort Expectancy

The fifteenth hypothesis in this study is that sex moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for females than males. The empirical results of the current research did not support this moderating effect (p=0.320), therefore, the hypothesis was rejected. Hence, this study concluded that sex does not affect the relationship between effort expectancy and behavioural intention to use Patient Online. This result may reflect the fact that the high computer anxiety and low computer self-efficacy that are more common among females (Frenkel, 1990; Gilroy and Desai, 1986; Lowe and Krahn, 1989; Morrow et al., 1986) have reduced due to the widespread availability of computers and internet access in the last two decades (Office for National Statistics, 2018). Therefore, females may not be concerned with the ease of use of technology.

This moderating effect of sex was not assessed by previous studies in the context of ePHRs. One ePHRs study tested only the direct effect of sex on effort expectancy and found a non-significant effect of sex (Wu, 2013). Accordingly, the current research may be the first study to test the moderating effect of sex on the relationship between effort expectancy and behavioural intention in the context of ePHRs.

One study assessed the moderating effect of sex in the context of CHITs, and it showed a non-significant influence of sex on the relationship between effort expectancy and patients' intention to use telemedicine (Rho et al., 2015). Thus, the results of the current study and the abovementioned study are consistent.

Social Influence

The sixteenth hypothesis in this study is that sex moderates the positive relationship between social influence and behavioural intention, such that the influence is stronger for females than males. The empirical results of the current research showed that this moderating effect of sex is not significant (p=0.068), thereby, the hypothesis was rejected. As a result, this study concluded that the relationship between social influence and behavioural intention to use Patient Online is not affected by patients' sex. This finding may be attributed to the fact that the sensitivity and deference of females to others' opinions, which found by dated studies (e.g. Eagly, 1978; Minton et al., 1971; Venkatesh and Morris, 2000), may have reduced in today's society. Therefore, females might not be affected by social influence.

This moderating effect of sex was not examined by previous ePHRs studies. Hence, the current research may be the first study to examine the moderating effect of sex on the relationship between social influence and behavioural intention.

One study in the area of CHITs demonstrated that the effect of social influence on patients' intention to use mobile health is not moderated by sex (Rho et al., 2015). Thus, this result supports the finding of the current study regarding the moderating effect of sex.

Perceived Privacy and Security

The seventeenth hypothesis in this study is that sex moderates the positive relationship between perceived privacy and security and behavioural intention, such that the influence is stronger for females than males. The empirical results in the current research showed that this moderating effect of sex is not significant (p=0.645), thereby, the hypothesis was rejected. Accordingly, this study concluded that the relationship between perceived privacy and security and behavioural intention to use Patient Online is not affected by patients' sex. This finding may be attributed to the fact that the recent NHS hack attacks might increase the concerns about the privacy and security of Patient Online for both males and females. This attribution was supported by patients' responses to the open-ended question, where concerns about the privacy and security were reported by males and females.

This moderating effect of sex was not examined by previous studies in the field of ePHRs adoption. Two ePHRs studies tested only the direct effect of sex on perceived privacy and security, and they found a non-significant relationship between them (Baird, 2012; Wu, 2013). Accordingly, the current study may be the first study to test the moderating effect of sex on the relationship between perceived privacy and security and behavioural intention in the context of ePHRs.

Two studies in the context of CHITs supported the finding of this research. The first study concluded that this moderating effect of sex is not statistically significant when adopting medical assistive technologies (Wilkowska and Ziefle, 2011). Similarly, Faqih and Jaradat (2015) showed that the effect of social influence on patients' intention to use mobile health is not moderated by sex. Accordingly, it could be said that the finding of the current study regarding this moderating effect is consistent with the findings of existing literature in the context of CHITs.

Facilitating Conditions

The eighteenth hypothesis in this study is that sex moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for females than males. The statistical analysis in the current research did not support this moderating effect (p=0.318), thus, the hypothesis was rejected. Consequently, this study concluded that the effect of facilitating conditions on use behaviour of Patient Online does not appear to be influenced by sex. This result may reflect the fact that the high computer anxiety and low computer self-efficacy that are more common among females (Frenkel, 1990; Gilroy and Desai, 1986; Lowe and Krahn, 1989; Morrow et al., 1986) have diminished due to the widespread availability of computers and internet access in the last two decades (Office for National Statistics, 2018). Thereby, females and males may have the same level of the need for facilitating conditions.

Although this moderating effect of sex was also shown in a consumer context by Venkatesh et al. (2012), it was not examined by previous studies in the area of ePHRs. Hence, the present study may be the first study to test the moderating effect of sex on the path from facilitating conditions to use behaviour in the context of ePHRs.

In respect of the area of CHITs, one study examined this moderating effect and found a non-significant influence of sex on the relationship between facilitating conditions and use behaviour of mobile health (Seethamraju et al., 2018). Thus, the finding of the current study regarding this moderating effect is consistent with the findings of previous studies in the context of CHITs.

6.2.2.3.3 Moderating Effect of Education level

Of four hypotheses regarding the moderating effect of education level, two were supported in this study: education level moderated the effect of effort expectancy on behavioural intention and the effect of facilitating conditions on use behaviour. These findings are discussed below.

Performance Expectancy

The nineteenth hypothesis in this study is that education level negatively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for patients with lower level of education. The results of the current study did not support this moderating effect, thereby, the hypothesis was rejected. Accordingly, this study concluded that the relationship between performance expectancy and behavioural intention to use Patient Online is not affected by education level. This may be attributed to the fact that patients with low and high education level have the same level of performance expectancy of Patient Online, and this was shown in three ePHR studies (Emani et al., 2012; Rao, 2014; Wu, 2013). Specifically, patients with low education may perceive the system as useful because they are less likely to be healthier, thereby, the system eases their recurrent interactions with healthcare providers (Beenkens, 2011; Hoogendijk et al., 2008; Jacobsen et al., 2011). On the other hand, patients with high education may perceive the system as useful because they are more likely to be busy, thereby, the system saves their time by enabling them to interact with healthcare providers in their free time.

This moderating effect of education level was not examined by previous studies in the context of ePHRs and CHITs. Three ePHR studies examined only the direct effect of education level on performance expectancy and demonstrated a non-significant difference between patients with low and high education level in their perception of the usefulness of ePHRs (Emani et al., 2012; Rao, 2014; Wu, 2013). Accordingly, the current research may be the first study to examine the moderating effect of education level on the relationship between performance expectancy and behavioural intention in the context of ePHRs and CHITs.

Effort Expectancy

The twentieth hypothesis in this study is that education level negatively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients with lower level of education. The empirical results in the current research supported this moderating effect when it was found that the effect of effort expectancy on behavioural intention is stronger for patients with college or lower than patients with a bachelor degree or higher. Thus, the hypothesis was supported. Accordingly, this study concluded that the relationship between effort expectancy and behavioural intention to use Patient Online is stronger among patients with lower level of education. This moderating effect of education level may be attributed to the following facts. Firstly, people with higher level of education are more likely to use the internet, be computer savvy, and have higher level of health literacy (Baker et al., 2003; Jabour and Jones, 2013; Paasche-Orlow et al., 2005; Rhee and Kim, 2004; Scott et al., 2002). Secondly, people with higher level of education usually have less computer anxiety (Ellis and Allaire, 1999; Gutek and Bikson, 1985; Howard and Smith, 1986; Igbaria and Parasuraman, 1989), thereby, they are less likely to worry about ease of use of a new technology (Ellis and Allaire, 1999; Igbaria and Iivari, 1995; Lai et al., 2008; Torres, 2011; Venkatesh, 2000). Lastly, people with higher level of education have more ability to learn a new innovation (Agarwal and Prasad, 1999).

This moderating effect of education level was not assessed by previous studies in the context of ePHRs and CHITs. Three studies tested only the direct effect of education level on effort expectancy in the context of ePHRs, and they found that patients with low education levels concentrate more on ease of use of ePHRs than those with high education levels (Daglish, 2013; Noblin, 2010; Richards, 2012). Accordingly, the current research may be the first study to test the moderating effect of education level on the relationship between effort expectancy and behavioural intention in the context of ePHRs and CHITs.

Perceived Privacy and Security

The twenty-first hypothesis in this study is that education level positively moderates the positive relationship between perceived privacy and security and behavioural intention, such that the influence is stronger for patients with higher level of education. The empirical results of the current research showed that this moderating effect of education level is not significant, thereby, the hypothesis was rejected. Accordingly, this study concluded that the relationship between perceived privacy and security and behavioural intention to use Patient Online is not affected by patients' education level. This finding may be attributed to the fact that patients with high and low education levels may have the same level of concern about the privacy and security of ePHRs. Specifically, more educated patients are more likely to be aware of threats of cyber attacks on breaching their privacy while less educated patients are less likely to trust the internet (Liebermann and Stashevsky, 2002; Zukowski and Brown, 2007). Additionally, the recent NHS hack attacks might increase the concerns about the privacy and security of Patient Online for all patients regardless of their education level. This attribution was supported by patients' responses to the open-ended question, where concerns about the privacy and security were reported by patients with low and high education level.

This moderating effect of education level was not examined by prior studies in the field of ePHRs and CHITs. One ePHR study investigated only the direct effect of education level on perceived privacy and security, and it found that patients with high and low education levels have similar perception regarding the privacy and security of ePHRs (Wu, 2013). Accordingly, the current study may be the first study to test the moderating effect of education level on the relationship between perceived privacy and security and behavioural intention in the context of ePHRs and CHITs.

Facilitating Conditions

The twenty-second hypothesis in this study is that education level negatively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients with lower level of education. The current research supported this moderating effect when it found that the relationship between facilitating conditions and use behaviour is stronger for patients with secondary school or lower than those with college and higher. Therefore, the hypothesis was supported. This study concluded that the relationship between facilitating conditions and use behaviour of Patient Online is stronger among patients with lower level of education. This finding may be attributed to the fact that people with lower level of education are less likely to use the internet and have lower level of health literacy (Baker et al., 2003; Liebermann and Stashevsky, 2002; Paasche-Orlow et al., 2005; Rainie, 2010; Rhee and Kim, 2004; Scott et al., 2002). Furthermore, people with lower level of education usually have more computer anxiety (Ellis and Allaire, 1999; Gutek and Bikson, 1985; Howard and Smith, 1986; Igbaria and Parasuraman, 1989). Accordingly, they may tend more to place emphasis on availability of sufficient external support when adopting new technologies.

To the best of the researcher's knowledge, this moderating effect of education level was not examined by studies in the context of ePHRs and CHITs. Consequently, the current study may be the first study to test this moderating effect of education level in the context of ePHRs and CHITs. This moderating effect was supported by the qualitative data collected from the open-ended question. To be more precise, three sub-themes were associated with facilitating conditions: lack of awareness of Patient Online, limited skills in using internet or computers, and lack of internet or computer access. These sub-themes emerged from many utterances provided by patients with low education.

6.2.2.3.4 Moderating Effect of Income

Of four hypotheses regarding the moderating effect of income, only one was supported in this study: income moderated the effect of facilitating conditions on use behaviour. These findings are discussed below.

Performance Expectancy

The twenty-third hypothesis in this study is that income positively moderates the positive relationship between performance expectancy and behavioural intention, such that the influence is stronger for patients with higher income. The results of the current study did not support this moderating effect, thereby, the hypothesis was rejected. Accordingly, this study concluded that the relationship between performance expectancy and behavioural intention to use Patient Online is not affected by income. This may be attributed to the fact that both patients with low and high income take into consideration the usefulness of Patient Online before adopting it. This was clear from patients' responses to the open-ended question, where both patients with low and high income reported concerns about the usefulness of ePHRs.

This moderating effect of income was not examined by prior studies in the context of ePHRs and CHITs. One study examined only the direct effect of income on performance expectancy in the context of ePHRs, and it found a non-significant effect of income (Emani et al., 2012). Accordingly, the current research may be the first study to examine the moderating effect of income on the relationship between performance expectancy and behavioural intention in the context of ePHRs and CHITs.

Effort Expectancy

The twenty-fourth hypothesis in this study is that income negatively moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients with lower income. The results of the current study did not support this moderating effect, thus, the hypothesis was rejected. Accordingly, the current research concluded that the relationship between effort expectancy and behavioural intention to use Patient Online is not influenced by income. This may be attributed to the fact that the difference in computer anxiety levels between low and high income people has considerably reduced due to the widespread availability of internet access and computers among both groups owing to falling prices of the technology (Chawla and Joshi, 2018; Hernández et al., 2011).

This moderating effect of income was not examined by previous studies in the context of ePHRs and CHITs. Accordingly, the current research may be the first study to assess the moderating effect of income on the relationship between effort expectancy and behavioural intention in the context of ePHRs and CHITs. The results of the qualitative analysis supported this finding, where both patients with low and high income were concerned with ease of use of Patient Online.

Perceived Privacy and Security

The twenty-fifth hypothesis in this study is that income negatively moderates the positive relationship between perceived privacy and security and behavioural intention, such that the influence is stronger for patients with lower income. The empirical results in this study found a non-significant moderating effect of income, thus, the hypothesis was rejected. So, the current research concluded that the relationship between perceived privacy and security and behavioural intention to use Patient Online is not affected by income. This finding may be attributed to the fact that the recent NHS hack attacks might increase the concerns about the privacy and security of Patient Online among patients with low and high income. This attribution was supported by patients' responses to the open-ended question, where concerns about the privacy and security were reported by patients with low and high income.

This moderating effect of income was not tested by previous studies in the field of ePHRs and CHITs. One ePHR study investigated only the direct effect of income on perceived privacy and security, and it found non-significant effect of income (Daglish, 2013). Accordingly, the current study may be the first study to test the moderating effect of income on the relationship between perceived privacy and security and behavioural intention in the context of ePHRs and CHITs.

Facilitating Conditions

The twenty-sixth hypothesis in this study is that income negatively moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients with lower income. The empirical results in the current research supported this moderating effect. Specifically, it was found that the effect of facilitating conditions on use behaviour is stronger for patients with lower income than patients with higher income, thereby, the hypothesis was supported. Accordingly, this study concluded that the relationship between facilitating conditions and use behaviour is stronger among patients with lower income. This moderating effect of income may be attributed to the fact that people with lower income are less likely to be able to afford internet access and latest technologies (Chawla and Joshi, 2018; Rainie, 2010; Rhee and Kim, 2004), and this may make those people having higher computer/ technology anxiety (Chawla and Joshi, 2018; Lee et al., 2010). Therefore, they are more likely to worry about availability of facilitating conditions before adopting a technology.

To the best of the researcher's knowledge, this moderating effect of income has not been examined in the contexts of ePHRs nor CHITs. Consequently, the current study may be the first study to test this moderating effect of income in the context of ePHRs and CHITs. This moderating effect was supported by the qualitative data collected by the open-ended question. Specifically, four sub-themes were associated with this hypothesis: lack of awareness of Patient Online, limited skills in using internet or computers, lack of internet or computer access, and low income. Most of the utterances that led to these sub-themes were provided by patients with low income.

6.2.2.3.5 Moderating Effect of Internet Access

The two hypotheses regarding the moderating effect of internet access were supported in this study: internet access moderated the effect of effort expectancy on behavioural intention and the effect of facilitating conditions on use behaviour. These findings are discussed below.

Effort Expectancy

The twenty-seventh hypothesis in this study is that internet access moderates the positive relationship between effort expectancy and behavioural intention, such that the influence is stronger for patients without internet access. The empirical results showed that this moderating effect is significant ($p=0.011$), therefore, the hypothesis was supported. Accordingly, this study concluded that the relationship between effort expectancy and behavioural intention to use Patient Online is stronger among patient without internet. This result may reflect the fact that patients without internet access tend more to worry about the ease of use of a technology due to their high computer anxiety and low computer self-efficacy (Rao, 2014; Torres, 2011; Venkatesh, 2000).

In the context of ePHRs and CHITs, the moderating effect of internet access was not investigated. Accordingly, the current research may be the first study to examine the moderating effect of internet access on the relationship between effort expectancy and behavioural intention in the context of ePHRs and CHITs.

Facilitating Conditions

The last hypothesis in this study is that internet access moderates the positive relationship between facilitating conditions and use behaviour, such that the influence is stronger for patients without internet access. The empirical results in the current study confirmed that this moderating effect is significant ($p<0.001$), therefore, the hypothesis was supported. Consequently, this study concluded that internet access moderates the relationship between facilitating conditions and use behaviour. This result may be attributed to the fact that patients without internet access tend more to worry about availability of sufficient external support when adopting new technologies owing to their high computer anxiety and low computer self-efficacy.

This moderating effect of internet access was not investigated by existing literature in the context of ePHRs and CHITs. Consequently, the current research may be the first study to assess the moderating effect of internet access on the relationship between facilitating conditions and use behaviour in the context of ePHRs and CHITs.

6.3 Research Contributions

Findings of the current research provide important contributions to theory and practice, which are presented in the following two subsections, respectively.

6.3.1 Contributions to Theory

This study contributes to the literature by examining the factors that affect patients' use of ePHRs in England context. According to the systematic review in the current research and other relevant reviews (i.e. Amante et al., 2014; Jabour and Jones, 2013; Najaftorkaman et al., 2014; Thompson et al., 2016), England context has not been investigated by previous studies. Although a large number of studies have been conducted in countries other than England, their findings may not be generalisable to England context since the adoption of technology highly depends on the context where the technology is implemented (Pagliari et al., 2007a; Pagliari et al., 2007b). The current study bridges the gap in the literature of ePHRs adoption by investigating a new context not tested before.

This research produced the first systematic review that differentiates between factors affecting each of the intention to use, subjectively-measured use, and objectively-measured use of ePHRs. This classification of factors provides more accuracy in identifying the influential factors. Further, this review is the only one focused on the tethered PHRs while other reviews either did not identify the type of ePHRs (e.g. Jabour and Jones, 2013) or focused on all types (e.g. Najaftorkaman et al., 2014). The factors that affect patients' use of tethered PHRs may be different from those affecting other types of ePHRs due to the differences in the characteristics and functionalities (Archer et al., 2011; Feistel, 2014; Gee, 2014; Jackman, 2016; Rice, 2014; Toscos et al., 2016). Further, this review found the largest number of factors (more than 120 different factors) in comparison with other reviews similar to the current study. These factors were also grouped into main categories and subcategories (i.e. personal, human-technology interaction, organisational, social factors) to enhance the understanding of them. The current review is the first review that drew definitive conclusions regarding the effect of factors, and this was based on predefined criteria developed by the reviewer.

Very few studies have utilised theories or models to understand the factors that impact patients' use of ePHRs (Andrews et al., 2014; Assadi, 2013; Emani et al., 2012; Najaftorkaman et al., 2014; Or and Karsh, 2009). Most of those studies have extensively used Technology Acceptance Model (TAM) despite the existence of other competing theories. Precisely, of 11 theory-based studies found in the systematic review, 6 studies used TAM and the other studies used different theories (more information about these theories is shown in Subsection 2.5.2). Accordingly, this study contributes to ePHR literature by adopting and validating a new model (i.e. UTAUT) in the context of ePHRs, which can be used by future studies in the context of ePHRs and CHITs. The selection of the theory was not arbitrary, instead, it was chosen according to well-established criteria and after critical comparisons between the most relevant theories and models. This way of selection has not been used in the previous studies, and it could help researchers to select an appropriate theory for their future studies.

Based on the results of the systematic review, the model was modified by adding the construct "perceived privacy and security" so as to be suitable for the context of ePHRs. This construct was not investigated by the previous theory-based studies in the context of ePHRs. Thus, the current study is the first research to add the construct "perceived privacy and security" to the research model in the context of ePHRs. To the best of the researcher's knowledge, moderating and mediating effects were not tested by previous studies in the field of ePHRs adoption. Accordingly, the current research is the first study to shed light on the important role of moderators and mediators in the context of ePHRs, and this enhances the understanding of factors that affect the adoption (Or and Karsh, 2009).

The model in this study includes both behavioural intention and use behaviour instead of including only one of them as all previous theory-based studies, except Tavares and Oliveira (2016), have done. Many researchers are opponents of the idea of using behavioural intention as a proxy for use behaviour since the relationship between them is usually not strong (Forquer et al., 2014; Gebauer et al., 2013; Haun et al., 2014; Kim, 2012; Kim, 2014; Wu and Du, 2012). Similarly, including use behaviour alone may be considered a controversial issue as behavioural intention is one of the main predictors of use behaviour in many theories (Ajzen, 1985; Davis et al., 1989; Fishbein and Ajzen, 1975; Venkatesh and Davis, 2000; Venkatesh et al., 2003). Accordingly, the current research and a study conducted by Tavares and Oliveira (2016) are the only studies in the area of ePHRs that applied the best practice to study technology adoption, which is including both behavioural intention and use behaviour in one model (Assadi, 2013; Logue and Effken, 2012).

The current study objectively collected data regarding use behaviour via system logs, which is the best practice to measure use behaviour (Burton-Jones and Gallivan, 2007; Karahanna et al., 2006; Podsakoff et al., 2003; Wu and Du, 2012). In contrast, all theory-based studies in the context of ePHRs assessed use behaviour subjectively by asking patients directly about their use of the system. The subjective measure of use may not reflect the actual use as light users may overestimate their use of a system, and vice versa (Collopy, 1996). Another explanation is that it is difficult for users to recall their previous uses, thereby, they are very error-prone in reporting (Devaraj and Kohli, 2003). Accordingly, the current study contributes to the existing ePHR literature by being the first theory-based study to measure the use behaviour objectively, and this may make the findings more reliable.

This study assessed the main dependent variable (i.e. use behaviour) after six months of assessing other variables, which is highly-recommended practice as discussed in Subsection 1.3 and 4.7.4.3 (Assadi, 2013; Bhattacherjee, 2012). None of the previous theory-based studies in the area of ePHRs has followed this practice; that is, all of them measured all variables at the same point in time. Therefore, these studies are subject to the common method bias (see Subsection 4.7.4.3) (Assadi, 2013; Bhattacherjee, 2012; Gebauer et al., 2013). The contribution of the current study is that it is the first theory-based study in the contexts of ePHRs endeavouring to minimise the common method bias by making a gap in time between the main dependent variable and other variables, and this may make the findings of this study more reliable.

The current research differentiates between the two phases of technology adoption (i.e. initial use and continuing use). This is a recommended practice because the factors that affect individuals' initial use are different from those affecting their continuing use (more details are explained in Section 1.4) (Bhattacherjee, 2001; Han, 2003; Karahanna et al., 1999; Peek et al., 2014). This study focused on the initial use, thereby, it recruited only non-users of ePHRs. All previous studies did not differentiate between these phases, and their samples included both users and non-users, thereby, this may affect the reliability of their findings. Thus, the current study contributes to the evidence base in the context of ePHRs by being the first study to focus on the factors that affect the initial use, and this enhances the understanding of the adoption of ePHRs.

This study collected the data using well-established questions adopted from previous studies. These questions were adapted to fit the context of ePHRs and were validated before administrating to the patients. This study contributes to the literature by providing a well-validated questionnaire for future studies in the context of ePHRs.

6.3.2 Contributions to Practice

In order to successfully implement ePHRs, GP practices, developers, and marketers should understand and consider the factors that affect patients' use of ePHRs. By doing so, they will be able to develop appropriate strategies and interventions and allocate effectively their resources. The current study found several factors affecting patients' use of ePHRs. According to these factors, the researcher suggests several valuable implications for developers of ePHRs, marketers, and GP practices. The implications for these different groups are outlined in the following three subsections.

6.3.2.1 Implications for Developers of ePHRs

The current study found that patients who perceive the system as useful and easy to use are more likely to intend to use it. It is highly recommended that developers identify patients' preferences, needs, and skills in order to design a system compatible with those needs (Abramson et al., 2014; Assadi, 2013; Majedi, 2014; Rao, 2014; Or et al., 2009; Wu, 2013). This could be accomplished by involving end-users in the process of development of the system (Demiris et al., 2001; Hartwick and Barki, 1994; Holden et al., 2008). Therefore, developers of ePHRs should involve patients in the process of designing and developing the system to consider functions and features that fit patients' preferences, desires, and skills, thereby, create a useful and easy to use system.

According to the data gathered by the open-ended question, some patients linked the usefulness of Patient Online with its ability to book walk-in appointments and select the required GP. Although Patient Online currently enables patients to choose the required GP, it is not suitable for booking walk-in appointments. Developers of Patient Online should consider adding this functionality in future enhancements of Patient Online. Other patients expressed their need to communicate with their GPs via Patient Online. Indeed, such services are provided by many ePHRs in the USA (e.g. MyChart, MyHealtheVet, and Patient Gateway) (Ancker et al., 2016; Emani et al., 2012; Shimada et al., 2014). Therefore, it seems advisable that developers of Patient Online embed a patient-provider communication tool such as email, online chat, and instant messages. Although such services may increase the workload on physicians, they may accept it if they are provided with incentives (Assadi, 2013).

To ensure ease of use of ePHRs, developers should pilot test the system using potential users before implementing it (Bjerkan et al., 2015; Tavares and Oliveira, 2016). Developers should also pay attention to the usability of ePHRs after implementation by tracking and measuring the patients' use behaviours, such as how patients navigate through pages, number of clicks needed for accessing a certain page, which services are used by patients usually or rarely, which services patients have not completed, time that patients spend on each page, and how patients leave the website (Al-Ghamdi, 2012). By tracking such activities, developers will be able to discover weaknesses in the system and modify it accordingly. As ePHRs should present patients' medical records in a clear and understandable way and without medical jargon, developers should embed a feature that assists patients to understand medical terms and numbers and complex health information (Wu, 2013).

According to the data collected by the open-ended question, ease of access to Patient Online is another aspect of ease of use that patients have a concern about. Patients attributed this concern to forgetting passwords and login details and difficulty to find the URL link to Patient Online. Accordingly, it seems advisable that Patient Online should enable patients to change the password given by the GP practice to one that they can easily memorise. Also, usernames given by the GP practice should be relevant in some way to the patients' details (e.g. surname, date of birth, mobile number) in order to be easy to remember. In respect to the URL link to Patient Online, developers should embed the link on the websites of GP practices, and it should be visible to patients. Some patients indicated that Patient Online would be more accessible as a mobile app, but they were not aware of availability of the Patient Online mobile app.

This study inferred that perceived privacy and security of Patient Online positively affects patients' intention to use it. Accordingly, developers should keep patients' records as private as possible by protecting the platforms using different security measures, such as strong firewalls, complex and long passwords, regular security reviews, and regular website updates (Majedi, 2014). Although protecting the system by complex and long passwords may make the process of accessing the system difficult as reported by respondents to the open-ended question, this method is the most efficient way to protect patients' privacy.

6.3.2.2 Implications for Marketers

One of the main themes emerged from the thematic analysis is lack of awareness of Patient Online. Patients attributed the lack of awareness of Patient Online to the lack of advertising about it. It is well-known that increasing public awareness about the system could accelerate the adoption of ePHRs (Majedi, 2014; Rao, 2014). Accordingly, marketers should improve the publicity of Patient Online to increase people awareness of it. To that end, marketers should conduct advertising campaigns about Patient Online through different channels, such as public media (e.g. television, radio, newspapers, and magazines), social media (e.g. Facebook, Twitter, and YouTube), emails, mails, automated messages on the practices' telephone system, and advertisements in general public areas (e.g. shopping centres, healthcare settings, highway streets, and universities) (Bannor et al., 2017; Rao, 2014). As face-to-face communication may be one of the most effective channels in marketing to persuade potential adopters to adopt an innovation (Andrews and Shimp, 2017; Kotler and Armstrong, 2017; Rogers, 2003), physicians, nurses, receptionists can play an important role in improving the publicity of Patient Online by informing patients about it in their contacts.

In order to ensure that patients perceive the system as useful, easy to use, and secure, marketers should conduct promotional campaigns about functions and features of the system, its advantages over other traditional methods, its ease of use, availability of different sources to support their use, its security measures, the laws and regulations protecting their privacy, and how they can use it safely. These campaigns should be based on correct and realistic information in order to avoid false perceptions and expectation about the system that may disappoint patients when using it, thereby, they may abandon it (Beenkens, 2011).

The current study demonstrated that the relationship between performance expectancy and behavioural intention is stronger for younger, male, and white patients. To increase the adoption among those groups, marketers should conduct promotional campaigns regarding the benefits of the system. This study showed that the relationship between effort expectancy and behavioural intention is stronger for older and less educated patients and those without internet access. Therefore, marketers should initiate advertising campaigns regarding ease of use of the system to increase the adoption rate among those groups.

6.3.2.3 Implications for GP Practices

Allowing patients to try a beta version of ePHRs could create a positive personal experience that may enhance their perceptions of usefulness and ease of use of the system (Emani et al., 2012; Majedi, 2014; Noblin, 2010). This trialability is also one of the main characteristics which promote adoption of an innovation according to Innovation Diffusion Theory (IDT) developed by Rogers (2003) (more details about this theory are explained in Subsection 3.3.1). Therefore, this study recommends GP practices to assist patients in using a beta version of Patient Online through a computer in a waiting room to enhance their perceptions of usefulness and ease of use of Patient Online.

This study concluded that perceived privacy and security of Patient Online positively affects patients’ intention to use it. Thus, the current study recommends GP practices to continue with their policy pertaining to handing out login details to only patients who attend the practice in person with their identity documents. Although this policy makes the process of signing up difficult according to some participants, this method is the most efficient way to protect patients' privacy.

The results demonstrated that patients who believe that an organisational and technical infrastructure exists to support the use of Patient Online are more likely to use it. Therefore, GP practices should provide patients with manuals and guidelines demonstrating step-by-step how they can use Patient Online (Assadi, 2013; Majedi, 2014; Rao, 2014). Such guidelines should be simple, understandable, and in different formats (e.g. written, video, audio) (Al-Ghamdi, 2012; Majedi, 2014). As England consists of people with different languages, the guidelines should cover the most commonly-spoken languages (e.g. English, Polish, Punjabi, and Urdu) to be clearly understandable by patients in different communities. Furthermore, GP practices should provide online assistance and technical support so as to solve any technical issue that faces patients when using Patient Online (Assadi, 2013). It also seems advisable that GP practices educate patients how to use Patient Online through practical training sessions (Assadi, 2013; Beenkens, 2011; Feistel, 2014; Laugesen, 2013). The current study showed that the relationship between facilitating conditions and use behaviour is stronger for older patients and those with lower level of education, lower income, and without internet access. Accordingly, GP practices should focus more on those groups when providing guidelines, assistance, and training sessions.

Lack of computer and internet access was another aspect of facilitating conditions addressed by respondents to the open-ended question. GP practices should collaborate with other parties (e.g. Patient Online providers and government bodies) to provide free computers and/or internet access for short period to patients who do not have them and cannot afford them, or they are provided to patients with reduced prices. Another suggestion is that these groups provide computers and internet access in public places, such as public libraries, city halls, and healthcare settings.

Although this study did not find a significant relationship between social influence and behavioural intention in general, this relationship was significant among patients with a bachelor degree or higher. Accordingly, physicians and nurses in the GP practices should target this group of patients to persuade them to use Patient Online. Further, GP practices should collaborate with patients who are heavy users of Patient Online and request them to convince their peers with a bachelor degree or higher.

6.4 Research Strengths and Limitations

The main research strengths and limitations of the current research are addressed in the following two subsections, respectively.

6.4.1 Research Strengths

The current research is grounded on a well-established theory. Use of a theory in research has several benefits, namely: it increases the predictive power of the adopted variables (Daulby, 2015; Or et al., 2011); it improves the understanding of the adoption process of ePHRs (Daulby, 2015; Emani et al., 2012; Stolyar, 2011); it enables designers and decision makers to make use of prescriptive findings and guidance on increasing the adoption (Emani et al., 2012; Or et al., 2011); and it produces a testable model for subsequent research in similar contexts. Moreover, Bhattacherjee (2012) pointed out the scientific knowledge depends on theories and observations, and scientific research is not considered valid if it ignores theories. In contrast to the previous theory-based studies in the context of ePHRs, the theory was chosen according to well-established criteria and after critical comparisons between the most relevant theories and models. The current research is the first study to use UTAUT in the context of ePHRs. Further, the current study tested the important role of moderators and mediators in the proposed model, which enhanced the understanding of factors that affect the adoption (Or and Karsh, 2009).

Contrary to the previous theory-based studies, the current research examined the factors affecting both behavioural intention and use behaviour, which is the best practice to study technology adoption (as discussed in Section 1.3) (Assadi, 2013; Logue and Effken, 2012). Further, the current study objectively collected data regarding use behaviour via system logs, which is the best practice to measure use behaviour (as discussed in Section 1.3) (Burton-Jones and Gallivan, 2007; Karahanna et al., 2006; Podsakoff et al., 2003; Wu and Du, 2012).

This study assessed the main dependent variable (i.e. use behaviour) after six months of assessing other variables, and this is highly-recommended practice in order to minimise the effect of common method bias (see Subsection 4.7.4.3) (Assadi, 2013; Bhattacherjee, 2012). Also, the method used for assessing the dependent variable (system logs) was different from the method used for measuring the other variables (questionnaires), and this is another advised practice to minimise the effect of common method bias (see Subsection 4.7.4.3) (Bhattacherjee, 2012; Gebauer et al., 2013).

The current research differentiates between the two phases of technology adoption (i.e. initial use and continuing use). This is a recommended practice because the factors that affect individuals’ initial use are different from those affecting their continuing use (more details are explained in Section 1.4) (Bhattacherjee, 2001; Han, 2003; Karahanna et al., 1999; Peek et al., 2014).

The response rate in the current study was high (78%). In addition, there was not significant difference between respondents and non-respondents in terms of age, sex, and ethnicity. This indicates that the risk of non-response bias is minimal in the current study. Also, participants were recruited from real-world settings (i.e. four GP practices), and this might minimise the risk of sampling bias (Assadi, 2013). These GP practices have different characteristics in terms of their patients' demographics, and this may increase generalisability of the findings.

The data collected by the open-ended question enriched the results of the current research. Specifically, the qualitative data enabled the researcher to support the inferences drawn from the quantitative data, find additional factors, and formulate practical implications.

6.4.2 Research Limitations

In spite of the abovementioned strengths, the researcher acknowledges that the current study had some limitations that need to be considered. This study focused on the adoption of tethered PHRs, and this may limit the generalisability of this study to other types of ePHRs (i.e. stand-alone and integrated PHRs). As standalone and integrated PHRs have features and functions different from the tethered PHRs, the factors affecting patients' use of each type of ePHRs might be different (Assadi, 2013; Cocosila and Archer, 2014; DesRoches et al., 2010). The current study focused on tethered PHRs because it is the same system type that is used in England (Patient Online) (NHS England, 2017), and it is the most common type in the world (Davis, 2008; Emani et al., 2012; Thompson et al., 2016).

The present study collected data from four GP practices implementing the same ePHRs (i.e. SystemOnline); therefore, the findings of this study may not be applicable to other practices implementing other ePHRs (i.e. Patient Access, Patient Services, The Waiting Room, Engage Consult, and Evergreen Life/i-Patient). However, this limitation may have less effect of generalisability of the findings as all systems mentioned earlier provide the same services to the patients (i.e. booking appointments, requesting prescriptions, and viewing health records), and all participants had not used any of them before, thereby, they are unlikely to have different perceptions about them.

Although investigating factors affecting the use of ePHRs among healthcare providers and caregivers are very important (Haun et al., 2014; Or and Karsh, 2009), this study concentrated on patients' adoption only. This is because Patient Online is designed to be used by patients in the first place, thereby, their adoption is the most important aspect to be assessed. Caregivers’ adoption is essential when the system is developed to be used mainly by them, such as ePHRs in paediatric or psychiatric healthcare settings, which is not the case for Patient Online. Further, healthcare providers’ adoption is important when the system requires healthcare providers to interact with patients through it, such as replying to emails, sending instructions, and monitoring health status, which is not the case for Patient Online.

The present study focused on assessing factors that affect patients’ initial use of ePHRs, therefore, the findings are not generalisable to the context of continuing use. This is attributed to the fact that factors that affect individuals’ initial use may differ from those influence their continuing use (Bhattacherjee, 2001; Han, 2003; Karahanna et al., 1999; Peek et al., 2014). Although examining the factors that affect both initial and continuing use are very important for IS success (Bhattacherjee, 2001; Forquer et al., 2014; Gebauer et al., 2013; Nijland et al., 2011), this research focused on initial use of ePHRs because studying the factors that influence continuing use needs surveying the same participants at least two distant points in time (i.e. longitudinal study) such as studies conducted by Forquer et al. (2014), Kim and Malhotra (2005), and Venkatesh et al. (2003). Thereby, it is not practical and risky to carry out such a study in a limited-time project (i.e. PhD project). Moreover, Patient online is still a new system in England and has a low adoption rate; therefore, it is better to focus on the initial use in this period.

The current research is subject to a sampling bias due to using convenience sampling technique to recruit the participants (Bhattacherjee, 2012; Zikmund et al., 2013). Therefore, the generalisability of findings of this study may be limited. This study found that the sample is representative of the population as there was no statistically significant difference between participants and non-participants in terms of age, sex, and ethnicity. Consequently, it can be said that the findings are generalisable to practices similar to the four practices in the current study.

As data were collected using a cross-sectional survey, causality cannot be inferred in the current study. This is attributed to the fact that the independent variable and the dependent variable are measured at the same point of time, thereby, this breaks the temporal precedent of causality and makes it impossible to identify the direction of the effect (Bhattacherjee, 2012; Calnan, 2013). This limitation might be mitigated since the main dependent variable (i.e. actual use) was measured after six months of measuring the independent variables (Bhattacherjee, 2012).

Although data was gathered from patients at four GP practices, these settings were located in a single geographical area (West Yorkshire) of England. Accordingly, the findings may not be generalisable to other areas in England nor other countries because people in West Yorkshire may have different demographics, cultures, digital divides, and health care system features from those in other districts and countries.

In spite of the importance of conducting a qualitative study to deeply understand and confirm the findings of the quantitative study and determine other factors that were not considered in the research model, it was difficult to do so in the current research due to time and cost limitations. Nonetheless, the questionnaire contained an open-ended question providing participants with the opportunity to exhibit their opinions and thoughts regarding the adoption of Patient Online. Although such questions may not equivalent to a qualitative study, it enabled the researcher to some extent to support the findings of the quantitative data and determine other factors.

The current study did not assess the effect of facilitating conditions on behavioural intention because Venkatesh et al. (2003) demonstrated that the relationship between facilitating conditions and behavioural intention is not statistically significant. However, a meta-analysis of 162 studies regarding IS acceptance and adoption found that facilitating conditions significantly affect behavioural intention in addition to use behaviour (Dwivedi et al., 2017). Thus, the proposed model might miss an important relationship (i.e. FC→BI) that could improve the model predictive power.

6.5 Recommendations for Future Research

Given the well-developed and validated model in this study, further studies are required to examine the applicability of this model in other contexts, such as other providers of Patient Online (e.g. Patient Access and The Waiting Room), other types of ePHRs (e.g. standalone and integrated), specific service/ function (e.g. booking appointments and ordering prescriptions), specific platform (e.g. mobiles, tablets, and computers), other users (e.g. caregivers and healthcare providers), other settings (e.g. hospitals), and other geographical areas or countries.

The current study focused on factors affecting the initial use of ePHRs. However, determining the factors influencing the continuing use is considered very important since long-term viability and eventual success of information technology count on its continuing use more than initial use (Bhattacherjee, 2001; Forquer et al., 2014; Gebauer et al., 2013; Nijland et al., 2011). Therefore, further primary studies and systematic reviews should be carried out to assess factors that affect continuing use of ePHRs. Researchers need to conduct longitudinal studies, which investigate the change of the effect of the proposed predictors over a period of time (Gebauer et al., 2013; Kim and Malhotra, 2005). When investigating the continuing use of ePHRs, researchers should consider adding new factors that are associated with continuing use, such as habit (as a direct predictor) and experience (as a moderator) (Venkatesh et al., 2012).

Chiasson et al. (2007, p.94) pointed out that "*the variety of human, contextual, and cultural factors that affect system acceptance in actual use would not have been identifiable through quantitative methods alone*". It seems advisable that researchers add qualitative studies to the quantitative studies so as to understand patients' adoption of ePHRs in depth, find other influential factors, and verify and interpret findings of the quantitative work.

The researcher calls for further research to explain the non-significant effect of social influence demonstrated in this study. Previous studies demonstrated that the effect of social influence depends on the type of processes of social influence that people consider in their decisions (internalisation, identification, and compliance) (Malhotra and Galletta, 1999; Venkatesh and Davis, 2000; Venkatesh et al., 2003). Those processes of social influence should be considered by researchers to explain the non-significant effect of social influence. Several studies argued that social influence may be affected by the culture of people (Ayouby and Croteau, 2009; Constantiou et al., 2009; Sun and Zhang, 2006). Future studies investigate cultural differences when examining the effect of social influence.

The proposed model could be improved by adding new predictors in the context of ePHRs adoption. Researchers should review the factors identified by the systematic review to choose and examine new factors that were not examined by the current research, such as patients' satisfaction, patient activation level, marital status, health status, language, perceived severity of the disease, and living arrangements.

According to patients' responses to the open-ended question, several factors were revealed but were not part of the proposed model, such as awareness of Patient Online, promotional ads, limited internet/computer skills (computer self-efficacy), use of GP services, the preference of personal contact, distance to the GP practice, disability, and trust in Patient Online. Such factors should be considered in future research.

Finally, although this study examined the effect of six moderators on most of the direct relationships, it did not examine their effect on the two indirect relationships (i.e. EE→PE→BI and PPS→PE→BI). This effect of moderators on indirect relationships is called moderated mediation or conditional indirect effect (Aguinis et al., 2016; Preacher et al., 2007; Sardeshmukh and Vandenberg, 2017). To the best of the researcher's knowledge, the moderated mediating effect has not been examined in the context of ePHRs nor CHITs. For this reason, the researcher recommends future studies to test such effect. The current study did not assess the effect of the moderators on the relationship between behavioural intention and use behaviour. To the best of the researcher's knowledge, this moderating effect has not been examined in the context of ePHRs nor CHITs. It seems advisable that future studies consider testing the moderating effect of those variables on the relationship between behavioural intention and use behaviour.

6.6 Conclusion

The current research aimed to examine the factors that affect patients' adoption of electronic personal health records in England. The results showed that performance expectancy, effort expectancy, and perceived privacy and security were significant predictors of behavioural intention. The relationship between social influence and behavioural intention was not statistically significant. Both facilitating conditions and behavioural intention affected use behaviour. Performance expectancy was also a significant mediator of the effect of both effort expectancy and perceived privacy and security on behavioural intention. Eleven relationships were moderated by age, sex, income, education, ethnicity, and internet access. The proposed model accounted for 76% and 48% of the variance in behavioural intention and use behaviour, respectively.

To be more precise, it was concluded that patients are more likely to intend to use Patient Online when they perceive it as a useful and advantageous system. This relationship between performance expectancy and behavioural intention is stronger for younger, male, and white patients. Thus, developers should design a system compatible with patients' needs, and marketers should conduct promotional campaigns regarding the benefits of the system to increase the adoption rate among those groups.

It was also found that patients are more likely to intend to use Patient Online when they perceive it as easy to use. For patients who perceive that Patient Online is easy to use, an increase of their perceived usefulness of Patient Online leads to an increase in their intention to use it. Further, the relationship between effort expectancy and behavioural intention is stronger for older and less educated patients and those without internet access. Therefore, developers should design a system compatible with patients' skills, marketers should initiate advertising campaigns regarding ease of use of the system to increase the adoption rate among those groups, and GP practices should support patients to try a beta version of the system.

The current study showed that patients are more likely to intend to use Patient Online when they perceive it as a secure system that is able to maintain their privacy. For patients who perceive that Patient Online is secure, an increase of their perceived usefulness of Patient Online leads to an increase in their intention to use it. Developers should protect the system using different security measures, and marketers should conduct promotional campaigns about the security of the system.

It was concluded in this study that patients are more likely to use Patient Online when they feel that they have the resources, knowledge, and skills enough to use it. The relationship between facilitating conditions and use behaviour is stronger for older patients and those with lower level of education, lower income, and without internet access. Accordingly, marketers should conduct advertising campaigns about Patient Online through different channels, and GP practices should provide the abovementioned groups with manuals, technical support, and training.

The current study showed that patients are more likely to use Patient Online when they have greater intention to use it. It was also concluded that opinions and beliefs of people who are important to the patient do not affect his or her intention to utilise ePHRs.

To conclude, the current study identified the main factors that affect patients' use of ePHRs in England (performance expectancy, effort expectancy, perceived privacy and security, facilitating conditions, behavioural intention, age, sex, ethnicity, education, income, internet access). These factors are very important for stakeholders in order to increase the adoption rate and, thereby, successfully implement the system. The proposed model accounted for 48% of the variance in use behaviour, and this indicates that there are other factors yet to be identified that would account for the unexplained variance. More studies are needed to confirm the effect of the factors identified in the current study and to identify additional factors.

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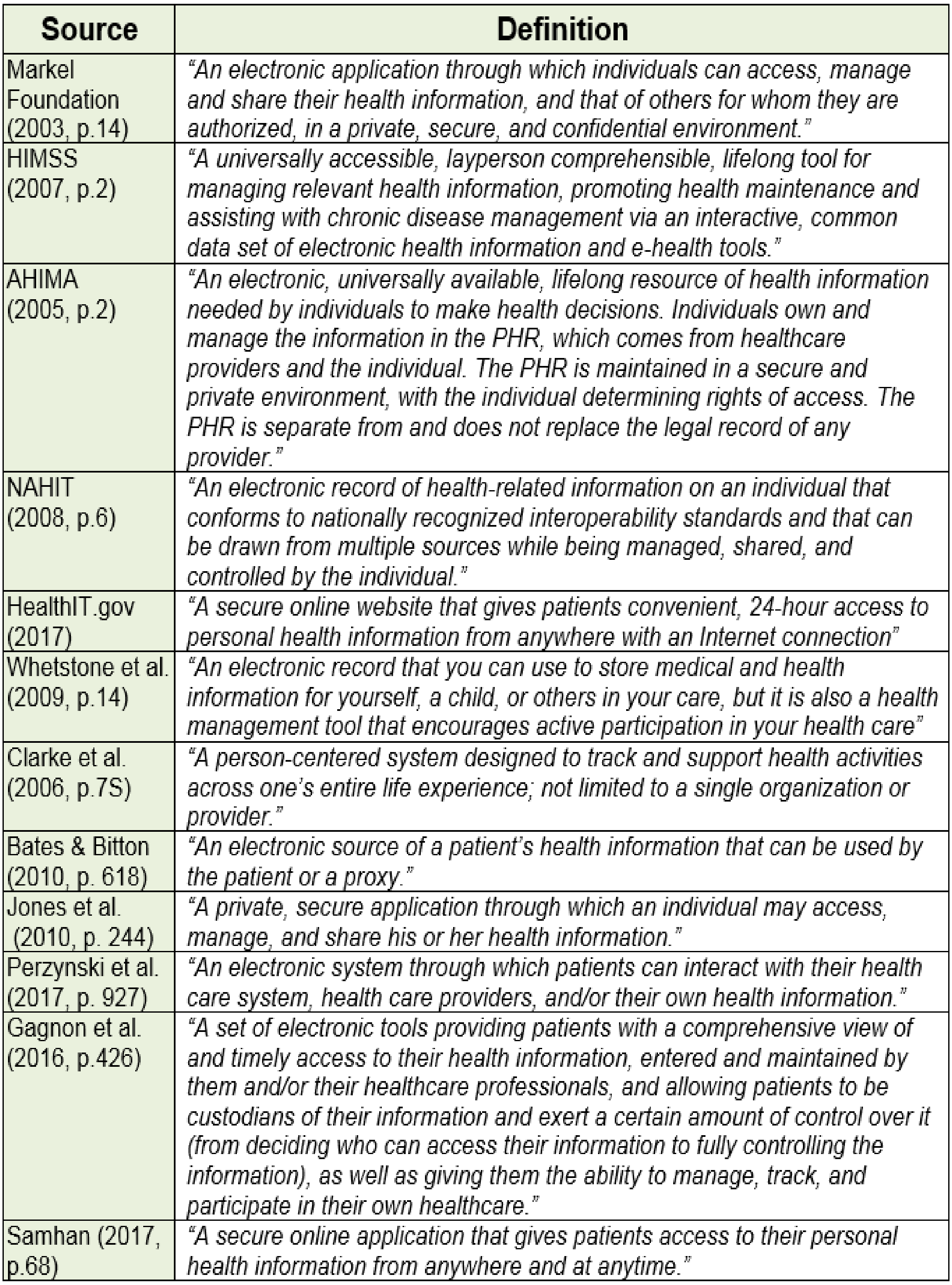
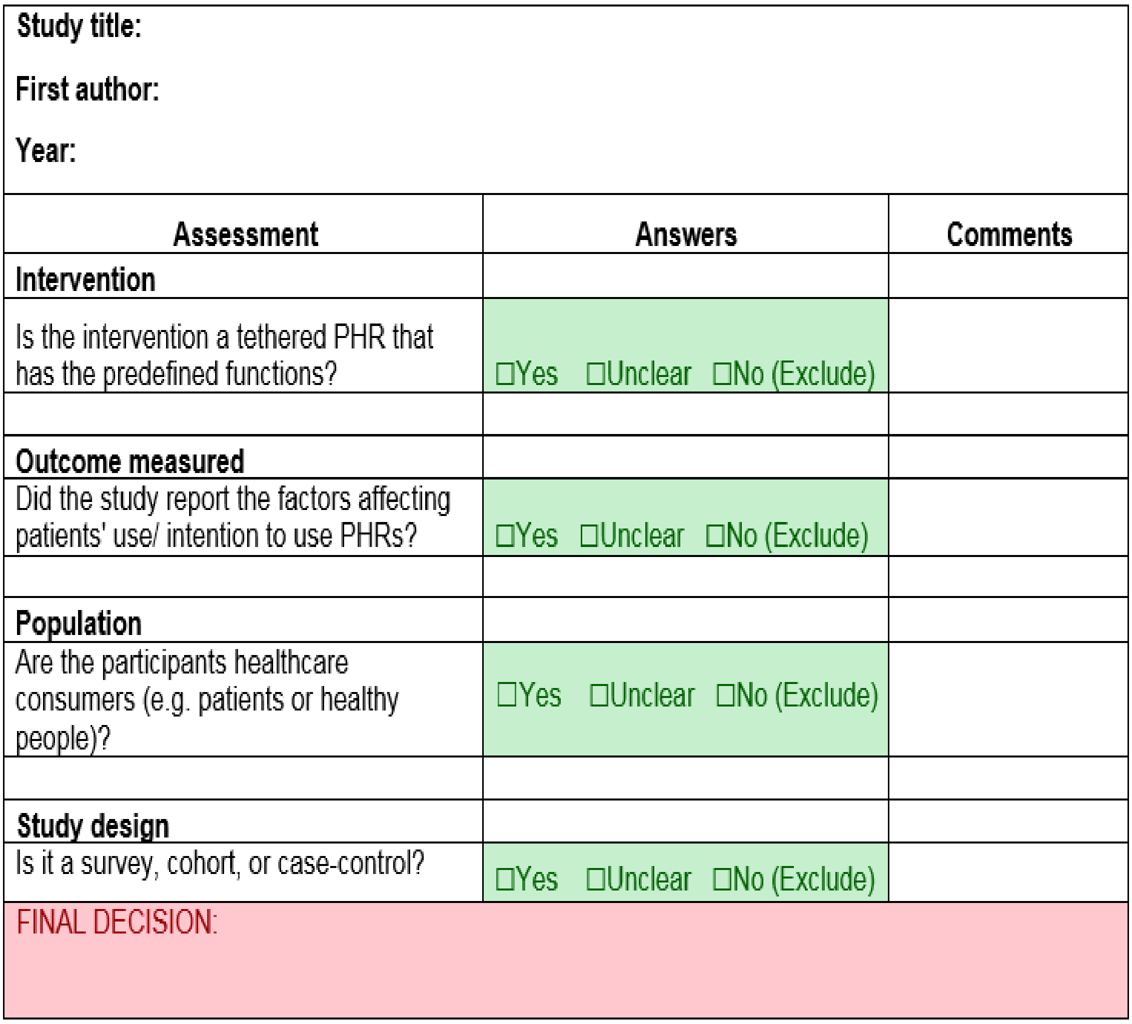
Appendices

Appendix 1: Definitions of Electronic Personal Health Records



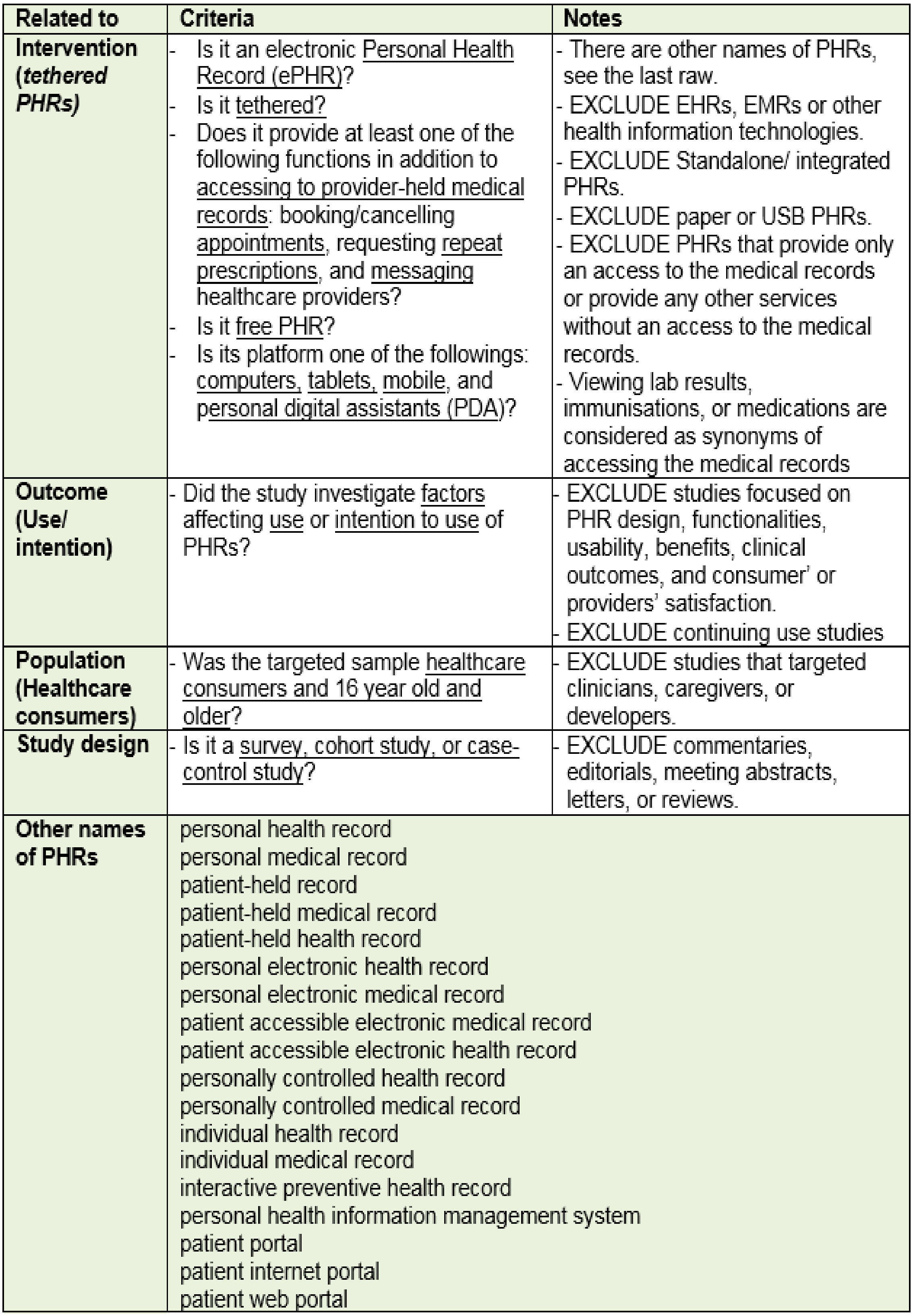
Source	Definition
Markel Foundation (2003, p.14)	*"An electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment."*
HIMSS (2007, p.2)	*"A universally accessible, layperson comprehensible, lifelong tool for managing relevant health information, promoting health maintenance and assisting with chronic disease management via an interactive, common data set of electronic health information and e-health tools."*
AHIMA (2005, p.2)	*"An electronic, universally available, lifelong resource of health information needed by individuals to make health decisions. Individuals own and manage the information in the PHR, which comes from healthcare providers and the individual. The PHR is maintained in a secure and private environment, with the individual determining rights of access. The PHR is separate from and does not replace the legal record of any provider."*
NAHIT (2008, p.6)	*"An electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be drawn from multiple sources while being managed, shared, and controlled by the individual."*
HealthIT.gov (2017)	*"A secure online website that gives patients convenient, 24-hour access to personal health information from anywhere with an Internet connection"*
Whetstone et al. (2009, p.14)	*"An electronic record that you can use to store medical and health information for yourself, a child, or others in your care, but it is also a health management tool that encourages active participation in your health care"*
Clarke et al. (2006, p.7S)	*"A person-centered system designed to track and support health activities across one's entire life experience; not limited to a single organization or provider."*
Bates & Bitton (2010, p. 618)	*"An electronic source of a patient's health information that can be used by the patient or a proxy."*
Jones et al. (2010, p. 244)	*"A private, secure application through which an individual may access, manage, and share his or her health information."*
Perzynski et al. (2017, p. 927)	*"An electronic system through which patients can interact with their health care system, health care providers, and/or their own health information."*
Gagnon et al. (2016, p.426)	*"A set of electronic tools providing patients with a comprehensive view of and timely access to their health information, entered and maintained by them and/or their healthcare professionals, and allowing patients to be custodians of their information and exert a certain amount of control over it (from deciding who can access their information to fully controlling the information), as well as giving them the ability to manage, track, and participate in their own healthcare."*
Samhan (2017, p.68)	*"A secure online application that gives patients access to their personal health information from anywhere and at anytime."*

Appendix 2: Eligibility Criteria Form



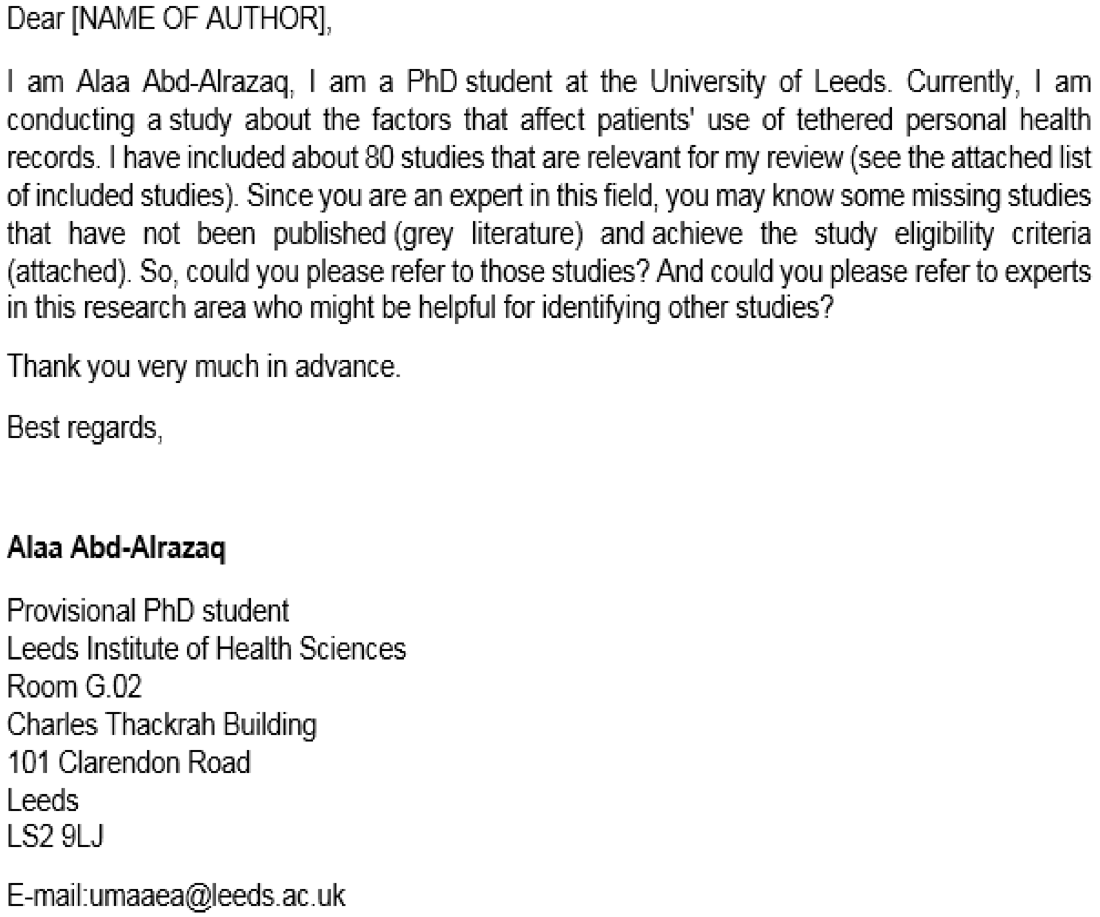
Study title: **First author:** **Year:**		
Assessment	**Answers**	**Comments**
Intervention		
Is the intervention a tethered PHR that has the predefined functions?	☐Yes ☐Unclear ☐No (Exclude)	
Outcome measured		
Did the study report the factors affecting patients' use/ intention to use PHRs?	☐Yes ☐Unclear ☐No (Exclude)	
Population		
Are the participants healthcare consumers (e.g. patients or healthy people)?	☐Yes ☐Unclear ☐No (Exclude)	
Study design		
Is it a survey, cohort, or case-control?	☐Yes ☐Unclear ☐No (Exclude)	
FINAL DECISION:		

Appendix 3: Explanations of Eligibility Criteria



Related to	Criteria	Notes
Intervention (*tethered* *PHRs)*	- Is it an electronic Personal Health Record (ePHR)? - Is it tethered? - Does it provide at least one of the following functions in addition to accessing to provider-held medical records: booking/cancelling appointments, requesting repeat prescriptions, and messaging healthcare providers? - Is it free PHR? - Is its platform one of the followings: computers, tablets, mobile, and personal digital assistants (PDA)?	- There are other names of PHRs, see the last raw. - EXCLUDE EHRs, EMRs or other health information technologies. - EXCLUDE Standalone/ integrated PHRs. - EXCLUDE paper or USB PHRs. - EXCLUDE PHRs that provide only an access to the medical records or provide any other services without an access to the medical records. - Viewing lab results, immunisations, or medications are considered as synonyms of accessing the medical records
Outcome (Use/ intention)	- Did the study investigate factors affecting use or intention to use of PHRs?	- EXCLUDE studies focused on PHR design, functionalities, usability, benefits, clinical outcomes, and consumer' or providers' satisfaction. - EXCLUDE continuing use studies
Population (Healthcare consumers)	- Was the targeted sample healthcare consumers and 16 year old and older?	- EXCLUDE studies that targeted clinicians, caregivers, or developers.
Study design	- Is it a survey, cohort study, or case-control study?	- EXCLUDE commentaries, editorials, meeting abstracts, letters, or reviews.
Other names of PHRs	personal health record personal medical record patient-held record patient-held medical record patient-held health record personal electronic health record personal electronic medical record patient accessible electronic medical record patient accessible electronic health record personally controlled health record personally controlled medical record individual health record individual medical record interactive preventive health record personal health information management system patient portal patient internet portal patient web portal	

Appendix 4: Content of Email Sent to Experts



Dear [NAME OF AUTHOR],

I am Alaa Abd-Alrazaq, I am a PhD student at the University of Leeds. Currently, I am conducting a study about the factors that affect patients' use of tethered personal health records. I have included about 80 studies that are relevant for my review (see the attached list of included studies). Since you are an expert in this field, you may know some missing studies that have not been published (grey literature) and achieve the study eligibility criteria (attached). So, could you please refer to those studies? And could you please refer to experts in this research area who might be helpful for identifying other studies?

Thank you very much in advance.

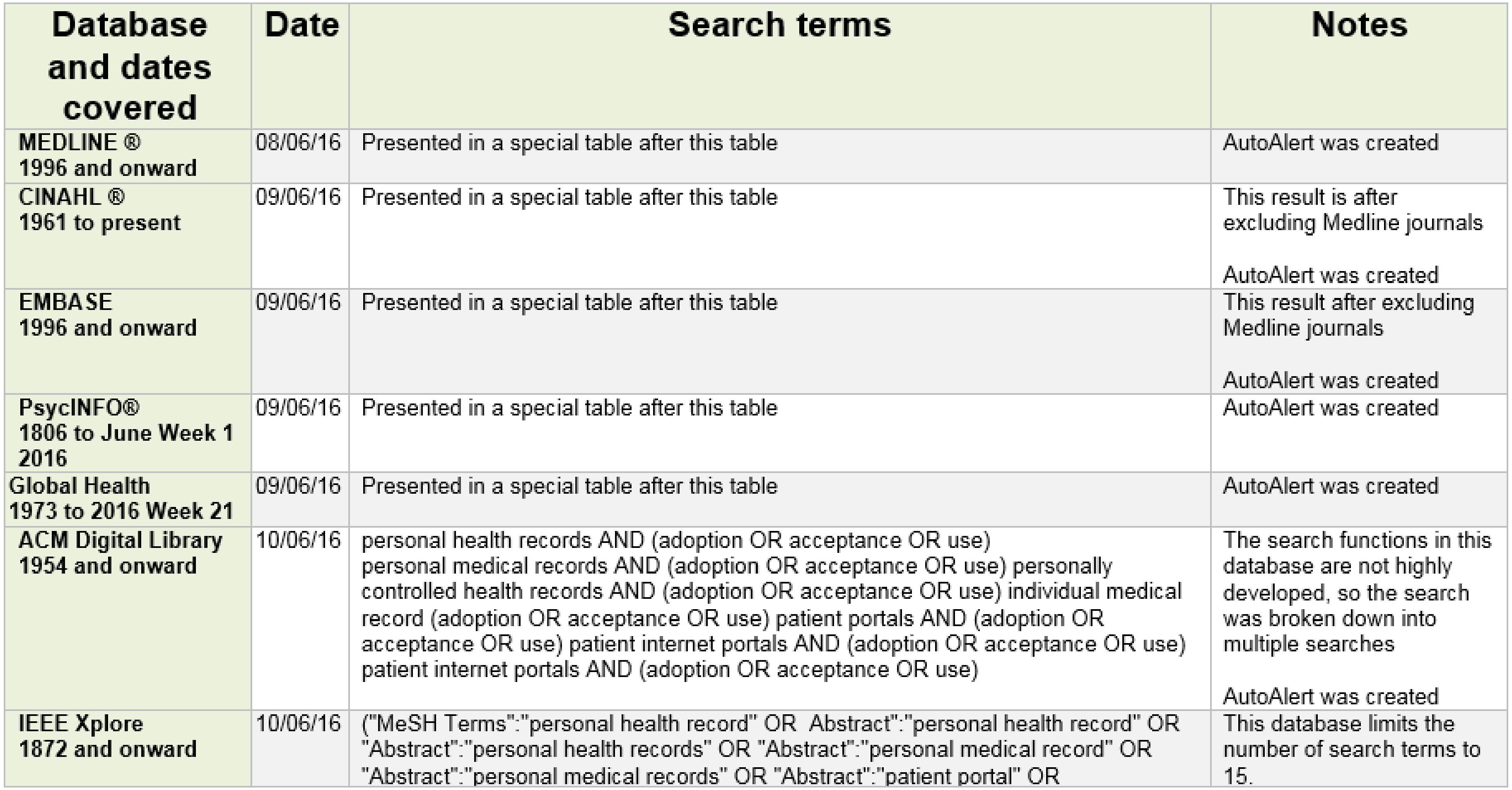
Best regards,

Alaa Abd-Alrazaq

Provisional PhD student
Leeds Institute of Health Sciences
Room G.02
Charles Thackrah Building
101 Clarendon Road
Leeds
LS2 9LJ

E-mail:umaaea@leeds.ac.uk

Appendix 5: Search Process Details for each Database



Database and dates covered	Date	Search terms	Notes
MEDLINE ® **1996 and onward**	08/06/16	Presented in a special table after this table	AutoAlert was created
CINAHL ® **1961 to present**	09/06/16	Presented in a special table after this table	This result is after excluding Medline journals AutoAlert was created
EMBASE **1996 and onward**	09/06/16	Presented in a special table after this table	This result after excluding Medline journals AutoAlert was created
PsycINFO® **1806 to June Week 1 2016**	09/06/16	Presented in a special table after this table	AutoAlert was created
Global Health **1973 to 2016 Week 21**	09/06/16	Presented in a special table after this table	AutoAlert was created
ACM Digital Library **1954 and onward**	10/06/16	personal health records AND (adoption OR acceptance OR use) personal medical records AND (adoption OR acceptance OR use) personally controlled health records AND (adoption OR acceptance OR use) individual medical record (adoption OR acceptance OR use) patient portals AND (adoption OR acceptance OR use) patient internet portals AND (adoption OR acceptance OR use) patient internet portals AND (adoption OR acceptance OR use)	The search functions in this database are not highly developed, so the search was broken down into multiple searches AutoAlert was created
IEEE Xplore **1872 and onward**	10/06/16	("MeSH Terms":"personal health record" OR Abstract":"personal health record" OR "Abstract":"personal health records" OR "Abstract":"personal medical record" OR "Abstract":"personal medical records" OR "Abstract":"patient portal" OR	This database limits the number of search terms to 15.

		Abstract":"patient portals" OR "Abstract":PHR) AND (p_Abstract:use OR "Abstract":accept* OR "Abstract":adopt* OR "Abstract":intention*) AND (p_Abstract:patient* OR Abstract":consumer)	AutoAlert was created
Scopus **1960 and onward**	10/06/16	(TITLE-ABS KEY (patient* OR consumer* OR elder* OR old* OR veteran*)) AND (TITLE-ABS-KEY(use* OR adopt* OR accept* OR intention* OR attitude* OR satisf*)) AND ((TITLE-ABS-KEY ([personal health record] OR [personal medical record] OR [patient-held record] OR [patient-held medical record] OR [patient accessible electronic medical record] OR [patient accessible electronic health record] OR [personally controlled health record])) OR (TITLE-ABS-KEY ([interactive preventive health record] OR [personal health information management system] OR [computer-based patient record] OR [patient portal OR [patient internet portal] OR [patient web portal])))	AutoAlert was created
Web of Science **1950 and onward**	10/06/16	(patient* OR consumer* OR elder* OR old* OR adult* OR senior* OR veteran*) AND ("personal health record*" OR "personal medical record*" OR "patient health record*" OR "patient medical record*" OR "patient-held record*" OR "patient-held medical record*" OR "patient-held health record*" OR "personal electronic health record*" OR "personal electronic medical record*" OR "patient accessible electronic medical record*" OR "patient accessible electronic health record*" OR "personally controlled health record*" OR "personally controlled medical record*" OR "individual health record*" OR "individual medical record*" OR "interactive preventive health record*" OR "personal health information management system*" OR "patient portal*" OR "patient internet portal*" OR "patient web portal*") AND (use* OR usage OR adopt* OR utilis* OR utiliz* OR accept* OR intention* OR attitude* OR satisf* OR adhere* OR reject* OR abandon*)	AutoAlert was created
Journal of the American Medical Informatics Association (JAMIA) **1977 and onward**	10/06/16	"personal health record" AND adoption (5) "personal health record" AND use (3) "personal health record" AND accept (0) "personal health record" AND intention (0) "personal medical record" AND adoption (0) "personal medical record" AND use (0)	It does not have an advanced search tool. Therefore, the search performed in a simple way.

		“personal medical record” AND accept (0) “personal medical record” AND intention (0) "electronic patient record" and adoption (0) "electronic patient record" and use (4) "electronic patient record" and accept (0) "electronic patient record" and intention (0) “patient health record" AND adoption (0) “patient health record" AND use (0) “patient health record" AND accept (0) “patient health record" AND intention (0) "patient medical record" AND adoption (0) "patient medical record" AND use (2) "patient medical record" AND accept (0) "patient medical record" AND intention (0) “patient portal” AND adoption (0) “patient portal” AND use (5) “patient portal” AND accept (0) “patient portal” AND intention (0)	
International Journal of Medical Informatics (IJMI) 1970 and onward	12/06/16	"personal health record*" in Title/Abs/Keywords OR "personal medical record*" in Title/Abs/ Keywords OR "patient health record*" in Title/ Abs/Keywords OR "patient medical record*" in Title/Abs/Keywords OR "patient-held record*" in Title/Abs/Keywords OR "personal electronic health record*" in Title/Abs/Keywords OR "personal electronic medical record*" in Title/Abs/Keywords OR "patient accessible electronic medical record*" in Title/Abs/ Keywords OR "patient accessible electronic health record*" inTitle/Abs/Keywords OR "personally controlled health record*" in Title/ Abs/Keywords OR "personally controlled medical record*" inTitle/Abs/Keywords OR "individual medical record*" in Title/Abs/ Keywords OR "individual health record*" inTitle/Abs/Keywords OR "interactive preventive health record*" inTitle/Abs/Keywords OR "personal health information management system*" inTitle/Abs/Keywords OR "patient portal*" in Title/Abs/Keywords OR "patient internet portal*" in Title/Abs/Keywords OR "patient web portal*" inTitle/Abs/Keywords	This database was searched using searching terms that are related to only the intervention because number of studies retrieved from this search are very low
Telemedicine and e-Health	12/06/16	You searched for: [Abstract: "personal health record*"] OR [Abstract: "personal medical record*"] OR[Abstract: "personal electronic health record*"] OR [Abstract: "personal electronic medical record*"] OR[Abstract: "patient-held	This database was searched using search terms that are related to

1995 and onward		record*"] OR [Abstract: "patient-held medical record*"] OR [Abstract: "patient-held health record*"] OR [Abstract: "patient accessible electronic health record*"] OR [Abstract: "personally controlled health record"] OR [Abstract: "personally controlled medical record*"] OR [Abstract: "personal health information management system*"] OR [Abstract : "interactive preventive health record*"] OR [Abstract: "patient portal*"] OR [Abstract: "patient internet portal*"] OR [Abstract: "patient web portal*"] AND [in Journal: Telemedicine and e-Health]	only the intervention because a number of studies retrieved from this search is very low This journal was searched via Mary Ann Liebert, Inc.
Health Informatics Journal (HIJ) **1995 and onward**	12/06/16	personal health record OR personal medical record OR patient health record OR patient medical record OR personal electronic health record OR personal electronic medical record OR patient accessible electronic medical record OR patient accessible electronic health record OR personally controlled health record OR personally controlled medical record OR individual health record OR individual medical record OR interactive preventive health record OR personal health information management system OR patient portal OR patient internet portal OR patient web portal	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
Journal of Medical Systems (JMS) **1977 and onward**	12/06/16	'"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"'	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low This journal was searched via SpringerLink
LILACS Database (Literatura Latino Americana em ciencias da Saude) **1980 and onward**	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR	This database was searched using search terms that are related to only the intervention because a number of

		"interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	studies retrieved from this search is very low This source was searched via VHL Regional Portal
Library & Information Networks for Knowledge Database (WHOLIS) **1948 and onward**	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low This source was searched via VHL Regional Portal
African Index Medicus (AIM) **1948 and onward**	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
Africa (AFRO) library database (AFROLIB) **1948 and onward**	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low

WHO Regional Office for Europe **1977 and onward**	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
Index Medicus for the Eastern Mediterranean Region (IMEMR) **1948 and onward**	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
Western Pacific Region Index Medicus (WPRIM) **1951 and onward**	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal" OR "personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
WHO Regional Office for South-East Asia (WROSEA)	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible	This database was searched using search terms that are related to

1950 and onward		electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	only the intervention because a number of studies retrieved from this search is very low
WHO Regional Office for Americas (PAHO) **1930 and onward**	12/06/16	"personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
National Library of Australia (NLA)	12/06/16	subject:("personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals")	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
IndMED **1985 and onward**	12/06/16	personal health records OR personal medical records OR personal electronic health records personal electronic medical records OR patient-held records OR patient-held medical records OR patient-held health records OR patient accessible electronic health records OR personally controlled health records OR personally controlled medical records OR personal health information management systems OR interactive preventive health records OR patient portals OR patient internet portals OR patient web portals	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
KoreaMed **1933 and onward**	12/06/16	"personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management	This database was searched using search terms that are related to only the intervention because a number of

		systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals" OR "personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	studies retrieved from this search is very low
ProQuest Dissertations & Theses Database **1743 onwards**	13/06/16	AB,TI(patient* OR consumer* OR elder* OR old* OR veteran*) AND AB,TI("personal health record*" OR "personal medical record*" OR "patient health record*" OR "patient medical record*" OR "patient-held record*" OR "patient-held medical record*" OR "patient-held health record*" OR "personal electronic health record*" OR "personal electronic medical record*" OR "patient accessible electronic medical record*" OR "patient accessible electronic health record*" OR "personally controlled health record*" OR "personally controlled medical record*" OR "individual health record*" OR "individual medical record*" OR "interactive preventive health record*" OR "personal health information management system*" OR "computer-based patient record*" OR "patient portal*" OR "patient internet portal*" OR "patient web portal*") AND AB,TI(use* OR usage OR adopt* OR utilis* OR utiliza* OR accept* OR intention* OR attitude* OR satisfy* OR adhere* OR reject* OR abandon*)	This search was not only for theses and dissertations but for scholarly journals and reports and books Auto Alert was created
Electronic Theses Online Service (EThOS)	13/06/16	"personal health record*" OR "personal medical record*" OR "patient health record*" OR "patient medical record*" OR "patient-held record*" OR "patient-held medical record*" OR "patient-held health record*" OR "personal electronic health record*" OR "personal electronic medical record*" OR "patient accessible electronic medical record*" OR "patient accessible electronic health record*" OR "personally controlled health record*" OR "personally controlled medical record*" OR "individual health record*" OR "individual medical record*" OR "interactive preventive health record*" OR "personal health information management system*" OR "computer-based patient record*" OR "patient portal*" OR "patient internet portal*" OR "patient web portal*"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
DART-Europe E-theses Portal **1900 and onward**	13/06/16	"personal health record*" OR "personal medical record*" OR "patient health record*" OR "patient medical record*" OR "patient-held record*" OR "patient-held medical record*" OR "patient-held health record*" OR "personal electronic health record*" OR "personal electronic medical record*" OR "patient accessible electronic medical	This database was searched using search terms that are related to only the intervention

		record*" OR "patient accessible electronic health record*" OR "personally controlled health record*" OR "personally controlled medical record*" OR "individual health record*" OR "individual medical record*" OR "interactive preventive health record*" OR "personal health information management system*" OR "computer-based patient record*" OR "patient portal*" OR "patient internet portal*" OR "patient web portal*"	because a number of studies retrieved from this search is very low
Networked Digital Library of Theses and Dissertations (NDLTD) **1970 and onward**	13/06/16	subject:"personal health record" OR subject:" personal medical record*" OR subject:"patient health record" OR subject:"patient medical record" OR subject:"personal electronic health record" OR subject:"personal electronic medical record" OR subject:"patient accessible electronic medical record" OR subject:"patient accessible electronic health record" OR subject:"personally controlled health record" OR subject:"personally controlled medical record" OR subject:"individual health record" OR subject:"individual medical record" OR subject:"interactive preventive health record" OR subject:"personal health information management system" OR subject:"computer based patient record" OR subject:"patient portal" OR subject:"patient internet portal" OR subject: "patient web portal" OR title:"personal health record" OR title:"personal medical record" OR title:"patient health record" OR title:"patient medical record" OR title:"personal electronic health record" OR title:"personal electronic medical record" OR title:"patient accessible electronic medical record" OR title:"patient accessible electronic health record" OR title: "personally controlled health record" OR title:" personally controlled medical record" OR title:" individual health record" OR title:"individual medical record" OR title:"interactive preventive health record" OR title:"personal health information management system" OR title:" computer based patient record" OR title:"patient portal" OR title:"patient internet portal" OR title:"patient web portal" OR subject:"personal health records" OR subject:"personal medical records" OR subject:"patient health records" OR subject:"patient medical records" OR subject:" personal electronic health records" OR subject:" personal electronic medical records" OR subject:"patient accessible electronic medical records" OR subject:"patient accessible electronic health records" OR subject:" personally controlled health records" OR subject:"personally controlled medical records" OR subject:"individual health records" OR subject:"individual medical records" OR subject: "interactive preventive health records" OR subject:"personal health information management systems" OR subject:"computer based patient records" OR subject:"patient portals" OR subject:"patient internet portasl" OR subject:"patient web portals" OR	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low

		title:"personal health records" OR title:"personal medical records" OR title:"patient health records" OR title :"patient medical records" OR title:"personal electronic health records" OR title:"personal electronic medical records" OR title:"patient accessible electronic medical records" OR title:"patient accessible electronic health records" OR title:"personally controlled health records" OR title:"personally controlled medical records" OR title:"individual health records" OR title: "individual medical records" OR title:" interactive preventive health records" OR title:"personal health information management systems" OR title:"computer based patient records" OR title:"patient portals" OR title:" patient internet portals" OR title:"patient web portals"	
Theses Canada	13/06/16	"personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
Brazilian Digital Library of Theses and Dissertations (BDLTD) **1942 and onward**	13/06/16	"personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
South African Theses and Dissertations (SATD) **1980 and onward**	13/06/16	"personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low

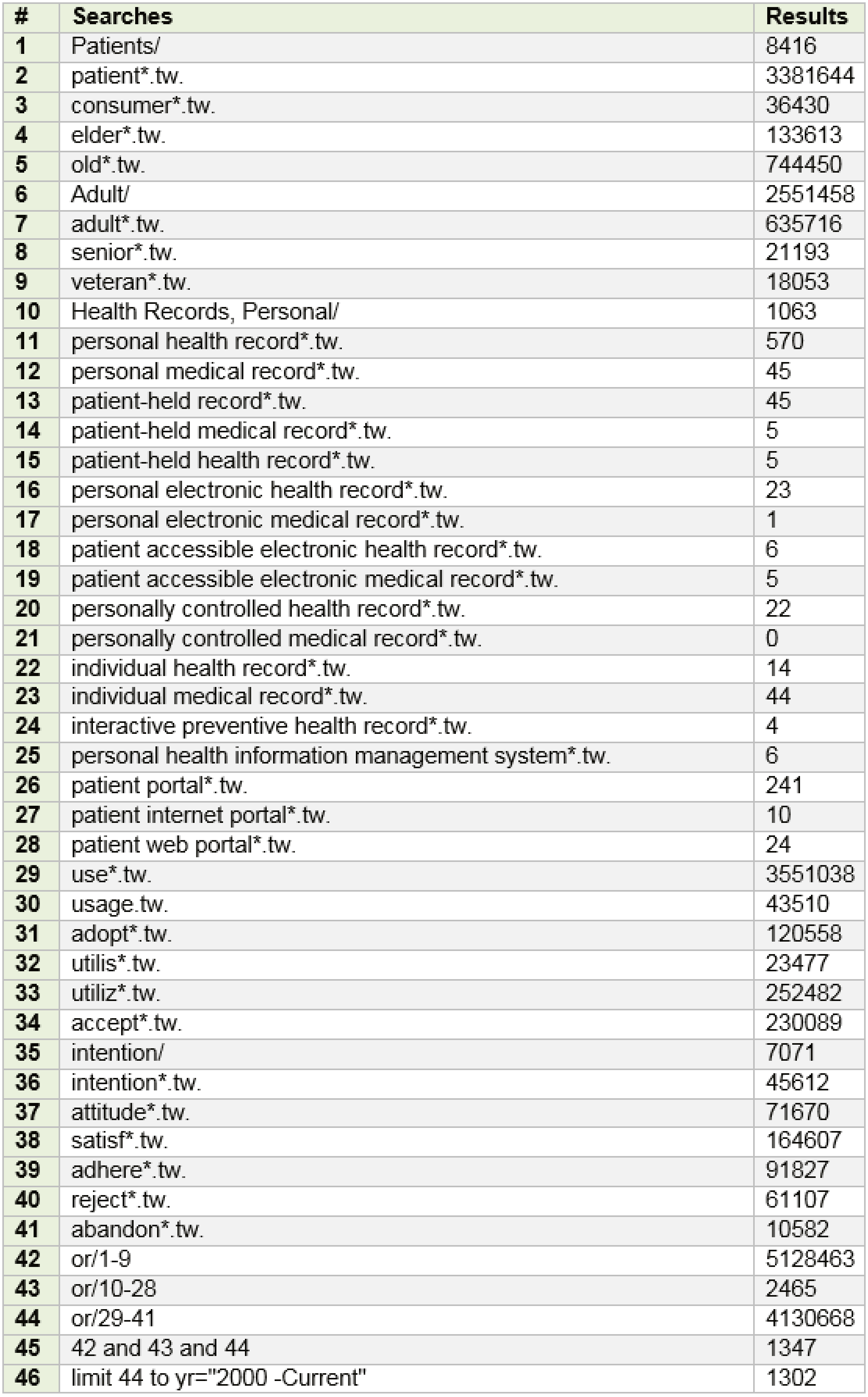
Hong Kong University Theses **1941 and onward**	13/06/16	((abstract:("personal health records")) OR (abstract:("personal medical records")) OR (abstract:("personal electronic health records")) OR (abstract:("personal electronic medical records")) OR (abstract:("patient-held records")) OR (abstract:("patient-held medical records")) OR (abstract:("patient-held health records")) OR (abstract:("patient accessible electronic health records")) OR (abstract:("personally controlled health records")) OR (abstract:("personally controlled medical records")) OR (abstract:("personal health information management systems")) OR (abstract:("interactive preventive health records")) OR (abstract:("patient internet portals")))	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
System for Information on Grey Literature in Europe (openSIGILE) **1980 and onward**	14/06/16	"personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals" OR "personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
COPAC **1850 and onward**	14/06/16	subject :"personal health record*" OR subject :"personal medical record*" OR subject :"patient health record*" OR subject :"patient medical record*" OR subject :"personal electronic health record*" OR subject :"personal electronic medical record*" OR subject :"patient accessible electronic medical record*" OR subject :"patient accessible electronic health record*" OR subject :"personally controlled health record*" OR subject:"personally controlled medical record*" OR subject:"individual health record*" OR subject:"individual medical record*" OR subject:"interactive preventive health record*" OR subject:"personal health information management system*" OR subject:"computer based patient record*" OR subject:"patient portal*" OR subject:"patient internet portal*" OR subject:"patient web portal*" OR title:"personal health record*" OR title:"personal medical record*" OR title:"patient health record*" OR title:"patient medical record*" OR title:"personal	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low

		electronic health record*" OR title:"personal electronic medical record*" OR title:"patient accessible electronic medical record*" OR title:"patient accessible electronic health record*" OR title:"personally controlled health record*" OR title:"personally controlled medical record*" OR title:"individual health record*" OR title:"individual medical record*" OR title:"interactive preventive health record*" OR title:"personal health information management system*" OR title:"computer based patient record*" OR title:"patient portal*" OR title:"patient internet portal*" OR title:"patient web portal*"	
BMC Proceedings	14/06/16	(Exact phrase) in All fields (full text)(personal health records OR personal medical records OR personal electronic health records OR personal electronic medical records OR patient-held records OR patient-held medical records OR patient-held health records OR patient accessible electronic health records OR personally controlled health records OR personally controlled medical records OR personal health information management systems OR interactive preventive health records OR patient portals OR patient internet portals OR patient web portals OR personal health record OR personal medical record OR personal electronic health record OR personal electronic medical record OR patient-held record OR patient-held medical record OR patient-held health record OR patient accessible electronic health record OR personally controlled health record OR personally controlled medical record OR personal health information management system OR interactive preventive health record OR patient portal OR patient internet portal OR patient web portal)	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
ISI Proceedings	14/06/16	personal health records OR personal medical records OR personal electronic health records OR personal electronic medical records OR patient-held records OR patient-held medical records OR patient-held health records OR patient accessible electronic health records OR personally controlled health records OR personally controlled medical records OR "personal health information management systems OR "interactive preventive health records OR patient portals OR patient internet portals OR patient web portals OR personal health record OR personal medical record OR personal electronic health record OR personal electronic medical record OR patient-held record OR patient-held medical record OR patient-held health record OR patient accessible electronic health record" OR "personally controlled health record OR personally controlled medical record OR personal health information management system OR interactive preventive health record OR patient portal OR patient internet portal OR patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low

NHS Evidence	16/06/16	("personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals" OR "personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal") AND (use* OR usage OR adopt* OR accept* OR intention* OR attitude* OR satisf* OR adhere* OR reject* OR abandon*)) AND (patient* OR consumer* OR elder* OR old* OR adult OR veteran*)	
ISRCTN registry	16/06/16	"personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals" OR "personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal"	This database was searched using search terms that are related to only the intervention because a number of studies retrieved from this search is very low
Explore the British Library	16/06/16	("personal health records" OR "personal medical records" OR "personal electronic health records" OR "personal electronic medical records" OR "patient-held records" OR "patient-held medical records" OR "patient-held health records" OR "patient accessible electronic health records" OR "personally controlled health records" OR "personally controlled medical records" OR "personal health information management	The number of retrieved studies was 132 but there were many duplicated records, so they were deleted directly

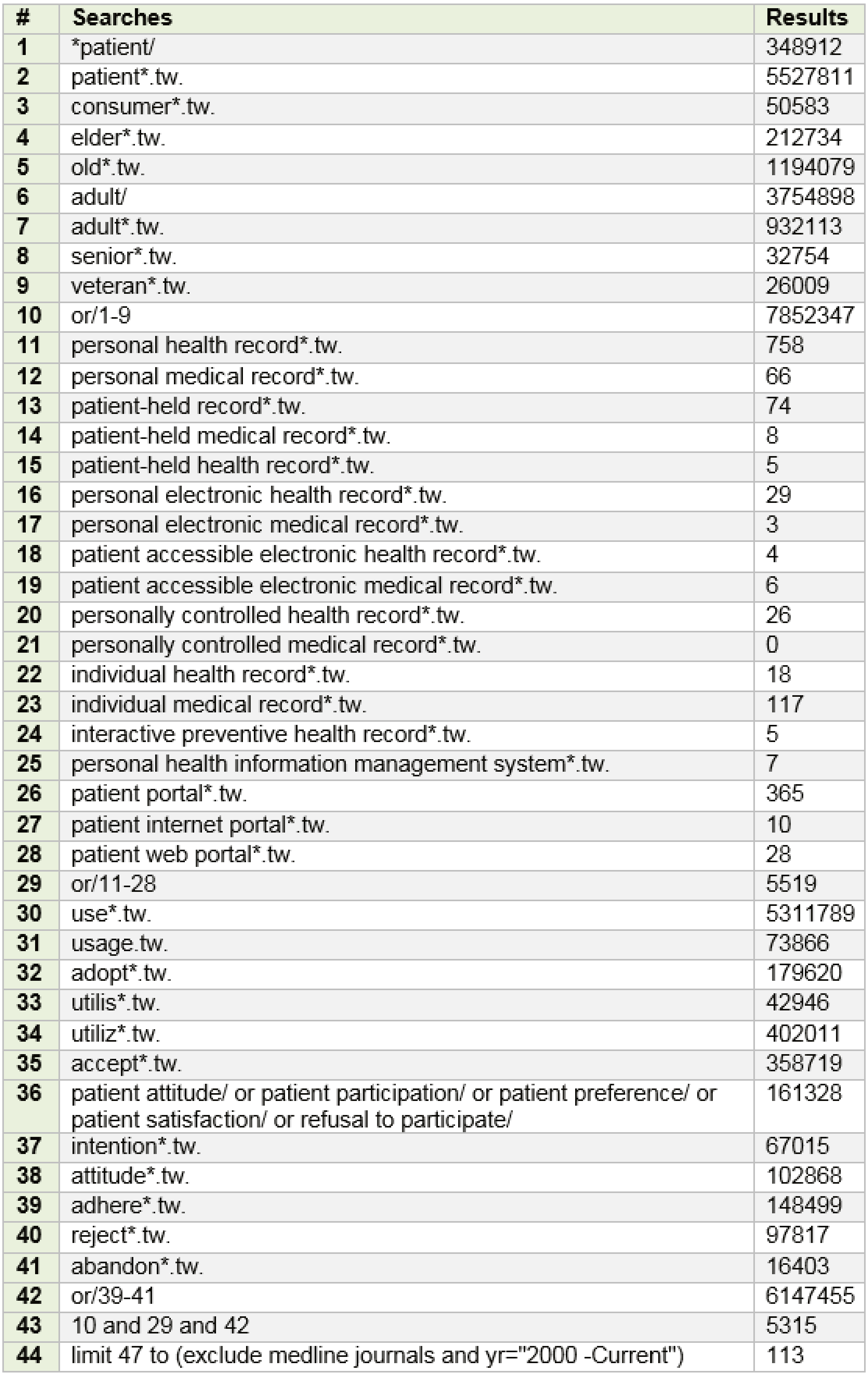
		systems" OR "interactive preventive health records" OR "patient portals" OR "patient internet portals" OR "patient web portals" OR "personal health record" OR "personal medical record" OR "personal electronic health record" OR "personal electronic medical record" OR "patient-held record" OR "patient-held medical record" OR "patient-held health record" OR "patient accessible electronic health record" OR "personally controlled health record" OR "personally controlled medical record" OR "personal health information management system" OR "interactive preventive health record" OR "patient portal" OR "patient internet portal" OR "patient web portal") AND (use* OR usage OR adopt* OR accept* OR intention* OR attitude* OR satisf* OR adhere* OR reject* OR abandon*)) AND (patient* OR consumer* OR elder* OR old* OR adult OR veteran*)	
Health Management Information Consortium (HMIC))	09/06/16	Presented in a special table after this table	
Google Scholar	16/06/16	("personal health records" OR "personal medical records" OR "patient portals" OR patient web portals") AND (use OR adoption OR acceptance OR intention) AND (patients OR consumers)	(the first 10 pages)
Turning Research Into Practice (TRIP)	16/06/16	("personal health record*" OR "personal medical record*" OR "personal electronic health record*" OR "personal electronic medical record*" OR "patient-held record*" OR "patient-held medical record*" OR "patient-held health record*" OR "patient accessible electronic health record*" OR "personally controlled health record*" OR "personally controlled medical record*" OR "personal health information management system*" OR "interactive preventive health record*" OR "patient portal*" OR "patient internet portal*" OR "patient web portal*") AND (use* OR usage OR adopt* OR utilis* OR utiliz* OR accept* OR intention* OR attitude* OR satisf* OR adhere* OR reject* OR abandon*) AND (patient* OR consumer* or elder* OR old* OR veteran*)	

Ovid MEDLINE(R) 1996 to June Week 2 2016



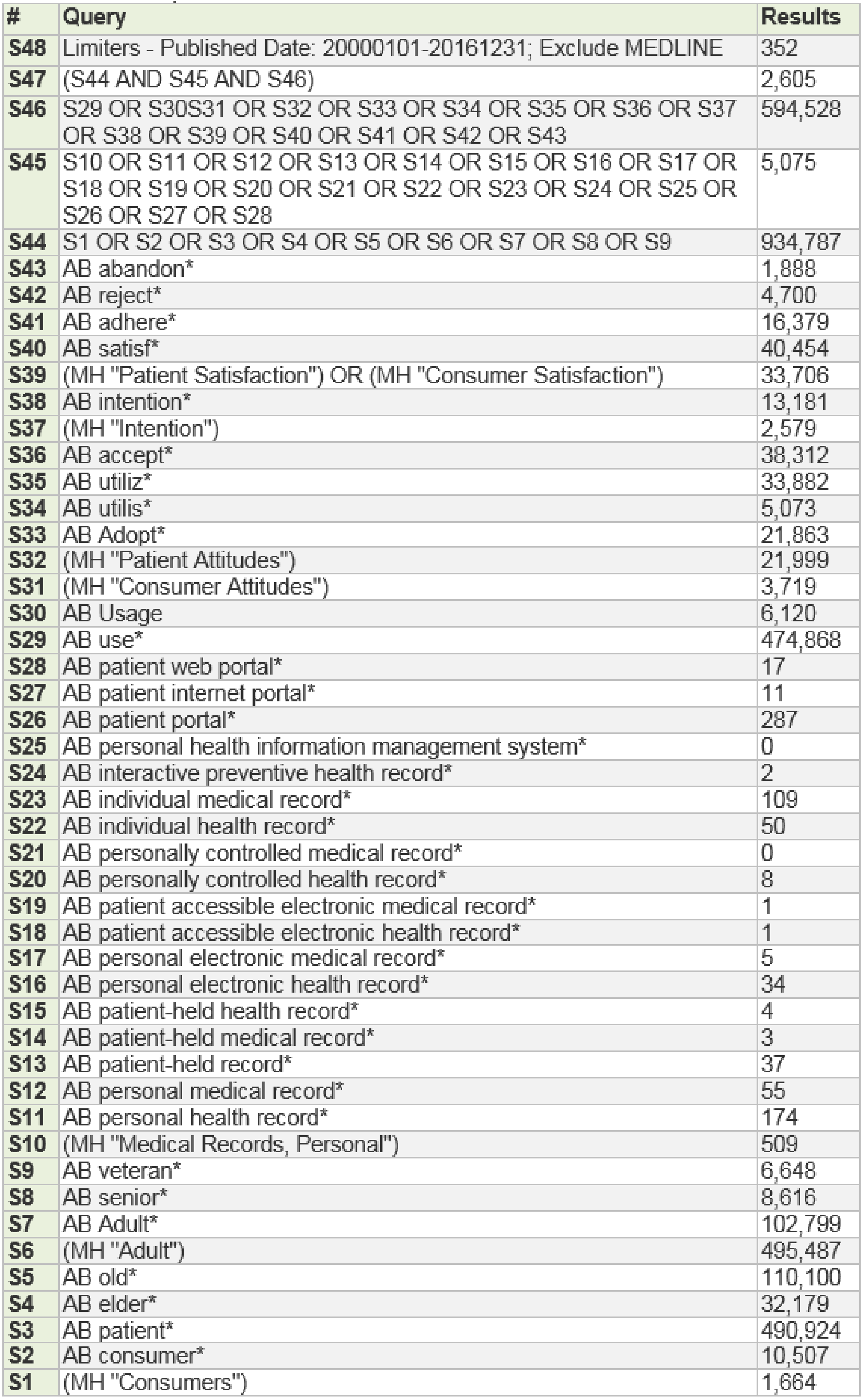
#	Searches	Results
1	Patients/	8416
2	patient*.tw.	3381644
3	consumer*.tw.	36430
4	elder*.tw.	133613
5	old*.tw.	744450
6	Adult/	2551458
7	adult*.tw.	635716
8	senior*.tw.	21193
9	veteran*.tw.	18053
10	Health Records, Personal/	1063
11	personal health record*.tw.	570
12	personal medical record*.tw.	45
13	patient-held record*.tw.	45
14	patient-held medical record*.tw.	5
15	patient-held health record*.tw.	5
16	personal electronic health record*.tw.	23
17	personal electronic medical record*.tw.	1
18	patient accessible electronic health record*.tw.	6
19	patient accessible electronic medical record*.tw.	5
20	personally controlled health record*.tw.	22
21	personally controlled medical record*.tw.	0
22	individual health record*.tw.	14
23	individual medical record*.tw.	44
24	interactive preventive health record*.tw.	4
25	personal health information management system*.tw.	6
26	patient portal*.tw.	241
27	patient internet portal*.tw.	10
28	patient web portal*.tw.	24
29	use*.tw.	3551038
30	usage.tw.	43510
31	adopt*.tw.	120558
32	utilis*.tw.	23477
33	utiliz*.tw.	252482
34	accept*.tw.	230089
35	intention/	7071
36	intention*.tw.	45612
37	attitude*.tw.	71670
38	satisf*.tw.	164607
39	adhere*.tw.	91827
40	reject*.tw.	61107
41	abandon*.tw.	10582
42	or/1-9	5128463
43	or/10-28	2465
44	or/29-41	4130668
45	42 and 43 and 44	1347
46	limit 44 to yr="2000 -Current"	1302

Embase 1996 to 2016 Week 23



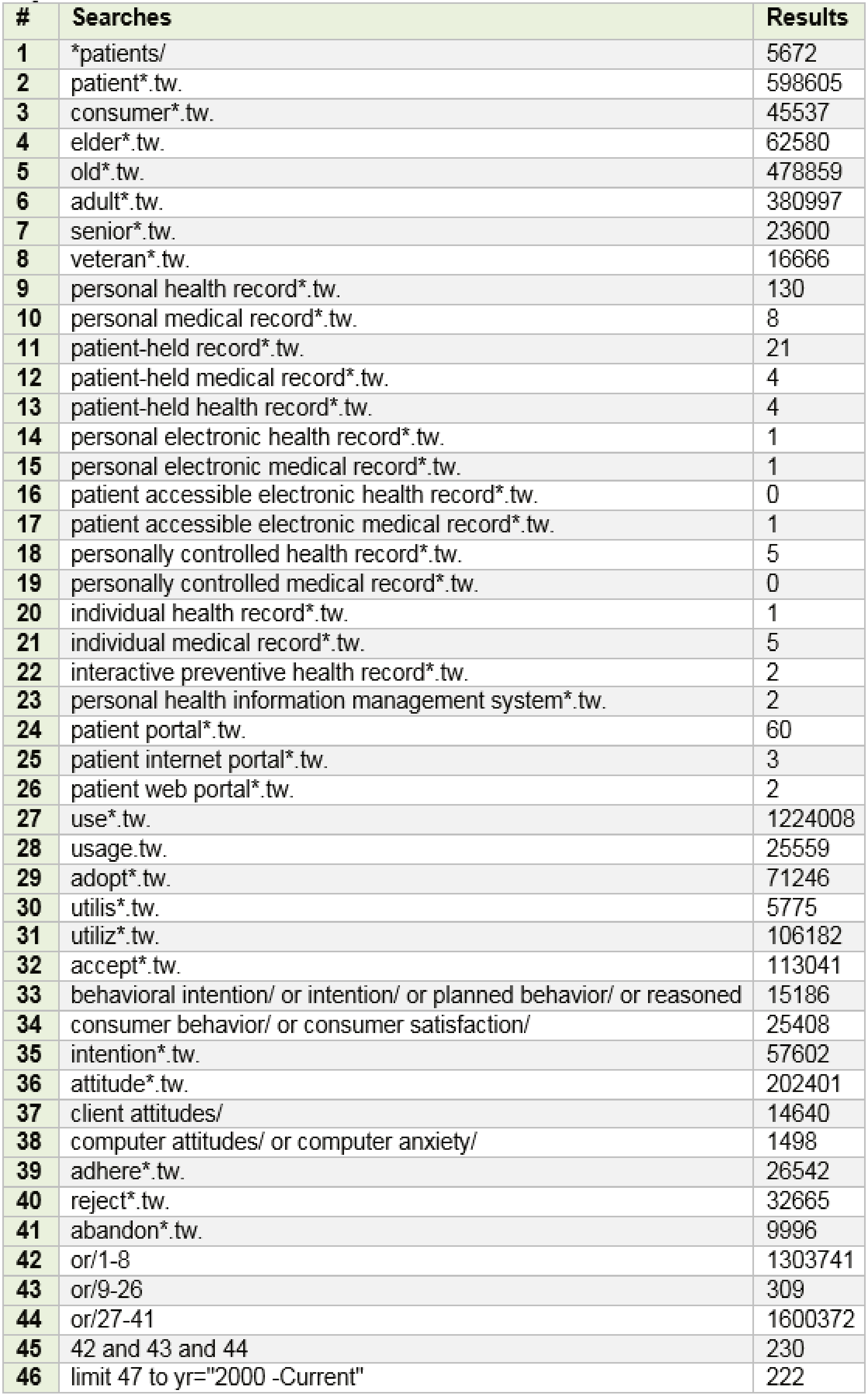
#	Searches	Results
1	*patient/	348912
2	patient*.tw.	5527811
3	consumer*.tw.	50583
4	elder*.tw.	212734
5	old*.tw.	1194079
6	adult/	3754898
7	adult*.tw.	932113
8	senior*.tw.	32754
9	veteran*.tw.	26009
10	or/1-9	7852347
11	personal health record*.tw.	758
12	personal medical record*.tw.	66
13	patient-held record*.tw.	74
14	patient-held medical record*.tw.	8
15	patient-held health record*.tw.	5
16	personal electronic health record*.tw.	29
17	personal electronic medical record*.tw.	3
18	patient accessible electronic health record*.tw.	4
19	patient accessible electronic medical record*.tw.	6
20	personally controlled health record*.tw.	26
21	personally controlled medical record*.tw.	0
22	individual health record*.tw.	18
23	individual medical record*.tw.	117
24	interactive preventive health record*.tw.	5
25	personal health information management system*.tw.	7
26	patient portal*.tw.	365
27	patient internet portal*.tw.	10
28	patient web portal*.tw.	28
29	or/11-28	5519
30	use*.tw.	5311789
31	usage.tw.	73866
32	adopt*.tw.	179620
33	utilis*.tw.	42946
34	utiliz*.tw.	402011
35	accept*.tw.	358719
36	patient attitude/ or patient participation/ or patient preference/ or patient satisfaction/ or refusal to participate/	161328
37	intention*.tw.	67015
38	attitude*.tw.	102868
39	adhere*.tw.	148499
40	reject*.tw.	97817
41	abandon*.tw.	16403
42	or/39-41	6147455
43	10 and 29 and 42	5315
44	limit 47 to (exclude medline journals and yr="2000 -Current")	113

CINAHL 1961 to present



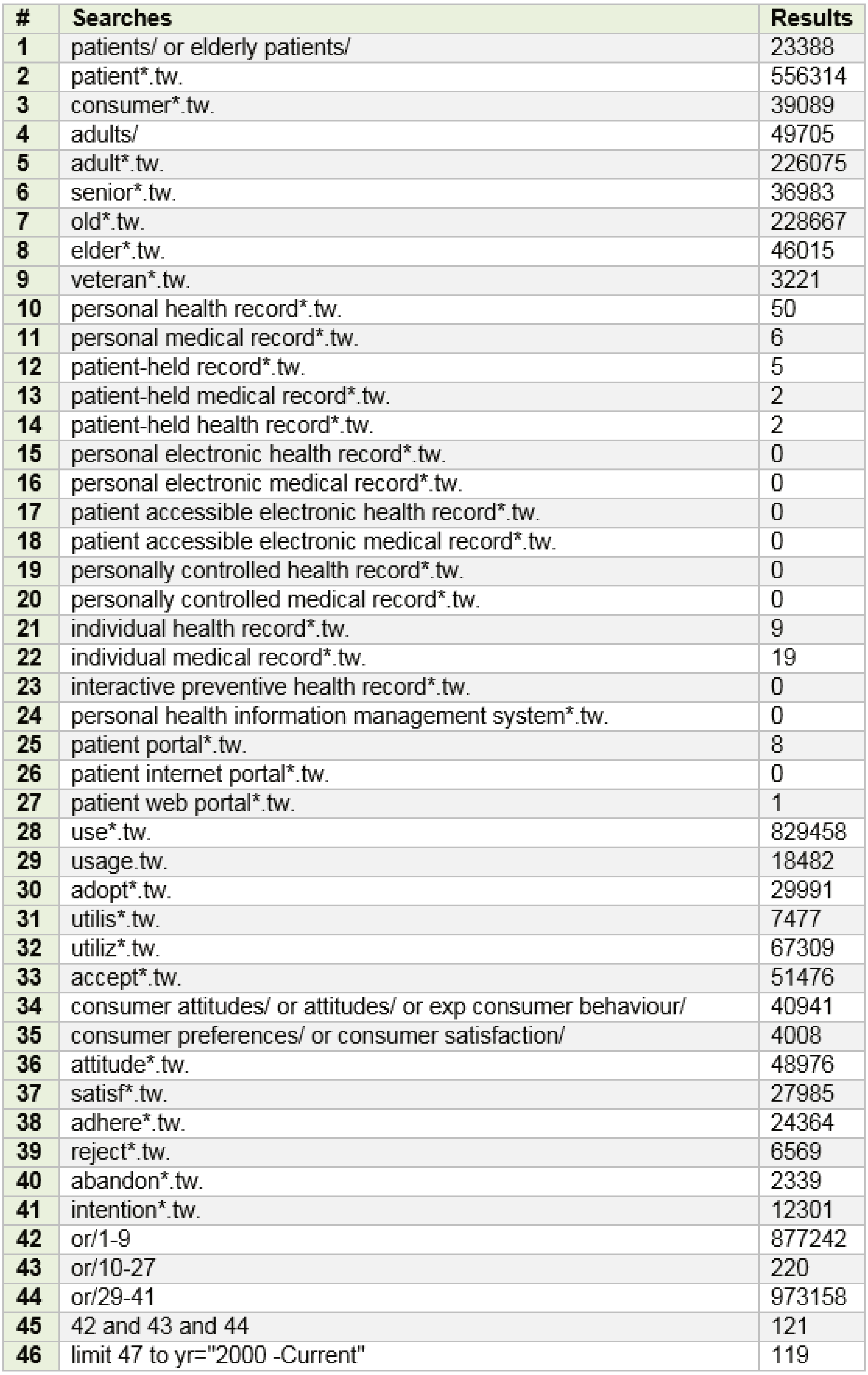
#	Query	Results
S48	Limiters - Published Date: 20000101-20161231; Exclude MEDLINE	352
S47	(S44 AND S45 AND S46)	2,605
S46	S29 OR S30S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43	594,528
S45	S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28	5,075
S44	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9	934,787
S43	AB abandon*	1,888
S42	AB reject*	4,700
S41	AB adhere*	16,379
S40	AB satisf*	40,454
S39	(MH "Patient Satisfaction") OR (MH "Consumer Satisfaction")	33,706
S38	AB intention*	13,181
S37	(MH "Intention")	2,579
S36	AB accept*	38,312
S35	AB utiliz*	33,882
S34	AB utilis*	5,073
S33	AB Adopt*	21,863
S32	(MH "Patient Attitudes")	21,999
S31	(MH "Consumer Attitudes")	3,719
S30	AB Usage	6,120
S29	AB use*	474,868
S28	AB patient web portal*	17
S27	AB patient internet portal*	11
S26	AB patient portal*	287
S25	AB personal health information management system*	0
S24	AB interactive preventive health record*	2
S23	AB individual medical record*	109
S22	AB individual health record*	50
S21	AB personally controlled medical record*	0
S20	AB personally controlled health record*	8
S19	AB patient accessible electronic medical record*	1
S18	AB patient accessible electronic health record*	1
S17	AB personal electronic medical record*	5
S16	AB personal electronic health record*	34
S15	AB patient-held health record*	4
S14	AB patient-held medical record*	3
S13	AB patient-held record*	37
S12	AB personal medical record*	55
S11	AB personal health record*	174
S10	(MH "Medical Records, Personal")	509
S9	AB veteran*	6,648
S8	AB senior*	8,616
S7	AB Adult*	102,799
S6	(MH "Adult")	495,487
S5	AB old*	110,100
S4	AB elder*	32,179
S3	AB patient*	490,924
S2	AB consumer*	10,507
S1	(MH "Consumers")	1,664

PsycINFO 1806 to June Week 2 2016



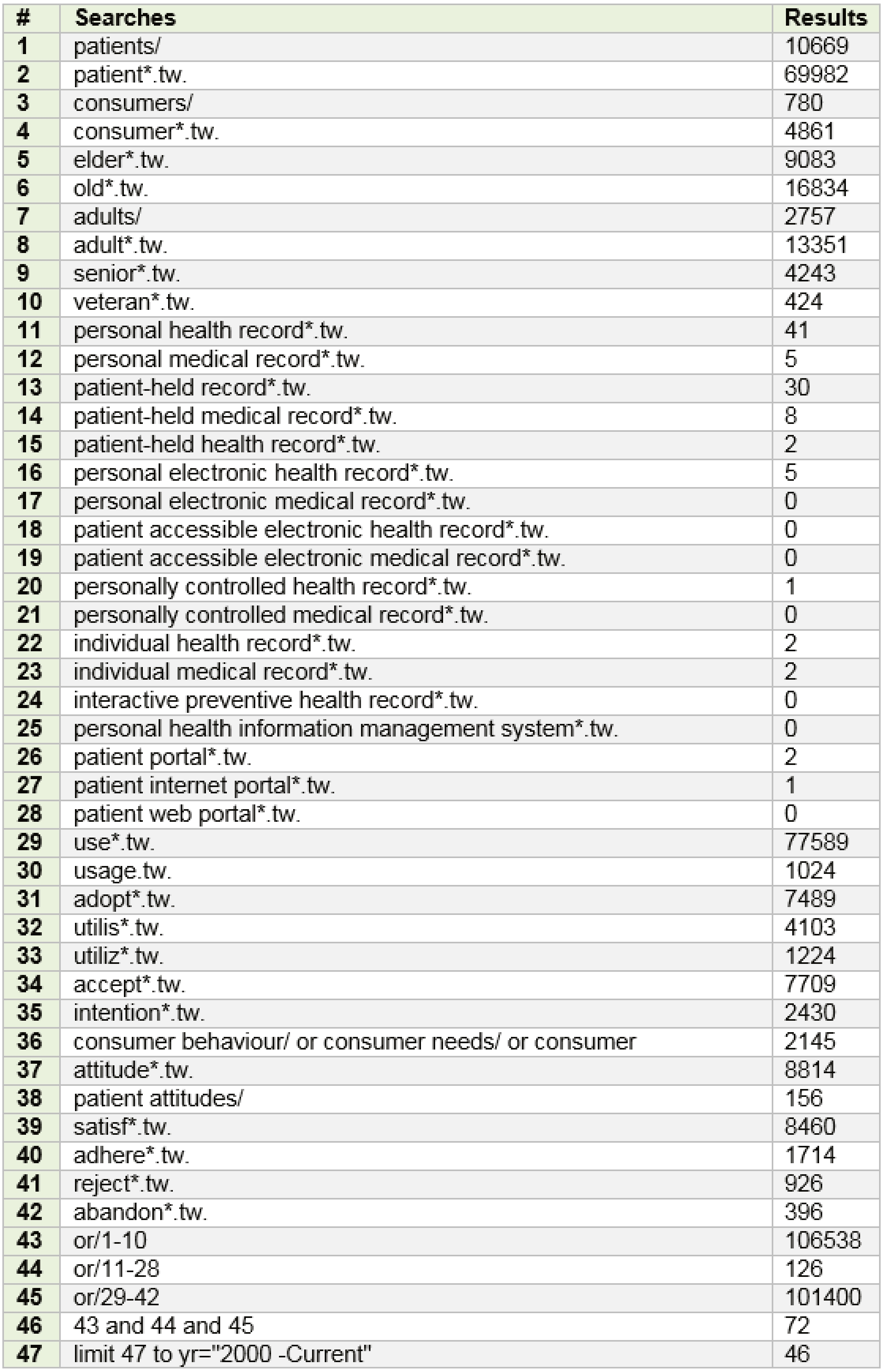
#	Searches	Results
1	*patients/	5672
2	patient*.tw.	598605
3	consumer*.tw.	45537
4	elder*.tw.	62580
5	old*.tw.	478859
6	adult*.tw.	380997
7	senior*.tw.	23600
8	veteran*.tw.	16666
9	personal health record*.tw.	130
10	personal medical record*.tw.	8
11	patient-held record*.tw.	21
12	patient-held medical record*.tw.	4
13	patient-held health record*.tw.	4
14	personal electronic health record*.tw.	1
15	personal electronic medical record*.tw.	1
16	patient accessible electronic health record*.tw.	0
17	patient accessible electronic medical record*.tw.	1
18	personally controlled health record*.tw.	5
19	personally controlled medical record*.tw.	0
20	individual health record*.tw.	1
21	individual medical record*.tw.	5
22	interactive preventive health record*.tw.	2
23	personal health information management system*.tw.	2
24	patient portal*.tw.	60
25	patient internet portal*.tw.	3
26	patient web portal*.tw.	2
27	use*.tw.	1224008
28	usage.tw.	25559
29	adopt*.tw.	71246
30	utilis*.tw.	5775
31	utiliz*.tw.	106182
32	accept*.tw.	113041
33	behavioral intention/ or intention/ or planned behavior/ or reasoned	15186
34	consumer behavior/ or consumer satisfaction/	25408
35	intention*.tw.	57602
36	attitude*.tw.	202401
37	client attitudes/	14640
38	computer attitudes/ or computer anxiety/	1498
39	adhere*.tw.	26542
40	reject*.tw.	32665
41	abandon*.tw.	9996
42	or/1-8	1303741
43	or/9-26	309
44	or/27-41	1600372
45	42 and 43 and 44	230
46	limit 47 to yr="2000 -Current"	222

Global Health 1973 to 2016 Week 22



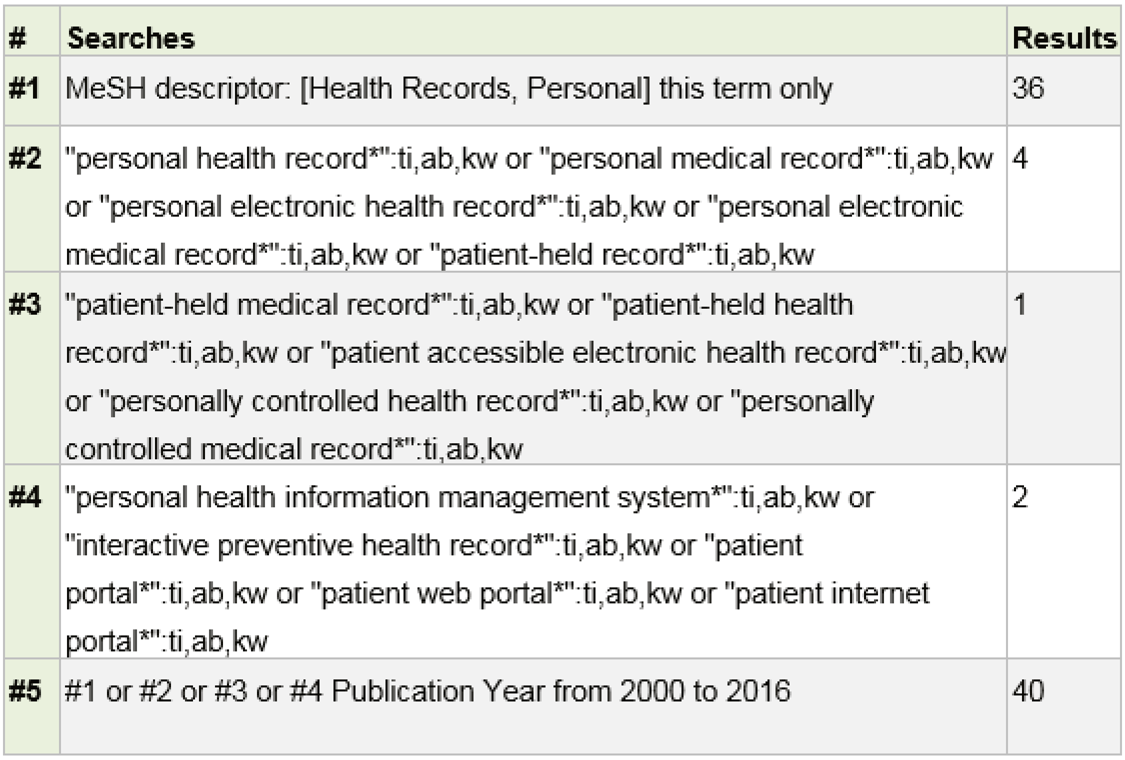
#	Searches	Results
1	patients/ or elderly patients/	23388
2	patient*.tw.	556314
3	consumer*.tw.	39089
4	adults/	49705
5	adult*.tw.	226075
6	senior*.tw.	36983
7	old*.tw.	228667
8	elder*.tw.	46015
9	veteran*.tw.	3221
10	personal health record*.tw.	50
11	personal medical record*.tw.	6
12	patient-held record*.tw.	5
13	patient-held medical record*.tw.	2
14	patient-held health record*.tw.	2
15	personal electronic health record*.tw.	0
16	personal electronic medical record*.tw.	0
17	patient accessible electronic health record*.tw.	0
18	patient accessible electronic medical record*.tw.	0
19	personally controlled health record*.tw.	0
20	personally controlled medical record*.tw.	0
21	individual health record*.tw.	9
22	individual medical record*.tw.	19
23	interactive preventive health record*.tw.	0
24	personal health information management system*.tw.	0
25	patient portal*.tw.	8
26	patient internet portal*.tw.	0
27	patient web portal*.tw.	1
28	use*.tw.	829458
29	usage.tw.	18482
30	adopt*.tw.	29991
31	utilis*.tw.	7477
32	utiliz*.tw.	67309
33	accept*.tw.	51476
34	consumer attitudes/ or attitudes/ or exp consumer behaviour/	40941
35	consumer preferences/ or consumer satisfaction/	4008
36	attitude*.tw.	48976
37	satisf*.tw.	27985
38	adhere*.tw.	24364
39	reject*.tw.	6569
40	abandon*.tw.	2339
41	intention*.tw.	12301
42	or/1-9	877242
43	or/10-27	220
44	or/29-41	973158
45	42 and 43 and 44	121
46	limit 47 to yr="2000 -Current"	119

HMIC Health Management Information Consortium 1983 - present



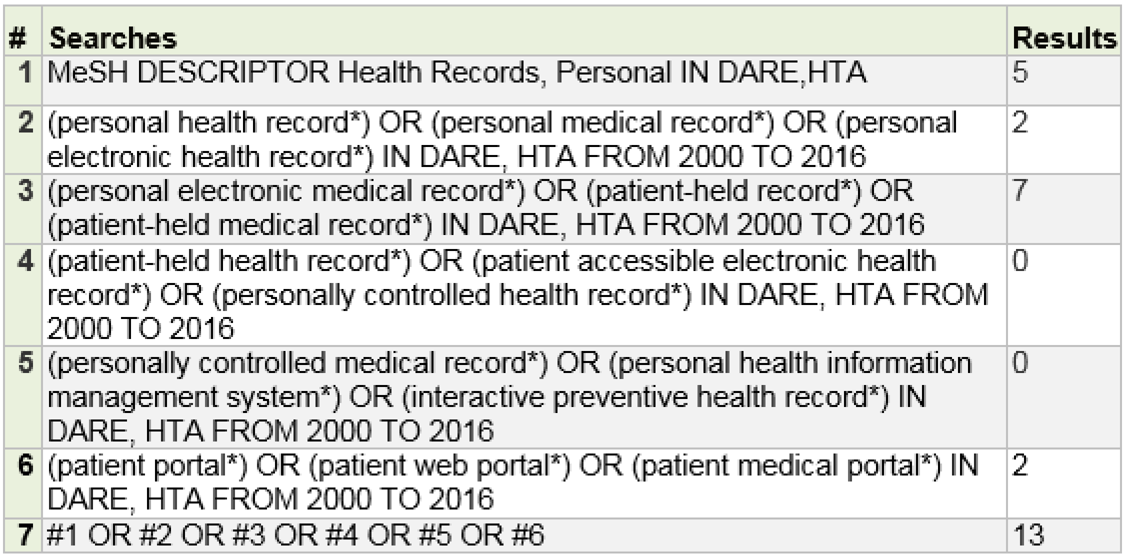
#	Searches	Results
1	patients/	10669
2	patient*.tw.	69982
3	consumers/	780
4	consumer*.tw.	4861
5	elder*.tw.	9083
6	old*.tw.	16834
7	adults/	2757
8	adult*.tw.	13351
9	senior*.tw.	4243
10	veteran*.tw.	424
11	personal health record*.tw.	41
12	personal medical record*.tw.	5
13	patient-held record*.tw.	30
14	patient-held medical record*.tw.	8
15	patient-held health record*.tw.	2
16	personal electronic health record*.tw.	5
17	personal electronic medical record*.tw.	0
18	patient accessible electronic health record*.tw.	0
19	patient accessible electronic medical record*.tw.	0
20	personally controlled health record*.tw.	1
21	personally controlled medical record*.tw.	0
22	individual health record*.tw.	2
23	individual medical record*.tw.	2
24	interactive preventive health record*.tw.	0
25	personal health information management system*.tw.	0
26	patient portal*.tw.	2
27	patient internet portal*.tw.	1
28	patient web portal*.tw.	0
29	use*.tw.	77589
30	usage.tw.	1024
31	adopt*.tw.	7489
32	utilis*.tw.	4103
33	utiliz*.tw.	1224
34	accept*.tw.	7709
35	intention*.tw.	2430
36	consumer behaviour/ or consumer needs/ or consumer	2145
37	attitude*.tw.	8814
38	patient attitudes/	156
39	satisf*.tw.	8460
40	adhere*.tw.	1714
41	reject*.tw.	926
42	abandon*.tw.	396
43	or/1-10	106538
44	or/11-28	126
45	or/29-42	101400
46	43 and 44 and 45	72
47	limit 47 to yr="2000 -Current"	46

Cochrane Library



#	Searches	Results
#1	MeSH descriptor: [Health Records, Personal] this term only	36
#2	"personal health record*":ti,ab,kw or "personal medical record*":ti,ab,kw or "personal electronic health record*":ti,ab,kw or "personal electronic medical record*":ti,ab,kw or "patient-held record*":ti,ab,kw	4
#3	"patient-held medical record*":ti,ab,kw or "patient-held health record*":ti,ab,kw or "patient accessible electronic health record*":ti,ab,kw or "personally controlled health record*":ti,ab,kw or "personally controlled medical record*":ti,ab,kw	1
#4	"personal health information management system*":ti,ab,kw or "interactive preventive health record*":ti,ab,kw or "patient portal*":ti,ab,kw or "patient web portal*":ti,ab,kw or "patient internet portal*":ti,ab,kw	2
#5	#1 or #2 or #3 or #4 Publication Year from 2000 to 2016	40

DARE & HTA (Centre of Reviews and Dissemination)



#	Searches	Results
1	MeSH DESCRIPTOR Health Records, Personal IN DARE,HTA	5
2	(personal health record*) OR (personal medical record*) OR (personal electronic health record*) IN DARE, HTA FROM 2000 TO 2016	2
3	(personal electronic medical record*) OR (patient-held record*) OR (patient-held medical record*) IN DARE, HTA FROM 2000 TO 2016	7
4	(patient-held health record*) OR (patient accessible electronic health record*) OR (personally controlled health record*) IN DARE, HTA FROM 2000 TO 2016	0
5	(personally controlled medical record*) OR (personal health information management system*) OR (interactive preventive health record*) IN DARE, HTA FROM 2000 TO 2016	0
6	(patient portal*) OR (patient web portal*) OR (patient medical portal*) IN DARE, HTA FROM 2000 TO 2016	2
7	#1 OR #2 OR #3 OR #4 OR #5 OR #6	13

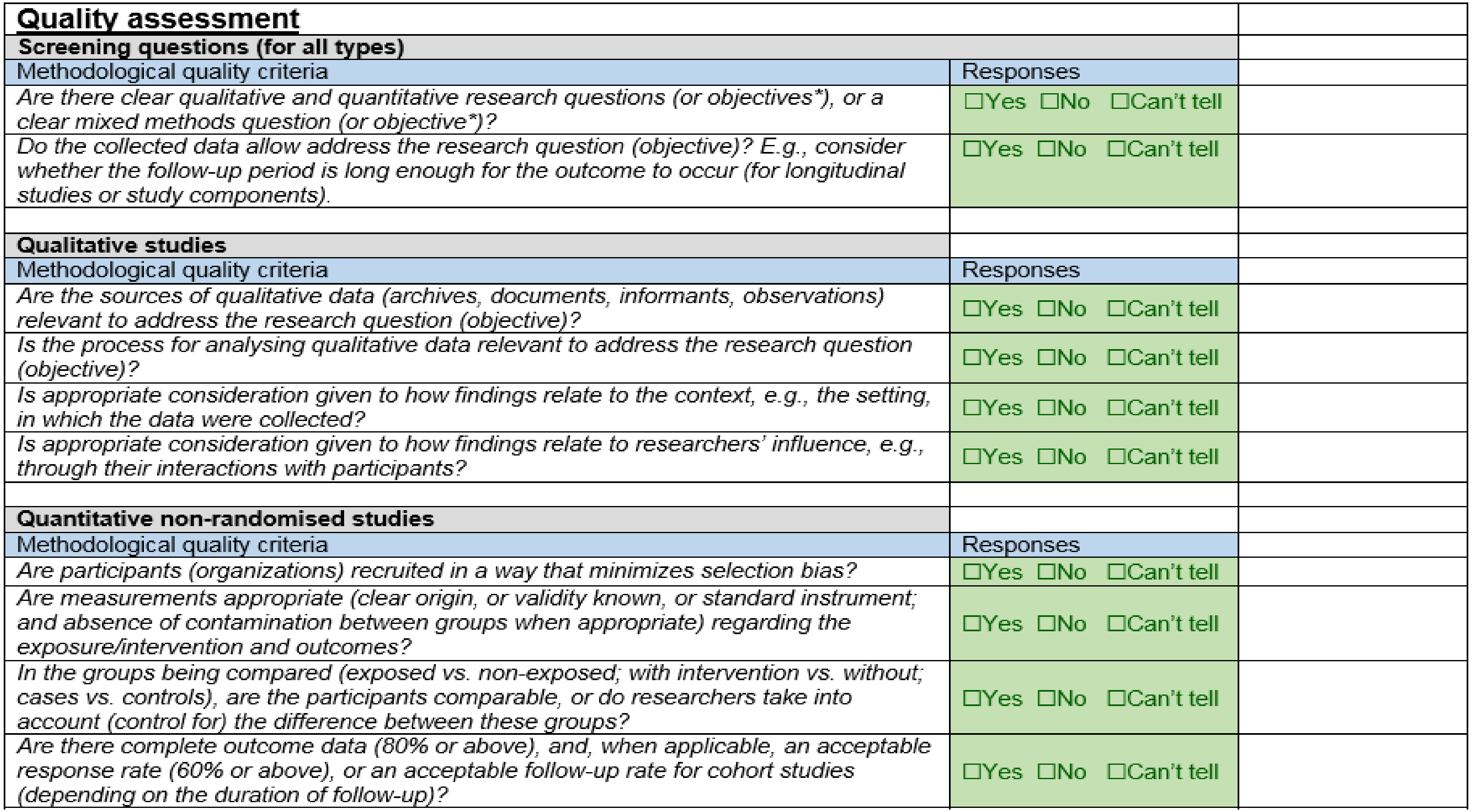
Appendix 6: Data Extraction Form

Identifying information	**Extracted data**	**Comments**
Reviewer extracting data	☐AA ☐HF ☐PG ☐HP	
Date of data extraction		
Study ID		
First author		
Year of study		
Title		
Country of origin	☐USA ☐UK ☐Canada ☐Australia ☐Other (specify in Comments)	
Type of publication	☐ Journal article ☐Conference proceeding/abstract ☐Report ☐Others	
Verification of eligibility		
Is the intervention a tethered PHR that has the predefined functions?	☐Yes ☐No	
Did the study report the factors affecting patients' use/ intention to use PHRs?	☐Yes ☐No	
Are the participants healthcare consumers?	☐Yes ☐No	
Is it an observational study qualitative, secondary data analysis or mixed method?	☐Yes ☐No	
Final decision	☐Include ☐Exclude	
Study characteristics		
Study Method	☐Quantitative ☐Qualitative ☐Mixed methods	
Study design	☐Cross-sectional ☐Cohort ☐Case-Control ☐Qualitative ☐Mixed methods	
Study aim		
Study setting		
Instrumentation	☐Survey ☐Interview ☐Focus group ☐System log ☐EHR patients data	
Inclusion criteria		
Exclusion criteria		
Study period		
Theory/ model used	☐Yes (specify in Comments) ☐No	

Participant characteristics		
Number of participants enrolled, responded, included in analysis, response rate	Enrolled: responded: Included in analysis: Response rate:	
Number of withdrawals, exclusions, lost to follow-up		
Range of age (Mean age)		
Gender (Female)		
Ethnicity		
Other socio-demographics		
Disease characteristics		
Intervention characteristics		
PHR name		
PHR functions	☐Accessing medical record ☐Booking appointments ☐Requesting repeat prescriptions ☐Messaging healthcare providers ☐Other (specify in the comments)	
PHR platforms	☐PC ☐Mobile ☐Personal digital assistance ☐Tablets	
Provided by	☐Primary care ☐ Hospital ☐Home care ☐Community ☐Specialised clinic ☐Other	
Outcome data		
Outcome	☐Use of ePHRs ☐Intention to use ePHRs	
Definition of the outcome measure		
Method of measure	☐Subjectively measured (self-reported) ☐Objectively measured (system logs)	

Results				
1. Quantitative factors				
Factor	**Type of analysis**		**Direction**	
			☐+ve ☐-ve ☐None	
			☐+ve ☐-ve ☐None	
			☐+ve ☐-ve ☐None	
			☐+ve ☐-ve ☐None	
2. Qualitative factors				
Factor	**Factor's source**	**Factor's type of relation to use**	**Direction**	
	☐Primary (by participants) ☐Secondary (by researcher/s)	☐Explicit ☐Inferred	☒+ve ☐-ve ☐None	
	☐Primary (by participants) ☐Secondary (by researcher/s)	☐Explicit ☐Inferred	☐+ve ☐-ve ☐None	
	☐Primary (by participants) ☐Secondary (by researcher/s)	☐Explicit ☐Inferred	☐+ve ☐-ve ☐None	
Relevant studies				
Relevant references found through reference list checking of the study				
Other relevant findings				
Author conclusion				

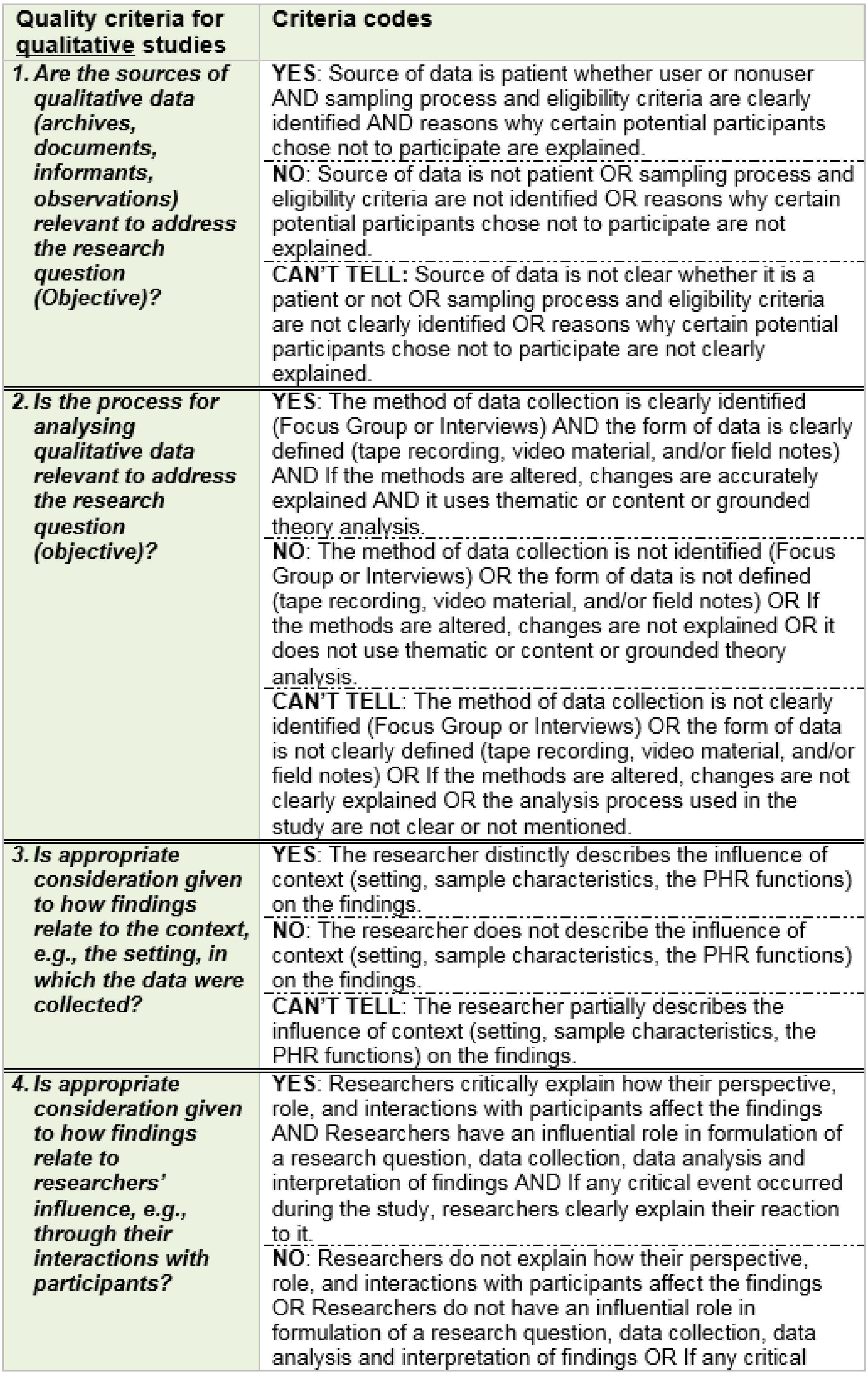
Appendix 7: Quality Assessment Form



Quality assessment		
Screening questions (for all types)		
Methodological quality criteria	Responses	
Are there clear qualitative and quantitative research questions (or objectives), or a clear mixed methods question (or objective*)?*	☐Yes ☐No ☐Can't tell	
Do the collected data allow address the research question (objective)? E.g., consider whether the follow-up period is long enough for the outcome to occur (for longitudinal studies or study components).	☐Yes ☐No ☐Can't tell	
Qualitative studies		
Methodological quality criteria	Responses	
Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	☐Yes ☐No ☐Can't tell	
Is the process for analysing qualitative data relevant to address the research question (objective)?	☐Yes ☐No ☐Can't tell	
Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	☐Yes ☐No ☐Can't tell	
Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?	☐Yes ☐No ☐Can't tell	
Quantitative non-randomised studies		
Methodological quality criteria	Responses	
Are participants (organizations) recruited in a way that minimizes selection bias?	☐Yes ☐No ☐Can't tell	
Are measurements appropriate (clear origin, or validity known, or standard instrument; and absence of contamination between groups when appropriate) regarding the exposure/intervention and outcomes?	☐Yes ☐No ☐Can't tell	
In the groups being compared (exposed vs. non-exposed; with intervention vs. without; cases vs. controls), are the participants comparable, or do researchers take into account (control for) the difference between these groups?	☐Yes ☐No ☐Can't tell	
Are there complete outcome data (80% or above), and, when applicable, an acceptable response rate (60% or above), or an acceptable follow-up rate for cohort studies (depending on the duration of follow-up)?	☐Yes ☐No ☐Can't tell	

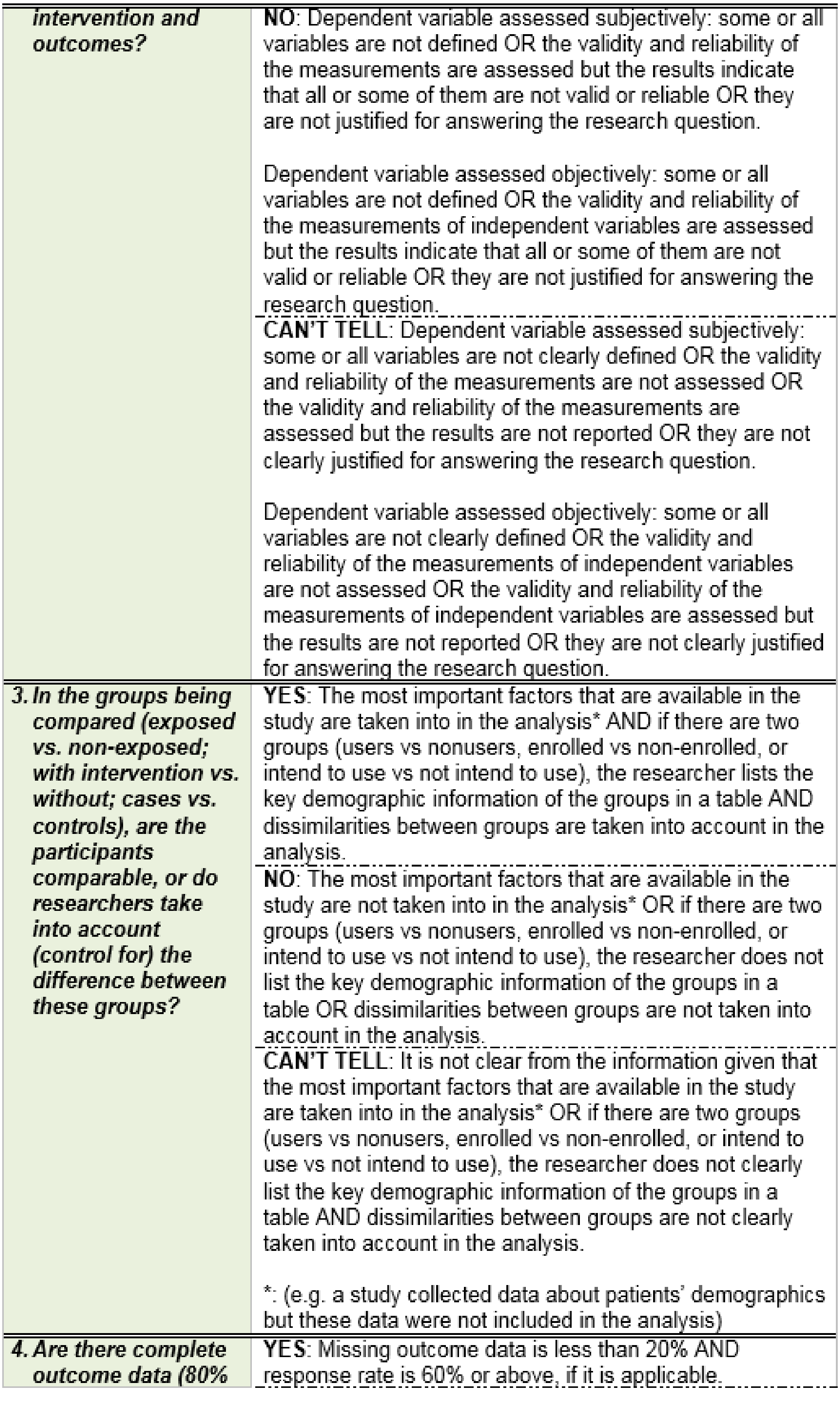
Mixed methods		
Methodological quality criteria	Responses	
Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)?	☐Yes ☐No ☐Can't tell	
Is the integration of qualitative and quantitative data (or results) relevant to address the research question (objective)?*	☐Yes ☐No ☐Can't tell	
Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results) in a triangulation design?*	☐Yes ☐No ☐Can't tell	

Appendix 8: Coding Guidelines for Quality Criteria

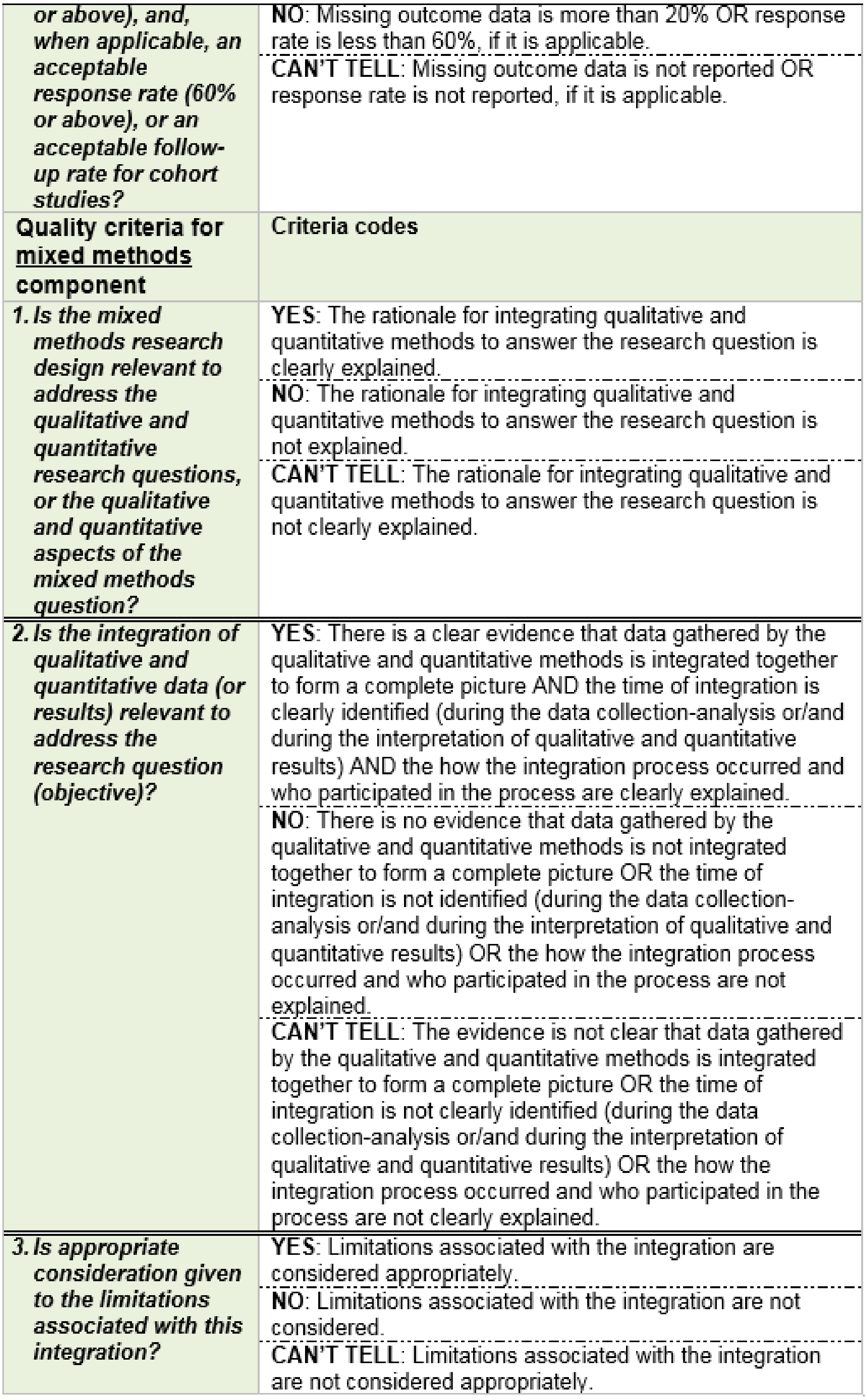


Quality criteria for <u>qualitative</u> studies	**Criteria codes**
1. Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (Objective)?	**YES**: Source of data is patient whether user or nonuser AND sampling process and eligibility criteria are clearly identified AND reasons why certain potential participants chose not to participate are explained. **NO**: Source of data is not patient OR sampling process and eligibility criteria are not identified OR reasons why certain potential participants chose not to participate are not explained. **CAN'T TELL:** Source of data is not clear whether it is a patient or not OR sampling process and eligibility criteria are not clearly identified OR reasons why certain potential participants chose not to participate are not clearly explained.
2. Is the process for analysing qualitative data relevant to address the research question (objective)?	**YES**: The method of data collection is clearly identified (Focus Group or Interviews) AND the form of data is clearly defined (tape recording, video material, and/or field notes) AND If the methods are altered, changes are accurately explained AND it uses thematic or content or grounded theory analysis. **NO**: The method of data collection is not identified (Focus Group or Interviews) OR the form of data is not defined (tape recording, video material, and/or field notes) OR If the methods are altered, changes are not explained OR it does not use thematic or content or grounded theory analysis. **CAN'T TELL**: The method of data collection is not clearly identified (Focus Group or Interviews) OR the form of data is not clearly defined (tape recording, video material, and/or field notes) OR If the methods are altered, changes are not clearly explained OR the analysis process used in the study are not clear or not mentioned.
3. Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	**YES**: The researcher distinctly describes the influence of context (setting, sample characteristics, the PHR functions) on the findings. **NO**: The researcher does not describe the influence of context (setting, sample characteristics, the PHR functions) on the findings. **CAN'T TELL**: The researcher partially describes the influence of context (setting, sample characteristics, the PHR functions) on the findings.
4. Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?	**YES**: Researchers critically explain how their perspective, role, and interactions with participants affect the findings AND Researchers have an influential role in formulation of a research question, data collection, data analysis and interpretation of findings AND If any critical event occurred during the study, researchers clearly explain their reaction to it. **NO**: Researchers do not explain how their perspective, role, and interactions with participants affect the findings OR Researchers do not have an influential role in formulation of a research question, data collection, data analysis and interpretation of findings OR If any critical

	event occurred during the study, researchers do not explain their reaction to it.
	CAN'T TELL: Researchers partially explain how their perspective, role, and interactions with participants affect the findings OR Researchers do not mention his role or have partially an influential role in formulation of a research question, data collection, data analysis and interpretation of findings. OR If any critical event occurred during the study, researchers do not clearly explain their reaction to it.
Quality criteria for quantitative studies	**Criteria codes**
1. Are participants (organizations) recruited in a way that minimizes selection bias?	**YES**: Survey: the characteristics of participants are compared with the population characteristics AND there are no significant differences between the sample and population characteristics. Secondary data analysis: Most of eligible data are included in the analysis OR the characteristics of the drawn sample are compared with the characteristics of all data in the system AND there are no significant differences between the sample and all data characteristics.
	NO: Survey: the characteristics of participants are compared with the population characteristics AND there are significant differences between the sample and population characteristics. Secondary data analysis: Most of eligible data are not included in the analysis AND the characteristics of the drawn sample are compared with the characteristics of all data in the system AND there are significant differences between the sample and all data characteristics.
	CAN'T TELL: Survey: The characteristics of participants are not compared with the population characteristics AND it is not clear if the sample is representative. Secondary data analysis: Most of eligible data are not included in the analysis AND the characteristics of the drawn sample are not compared with the characteristics of all data in the system AND it is not clear if the sample is representative.
2. Are measurements appropriate (clear origin, or validity known, or standard instrument; and absence of contamination between groups when appropriate) regarding the exposure/	**YES**: Dependent variable assessed subjectively: all variables are clearly defined AND the validity and reliability of the measurements are assessed and reported as valid and reliable measurements AND they are clearly justified for answering the research question. Dependent variable assessed objectively: all variables are clearly defined AND the validity and reliability of the measurements of independent variables are assessed and reported as valid and reliable measurements AND they are clearly justified for answering the research question.



intervention and outcomes?	**NO**: Dependent variable assessed subjectively: some or all variables are not defined OR the validity and reliability of the measurements are assessed but the results indicate that all or some of them are not valid or reliable OR they are not justified for answering the research question. Dependent variable assessed objectively: some or all variables are not defined OR the validity and reliability of the measurements of independent variables are assessed but the results indicate that all or some of them are not valid or reliable OR they are not justified for answering the research question.
	CAN'T TELL: Dependent variable assessed subjectively: some or all variables are not clearly defined OR the validity and reliability of the measurements are not assessed OR the validity and reliability of the measurements are assessed but the results are not reported OR they are not clearly justified for answering the research question. Dependent variable assessed objectively: some or all variables are not clearly defined OR the validity and reliability of the measurements of independent variables are not assessed OR the validity and reliability of the measurements of independent variables are assessed but the results are not reported OR they are not clearly justified for answering the research question.
3. In the groups being compared (exposed vs. non-exposed; with intervention vs. without; cases vs. controls), are the participants comparable, or do researchers take into account (control for) the difference between these groups?	**YES**: The most important factors that are available in the study are taken into in the analysis* AND if there are two groups (users vs nonusers, enrolled vs non-enrolled, or intend to use vs not intend to use), the researcher lists the key demographic information of the groups in a table AND dissimilarities between groups are taken into account in the analysis.
	NO: The most important factors that are available in the study are not taken into in the analysis* OR if there are two groups (users vs nonusers, enrolled vs non-enrolled, or intend to use vs not intend to use), the researcher does not list the key demographic information of the groups in a table OR dissimilarities between groups are not taken into account in the analysis.
	CAN'T TELL: It is not clear from the information given that the most important factors that are available in the study are taken into in the analysis* OR if there are two groups (users vs nonusers, enrolled vs non-enrolled, or intend to use vs not intend to use), the researcher does not clearly list the key demographic information of the groups in a table AND dissimilarities between groups are not clearly taken into account in the analysis. *: (e.g. a study collected data about patients' demographics but these data were not included in the analysis)
4. Are there complete outcome data (80%	**YES**: Missing outcome data is less than 20% AND response rate is 60% or above, if it is applicable.



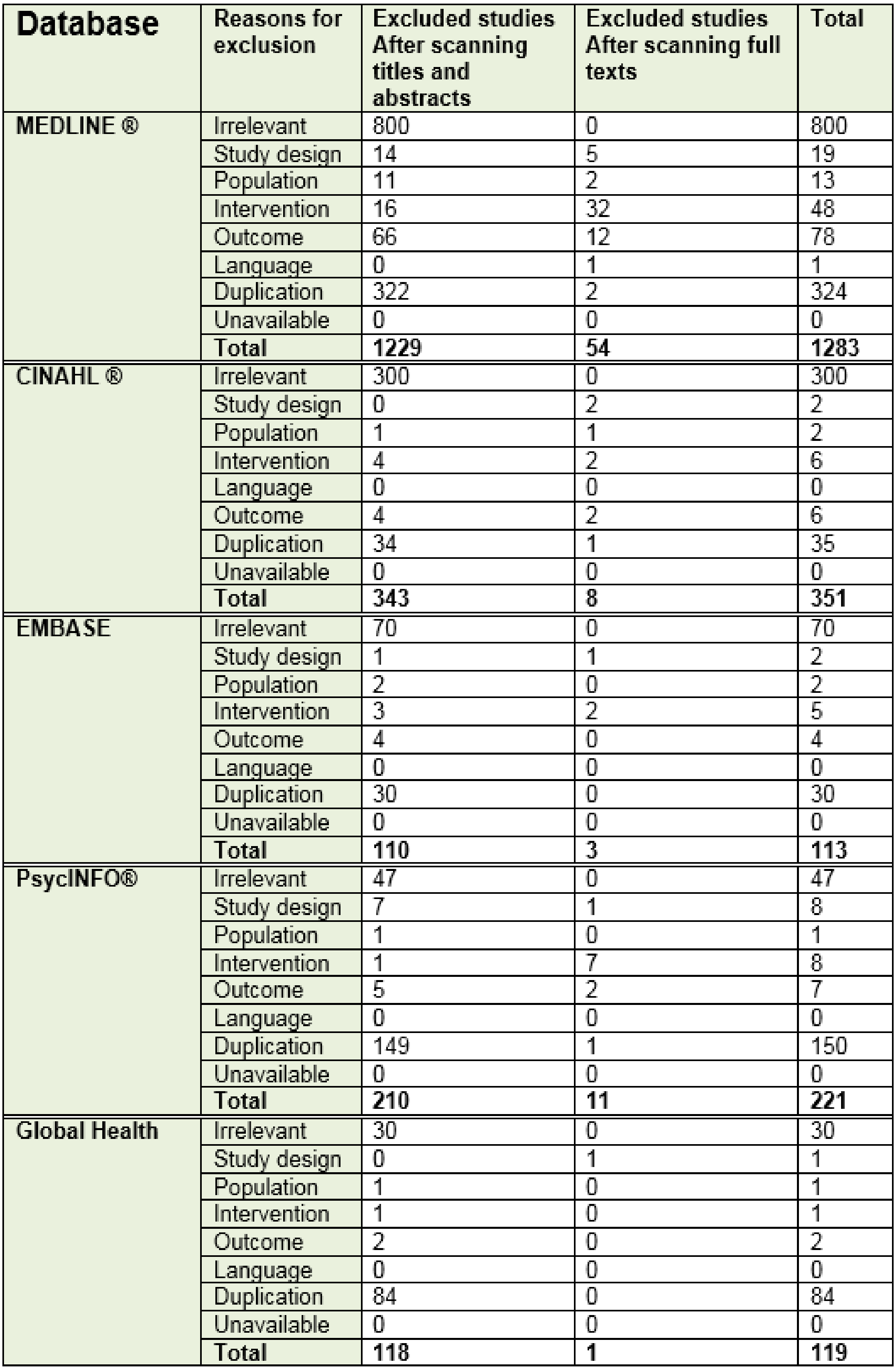
or above), and, when applicable, an acceptable response rate (60% or above), or an acceptable follow-up rate for cohort studies?	**NO**: Missing outcome data is more than 20% OR response rate is less than 60%, if it is applicable. **CAN'T TELL**: Missing outcome data is not reported OR response rate is not reported, if it is applicable.
Quality criteria for mixed methods component	**Criteria codes**
1. Is the mixed methods research design relevant to address the qualitative and quantitative research questions, or the qualitative and quantitative aspects of the mixed methods question?	**YES**: The rationale for integrating qualitative and quantitative methods to answer the research question is clearly explained. **NO**: The rationale for integrating qualitative and quantitative methods to answer the research question is not explained. **CAN'T TELL**: The rationale for integrating qualitative and quantitative methods to answer the research question is not clearly explained.
2. Is the integration of qualitative and quantitative data (or results) relevant to address the research question (objective)?	**YES**: There is a clear evidence that data gathered by the qualitative and quantitative methods is integrated together to form a complete picture AND the time of integration is clearly identified (during the data collection-analysis or/and during the interpretation of qualitative and quantitative results) AND the how the integration process occurred and who participated in the process are clearly explained. **NO**: There is no evidence that data gathered by the qualitative and quantitative methods is not integrated together to form a complete picture OR the time of integration is not identified (during the data collection-analysis or/and during the interpretation of qualitative and quantitative results) OR the how the integration process occurred and who participated in the process are not explained. **CAN'T TELL**: The evidence is not clear that data gathered by the qualitative and quantitative methods is integrated together to form a complete picture OR the time of integration is not clearly identified (during the data collection-analysis or/and during the interpretation of qualitative and quantitative results) OR the how the integration process occurred and who participated in the process are not clearly explained.
3. Is appropriate consideration given to the limitations associated with this integration?	**YES**: Limitations associated with the integration are considered appropriately. **NO**: Limitations associated with the integration are not considered. **CAN'T TELL**: Limitations associated with the integration are not considered appropriately.

Appendix 9: Included Studies in each Step of the Selection Process

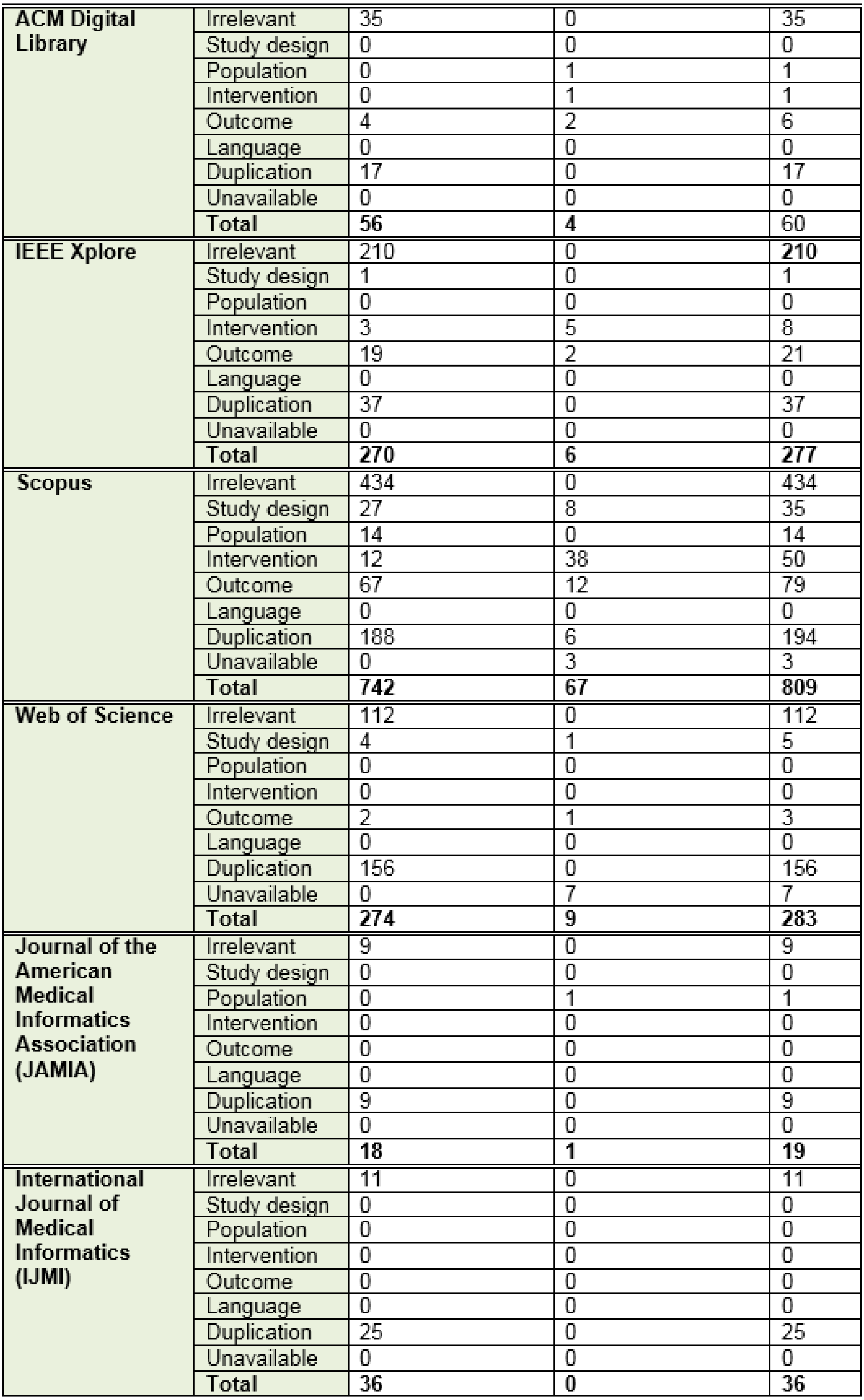
Database	Hits	After removing duplicated studies	After screening titles and abstracts	After screening full texts
MEDLINE ®	1302	980	73	19
CINAHL ®	352	318	9	1
EMBASE	113	83	3	0
PsycINFO®	222	73	12	1
Global Health	119	35	1	0
ACM Digital Library	60	43	4	0
IEEE Xplore	279	245	9	2
Scopus	841	653	99	32
Web of Science	285	129	8	2
Journal of the American Medical Informatics Association (JAMIA)	19	10	1	0
International Journal of Medical Informatics (IJMI)	36	11	0	0
Telemedicine and e-Health	18	2	0	0
Health Informatics Journal (HIJ)	24	22	1	0
Journal of Medical Systems (JMS)	78	57	0	0
LILACS Database (Literatura Latino Americana em ciencias da Saude)	4	4	0	0
Library & Information Networks for Knowledge Database (WHOLIS)	0	0	0	0
African Index Medicus (AIM)	0	0	0	0
Africa (AFRO) library database (AFROLIB)	0	0	0	0
WHO Regional Office for Europe	16	16	0	0
Index Medicus for the Eastern Mediterranean Region (IMEMR)	4	3	0	0
Western Pacific Region Index Medicus (WPRIM)	18	9	0	0

WHO Regional Office for South-East Asia (WROSEA)	3	3	0	0
WHO Regional Office for Americas (PAHO)	1	1	0	0
National Library of Australia (NLA)	28	21	0	0
IndMED	0	0	0	0
KoreaMed	16	4	0	0
ProQuest Dissertations & Theses Database	202	126	9	3
Electronic Theses Online Service (EThOS)	18	14	0	0
DART-Europe E-theses Portal	10	10	0	0
Networked Digital Library of Theses and Dissertations (NDLTD)	66	58	6	1
Theses Canada	7	2	0	0
Brazilian Digital Library of Theses and Dissertations (BDLTD)	0	0	0	0
South African Theses and Dissertations (SATD)	2	2	0	0
Hong Kong University Theses	0	0	0	0
System for Information on Grey Literature in Europe (openSIGILE)	6	6	0	0
COPAC	38	17	0	0
BMC Proceedings	0	0	0	0
ISI Proceedings	0	0	0	0
NHS Evidence	265	193	0	0
ISRCTN registry	0	0	0	0
Explore the British Library	73	15	1	1
Health Management Information Consortium (HMIC)	46	9	0	0
Google Scholar	100	55	5	4
Turning Research Into Practice (TRIP)	172	19	1	0
Total	**4843**	**3250**	**245**	**66**

Appendix 10: Excluded Studies in each Step of the Selection Process

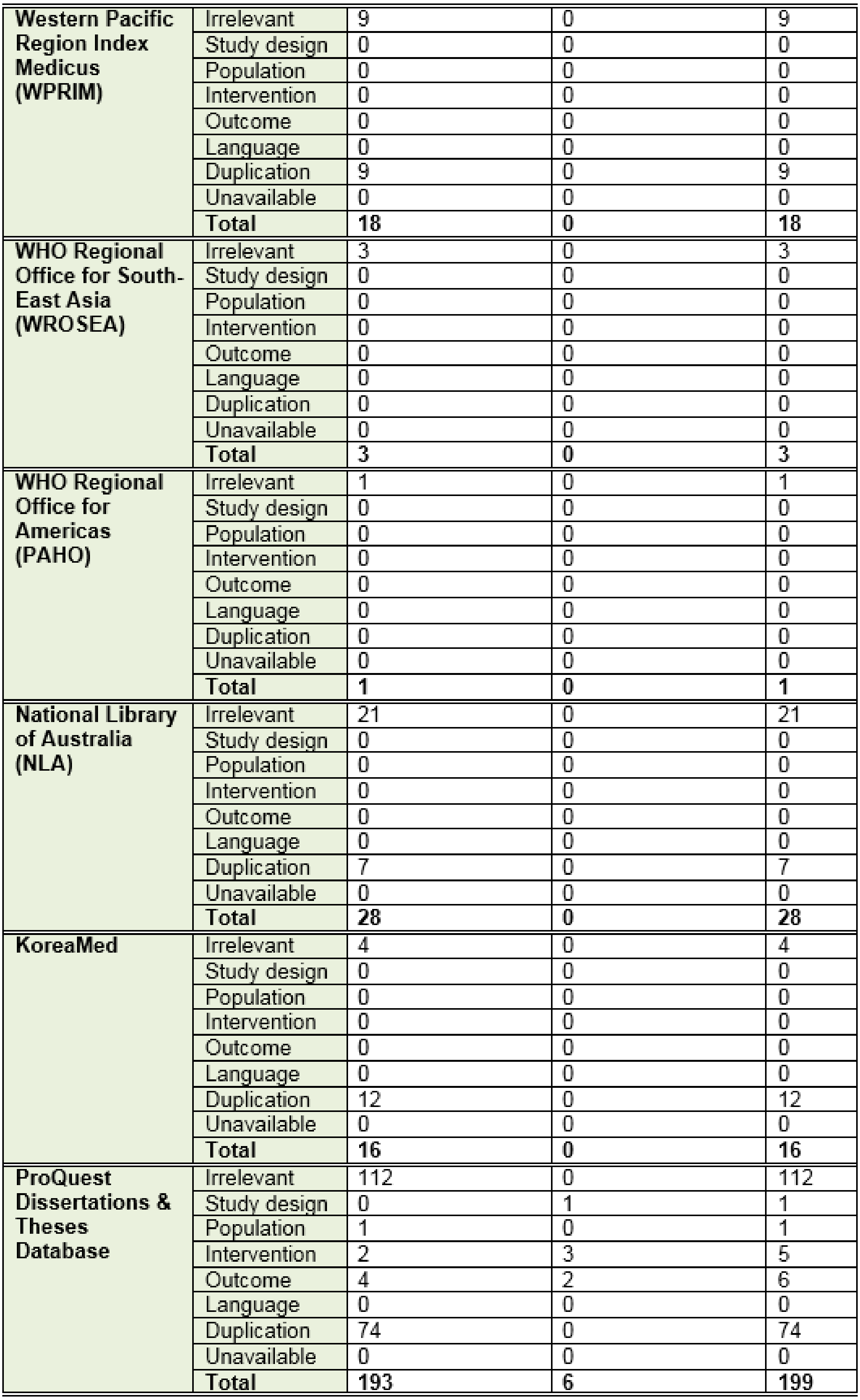


Database	Reasons for exclusion	Excluded studies After scanning titles and abstracts	Excluded studies After scanning full texts	Total
MEDLINE ®	Irrelevant	800	0	800
	Study design	14	5	19
	Population	11	2	13
	Intervention	16	32	48
	Outcome	66	12	78
	Language	0	1	1
	Duplication	322	2	324
	Unavailable	0	0	0
	Total	**1229**	**54**	**1283**
CINAHL ®	Irrelevant	300	0	300
	Study design	0	2	2
	Population	1	1	2
	Intervention	4	2	6
	Language	0	0	0
	Outcome	4	2	6
	Duplication	34	1	35
	Unavailable	0	0	0
	Total	**343**	**8**	**351**
EMBASE	Irrelevant	70	0	70
	Study design	1	1	2
	Population	2	0	2
	Intervention	3	2	5
	Outcome	4	0	4
	Language	0	0	0
	Duplication	30	0	30
	Unavailable	0	0	0
	Total	**110**	**3**	**113**
PsycINFO®	Irrelevant	47	0	47
	Study design	7	1	8
	Population	1	0	1
	Intervention	1	7	8
	Outcome	5	2	7
	Language	0	0	0
	Duplication	149	1	150
	Unavailable	0	0	0
	Total	**210**	**11**	**221**
Global Health	Irrelevant	30	0	30
	Study design	0	1	1
	Population	1	0	1
	Intervention	1	0	1
	Outcome	2	0	2
	Language	0	0	0
	Duplication	84	0	84
	Unavailable	0	0	0
	Total	**118**	**1**	**119**



ACM Digital Library	Irrelevant	35	0	35
	Study design	0	0	0
	Population	0	1	1
	Intervention	0	1	1
	Outcome	4	2	6
	Language	0	0	0
	Duplication	17	0	17
	Unavailable	0	0	0
	Total	**56**	**4**	60
IEEE Xplore	Irrelevant	210	0	**210**
	Study design	1	0	1
	Population	0	0	0
	Intervention	3	5	8
	Outcome	19	2	21
	Language	0	0	0
	Duplication	37	0	37
	Unavailable	0	0	0
	Total	**270**	**6**	**277**
Scopus	Irrelevant	434	0	434
	Study design	27	8	35
	Population	14	0	14
	Intervention	12	38	50
	Outcome	67	12	79
	Language	0	0	0
	Duplication	188	6	194
	Unavailable	0	3	3
	Total	**742**	**67**	**809**
Web of Science	Irrelevant	112	0	112
	Study design	4	1	5
	Population	0	0	0
	Intervention	0	0	0
	Outcome	2	1	3
	Language	0	0	0
	Duplication	156	0	156
	Unavailable	0	7	7
	Total	**274**	**9**	**283**
Journal of the American Medical Informatics Association (JAMIA)	Irrelevant	9	0	9
	Study design	0	0	0
	Population	0	1	1
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	9	0	9
	Unavailable	0	0	0
	Total	**18**	**1**	**19**
International Journal of Medical Informatics (IJMI)	Irrelevant	11	0	11
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	25	0	25
	Unavailable	0	0	0
	Total	**36**	**0**	**36**

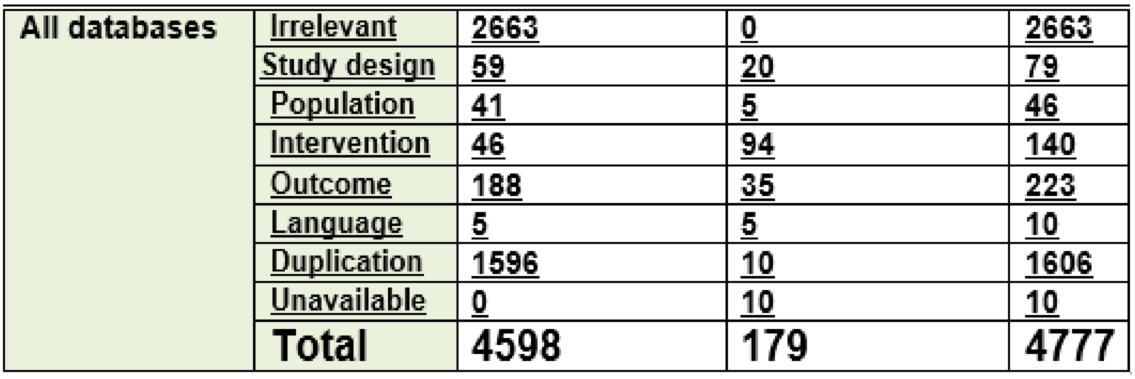
Telemedicine and e-Health	Irrelevant	2	0	2
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	16	0	16
	Unavailable	0	0	0
	Total	**18**	**0**	**18**
Health Informatics Journal (HIJ)	Irrelevant	20	0	20
	Study design	0	0	0
	Population	1	0	1
	Intervention	0	1	1
	Outcome	0	0	0
	Language	0	0	0
	Duplication	2	0	2
	Unavailable	0	0	0
	Total	**23**	**1**	**24**
Journal of Medical Systems (JMS)	Irrelevant	57	0	57
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	21	0	21
	Unavailable	0	0	0
	Total	**78**	**0**	78
LILACS Database (Literatura Latino Americana em ciencias da Saude)	Irrelevant	2	0	2
	Study design	1	0	1
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	1	0	1
	Duplication	0	0	0
	Unavailable	0	0	0
	Total	**4**	**0**	**4**
WHO Regional Office for Europe	Irrelevant	16	0	16
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	0	0	0
	Unavailable	0	0	0
	Total	**16**	**0**	**16**
Index Medicus for the Eastern Mediterranean Region (IMEMR)	Irrelevant	3	0	3
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	1	0	1
	Unavailable	0	0	0
	Total	**4**	**0**	**4**



Western Pacific Region Index Medicus (WPRIM)	Irrelevant	9	0	9
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	9	0	9
	Unavailable	0	0	0
	Total	**18**	**0**	**18**
WHO Regional Office for South-East Asia (WROSEA)	Irrelevant	3	0	3
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	0	0	0
	Unavailable	0	0	0
	Total	**3**	**0**	**3**
WHO Regional Office for Americas (PAHO)	Irrelevant	1	0	1
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	0	0	0
	Unavailable	0	0	0
	Total	**1**	**0**	**1**
National Library of Australia (NLA)	Irrelevant	21	0	21
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	7	0	7
	Unavailable	0	0	0
	Total	**28**	**0**	**28**
KoreaMed	Irrelevant	4	0	4
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	12	0	12
	Unavailable	0	0	0
	Total	**16**	**0**	**16**
ProQuest Dissertations & Theses Database	Irrelevant	112	0	112
	Study design	0	1	1
	Population	1	0	1
	Intervention	2	3	5
	Outcome	4	2	6
	Language	0	0	0
	Duplication	74	0	74
	Unavailable	0	0	0
	Total	**193**	**6**	**199**

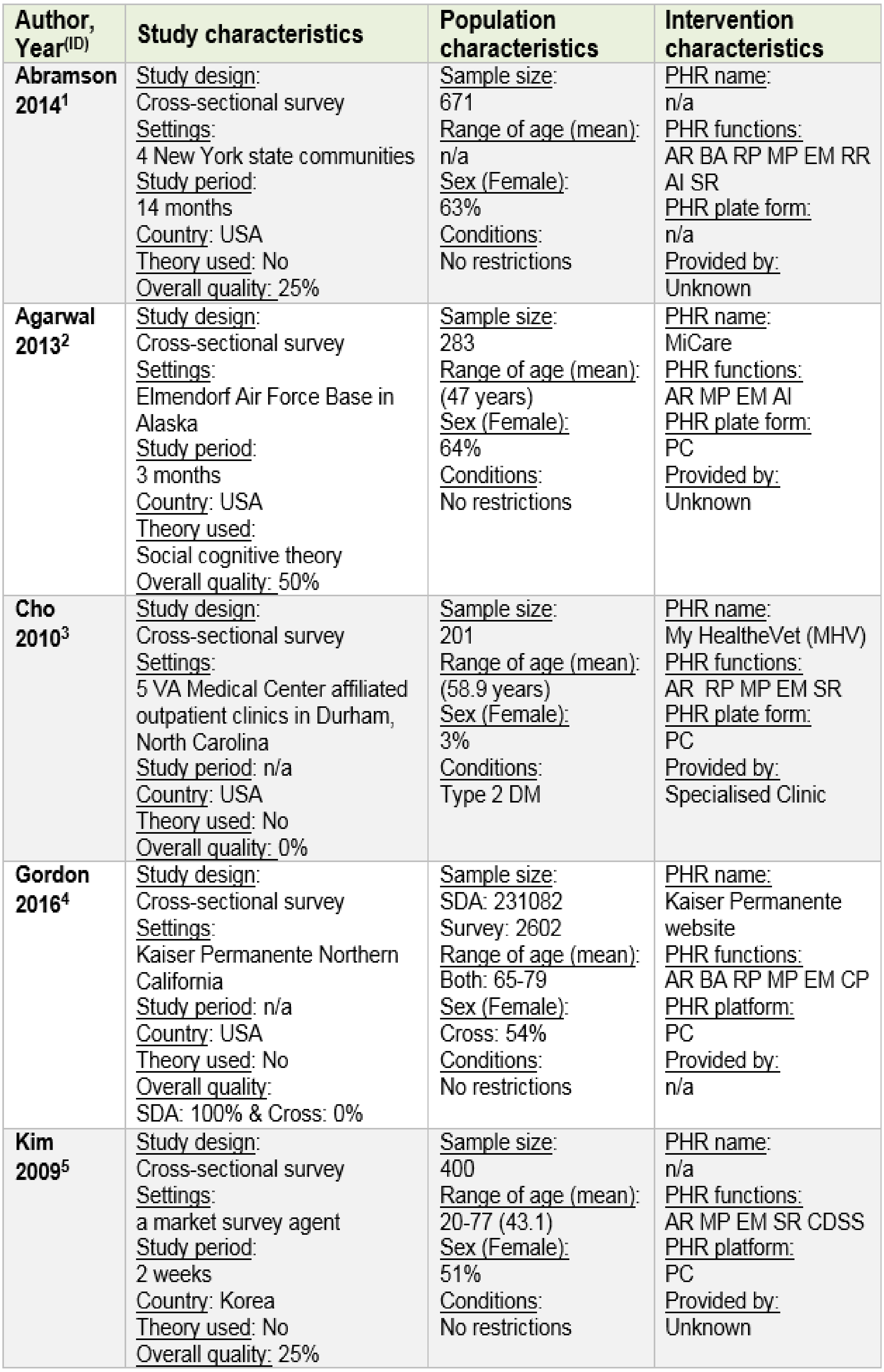
Electronic Theses Online Service (EThOS)	Irrelevant	14	0	14
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	4	0	4
	Unavailable	0	0	0
	Total	**18**	**0**	**18**
DART-Europe E-theses Portal	Irrelevant	9	0	9
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	1	0	1
	Duplication	0	0	0
	Unavailable	0	0	0
	Total	**10**	**0**	**10**
Networked Digital Library of Theses and Dissertations (NDLTD)	Irrelevant	36	0	36
	Study design	0	0	0
	Population	4	0	4
	Intervention	1	1	2
	Outcome	8	0	8
	Language	3	4	7
	Duplication	8	0	8
	Unavailable	0	0	0
	Total	**60**	**5**	**65**
Theses Canada	Irrelevant	2	0	2
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	5	0	5
	Unavailable	0	0	0
	Total	**7**	**0**	**7**
South African Theses and Dissertations (SATD)	Irrelevant	2	0	2
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	0	0	0
	Unavailable	0	0	0
	Total	**2**	**0**	**2**
System for Information on Grey Literature in Europe (openSIGILE)	Irrelevant	4	0	4
	Study design	0	0	0
	Population	1	0	1
	Intervention	0	0	0
	Outcome	1	0	1
	Language	0	0	0
	Duplication	0	0	0
	Unavailable	0	0	0
	Total	**6**	**0**	**6**

COPAC	Irrelevant	17	0	17
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	21	0	21
	Unavailable	0	0	0
	Total	**38**	**0**	**38**
NHS Evidence	Irrelevant	190	0	190
	Study design	1	0	1
	Population	0	0	0
	Intervention	1	0	1
	Outcome	1	0	1
	Language	0	0	0
	Duplication	72	0	72
	Unavailable	0	0	0
	Total	**265**	**0**	**265**
Explore the British Library	Irrelevant	14	0	14
	Study design	0	0	0
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	58	0	58
	Unavailable	0	0	0
	Total	**72**	**0**	**72**
Health Management Information Consortium (HMIC)	Irrelevant	8	0	8
	Study design	1	0	1
	Population	0	0	0
	Intervention	0	0	0
	Outcome	0	0	0
	Language	0	0	0
	Duplication	37	0	37
	Unavailable	0	0	0
	Total	**46**	**0**	**46**
Google Scholar	Irrelevant	45	0	45
	Study design	1	0	1
	Population	3	0	3
	Intervention	1	1	2
	Outcome	0	0	0
	Language	0	0	0
	Duplication	45	0	45
	Unavailable	0	0	0
	Total	**95**	**1**	96
Turning Research Into Practice (TRIP)	Irrelevant	14	0	**14**
	Study design	1	0	1
	Population	1	0	1
	Intervention	1	1	2
	Outcome	1	0	1
	Language	0	0	0
	Duplication	153	0	153
	Unavailable	0	0	0
	Total	**171**	**1**	**172**



All databases	Irrelevant	2663	0	2663
	Study design	59	20	79
	Population	41	5	46
	Intervention	46	94	140
	Outcome	188	35	223
	Language	5	5	10
	Duplication	1596	10	1606
	Unavailable	0	10	10
	Total	**4598**	**179**	**4777**

Appendix 11: Characteristics of Intention Studies



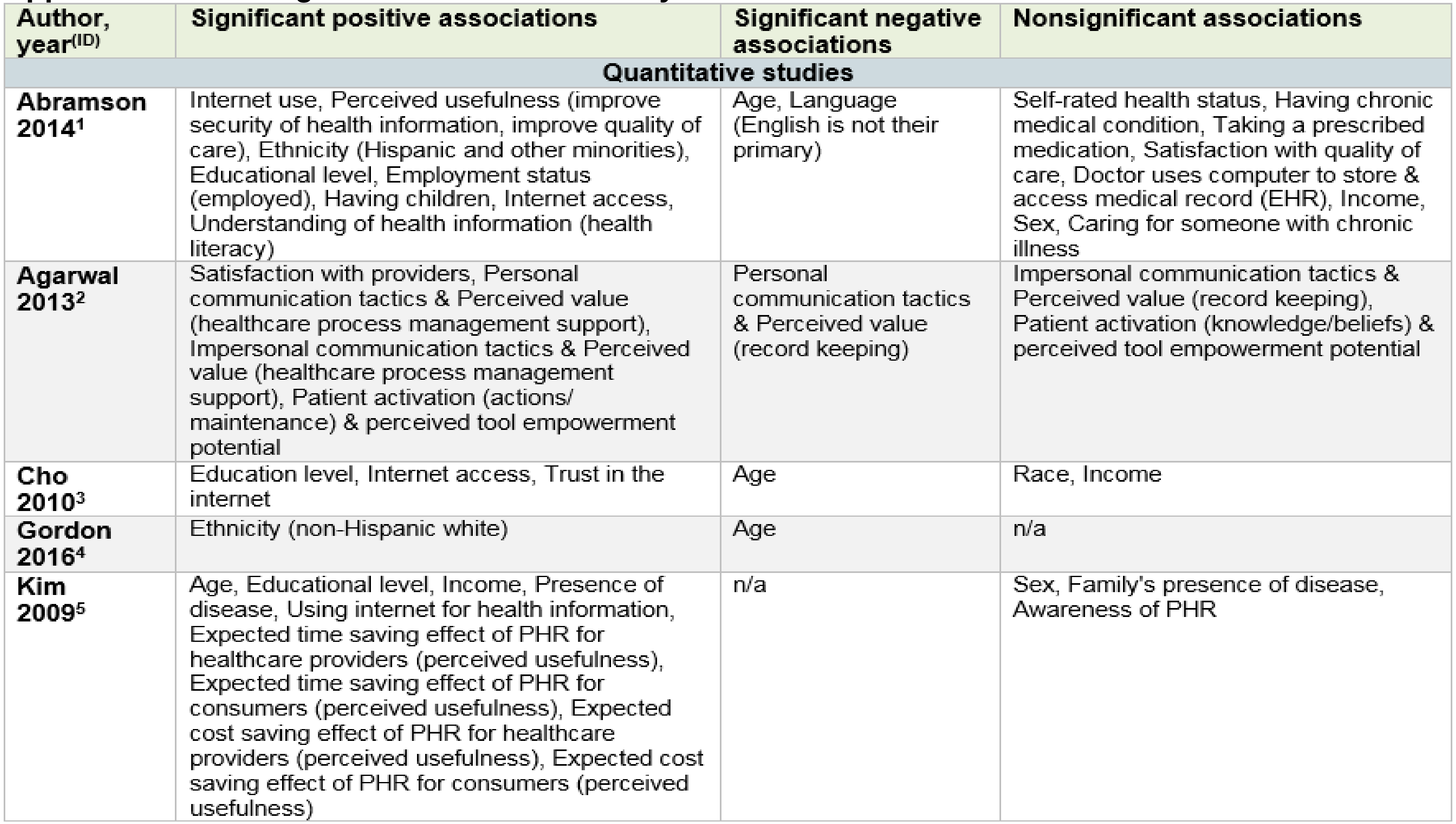
Author, Year(ID)	Study characteristics	Population characteristics	Intervention characteristics
Abramson 2014[1]	Study design: Cross-sectional survey Settings: 4 New York state communities Study period: 14 months Country: USA Theory used: No Overall quality: 25%	Sample size: 671 Range of age (mean): n/a Sex (Female): 63% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP EM RR AI SR PHR plate form: n/a Provided by: Unknown
Agarwal 2013[2]	Study design: Cross-sectional survey Settings: Elmendorf Air Force Base in Alaska Study period: 3 months Country: USA Theory used: Social cognitive theory Overall quality: 50%	Sample size: 283 Range of age (mean): (47 years) Sex (Female): 64% Conditions: No restrictions	PHR name: MiCare PHR functions: AR MP EM AI PHR plate form: PC Provided by: Unknown
Cho 2010[3]	Study design: Cross-sectional survey Settings: 5 VA Medical Center affiliated outpatient clinics in Durham, North Carolina Study period: n/a Country: USA Theory used: No Overall quality: 0%	Sample size: 201 Range of age (mean): (58.9 years) Sex (Female): 3% Conditions: Type 2 DM	PHR name: My HealtheVet (MHV) PHR functions: AR RP MP EM SR PHR plate form: PC Provided by: Specialised Clinic
Gordon 2016[4]	Study design: Cross-sectional survey Settings: Kaiser Permanente Northern California Study period: n/a Country: USA Theory used: No Overall quality: SDA: 100% & Cross: 0%	Sample size: SDA: 231082 Survey: 2602 Range of age (mean): Both: 65-79 Sex (Female): Cross: 54% Conditions: No restrictions	PHR name: Kaiser Permanente website PHR functions: AR BA RP MP EM CP PHR platform: PC Provided by: n/a
Kim 2009[5]	Study design: Cross-sectional survey Settings: a market survey agent Study period: 2 weeks Country: Korea Theory used: No Overall quality: 25%	Sample size: 400 Range of age (mean): 20-77 (43.1) Sex (Female): 51% Conditions: No restrictions	PHR name: n/a PHR functions: AR MP EM SR CDSS PHR platform: PC Provided by: Unknown

Klein 2007[6]	Study design: Cross-sectional survey Settings: n/a Study period: n/a Country: USA Theory used: TAM Overall quality: 50%	Sample size: 294 Range of age (mean): 18-74 (39.7) Sex (Female): 53.2% Conditions: No restrictions	PHR name: Internet-based patient–physician portal PHR functions: AR RP MP PHR platform: PC Provided by: Primary care and specialised clinics
Laugesen 2013[7]	Study design: Cross-sectional survey Settings: n/a Study period: 5 weeks Country: Canada Theory used: Protection Motivation Theory (PMT), Task Technology Fit (TTF), Patient Activation Measure (PAM) Overall quality:50%	Sample size: 230 Range of age (mean): n/a Sex (Female): 47% Conditions: Type 2 Diabetes	PHR name: n/a PHR functions: AR BA MP EM SR TS DC Ca PHR platform: PC & Mobile Provided by: n/a
Lazard 2016[8]	Study design: Cross-sectional survey Settings: n/a Study period: 6 months Country: USA Theory used: TAM Overall quality: 0%	Sample size: 333 Range of age (mean): 18-87 (52) Sex (Female): 72% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA MP CB PHR platform: PC Provided by: n/a
Noblin 2010[9] **2012**[10] **2013**[11]	Study design: Cross-sectional survey Settings: St. Augustine in St. Johns County and Palm Coast in Flagler County Study period: 6 weeks Country: USA Theory used: TAM Overall quality:50%	Sample size: 472 Range of age (mean): n/a Sex (Female): 73% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care
Patel 2011[12]	Study design: Cross-sectional survey Settings: New York State's greater Buffalo region Study period: 1 month Country: USA Theory used: No Overall quality: 25%	Sample size: 200 Range of age (mean): n/a Sex (Female): 50% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP RR PHR platform: PC Provided by: n/a

Patel 2011[13]	Study design: Cross-sectional survey Settings: 3 ambulatory care sites and an emergency department (ED) Study period: 6 weeks Country: USA Theory used: No Overall quality: 0%	Sample size: 214 Range of age (mean): n/a Sex (Female): 78% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP PHR platform: PC Provided by: n/a
Patel 2012[14]	Study design: Cross-sectional survey Settings: 5 primary care practices in the Rochester Study period: 1 month Country: USA Theory used: No Overall quality: 0%	Sample size: 117 Range of age (mean): n/a Sex (Female): 73% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA MP PHR platform: PC Provided by: n/a
Sanders 2013[15]	Study design: Cross-sectional survey Settings: 7 safety-net practices in Rochester Study period: 6 months Country: USA Theory used: No Overall quality:25%	Sample size: 654 Range of age (mean): n/a Sex (Female): n/a Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care
Tavares 2016[16]	Study design: Cross-sectional survey Settings: 3 institutions that provide educational services Study period: n/a Country: Portugal Theory used: UTAUT Overall quality: 50%	Sample size: 465 Range of age (mean): n/a Sex (Female): 61% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP PHR platform: PC Provided by: n/a
Torres 2011[17]	Study design: Cross-sectional survey Settings: Florida State University, University of Alabama, and University of Puerto Rico Study period: n/a Country: USA Theory used: TAM & TPB Overall quality: 25%	Sample size: 299 Range of age (mean): 19-69 (24) Sex (Female): 62% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care

van Der Vaart 2011[18]	Study design: Cross-sectional survey Settings: a large hospital's rheumatology clinic of Medisch Spectrum Twente in Enschede Study period: n/a Country: Netherland Theory used: No Overall quality: 0%	Sample size: 277 Range of age (mean): 52 years Sex (Female): 63% Conditions: Rheumatic diseases	PHR name: Interactive Health Communication Application (IHCA) PHR functions: AR MP EM PC TM PHR platform: PC Provided by: Specialised clinic
Wakefield 2012[19]	Study design: Cross-sectional survey Settings: 5 primary care clinics, 3 clinics served as pilot sites for portal implementation, Midwestern academic medical center Study period: 17 months Country: USA Theory used: No Overall quality: 0%	Sample size: 499, 163, 79= 741 Range of age (mean): n/a Sex (Female): 71,62,71 (mean= 68) Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP TS PHR platform: PC Provided by: Primary care
Nguyen 2011[20] **2016**[21]	Study design: Focus group Settings: a community setting in Montreal Study period: 8 months Country: Canada Theory used: No Overall quality: 75%	Sample size: 29 Range of age (mean): 18-34 Sex (Female): 51.7% Conditions: Healthy people	PHR name: n/a PHR functions: AR BA RP MP EM PHR platform: PC Provided by: n/a
Zickmund 2008[22]	Study design: Focus group Settings: 3 primary care practices affiliated with the UPMC Study period: 29 months Country: USA Theory used: No Overall quality: 75%	Sample size: 39 Range of age (mean): 54 years Sex (Female): 49% Conditions: Diabetes	PHR name: UPMC HealthTrak PHR functions: AR MP EM TS PHR platform: PC Provided by: Primary care
Luque 2013[23]	Study design: Cross-sectional survey & Focus group Settings: HIV clinic Study period: 2 weeks Country: USA Theory used: No Overall quality: 0%	Sample size: Survey: 90 Focus group: 8 Range of age (mean): n/a Sex (Female): Survey: 36% Focus group: n/a Conditions: HIV	PHR name: MyChart PHR functions: AR BA RP MP PHR platform: PC Provided by: Specialised clinic

Appendix 12: Findings of each Intention Study



Author, year[(ID)]	Significant positive associations	Significant negative associations	Nonsignificant associations
Quantitative studies			
Abramson 2014[1]	Internet use, Perceived usefulness (improve security of health information, improve quality of care), Ethnicity (Hispanic and other minorities), Educational level, Employment status (employed), Having children, Internet access, Understanding of health information (health literacy)	Age, Language (English is not their primary)	Self-rated health status, Having chronic medical condition, Taking a prescribed medication, Satisfaction with quality of care, Doctor uses computer to store & access medical record (EHR), Income, Sex, Caring for someone with chronic illness
Agarwal 2013[2]	Satisfaction with providers, Personal communication tactics & Perceived value (healthcare process management support), Impersonal communication tactics & Perceived value (healthcare process management support), Patient activation (actions/ maintenance) & perceived tool empowerment potential	Personal communication tactics & Perceived value (record keeping)	Impersonal communication tactics & Perceived value (record keeping), Patient activation (knowledge/beliefs) & perceived tool empowerment potential
Cho 2010[3]	Education level, Internet access, Trust in the internet	Age	Race, Income
Gordon 2016[4]	Ethnicity (non-Hispanic white)	Age	n/a
Kim 2009[5]	Age, Educational level, Income, Presence of disease, Using internet for health information, Expected time saving effect of PHR for healthcare providers (perceived usefulness), Expected time saving effect of PHR for consumers (perceived usefulness), Expected cost saving effect of PHR for healthcare providers (perceived usefulness), Expected cost saving effect of PHR for consumers (perceived usefulness)	n/a	Sex, Family's presence of disease, Awareness of PHR

Klein 2007[6]	Perceived usefulness, Personal innovativeness, Healthcare need (health status), Primary care provider setting	Perceived ease of use, Computer self-efficacy	n/a
Laugesen 2013[7]	Response efficacy, Self-efficacy, Severity, Vulnerability, Perceived Task Technology Fit, Patient activation measure, Education, Income, Health knowledge	Response costs, Age	General health, Duration since diagnosed, Diabetes control, Diabetes knowledge
Lazard 2016[8]	Perceived usefulness	Perceived ease of use	n/a
Noblin 2010[9] **2012**[10] **2013**[11]	Perceived usefulness, Perceived technology positively (ease of use), Sex	n/a	Age, Marital status, Health literacy, Health status, socioeconomic status level (income, education, occupation)
Patel 2011[12]	Perceived potential benefits (Perceived usefulness), Internet access, Internet use, Income, Employment status	Age, Privacy concerns, Using internet for health information,	Sex, Ethnicity, Education, Health status, Collaborative medical decision making, Satisfaction with the quality of health care received in past 5 years, Taking prescribed medication, Presence of chronic disease, Visiting primary care doctor
Patel 2011[13]	Internet use, Perceived usefulness	Privacy concerns	Age, Sex, Ethnicity, Income, Employment status,
Patel 2012[14]	Perceived benefits (Perceived usefulness), Using the Internet to manage their healthcare, Educational level, Live with children, Employment status, Perceived importance of technical support for health information services, Perceived security of the internet , Frequency of internet use	Age, Privacy and security concerns	Sharing personal information over the Internet (purchased or paid bills online), Ease of use of (access and navigate) websites important for online health services, Experience with health care system
Sanders 2013[15]	Internet use, Internet access (location, home)	n/a	Age, Sex, Ethnicity, Educational level, Marital status, Insurance status, Language
Tavares 2016[16]	Performance expectancy (Usefulness), Effort expectancy (ease of use), Habit, Self-perception (perceived severity)	n/a	Hedonic Motivation, Price value, Social influence, Facilitating conditions, Age, Sex, Chronic disability

Torres 2011[17]	Attitude, Social norm, Perceived behavioural control, Electronic PHIM apathy (contrary to intrinsic motivation), Prior use of a PHR	n/a	Electronic PHIM anxiety, Age, Sex, Current residence, Ethnicity
van Der Vaart 2011[18]	Mental health	n/a	Age, Sex, Education, Employment, Income, Disease duration, Physical health, Functional health literacy, Communicative health literacy, Critical health literacy
Wakefield 2012[19]	Internet use	n/a	n/a
Qualitative studies			
Nguyen 2011[20] **2016**[21]	Computer literacy, Computer use, Internet use, Education, Health Literacy, PHR sponsor, Data integrity, Ease of use, Control and customisation of PHR, Motivations to use, PHR price	Age, Number of health issues, Security and privacy concerns	n/a
Zickmund 2008[22]	Ease of use, Computer literacy, Relative advantages, Logistical problems with the office communication (unsatisfied with provider), Inability to obtain medical information (unsatisfied with provider)	Fear of losing relationships, Fear of losing the use of email outside the portal, Satisfaction with provider communication/ responsiveness	n/a
Mixed methods studies			
Luque 2013[23]	QN: Training QL: Easy-to-use technology, Computer literacy, Training.	QL: Lack of physical access (computers/ internet), Privacy concerns, Lack of knowledge about using the system	QN: Age, Sex, Educational level, Insurance, Marital status, Computer access and comfort.

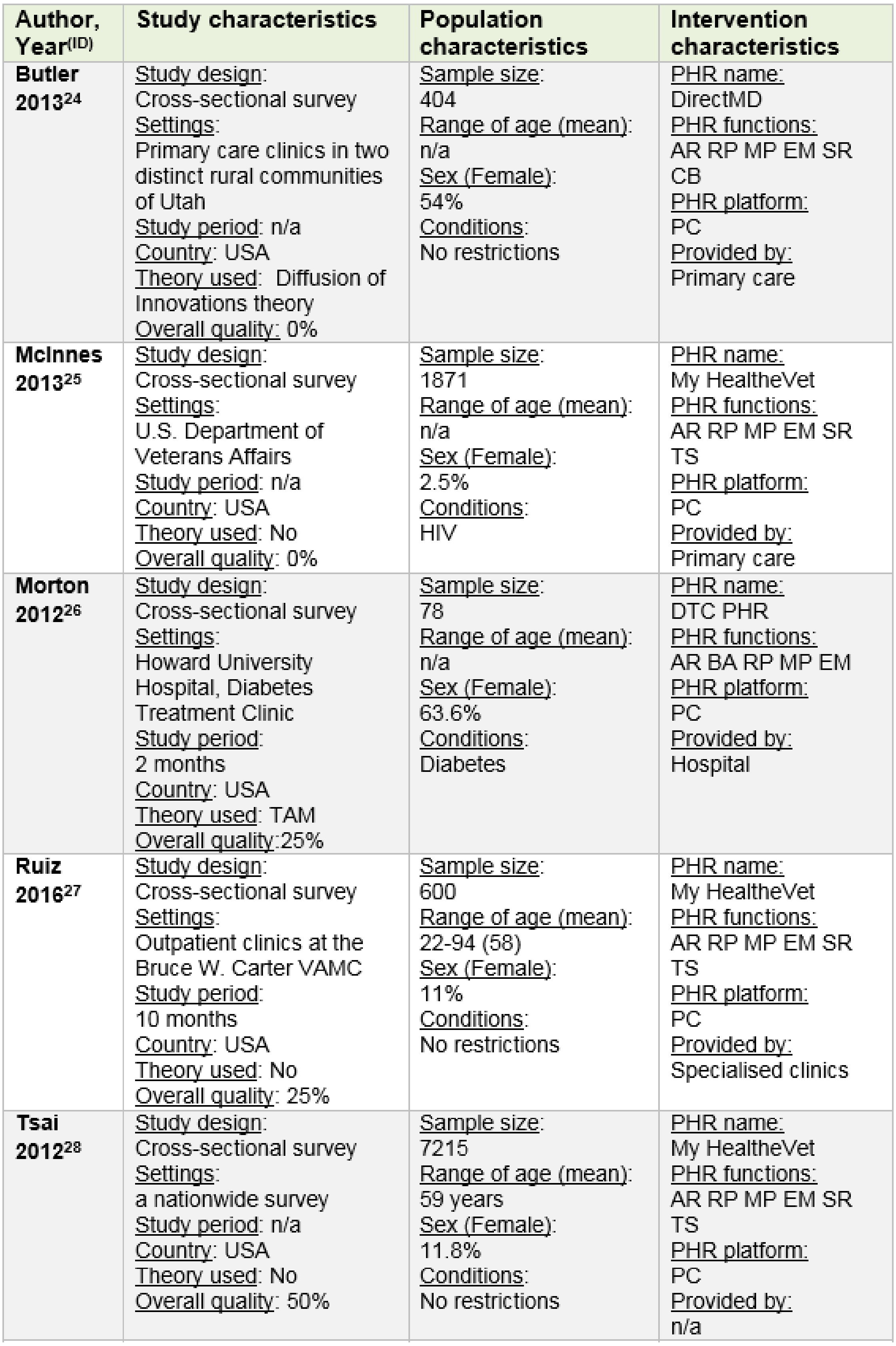
Appendix 13: Studies that Assessed each Factor Affecting Intention

Group	Factors	Positive associations	Negative associations	No associations	Total	Notes
Personal factors: Sociodemographic factors	Age	1[5]	6[1,3,4,12,14,20/21]	8[7,9/10/11,13,15,16,17,18,23]	15	
	Education level	6[1,3,5,7,14,20/21]		5[9/10/11,12,15,18,23]	11	
	Sex (female)	1[9/10/11]		10[1,5,7,12,13,15,16,17,18,23]	11	
	Income	3[5,7,12]		5[1,3,9/10/11,13,18]	8	
	Ethnicity (white and non-Hispanic)	1[4]	1[1]	5[3,12,13,15,17]	7	
	Employment status (Employed)	3[1,12,14]		3[9/10/11,13,18]	6	
	Marital status			3[9/10/11,15,23]	3	
	Insurance status			2[15,23]	2	
	Language	1[1]		1[15]	2	[1]: English
	Living arrangements (alone)		2[1,14]		2	
	Residence place			1[17]	1	
Personal factors: Digital divide-related factors	Internet use/experience	8[1,5,12,13,14,15,19,20/21]		1[14]	8	[14]: Using the internet for health information/ managing healthcare & Using internet in general (+ve) [14]: Using the internet for sharing personal information (purchasing or paying bills online) (no)
	Internet access	5[1,3,12,15,23]			5	
	Computer literacy	3[20/21,22,23]			3	
	Computer/ IT self-efficacy	2[7,23]		1[6]	3	
	Computer anxiety			2[17,23]	2	
	Experience with health care systems	1[17]		1[14]	2	
	Trust in the internet	1[3]			1	
	Computer use/ experience	1[20/21]			1	
	Computer access	1[23]			1	
	Personal innovativeness	1[6]			1	

Personal factors: health-related factors	Health status (healthier)	1[18]	1[6]	5[1,7,9/10/11,12,18]	6	[18]: mental health (+ve), physical health (no)
	Health Literacy/ knowledge	3[1,7,20/21]		3[7,9/10/11,18]	6	[7]: Health knowledge (+ve), Diabetes knowledge (no)
	Number or presence of diseases/ health issues	1[5]	1[20/21]	2[1,12]	4	
	Perceived severity of the disease	2[7,16]			2	
	Patient activation level	2[7,2]		1[2]	2	[2]: Patient activation (action/maintenance) moderates the relationship between tool empowerment potential and intentions, while patient activation (knowledge/beliefs) had no influence on the relationship between tool empowerment potential and intentions
	Caring for someone with disease			2[1,5]	2	
	Duration since diagnosed			2[7,18]	2	
	Number of prescriptions			2[1,12]	2	
	Disability			1[16]	1	
	Clinical office visits			1[12]	1	
	Control over the disease			1[7]	1	
	Making treatment decisions collaboratively with their provider			1[12]	1	
	Perceived vulnerability	1[7]			1	
Human-technology interaction factors	Perceived usefulness/ benefits/ value	12[1,2,5,6,7,8,9/10/11,12,13,14,16,22]			12	
	Perceived ease of use	5[9/10/11,16,20/21,22,23]		3[6,8,14]	8	
	Privacy & security concerns		5[12,13,14,20/21,23]		5	
	Price value/ Response costs/ ePHR cost		2[7,20/21]	1[16]	3	Potential costs (monetary, time, etc.) incurred by the individual in using ePHR
	Hedonic motivation	2[17,20/21]		1[16]	3	Intrinsic motivation (e.g. enjoyment) [17] :Electronic PHIM apathy (motivational loss)
	Perceived task technology fit	1[7]			1	Perception that the technology matches the user's task requirements and the user's abilities
	Habit	1[16]			1	
	Attitude	1[17]			1	

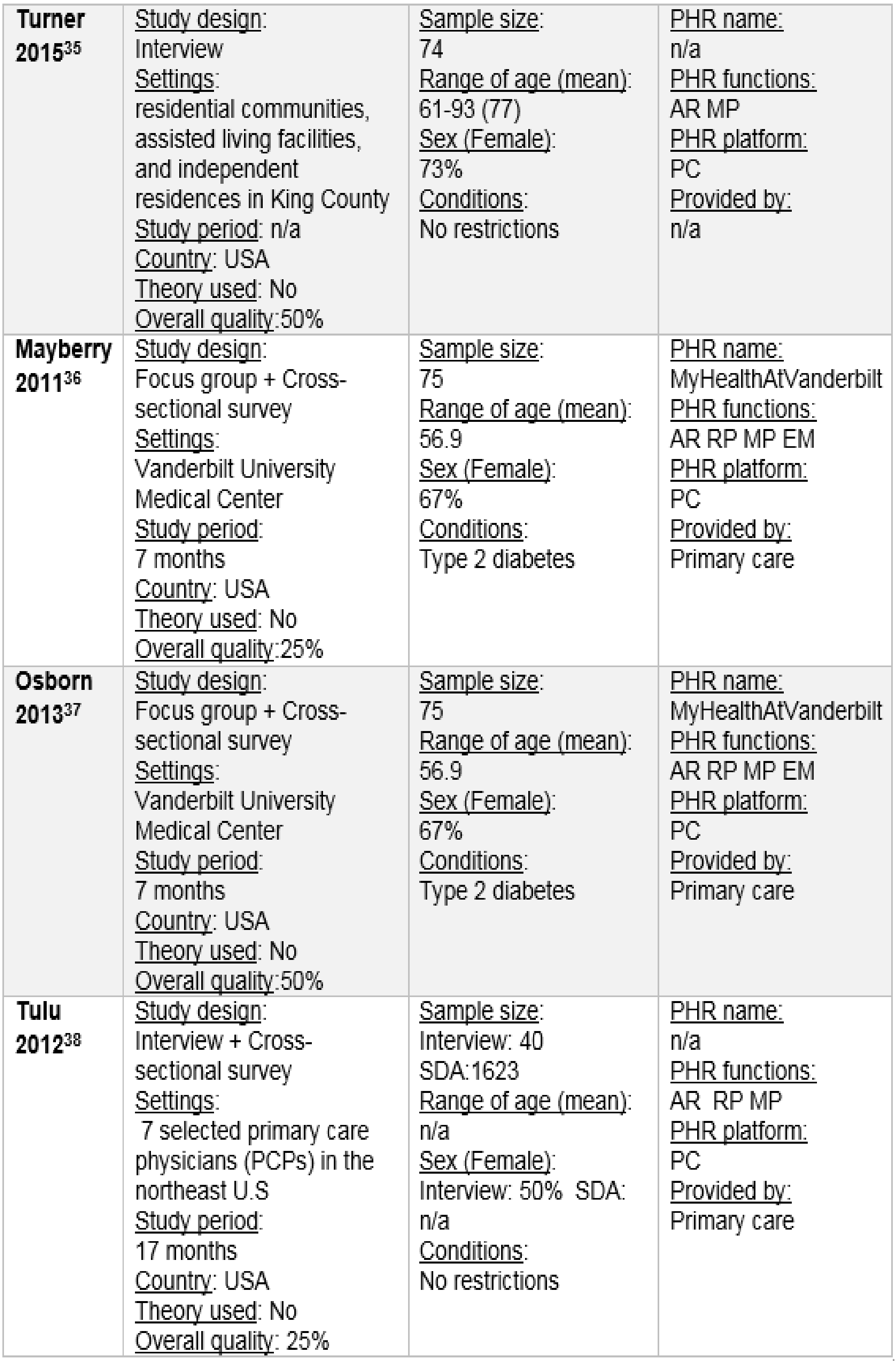
	Comfort with sharing ePHRs data with the primary care doctor	1[13]			1	
	Awareness of ePHRs			1[5]	1	
Organisational factors	Facilitating conditions	3[14,17,23]		1[16]	4	Individual's perception of the support available for using a technology activity (e.g. training, manuals, technical support)
	Satisfaction with health care providers	1[2]	1[22]		2	
	Satisfaction with quality of care			2[1,12]	2	
	Communication tactics (CT)	1[2]	1[2]	1[2]	1	[2]: Personal & impersonal CT positively moderated the relationship between perceived usefulness of healthcare process management support functions and intention. Personal CT negatively moderated the relationship between the perceived usefulness of the record keeping functions and intention. Impersonal CT had no influence on the relationship between the perceived usefulness of the record keeping functions and intentions.
	Practice setting (primary care)	1[6]			1	Primary vs Specialist
	ePHRs sponsor (government)	1[20/21]			1	Government vs private
	Data integrity	1[20/21]			1	
	Control & customisation of ePHRs	1[20/21]			1	
	fear of losing relationships and e-mail contact with the provider		1[22]		1	
	Doctors' use of EHR			1[1]	1	
Social factors	Social influence/norm	1[17]		1[16]	2	
Hint	Black numbers: Quantitative studies	Red numbers: Qualitative studies		Blue numbers: Mixed-methods studies		

Appendix 14: Characteristics of Subjective Use Studies



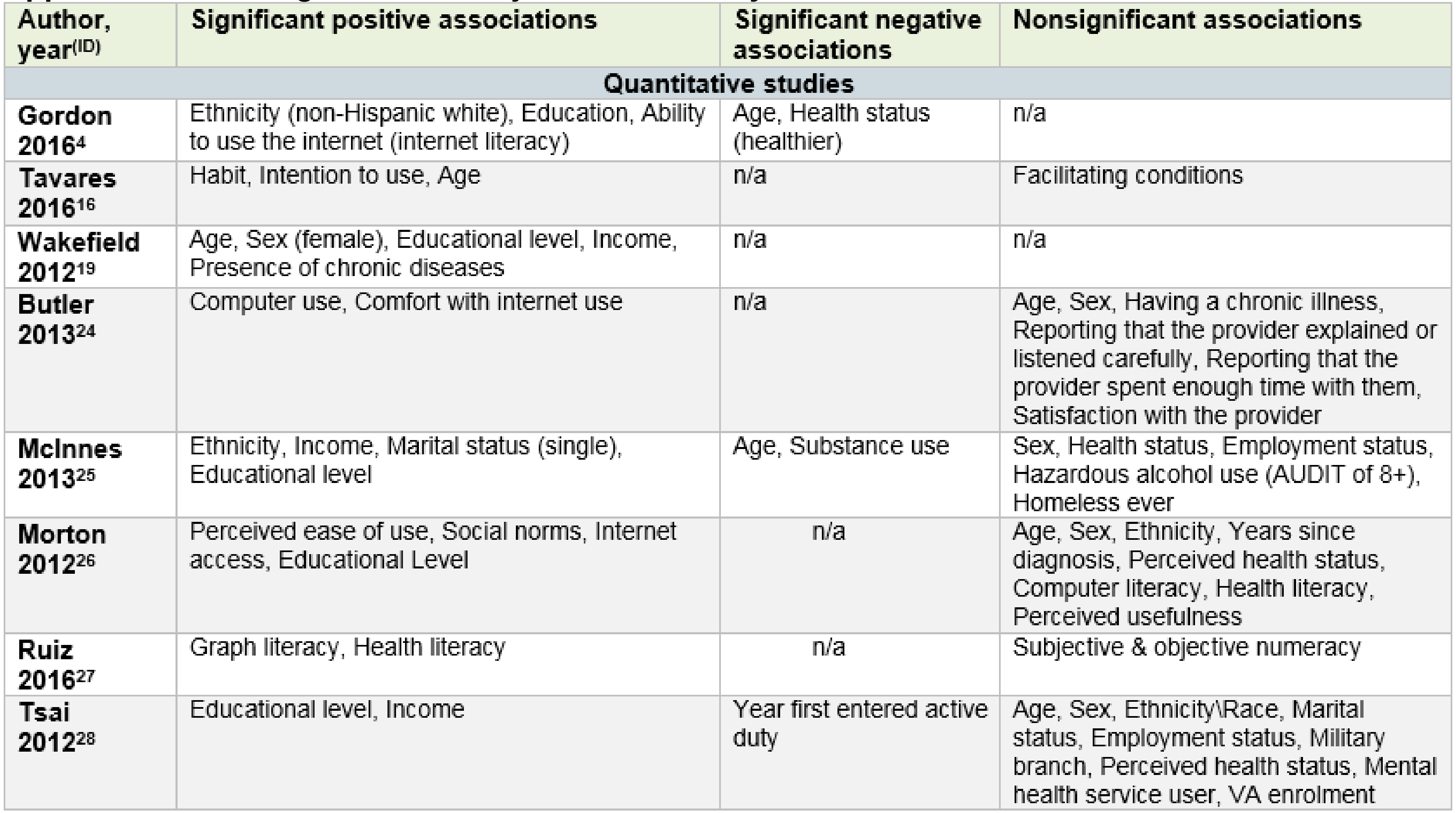
Author, Year(ID)	Study characteristics	Population characteristics	Intervention characteristics
Butler 2013[24]	Study design: Cross-sectional survey Settings: Primary care clinics in two distinct rural communities of Utah Study period: n/a Country: USA Theory used: Diffusion of Innovations theory Overall quality: 0%	Sample size: 404 Range of age (mean): n/a Sex (Female): 54% Conditions: No restrictions	PHR name: DirectMD PHR functions: AR RP MP EM SR CB PHR platform: PC Provided by: Primary care
McInnes 2013[25]	Study design: Cross-sectional survey Settings: U.S. Department of Veterans Affairs Study period: n/a Country: USA Theory used: No Overall quality: 0%	Sample size: 1871 Range of age (mean): n/a Sex (Female): 2.5% Conditions: HIV	PHR name: My HealtheVet PHR functions: AR RP MP EM SR TS PHR platform: PC Provided by: Primary care
Morton 2012[26]	Study design: Cross-sectional survey Settings: Howard University Hospital, Diabetes Treatment Clinic Study period: 2 months Country: USA Theory used: TAM Overall quality:25%	Sample size: 78 Range of age (mean): n/a Sex (Female): 63.6% Conditions: Diabetes	PHR name: DTC PHR PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Hospital
Ruiz 2016[27]	Study design: Cross-sectional survey Settings: Outpatient clinics at the Bruce W. Carter VAMC Study period: 10 months Country: USA Theory used: No Overall quality: 25%	Sample size: 600 Range of age (mean): 22-94 (58) Sex (Female): 11% Conditions: No restrictions	PHR name: My HealtheVet PHR functions: AR RP MP EM SR TS PHR platform: PC Provided by: Specialised clinics
Tsai 2012[28]	Study design: Cross-sectional survey Settings: a nationwide survey Study period: n/a Country: USA Theory used: No Overall quality: 50%	Sample size: 7215 Range of age (mean): 59 years Sex (Female): 11.8% Conditions: No restrictions	PHR name: My HealtheVet PHR functions: AR RP MP EM SR TS PHR platform: PC Provided by: n/a

Day 2012[29] **Gu 2013**[30]	Study design: Interview Settings: Wellington primary care practice Study period: n/a Country: New Zealand Theory used: TAM Overall quality: 75%	Sample size: 10 Range of age (mean): 35-79 Sex (Female): 30% Conditions: No restrictions	PHR name: n/a PHR functions: AR RP MP EM SR TS PHR platform: PC Provided by: Primary care
Dontje 2014[31]	Study design: Focus group Settings: 2 primary care clinics Study period: n/a Country: USA Theory used: n/a Overall quality: 75%	Sample size: 21 Range of age (mean): 64 Sex (Female): n/a Conditions: No restrictions	PHR name: n/a PHR functions: AR MP PHR platform: PC Provided by: Primary care
Hess 2007[32]	Study design: Focus group Settings: 3 primary care practices affiliated with the UPMC Study period: 29 months Country: USA Theory used: No Overall quality: 25%	Sample size: 39 Range of age (mean): 54 Sex (Female): 49% Conditions: Diabetes	PHR name: UPMC HealthTrak PHR functions: AR MP EM TS PHR platform: PC Provided by: Primary care
Mishuris 2014[33]	Study design: Interview Settings: by telephone, in the Veteran's home , or at a VA Boston clinic Study period: 6 months Country: USA Theory used: No Overall quality: 75%	Sample size: 14 Range of age (mean): n/a Sex (Female): 14% Conditions: No restrictions	PHR name: My HealtheVet (MHV) PHR functions: AR BA RP MP EM AI PHR platform: PC Provided by: Primary care
Tieu 2015[34]	Study design: Interview Settings: San Francisco General Hospital Study period: 10 months Country: USA Theory used: No Overall quality: 75%	Sample size: 11 Range of age (mean): 57 Sex (Female): 18% Conditions: Chronic diseases	PHR name: n/a PHR functions: AR RP MP PHR platform: PC Provided by: Hospital



Turner 2015[35]	Study design: Interview Settings: residential communities, assisted living facilities, and independent residences in King County Study period: n/a Country: USA Theory used: No Overall quality:50%	Sample size: 74 Range of age (mean): 61-93 (77) Sex (Female): 73% Conditions: No restrictions	PHR name: n/a PHR functions: AR MP PHR platform: PC Provided by: n/a
Mayberry 2011[36]	Study design: Focus group + Cross-sectional survey Settings: Vanderbilt University Medical Center Study period: 7 months Country: USA Theory used: No Overall quality:25%	Sample size: 75 Range of age (mean): 56.9 Sex (Female): 67% Conditions: Type 2 diabetes	PHR name: MyHealthAtVanderbilt PHR functions: AR RP MP EM PHR platform: PC Provided by: Primary care
Osborn 2013[37]	Study design: Focus group + Cross-sectional survey Settings: Vanderbilt University Medical Center Study period: 7 months Country: USA Theory used: No Overall quality:50%	Sample size: 75 Range of age (mean): 56.9 Sex (Female): 67% Conditions: Type 2 diabetes	PHR name: MyHealthAtVanderbilt PHR functions: AR RP MP EM PHR platform: PC Provided by: Primary care
Tulu 2012[38]	Study design: Interview + Cross-sectional survey Settings: 7 selected primary care physicians (PCPs) in the northeast U.S Study period: 17 months Country: USA Theory used: No Overall quality: 25%	Sample size: Interview: 40 SDA:1623 Range of age (mean): n/a Sex (Female): Interview: 50% SDA: n/a Conditions: No restrictions	PHR name: n/a PHR functions: AR RP MP PHR platform: PC Provided by: Primary care

Appendix 15: Findings of each Subjective Use Study

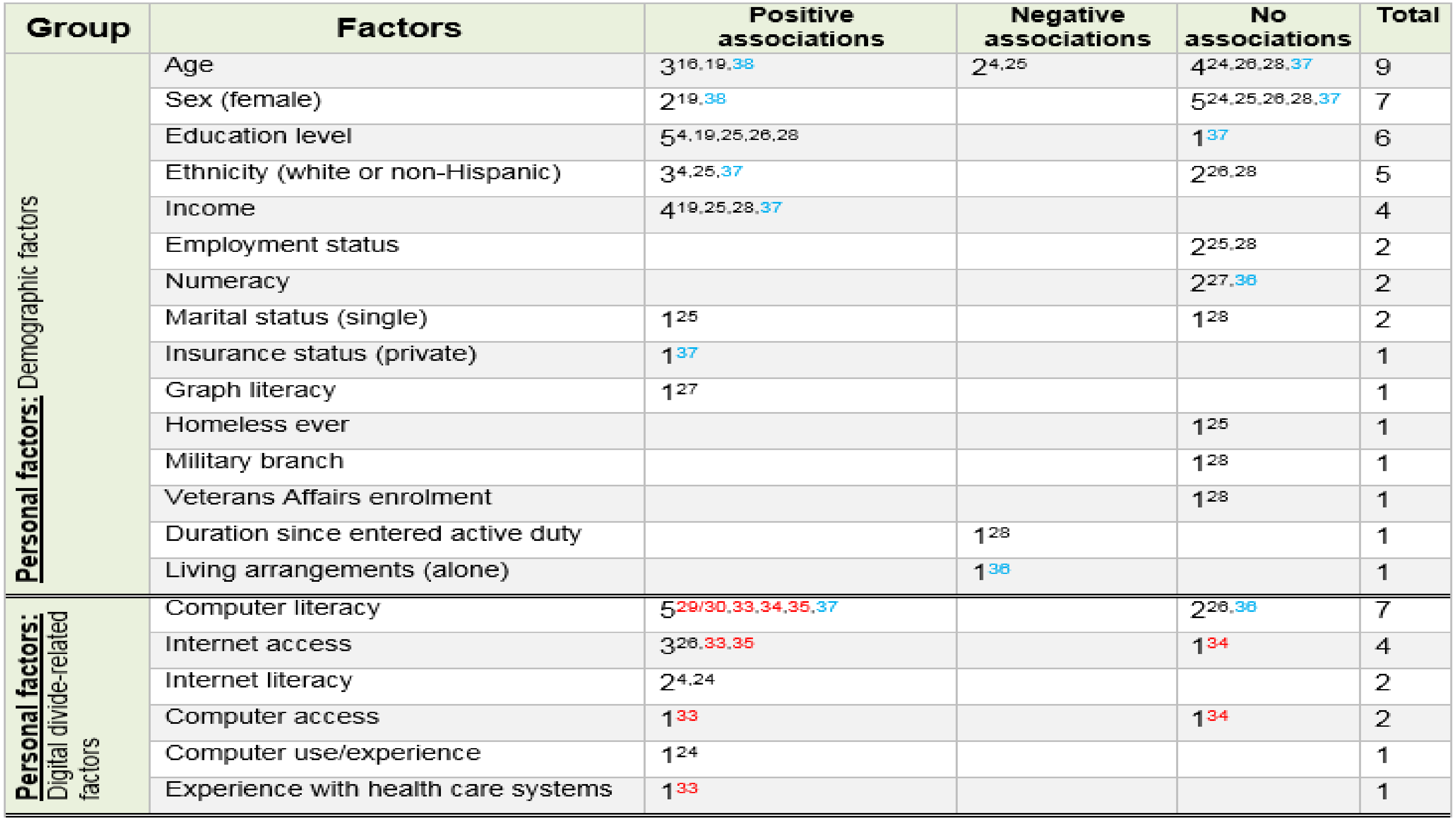


Author, year[(ID)]	**Significant positive associations**	**Significant negative associations**	**Nonsignificant associations**
Quantitative studies			
Gordon 2016[4]	Ethnicity (non-Hispanic white), Education, Ability to use the internet (internet literacy)	Age, Health status (healthier)	n/a
Tavares 2016[16]	Habit, Intention to use, Age	n/a	Facilitating conditions
Wakefield 2012[19]	Age, Sex (female), Educational level, Income, Presence of chronic diseases	n/a	n/a
Butler 2013[24]	Computer use, Comfort with internet use	n/a	Age, Sex, Having a chronic illness, Reporting that the provider explained or listened carefully, Reporting that the provider spent enough time with them, Satisfaction with the provider
McInnes 2013[25]	Ethnicity, Income, Marital status (single), Educational level	Age, Substance use	Sex, Health status, Employment status, Hazardous alcohol use (AUDIT of 8+), Homeless ever
Morton 2012[26]	Perceived ease of use, Social norms, Internet access, Educational Level	n/a	Age, Sex, Ethnicity, Years since diagnosis, Perceived health status, Computer literacy, Health literacy, Perceived usefulness
Ruiz 2016[27]	Graph literacy, Health literacy	n/a	Subjective & objective numeracy
Tsai 2012[28]	Educational level, Income	Year first entered active duty	Age, Sex, Ethnicity\Race, Marital status, Employment status, Military branch, Perceived health status, Mental health service user, VA enrolment

Qualitative studies			
Day 2012[29] **Gu 2013**[30]	Perceived usefulness (convenience, time saving, efficiency and effectiveness of care), Perceived ease of use, Computer literacy, Health literacy	PHR cost	n/a
Dontje 2014[31]	Awareness of the PHR, Perceived value of the PHR (perceived usefulness), Perceived ease of use, Health literacy	Difficulty getting onto the system (price value), Perceived value in contrast to time required to learn a new system, Security concerns	n/a
Hess 2007[32]	n/a	Lost or unknown user names and passwords, Lack of awareness about all aspects of the system, Inability to view all records of interest, Inability to contact all physicians (instead of their primary physicians)	n/a
Mishuris 2014[33]	Prior knowledge of PHR, Perceived usefulness, Computer and Internet access, Desire to learn more about MHV, The perception that it is a complementary service not replacing HBPC service, Computer skills, Training	Privacy concerns, Satisfaction with current HBPC care	n/a
Tieu 2015[34]	Health literacy, Convenience (ease of use), Perceived usefulness	Security concerns, Lack of technological skills and interest, Preference for in-person communication	Computer Access, Internet Access

Turner 2015[35]	Computer proficiency, Perceived usefulness, Perceived ease of use, Awareness of the portal	Internet cost (internet access), Security concerns, Forgetting the password	n/a
Mixed methods studies			
Mayberry 2011[36]	QL: Family member support, Patient activation	n/a	QN: Health literacy, Numeracy, Computer Literacy QL: Health literacy, Computer Literacy, Numeracy, Privacy and security concern
Osborn 2013[37]	QN: Ethnicity (Caucasian/white), Income, Insurance status (Private), QL: Awareness of PHR, Perceived usefulness, Computer literacy	n/a	QN: Age, Sex, Educational level
Tulu 2012[38]	QN: Age, Sex (female), QL: Perceived usefulness, Lack of awareness of all the portal functions, Perceived ease of use, Health conditions	Health status (healthier)	n/a

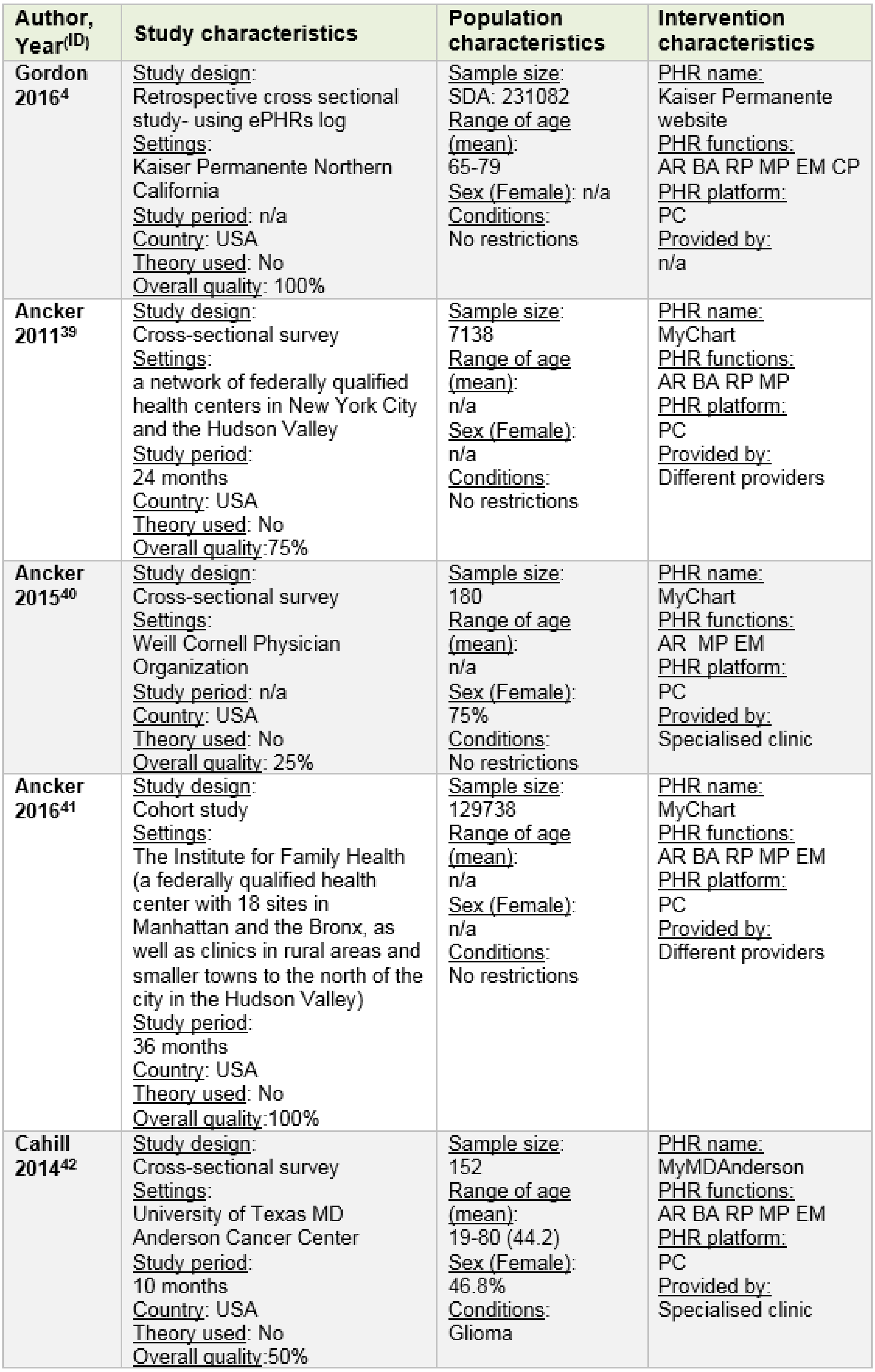
Appendix 16: Studies that Assessed each Factor Affecting Subjective Use



Group	Factors	Positive associations	Negative associations	No associations	Total
Personal factors: Demographic factors	Age	3[16,19,38]	2[4,25]	4[24,26,28,37]	9
	Sex (female)	2[19,38]		5[24,25,26,28,37]	7
	Education level	5[4,19,25,26,28]		1[37]	6
	Ethnicity (white or non-Hispanic)	3[4,25,37]		2[26,28]	5
	Income	4[19,25,28,37]			4
	Employment status			2[25,28]	2
	Numeracy			2[27,36]	2
	Marital status (single)	1[25]		1[28]	2
	Insurance status (private)	1[37]			1
	Graph literacy	1[27]			1
	Homeless ever			1[25]	1
	Military branch			1[28]	1
	Veterans Affairs enrolment			1[28]	1
	Duration since entered active duty		1[28]		1
	Living arrangements (alone)		1[36]		1
Personal factors: Digital divide-related factors	Computer literacy	5[29/30,33,34,35,37]		2[26,36]	7
	Internet access	3[26,33,35]		1[34]	4
	Internet literacy	2[4,24]			2
	Computer access	1[33]		1[34]	2
	Computer use/experience	1[24]			1
	Experience with health care systems	1[33]			1

Personal factors: health-related factors	Health Literacy/ knowledge	4[27,29/30,31,34]		2[26,36]	6
	Health status (healthier)	1[4]	1[38]	3[25,26,28]	5
	Presence of chronic diseases	1[19]		1[24]	2
	Type of disease	1[38]			1
	Patient activation level	1[36]			1
	Substance use		1[25]		1
	Duration since diagnosed			1[26]	1
	Using mental health service			1[28]	1
	Hazardous alcohol use (AUDIT of 8+)			1[25]	1
Human-technology interaction factors	Perceived usefulness/ benefits/ value	8[29/30,31,32,33,34,35,37,38]		1[26]	8
	Perceived ease of use	6[26,29/30,31,34,35,38]			6
	Awareness of ePHRs	5[31,32,35,37,38]			5
	Privacy and security concerns		4[31,33,34,35]	1[36]	5
	Difficulty getting onto the system		3[31,32,35]		3
	Response costs/ price value/ ePHRs cost		2[29/30,31]		2
	Intention to use	1[16]			1
	Habit	1[16]			1
	Preferences (in-person communication)		1[34]		1
Organisational factors	Satisfaction with providers		1[33]	1[24]	2
	Facilitating conditions	1[33]		1[16]	2
	Being complementary service	1[33]			1
Social factors	Social influence/norm	1[26]			1
Hint	Black numbers: Quantitative studies Red numbers: Qualitative studies Blue numbers: Mixed-methods studies				

Appendix 17: Characteristics of Objective Use Studies



Author, Year(ID)	Study characteristics	Population characteristics	Intervention characteristics
Gordon 2016[4]	Study design: Retrospective cross sectional study- using ePHRs log Settings: Kaiser Permanente Northern California Study period: n/a Country: USA Theory used: No Overall quality: 100%	Sample size: SDA: 231082 Range of age (mean): 65-79 Sex (Female): n/a Conditions: No restrictions	PHR name: Kaiser Permanente website PHR functions: AR BA RP MP EM CP PHR platform: PC Provided by: n/a
Ancker 2011[39]	Study design: Cross-sectional survey Settings: a network of federally qualified health centers in New York City and the Hudson Valley Study period: 24 months Country: USA Theory used: No Overall quality:75%	Sample size: 7138 Range of age (mean): n/a Sex (Female): n/a Conditions: No restrictions	PHR name: MyChart PHR functions: AR BA RP MP PHR platform: PC Provided by: Different providers
Ancker 2015[40]	Study design: Cross-sectional survey Settings: Weill Cornell Physician Organization Study period: n/a Country: USA Theory used: No Overall quality: 25%	Sample size: 180 Range of age (mean): n/a Sex (Female): 75% Conditions: No restrictions	PHR name: MyChart PHR functions: AR MP EM PHR platform: PC Provided by: Specialised clinic
Ancker 2016[41]	Study design: Cohort study Settings: The Institute for Family Health (a federally qualified health center with 18 sites in Manhattan and the Bronx, as well as clinics in rural areas and smaller towns to the north of the city in the Hudson Valley) Study period: 36 months Country: USA Theory used: No Overall quality:100%	Sample size: 129738 Range of age (mean): n/a Sex (Female): n/a Conditions: No restrictions	PHR name: MyChart PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Different providers
Cahill 2014[42]	Study design: Cross-sectional survey Settings: University of Texas MD Anderson Cancer Center Study period: 10 months Country: USA Theory used: No Overall quality:50%	Sample size: 152 Range of age (mean): 19-80 (44.2) Sex (Female): 46.8% Conditions: Glioma	PHR name: MyMDAnderson PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Specialised clinic

Carrell 2006[43]	Study design: Cross-sectional survey Settings: Group Health Cooperative in Seattle, Washington Study period: n/a Country: USA Theory used: No Overall quality:25%	Sample size: 215998 Range of age (mean): n/a Sex (Female): n/a Conditions: No restrictions	PHR name: MyGroupHealth PHR functions: AR RP MP EM AT PHR platform: PC Provided by: n/a
Davis 2015[44]	Study design: Cross-sectional survey Settings: Vanderbilt University Medical Center Study period: 24 months Country: USA Theory used: No Overall quality:75%	Sample size: 60159 Range of age (mean): 41-66 (55, median) Sex (Female): 49% Conditions: No restrictions	PHR name: My Health at Vanderbilt PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Hospital
Emani 2012[45]	Study design: Cross-sectional survey Settings: ambulatory care practices of two academic medical centers Study period: n/a Country: USA Theory used: Diffusion of Innovation Theory Overall quality:50%	Sample size: 760 Range of age (mean): 59 years Sex (Female): 68.6% Conditions: No restrictions	PHR name: Patient Gateway PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Hospital
Garrido 2015[46]	Study design: Cross-sectional survey Settings: Kaiser Permanente Southern California Study period: n/a Country: USA Theory used: No Overall quality:100%	Sample size: 3173774 Range of age (mean): n/a Sex (Female): n/a Conditions: No restrictions	PHR name: Kaiser Permanente Southern California PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Medical office
Gerber 2014[47]	Study design: Cohort study Settings: Simmons Cancer Center Study period: 72 months Country: USA Theory used: No Overall quality:100%	Sample size: 6495 Range of age (mean): 60 years Sex (Female): 68% Conditions: Cancer	PHR name: MyChart PHR functions: AR BA RP MP EM CP PHR platform: PC Provided by: Specialised clinic
Goel 2011[48]	Study design: Cross-sectional survey Settings: Northwestern Medical Faculty Foundation Study period: 5 months Country: USA Theory used: No Overall quality:25%	Sample size: 159 Range of age (mean): 51 years Sex (Female): 72% Conditions: No restrictions	PHR name: MyChart PHR functions: AR BA RP MP PHR platform: PC Provided by: Specialised clinic

Goel 2011[49]	Study design: Cross-sectional survey Settings: Northwestern Medical Faculty Foundation Study period: 18 months Country: USA Theory used: No Overall quality:100%	Sample size: 4607 Range of age (mean): 48 years (median) Sex (Female): 64% Conditions: No restrictions	PHR name: MyChart PHR functions: AR BA RP MP PHR platform: PC Provided by: Specialised clinic
Hibbard 2011[50]	Study design: Cross-sectional survey Settings: Fairview Health Systems Study period: 7 months Country: USA Theory used: No Overall quality:100%	Sample size: 16357 Range of age (mean): n/a Sex (Female): 65.2% Conditions: No restrictions	PHR name: MyChart PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care
Horvath 2011[51]	Study design: Cross-sectional survey Settings: Seven clinics located in Durham County, North Carolina Study period: 12 months Country: USA Theory used: No Overall quality:75%	Sample size: 58942 Range of age (mean): n/a Sex (Female): 57.8% Conditions: No restrictions	PHR name: HealthView Portal PHR functions: AR BA MP AI PHR platform: PC Provided by: Primary care & Specialised clinic
Jhamb 2015[52]	Study design: Cross-sectional survey Settings: 4 university-affiliated nephrology offices in western Pennsylvania Study period: n/a Country: USA Theory used: No Overall quality:100%	Sample size: 2803 Range of age (mean): 61 years Sex (Female): 49% Conditions: No restrictions	PHR name: Electronic health record portal PHR functions: AR BA RP MP PHR platform: PC Provided by: Specialised clinics
Lau 2014[53]	Study design: Cross-sectional survey Settings: Vancouver-based tertiary care diabetologist Study period: 55 months Country: Canada Theory used: No Overall quality:75%	Sample size: 157 Range of age (mean): 54.7 years Sex (Female): 39.8% Conditions: Diabetes	PHR name: n/a PHR functions: AR MP EM PHR platform: PC Provided by: Specialised clinic
Leveille 2016[54]	Study design: Cohort study Settings: Beth Israel Deaconess Medical Center and Geisinger Health Study period: 26 months Country: USA Theory used: No Overall quality:100%	Sample size: 44951 Range of age (mean): 51 years Sex (Female): 61.8 Conditions: No restrictions	PHR name: OpenNotes PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care

Lyles 2012[55]	Study design: Cross-sectional survey Settings: 5 medical clinics in western Washington Study period: 1 months Country: USA Theory used: No Overall quality:50%	Sample size: 718 Range of age (mean): n/a Sex (Female): 51.5% Conditions: Diabetes	PHR name: MyGroupHealth PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care
Lyles 2013[56]	Study design: Cross-sectional survey Settings: Kaiser Foundation Health Plan Study period: 24 months Country: USA Theory used: No Overall quality: 0%	Sample size: 11518 Range of age (mean): 30-75 Sex (Female): 49% Conditions: Diabetes	PHR name: kp.org PHR functions: AR BA RP MP PHR platform: PC Provided by: n/a
Martinez 2013[57]	Study design: Cross-sectional survey Settings: Hospital Italiano de Buenos Aires Study period: 3 months Country: Argentina Theory used: No Overall quality:100%	Sample size: 122006 Range of age (mean): 55.5 years Sex (Female): 60.5% Conditions: No restrictions	PHR name: Portal Personal de Salud PHR functions: AR BA MP PHR platform: PC Provided by: Hospital
Mikles 2015[58]	Study design: Cross-sectional survey Settings: a Federally Qualified Health Center (FQHC) in New York City Study period: 11 months Country: USA Theory used: No Overall quality:100%	Sample size: 42317 Range of age (mean): n/a Sex (Female): 65.18% Conditions: No restrictions	PHR name: MyChart PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care
Miller 2007[59]	Study design: Cross-sectional survey Settings: Cleveland Clinic Study period: n/a Country: USA Theory used: No Overall quality:100%	Sample size: 63295 Range of age (mean): 50.4 Sex (Female): 61.5% Conditions: No restrictions	PHR name: MyChart PHR functions: AR BA RP MP EM SR PHR platform: PC Provided by: Specialised clinic
Nazi 2010[60]	Study design: Cross-sectional survey Settings: All VA facilities Study period: 12 months Country: USA Theory used: No Overall quality: 0%	Sample size: 100617 Range of age (mean): n/a Sex (Female): 9% Conditions: No restrictions	PHR name: My HealtheVet PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Various settings

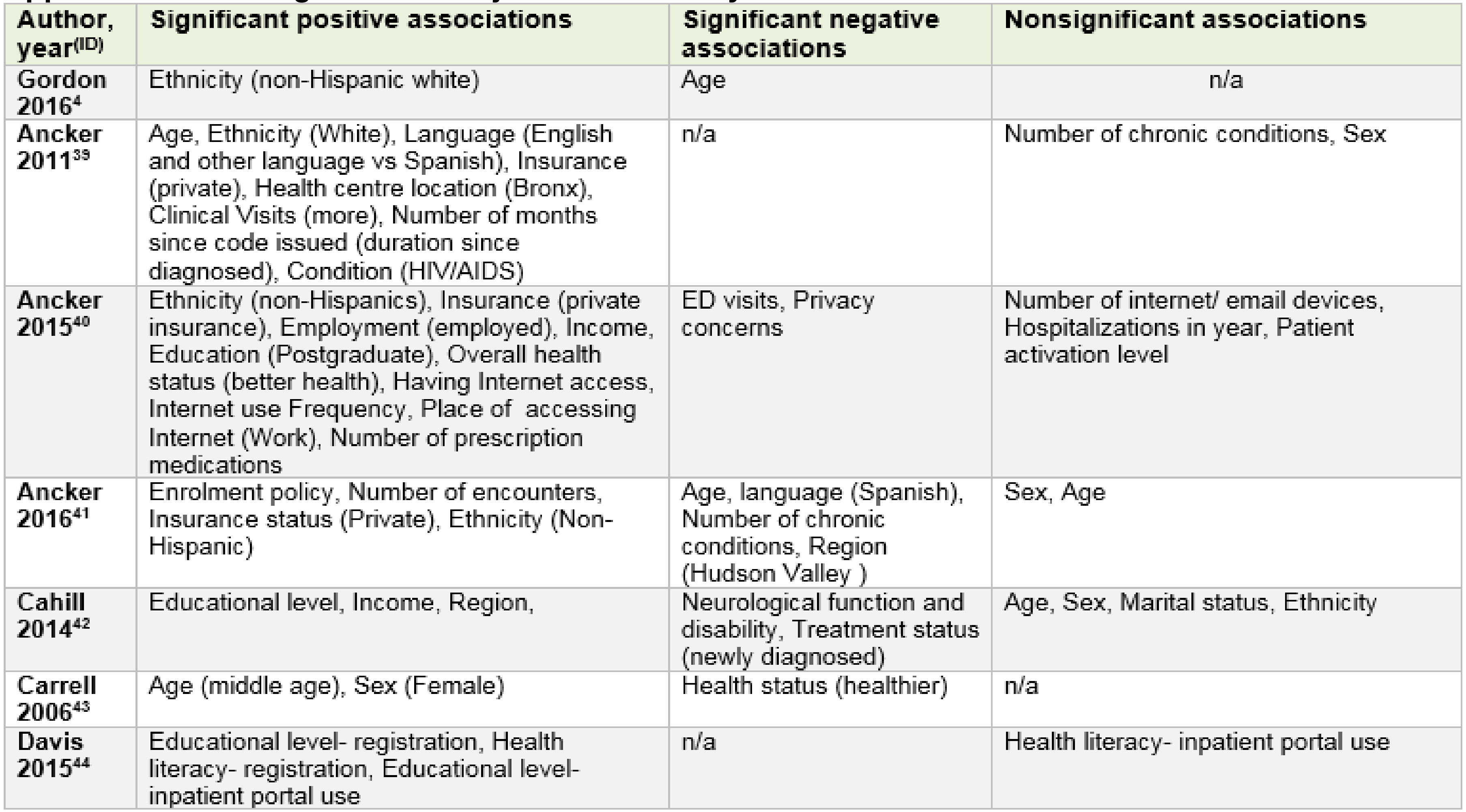
Nielsen 2012[61]	Study design: Case-control study Settings: Beth Israel Deaconess Medical Center Study period: 24 months Country: USA Theory used: No Overall quality:75%	Sample size: 240 Range of age (mean): n/a Sex (Female): 73.3% Conditions: Multiple sclerosis	PHR name: PatientSite PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Specialised clinic
Palen 2012[62]	Study design: Cohort study Settings: Kaiser Permanente Colorado Study period: 62 months Country: USA Theory used: No Overall quality:100%	Sample size: 158869 Range of age (mean): 45.7 years Sex (Female): 52.4% Conditions: No restrictions	PHR name: MyHealthManager PHR functions: AR BA RP MP PHR platform: PC Provided by: n/a
Raghu 2015[63]	Study design: Cross-sectional survey Settings: Mayo Clinic, Arizona Study period: 6 months Country: USA Theory used: No Overall quality:100%	Sample size: 18702 Range of age (mean): 18-98 (61) Sex (Female): 54.2% Conditions: No restrictions	PHR name: n/a PHR functions: AR MP PHR platform: PC Provided by: Primary care
Ralston 2007[64] **2006**[65]	Study design: Cross-sectional survey Settings: Group Health Cooperative Study period: 40 months Country: USA Theory used: No Overall quality:100%	Sample size: 269864 Range of age (mean): 50.5 years Sex (Female): 56% Conditions: No restrictions	PHR name: MyGroupHealth PHR functions: AR BA RP MP EM DG AT PHR platform: AR BA RP MP EM DG AT Provided by: Primary care
Ralston 2013[66]	Study design: Cohort study Settings: Group Health and Kaiser Permanente Northern California Study period: 36 months Country: USA Theory used: No Overall quality:75%	Sample size: 7398 Range of age (mean): 45.6 Sex (Female): 10.3% Conditions: HIV	PHR name: MyGroupHealth & kp.org PHR functions: AR BA RP MP PHR platform: PC Provided by: Specialised clinic
Riippa 2014[67]	Study design: Cross-sectional survey & Cross-sectional survey Settings: primary care in Hämeenlinna Study period: 6 months Country: Finland Theory used: No Overall quality:25%	Sample size: 222 Range of age (mean): 62.7 Sex (Female): 49.1% Conditions: Chronic diseases	PHR name: n/a PHR functions: AR RP MP PHR platform: PC Provided by: Primary care

Roblin 2009[68]	Study design: Cohort study Settings: Kaiser Permanente Georgia Study period: 26 months Country: USA Theory used: No Overall quality:25%	Sample size: 2224 Range of age (mean): 25-59 (50) median Sex (Female): 59.2% Conditions: DM, elevated lipids, and low risk adults.	PHR name: kp.org PHR functions: AR BA RP MP EM AT PHR platform: PC Provided by: Primary care
Rodman 2015[69]	Study design: Cross-sectional survey Settings: a multi-specialty medical group with three primary and 19 satellite locations in Western New York Study period: 12 months Country: USA Theory used: No Overall quality:100%	Sample size: 130960 Range of age (mean): n/a Sex (Female): 58.9% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care
Ronda 2013[70]	Study design: Cross-sectional survey Settings: 62 primary care practices and 1 outpatient hospital clinic in Netherlands Study period: 5 months Country: Netherlands Theory used: No Overall quality:50%	Sample size: 2931 Range of age (mean): 63.9 years Sex (Female): 40.6% Conditions: Diabetes	PHR name: Digitaal Logboek PHR functions: AR MP EM AI PHR platform: PC Provided by: Primary care & Hospital
Ronda 2013[71]	Study design: Cross-sectional survey Settings: 62 primary care practices and 1 outpatient hospital clinic in Netherlands Study period: 5 months Country: Netherlands Theory used: No Overall quality:25%	Sample size: 2931 Range of age (mean): 63.9 years Sex (Female): 40.6% Conditions: Diabetes	PHR name: Digitaal Logboek PHR functions: AR MP EM AI PHR platform: PC Provided by: Primary care & Hospital
Ronda 2015[72]	Study design: Cross-sectional survey Settings: 62 primary care practices and 1 outpatient hospital clinic in Netherlands Study period: 5 months Country: Netherlands Theory used: No Overall quality:25%	Sample size: 632 Range of age (mean): 59.7 years Sex (Female): 36.9% Conditions: Diabetes	PHR name: Digitaal Logboek PHR functions: AR MP EM AI PHR platform: PC Provided by: Primary care & Hospital

Sarker 2010[73] 2011[74]	Study design: Cross-sectional survey Settings: Kaiser Permanente Northern California Study period: 12 months Country: USA Theory used: No Overall quality:50%	Sample size: 14102 Range of age (mean): 59 years Sex (Female): 49% Conditions: Diabetes	PHR name: Kp.org PHR functions: AR BA RP MP EM PHR platform: PC Provided by: n/a
Shimada 2014[75]	Study design: Cross-sectional survey Settings: Edith Nourse Rogers VA Hospital in Bedford Study period: 24 months Country: USA Theory used: No Overall quality:100%	Sample size: 5988043 Range of age (mean): 63.3 years Sex (Female): 6.2% Conditions: No restrictions	PHR name: My HealtheVet PHR functions: AR RP MP EM TS PHR platform: PC Provided by: Hospital
Silvestre 2009[76]	Study design: Cross-sectional survey Settings: Kaiser Permanente Study period: n/a Country: USA Theory used: TAM Overall quality: 0%	Sample size: 1702 Range of age (mean): 19-95 Sex (Female): 57% Conditions: No restrictions	PHR name: MyHealthManager PHR functions: AR BA RP MP EM AT PHR platform: PC Provided by: n/a
Smith 2015[77]	Study design: Cross-sectional survey Settings: Internal medicine clinic based at Northwestern Medical Faculty Foundation Study period: 39 months Country: USA Theory used: No Overall quality: 0%	Sample size: 534 Range of age (mean): n/a Sex (Female): 70% Conditions: No restrictions	PHR name: n/a PHR functions: AR RP MP EM TS PHR platform: PC Provided by: Specialised clinic
Sue 2011[78]	Study design: Cross-sectional survey Settings: Kaiser Permanente Study period: 36 months Country: USA Theory used: No Overall quality: 75%	Sample size: 6877138 Range of age (mean): n/a Sex (Female): 53% Conditions: No restrictions	PHR name: MyHealthManager PHR functions: AR BA RP MP EM PHR platform: PC Provided by: n/a
Sue 2013[79]	Study design: Cross-sectional survey Settings: Kaiser Permanente Study period: 12 months Country: USA Theory used: No Overall quality: 100%	Sample size: 3677 Range of age (mean): n/a Sex (Female): 59% Conditions: No restrictions	PHR name: MyHealthManager PHR functions: AR BA RP MP EM PHR platform: PC Provided by: Specialised clinic

Tenforde 2012[80]	Study design: Cross-sectional survey Settings: Cleveland Clinic Study period: 12 months Country: USA Theory used: No Overall quality:100%	Sample size: 10746 Range of age (mean): 60.5 years Sex (Female): 48% Conditions: No restrictions	PHR name: MyChart PHR functions: AR MP EM SR PHR platform: PC Provided by: Primary care
Tulu 2016[81]	Study design: Cross-sectional survey Settings: Seven primary care physicians located in the northeast USA Study period: 24 months Country: USA Theory used: No Overall quality:100%	Sample size: 1886 Range of age (mean): n/a Sex (Female): 58.9% Conditions: No restrictions	PHR name: n/a PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care
Wallace 2016[82]	Study design: Cross-sectional survey Settings: The OCHIN practice-based research network Study period: 12 months Country: USA Theory used: No Overall quality:50%	Sample size: 200 Range of age (mean): n/a Sex (Female): 64.5% Conditions: No restrictions	PHR name: MyChart PHR functions: AR BA RP MP AI PHR platform: PC Provided by: Primary care
Weingart 2006[83]	Study design: Case-control study Settings: Two primary care practices Study period: 1 month Country: USA Theory used: No Overall quality: 100%	Sample size: 200 Range of age (mean): 20-92 (47.9) Sex (Female): 61.5% Conditions: No restrictions	PHR name: PatientSite PHR functions: AR BA RP MP RR AI PHR platform: PC Provided by: Primary care
Weppner 2010[84]	Study design: Cohort study Settings: 5 medical clinics in western Washington Study period: 52 months Country: USA Theory used: No Overall quality:75%	Sample size: 6185 Range of age (mean): n/a Sex (Female): 50.9% Conditions: Diabetes	PHR name: MyGroupHealth PHR functions: AR BA RP MP PHR platform: PC Provided by: Primary care
Yamin 2011[85]	Study design: Cross-sectional survey Settings: Partners HealthCare Study period: 33 months Country: USA Theory used: No Overall quality:100%	Sample size: 75056 Range of age (mean): n/a Sex (Female): 61% Conditions: No restrictions	PHR name: Patient Gateway PHR functions: AR BA RP MP RR PHR platform: PC Provided by: Primary care

Appendix 18: Findings of each Objective Use Study



Author, year(ID)	Significant positive associations	Significant negative associations	Nonsignificant associations
Gordon 2016[4]	Ethnicity (non-Hispanic white)	Age	n/a
Ancker 2011[39]	Age, Ethnicity (White), Language (English and other language vs Spanish), Insurance (private), Health centre location (Bronx), Clinical Visits (more), Number of months since code issued (duration since diagnosed), Condition (HIV/AIDS)	n/a	Number of chronic conditions, Sex
Ancker 2015[40]	Ethnicity (non-Hispanics), Insurance (private insurance), Employment (employed), Income, Education (Postgraduate), Overall health status (better health), Having Internet access, Internet use Frequency, Place of accessing Internet (Work), Number of prescription medications	ED visits, Privacy concerns	Number of internet/ email devices, Hospitalizations in year, Patient activation level
Ancker 2016[41]	Enrolment policy, Number of encounters, Insurance status (Private), Ethnicity (Non-Hispanic)	Age, language (Spanish), Number of chronic conditions, Region (Hudson Valley)	Sex, Age
Cahill 2014[42]	Educational level, Income, Region,	Neurological function and disability, Treatment status (newly diagnosed)	Age, Sex, Marital status, Ethnicity
Carrell 2006[43]	Age (middle age), Sex (Female)	Health status (healthier)	n/a
Davis 2015[44]	Educational level- registration, Health literacy- registration, Educational level- inpatient portal use	n/a	Health literacy- inpatient portal use

Emani 2012[45]	Ease of use, Relative advantages, Observability, Trialability, Income, Education, Technology (computer) use and access, Personal innovativeness in information technology, Perceived Privacy and security of information in the PHR, Age, Ethnicity (Caucasian), Marital status (Married), Overall Health status	Number of comorbidities	Sex
Garrido 2015[46]	Ethnicity (non-Hispanic white), Written language preference (English), Sex (Women), Age (>=30 years), Number of annual office visits, Illness burden (health status), Distance to the nearest healthcare setting, Length of membership in the healthcare setting	n/a	n/a
Gerber 2014[47]	Ethnicity (White), Primary cancer type (upper aerodigestive malignancy)	Age	Sex
Goel 2011[48]	Perceived usefulness	Lack of motivation (Forgot/lazy/busy, taking too much time to enroll), Preference (phone over email), Security concerns, Lack of information (about enrolment instructions),	Perceived ease of use, Lack of computer skills, Lack of access to computers, Lack of access to the internet, Ethnicity
Goel 2011[49]	Ethnicity (white)	Age	Sex
Hibbard 2011[50]	Income, Patient activation level, Type of healthcare provider (physicians and nurse practitioners vs Physician assistants)	Age, Provider age	Sex, Provider Sex, Number of chronic conditions
Horvath 2011[51]	Age, Sex (female), Ethnicity (non-Hispanic), Ethnicity (white), Insurance status (Private)	n/a	n/a

Jhamb 2015[52]	Ethnicity (non-black), Marital status (Married), Insurance status (Private), Neighbourhood median household income (Higher), Estimated Glomerular Filtration Rate (eGFRb) (ml/min per 1.73 m2), Having kidney transplant, presence of a university-affiliated PCP, Outpatient visits with a university-affiliated provider (excluding nephrology)	Age, Having diabetes, Having Coronary artery disease, Having Congestive heart failure, Tobacco use, Dipstick proteinuria (=>1+), Serum creatinine (mg/dl), Nephrology office visits/yr	Sex, Having Hypertension, Having Hyperlipidemia, Having Cerebrovascular disease, Having Peripheral vascular disease, Chronic Kidney Disease (CKD) stage, Having Nephrolithiasis, Charlson comorbidity index
Lau 2014[53]	Weight, Follow-up A1C <7% at last visit	Age, Baseline A1C level, Follow-up A1C	Sex, Total follow up time, Baseline LDL, Follow-up LDL, Baseline systolic blood pressure, Follow-up Systolic blood pressure
Leveille 2016[54]	Age, Sex (Female), Having major chronic diseases, Number of emergency department visit, Hospitalizations	n/a	n/a
Lyles 2012[55]	Educational level, Income, Insulin use, Provider encouragement, Provider use of secure messaging, Ethnicity (white), Access to a computer or Internet, Knowledge/technical literacy, Awareness of the system	Age, Security concerns, Diabetes severity, Preferences/ attitude (waste of time, don't want to/don't like using computers, prefer in-person/phone communication)	Sex, Comorbidity score
Lyles 2013[56]	Trust in provider	n/a	Patient–provider communication
Martinez 2013[57]	Sex (female), Consultations in the last 12 months, Hospitalisation in the last 12 months, Comorbidity	Age	Residence place
Mikles 2015[58]	Sex (female), Language preference (English), Number of office visits during the year (more visits), Income, Educational level, Provider MyChart patient ratio	Age, Number of diagnoses, Under the poverty level	Ethnicity, Insurance status

Miller 2007[59]	Ethnicity (Caucasian), Insurance status (Insured), Marital status (Married), Number of health problems, Number of office visits, Employment (working).	Age	Sex
Nazi 2010[60]	Age, Sex (male), Military period of service	n/a	n/a
Nielsen 2012[61]	Ethnicity (White), Number of medications prescribed, Visual acuity, Employment (employed)	Upper extremity disability level	Age, Sex, Insurance status, Disease duration, Status of psychiatric history, Number of medical conditions
Palen 2012[62]	Age, Sex (female), Ethnicity (white)	n/a	n/a
Raghu 2015[63]	Insurance status (Private), Ethnicity (white), Visiting a primary care/medicine provider, Number of prescriptions, Emergency department visits, In-patient admissions	Age, Visiting a specialist, Outpatient visits in the last six months	Sex
Ralston 2007[64] **2006**[65]	Sex (female), Insurance status (private), Expected clinical needs (health status)	n/a	Age
Ralston 2013[66]	Age, Sex (male), Ethnicity (white), Socioeconomic neighbourhoods, Risk Factor for HIV (Men sex with men), Taking antiretroviral therapy, Have CD4+ count <200 cells/µL, Have hepatitis C, Have depression, Insurance status (Medicare or Medicaid), New to antiretroviral therapy (ART) (1st time),	Non-HIV comorbidity score, Health plan duration	History of depression, Have hepatitis B
Riippa 2014[67]	Number of referrals to specialized care	Having at least one HbA1c measurement, Having at least one BMI measurement, Having at least one blood pressure measurement, Number of nurse visits	Age, Sex, Patient activation, Doctor visits, Doctor calls, Nurse calls, Having at least one LDL measurement, Mental Health at access, Comorbidity, Having type 1 or 2 diabetes, Patients' physiological health, Having Hypercholesterolemia

Roblin 2009[68]	Sex (female), Ethnicity (white), Baseline Internet access, Educational level, Health problem (diabetes or elevated lipids)	n/a	Age, Patient activation
Rodman 2015[69]	Sex (male), Insurance status (private/commercial/other), Number of active problems	Age	n/a
Ronda 2013[70]	Sex (male), Educational level, Employment status, Fluency in Dutch, Internet access, Computer access, Polypharmacy, Alcohol, Smoking, Insulin use, Systolic blood pressure, Diastolic blood pressure, Total cholesterol, HDL-cholesterol, LDL-cholesterol, Perceived frequency of hyperglycemia, Perceived frequency of hypoglycemia, Self-efficacy, Diabetes knowledge, Diabetes-specific distress score.	Age, Treatment setting (general practice), Living arrangements (alone), Physical active, Nonadherence	Duration of diabetes, HbA1c level, score on Patient-reported outcomes, Quality of life (health status), General treatment satisfaction, Comorbidity (Peripheral arterial disease, Cardiac complications, Cerebral complications, Nephropathy, Retinopathy, Neuropathy, Body mass index, Ethnicity
Ronda 2013[71]	Educational level, Using insulin, Polypharmacy, Diabetes knowledge, Hyperglycemic episodes, hypoglycemia episodes, Perceived usefulness, Informed about the portal by provider, Employment status (paid job), Fluency in Dutch (higher), Computer access, internet access, internet use, Searching internet for health information, Type of diabetes (type 1), Duration of diabetes, DM medications, Self-Efficacy, diabetes-specific distress, Drinking alcohol	Age, Smoking, Living arrangement (alone), Treatment setting (general practice),	Sex, Ethnicity

Ronda 2015[72]	Employment status (paid job), Internet use, Treatment setting (internist), diabetes-related medication (insulin), Diabetes knowledge, hyperglycemic episodes, hypoglycemic episodes, use of insulin, Searching internet for health information, Easy to use, Easy to login, Satisfaction with the layout, Comprehensibility of the information, Usefulness	Age, HbA1c level	Sex, Ethnicity, Educational level, Living arrangements (alone), Fluency in Dutch, Type of Diabetes, Duration of diabetes, Polypharmacy (using > 4 medications), Total cholesterol, Smoking, Alcohol, Diabetes-specific distress, Self-Efficacy
Sarker 2010[73] **2011**[74]	Ethnicity (white and Asian), Educational level, Health literacy, Computer/internet access	n/a	Age, Sex, Income
Shimada 2014[75]	Sex (women), Health conditions (HIV, Hyperlipidemia and hypertension, SCI, PTSD, TBI, spinal cord injury, depression and anxiety)	Age, Economic need (eligibility for free care based on the annual VA financial assessment), Having complex chronic medical conditions (CHD, CHF, Schizophrenia)	n/a
Silvestre 2009[76]	Perceived usefulness, Perceived system quality	n/a	Perceived ease of use
Smith 2015[77]	Ethnicity (white), Educational level, Health literacy	n/a	Age, Sex, Number of chronic conditions
Sue 2011[78]	Age, Sex (female), Ethnicity (white)	n/a	n/a
Sue 2013[79]	Age, Income	Ethnicity (Hispanic)	Sex, Educational level
Tenforde 2012[80]	Ethnicity (Caucasian), Income, Educational level, Insurance status (commercial), Diabetes quality measure values (lower HbA1c values, SBP & DBP values)	Age	Sex

Tulu 2016[81]	Age	n/a	Sex
Wallace 2016[82]	Sex (female), Ethnicity (non-Hispanic), Insurance status (private), Income, Language (English), Number of primary care visits	n/a	Age, Number of chronic conditions
Weingart 2006[83]	Ethnicity (white)	Age, Insurance status (Medicare or Medicaid insurance), number of medical problems, Number of prescription medications, Number of office visits in past year, Number of hospitalizations in past year	Sex
Weppner 2010[84]	Sex (male), Socioeconomic status neighborhood, PCP use of secure messaging	Age	Distance from clinic, Insulin use
Yamin 2011[85]	Ethnicity (white), Income, Number of Comorbidity, Marketing strategy (aggressive)	Number of visits to a primary care provider	Age, Sex, Insurance status

Appendix 19: Studies that Assessed each Factor Affecting Objective Use

Group	Factors	Positive associations	Negative associations	No associations	Total	Notes
Personal factors: Demographic factors	Age	12[39,43,45,46,51,54,60,62,66,78,79,81]	20[4,41,47,49,50,52,53,55,57,58,59,63,69,70,71,72,75,80,83, 84]	10[41,42,61,64/65,67,68,73/74,77,82,85]	41	[41]:negative relationship when the setting adopted opt-in policy, and no relationship when the setting used universal access policy
	Sex (female)	12[43,46,51,54,57,58,62,64/65,68,75,78,82]	5[60,66,69,70,84]	23[39,41,42,45,47,49,50,52,53,55,59,61,63,67,71,72,73/74,77,79,80,81,83,85]	40	
	Ethnicity (white)	26[4,39,40,41,45,46,47,49,51,52,55,58,59,61,62,63,66,68,73/74,77,78,79,80,82,83,85]		6[41,42,48,70,71,72]	31	[41]:there is positive relationship when the setting adopted the opt-in policy and there is no relationship when the setting used the universal access policy
	Education level	15[40,42,44,45,55,57,58,66,68,70,71,73/74,77,80,84]		2[72,79]	17	[66,84]:Socioeconomic status
	Insurance status (private)	12[39,40,41,51,52,59,63,64/65,69,80,82,83]	1[66]	3[58,61,85]	16	
	Income	14[40,42,45,50,52,55,58,66,75,79,80,82,84,85]		1[73/74]	15	[66,84]:Socioeconomic status
	Language	7[39,41,46,58,70,71,82]		1[72]	8	[39,41,46,58,82]: English [70,71,72]: Dutch
	Employment status (Employed)	8[40,59,61,66,70,71,72, 84]			8	[66,84]:Socioeconomic status
	Marital status (married)	3[45,52,59]		1[42]	4	
	Residence place	2[41,42]		1[57]	3	
	Living arrangements (alone)		2[70,71]	1[72]	3	
	Distance to the nearest healthcare setting	1[46]		1[84]	2	
	Military period of service	1[60]			1	

Personal factors: Digital divide-related factors	Internet access	6[40,55,68,70,71,73/74]		1[48]	7	
	Computer access	5[45,55,70,71,73/74]		1[48]	6	
	Internet use/experience	3[40,71,72]			3	
	Self-efficacy	2[70,71]		1[72]	3	
	Computer literacy	2[48,55]			2	
	Personal innovativeness	1[45]			1	
	Place of accessing internet (work)	1[40]			1	
	Computer use	1[45]			1	
	Number of internet/ email devices			1[40]	1	
Personal factors: health- related factors	Number of diseases/ comorbidities	5[54,57,59,69,85]	5[41,44,58,66,83]	9[39,50,52,55,61,67,70,77,82]	19	[39,41,50, 54,77,82]: Number of chronic conditions
	Clinical office visits	9[39,41,46,52,57,58,59,63,82]	5[52,63,67,83,85]	1[67]	12	[52]: All outpatient offices (+ve) except nephrology office (-ve) [63]:Visiting a specialist & outpatient visits (-ve) Visiting a primary care/medicine provider (+ve) [67]: Number of nurse visits (-ve), number of doctor visits (no)
	Type of disease	6[39,47,66,68,71,75]	2[52,75]	5[52,61,66,67,72]	10	[39]: HIV/AIDS [47]: Upper aerodigestive malignancy [52]: Diabetes, coronary artery disease, congestive heart failure (-ve) [52]: Hypertension, hyperlipidemia, cerebrovascular disease, peripheral vascular disease, chronic kidney disease stage, nephrolithiasis (no) [61]: Psychiatric history [66]: Hepatitis C, depression (+ve), hepatitis B (no) [67]: Type 1 or 2 diabetes, hypercholesterolemia (no) [68]: Diabetes or elevated lipids [71]: Type 1 Diabetes [72]: Type of diabetes [75]: HIV, hyperlipidemia, hypertension, post-traumatic stress disorder, traumatic brain injury, spinal cord injury, depression and anxiety (+ve) complex chronic medical conditions (CHD, CHF, Schizophrenia) (-ve)
	Number of medications	5[40,61,63,70,71]	1[83]	1[72]	7	

	Health status (healthier)	5[40,45,46,52,64/65]		1[67]	6	[46]: Illness burden [52]: Stage of chronic kidney disease [64/65]: Expected clinical needs [67]: Physiological health & mental health
	Duration since diagnosed	2[39,71]		3[61,70,72]	5	
	Hospitalizations	3[54,57,63]	1[83]	1[40]	5	
	Tobacco use	1[70]	3[52,71,80]	1[72]	5	
	Using diabetes-related medication (insulin)	3[55,71,72]		1[84]	4	
	HbA1C level		2[72,80]	1[70]	3	
	Patient activation level	1[50]		2[67,68]	3	
	Health literacy	3[44,73/74,77]		1[44]	3	[44]:Effect of health literacy on PHR use (no), Effect of health literacy on PHR registration (+ve)
	Emergency department visits	2[54,63]	1[40]		3	
	Alcohol use	2[70,71]		1[72]	3	
	Weight/ body mass index	1[53]		2[70,80]	3	
	Diabetes-specific distress score	2[70,71]		1[72]	3	
	Episodes of hypoglycemia or hyperglycemia	3[70,71,72]			3	
	Diabetes knowledge	3[70,71,72]			3	
	Low-density lipoprotein (LDL) cholesterol level			3[53,70,80]	3	
	Systolic blood pressure level		2[70,80]	1[53]	3	
	Diastolic blood pressure level		1[80]	1[70]	2	
	Total Cholesterol level		1[70]	1[72]	2	
	Disability		2[42,61]		2	
	Number of referrals	1[67]			1	
	Taking antiretroviral therapy	1[66]			1	
	CD4+ count <200 cells/μL	1[66]			1	
	HIV RNA ≥77 copies/ml	1[66]			1	

	New to antiretroviral therapy (ART) (1st time)	1[66]			1	
	Visual acuity	1[61]			1	
	Risk factor for HIV (gay)	1[66]			1	
	Having kidney transplant	1[52]			1	
	Length of membership in the healthcare setting	1[46]			1	
	Nonadherence		1[70]		1	
	Treatment stage (newly diagnosed)		1[42]		1	
	Health plan duration		1[66]		1	
	Dipstick proteinuria (≥1+)		1[52]		1	
	Serum creatinine level		1[52]		1	
	Having ≥1 HbA1C measurement		1[67]		1	
	Having ≥1 BMI measurement		1[67]		1	
	Having ≥1 blood pressure measurement		1[67]		1	
	High-density lipoprotein (HDL) cholesterol level			1[70]	1	
	Having at least one LDL measurement			1[67]	1	
	Total follow up time			1[53]	1	
	Number of provider calls			1[67]	1	
	Physically active			1[70]	1	
	Score on patient-reported outcomes			1[70]	1	
	Quality of life			1[70]	1	

Human-technology interaction factors	Perceived usefulness/ benefits/ value	4[45,48,71,72,76]			5	
	Perceived ease of use	2[45,72]		2[48,76]	4	[72]: Easy to use, Easy to login
	Privacy and security concerns		4[40,45,48,55]		4	
	Awareness of ePHRs	2[48,55]			2	
	Preferences (in person)		2[48,55]		2	
	Observability	1[45]			1	
	Trialability	1[45]			1	
	Perceived system quality	1[76]			1	
	Lack of motivation		1[48]		1	
Organisational factors	Practice setting (Primary care)		3[70,71,72]		3	
	Provider use of secure messaging	2[55,84]			2	
	Provider encouragement	1[55]			1	
	Trust in provider	1[56]			1	
	Enrolment policy (universal access policy)	1[41]			1	[41]: opt-in policy vs universal access policy
	Type of healthcare provider (Physicians and nurse practitioners)	1[50]			1	
	Provider ePHRs patient ratio	1[58]			1	
	University-affiliated primary care provider	1[52]			1	[52]:versus non-university-affiliated primary care provider
	Number of practice's marketing strategies (aggressive)	1[85]			1	Aggressive marketing strategy (using more than 5 strategies) vs Normal (using 5 or fewer strategies)
	Provider age		1[50]		1	
	Provider gender			1[50]	1	
	Satisfaction with general treatment			1[70]	1	
	Patient–provider communication			1[56]	1	

Appendix 20: Theory-Based Studies

Author (year)	Theory used	Technology studied	Dependent variable	Independent variables	Influential variables	Variance explained/ notes
Day and Gu (2012)	Technology Acceptance Model (TAM)	ePHRs	Use	Perceived usefulness, Perceived ease of use, Computer literacy, Health literacy, and PHR cost.	Perceived usefulness, Perceived ease of use, Computer literacy, Health literacy, and PHR cost.	Variance: n/a Qualitative study
Klein (2007)	Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived Usefulness, Perceived ease of use, Computer self-efficacy, Personal innovativeness, Healthcare needs, and Settings.	Perceived Usefulness, Perceived ease of use (on Perceived usefulness), Computer self-efficacy (on perceived ease of use and Personal innovativeness), Personal innovativeness, Healthcare needs, and Settings.	Variance: 39%-49%
Lazard et al. (2015)	Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived usefulness, Perceived ease of use, Simplicity, Diversity, Colorfulness, and Craftsmanship.	Perceived usefulness, Perceived ease of use (on perceived usefulness), and Simplicity (on perceived ease of use).	Variance: 29%
Morton (2012)	Technology Acceptance Model (TAM)	ePHRs	Use	Perceived usefulness, Perceived ease of use, Sex, Age, Education, Years since diagnosed, Health status, Computer access/use, Computer literacy, and Health literacy.	Perceived ease of use, Education, and Computer access.	Variance: n/a Diabetic patients
Noblin (2010)	Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived usefulness, Perceived Ease of use, Health literacy, Health status, Socioeconomic status.	Perceived usefulness, Perceived Ease of use, Health literacy (only on perceived usefulness), and Socioeconomic status (only on perceived ease of use and health literacy).	Variance: 49.6%
Silvestre, Sue, and Allen (2009)	Technology Acceptance Model (TAM)	ePHRs	Use	Perceived usefulness, Perceived ease of use, and Perceived system quality.	Perceived usefulness, and Perceived system quality.	Variance: 57%

Silvestre, Sue, and Allen (2009)	Technology Acceptance Model (TAM)	ePHRs	Use	Perceived usefulness, Perceived ease of use, and Perceived system quality.	Perceived usefulness, and Perceived system quality.	Variance: 57%
Torres (2011)	Combined Technology Acceptance Model-Theory of Planned Behaviour (C-TAM-TPB)	ePHRs	Intention to use	Perceived usefulness, Perceived ease of use, Attitude, Social influences, Perceived behavioural control, Electronic PHIM Apathy, and Electronic PHIM anxiety.	Perceived usefulness, Perceived ease of use, Attitude, Social influences, Perceived behavioural control, Electronic PHIM anxiety (as a moderator of the effect of PU & PEU on Attitude and Social influence on intention), and Electronic PHIM Apathy.	Variance: 68% College students
Agarwal et al. (2013)	Social Cognitive Theory (SCT)	ePHRs	Intention to use	Patient activation, Provider satisfaction, Tool empowerment potential, Value of tool functionality, and Communication tactics.	Provider satisfaction, interactions between communication tactics and value of the tool functionality, and interactions between patient activation and tool empowerment potential.	Variance: 42%
Laugesen (2013)	Protection Motivation Theory (PMT), Task-Technology Fit (TTF)	ePHRs	Intention to use	Response efficacy (RE), Self-efficacy (SE), Perceived task technology fit (PTTF), Response Costs (RC), Patient Activation Measure (PAM), Severity, Vulnerability Age, Education, Income, and Type 2 Diabetes Control.	Response efficacy, Self-efficacy, Perceived task technology fit, Response Costs, Patient Activation Measure (on SE & PTTF), Severity (on RE & PTTF), Vulnerability (on SE, RE & PTTF), Age (on SE, RE & PTTF), Income (intention), and Type 2 Diabetes Control (on RE & PTTF).	Variance: 68.6% Patients with type 2 diabetes
Tavares and Oliveira (2016)	Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)	ePHRs	Use	Intention, Perceived usefulness, Perceived ease of use, Social influence, Facilitating conditions, Habit, Self-perception, Price value, Hedonic motivation, Chronic disability (as moderator and predictor), Age (as moderator and predictor), and Sex (as moderator and predictor).	Intention (on use), Perceived usefulness, Perceived ease of use, Habit (on use), Self-perception, and Age (on Use)	Variance: Use: 26.8% Intention: 49.7% Users & students

Emani et al. (2012)	Innovation Diffusion Theory (IDT)	ePHRs	Use	Ease of use, Relative advantages, Observability, Trialability, Income, Education, Technology (computer) use and access, Personal innovativeness in information technology, Perceived privacy and security of information in the PHR, Age, Sex, Race, Marital status, Overall Health status, and Number of comorbidities.	Ease of use, Relative advantages, Observability, Trialability, Computer use (on perceived value of ePHRs), Perceived Privacy and security (on perceived value of ePHRs), and Age (on perceived value of ePHRs)	Variance: 72%
Andrews, Gajanayake, and Sahama (2014)	Theory of Planned Behaviour	ePHRs	Intention to use	Attitudes, Social influences, Perceived behavioural control Perceived value, Perceived risk, Perceived usefulness, Perceived ease of use, Compatibility, Web-self efficacy, Trust, and Privacy concerns.	Attitudes, Perceived value, Perceived risk, Perceived usefulness, Trust (as a mediator), Privacy concerns (as a mediator), Compatibility, and Web-self efficacy (as a mediator), Social influences (not testable).	Variance: 50%
Archer and Cocosila (2014)	Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT)	ePHRs	Intention to use	Perceived usefulness, Internet reliance, Computer self-efficacy, Security, Privacy and Trust in PHRs, Personal IT innovativeness, Computer anxiety, Access to data sources, Satisfaction with medical care, and Information seeking.	Perceived usefulness, Security, Privacy and Trust in PHRs (on perceived usefulness only), Personal IT innovativeness, and Computer anxiety.	Variance: 61%
Assadi (2013)	IS theories & Self-Determination Theory	ePHRs	Intention to use	Perceived usefulness, Complexity, ePHR self-efficacy, Basic needs satisfaction, Physician autonomy support, and Autonomous causality orientation.	Perceived usefulness, Complexity, ePHR self-efficacy (only on complexity), Basic needs satisfaction, Physician autonomy support, and Autonomous causality orientation.	Variance: 65%
Baird (2012)	Innovation Diffusion Theory (IDT)	ePHRs	Intention to use	Relative advantage, Compatibility, Complexity, Trialability, Observability, Age, Income, Sex, Perceived health status, Number of household residents, Privacy and Security concerns, and Interoperability.	Relative advantage, Compatibility, Complexity, and Sex, Privacy and Security concerns, Interoperability.	Variance: Model 1 13.9% Model 2 14.9% Model 3 10%

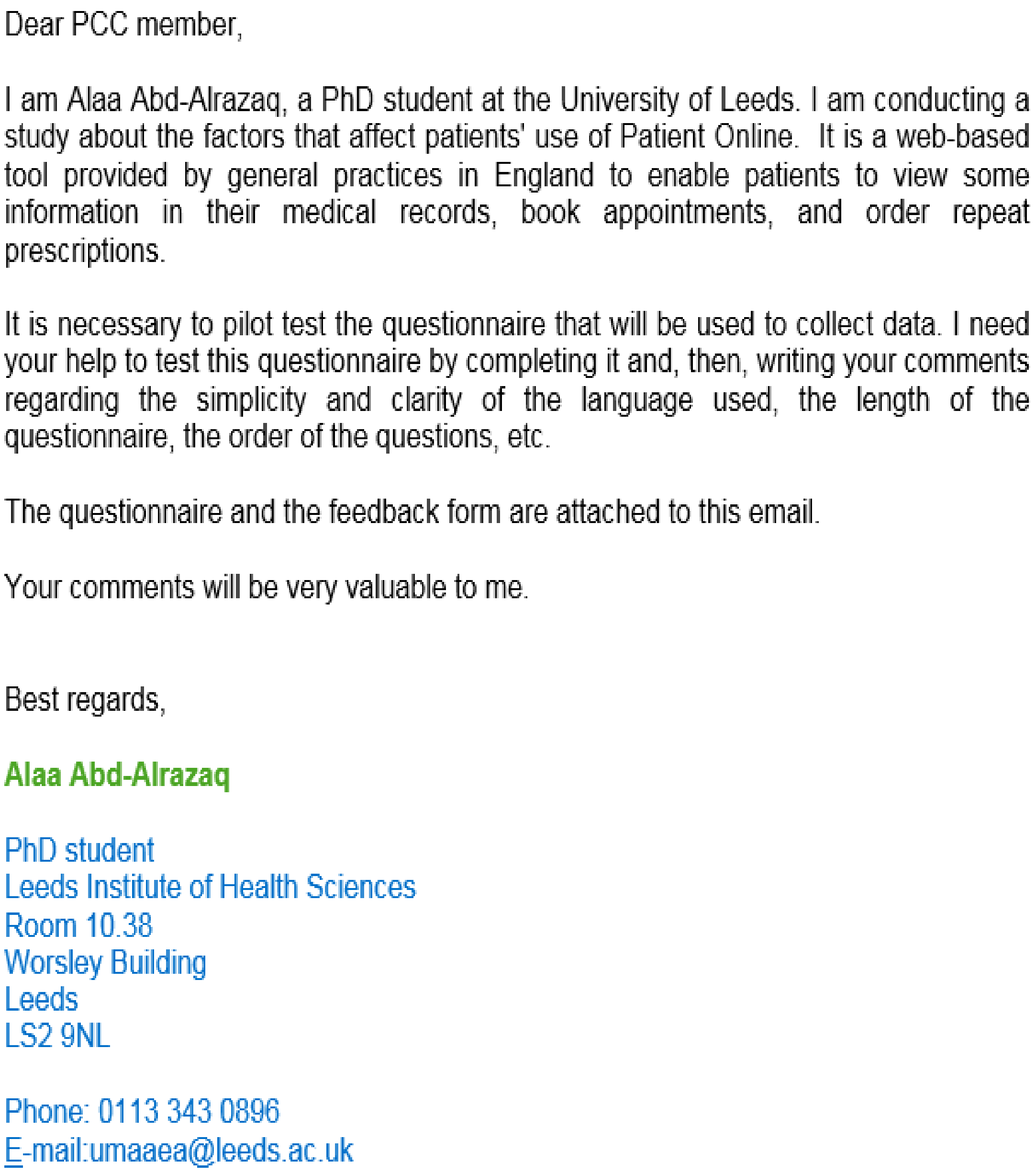
Daglish (2013)	Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived usefulness, Computer self-efficacy, Perceived risk (privacy), Risk profile, Trust, Distrust, Disposition to trust, Disposition to distrust, institutional trust, Institutional distrust, and Structural assurances.	Perceived usefulness, Computer self-efficacy, Perceived risk (privacy), Trust, Distrust, Disposition to trust, Disposition to distrust, institutional trust, Institutional distrust, and Structural assurances.	Variance: 52%
Feistel (2014)	Technology Acceptance Model, Theory of Reasoned Action, Theory of Planned Behavior	ePHRs	Intention to use	Attitude, Perceived usefulness, Perceived ease of use, Privacy concerns, Security concerns, Enablement, Trust in health care provider, Sex, ePHRs Anxiety, Health self-efficacy, and Perceived risk.	Attitude, Perceived usefulness, Perceived ease of use, Privacy concerns (on PU and PEU), Security concerns (on PU and PEU), Enablement, Trust in health care provider.	Variance: 35%
Gartrell (2014)	Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived usefulness, Perceived ease of use, Perceived data privacy and security protections, Perceived Health promoting role model As moderators: age, Chronic illness/ medication use, and Providers' use of EHR.	Perceived usefulness, Perceived ease of use, Perceived Health promoting role model, age (on perceived Health promoting role model), Providers' use of EHR (on perceived data privacy and security protections).	Variance: n/a It focused on use of ePHRs by nurses
Jian et al. (2012)	Technology Acceptance Model (TAM)	USB PHRs	Use	Intention, Perceived Usefulness, Perceived ease of use, Social influence, Computer Self-efficacy, and Security and Privacy, Education, Age, and Sex.	Intention, Perceived Usefulness, Social influence, and Age.	Variance: n/a
Liu et al. (2013)	Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived usefulness, Perceived ease of use, and physician-patient relationship.	Perceived usefulness, Perceived ease of use (on perceived usefulness), and physician-patient relationship.	Variance: 57.7%
Logue (2011)	SCT, UTAUT Integrated Behavioral Model, Individual and Family Self-Management Theory	ePHRs	Intention to use	Environmental factors, Personal factors, Technology factors, and Chronic illness factors.	Environmental factors, Personal factors, Technology factors, and Chronic illness factors.	Variance: n/a Older adults with chronic diseases

Majedi (2014)	Social Cognitive Theory (SCT) & Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived usefulness, Perceived ease of use, Social influence, Computer anxiety, Degree of integration, Information accessibility, and User awareness.	Perceived usefulness, Perceived ease of use, Social influence (on awareness and ease of use), Computer anxiety, Information accessibility, and User awareness.	Variance: 68.2%
Rao (2014)	Technology Acceptance Model, Innovation Diffusion Theory (IDT), Theory of self-efficacy	ePHRs	Intention to use	Perceived usefulness, Perceived ease of use, Privacy, Health status, Self-efficacy, Age, and Education.	Perceived usefulness, Perceived ease of use, Privacy, and Self-efficacy.	Variance: 17.3%-59% Older adults
Richards (2012)	Technology Acceptance Model, Information Boundary Theory, and trust models,	ePHRs	Intention to use	Perceived usefulness, Perceived ease of use, Privacy concerns, Trust, Computer Self-Efficacy, Personal Innovativeness, Health Literacy, Health Conditions, Age, Income, Educational level, Sex, healthcare need, and healthcare knowledge.	Perceived usefulness, Perceived ease of use (on usefulness), Trust (on ease of use and usefulness), As moderators (Age, Sex, Income, Educational level, Computer Self-Efficacy, and Personal Innovativeness.	Variance: n/a
Wilson and Lankton (2004)	Technology Acceptance Model (TAM), Motivational Model (MM)	ePHRs	Intention to use	Perceived Usefulness, Perceived ease of use, Intrinsic motivation, Extrinsic motivation, Satisfaction with medical care, Health Care knowledge, Information-seeking preference, Health care need, and Internet dependence.	Perceived Usefulness, Perceived ease of use, Intrinsic motivation, extrinsic motivation, Satisfaction with medical care (on intrinsic motivation), Information-seeking preference (on perceived ease of use), and Internet dependence (on perceived Usefulness, and intrinsic motivation).	Variance: 70%
Whetstone and Goldsmith (2009)	Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived Usefulness, Personal innovativeness, Privacy and security, Sex, Age, Presence of a chronic illness, and Awareness of PHRs.	Perceived Usefulness, Personal innovativeness, Privacy and security, and Awareness of PHRs.	Variance: 38% Sample of undergraduate students

Wu (2013)	Technology Acceptance Model (TAM)	ePHRs	Intention to use	Perceived usefulness, Perceived ease of use, Security, Health information understandability, personalization, Patient-clinician communication, Willingness to share, Health motivation, Health knowledge, Self-efficacy, and Social influence.	Perceived usefulness, Health information understandability, personalization, Patient-clinician communication, Social influence, and Willingness to share.	Variance: 26%
Beenkens (2011)	Unified Theory of Acceptance and Use of Technology (UTAUT)	e-health	Intention to use	Perceived usefulness, Perceived ease of use, Social influence, Quality of care provided, Computer self-efficacy, Computer anxiety Moderator: Education, Quality of care provided.	Perceived usefulness, Perceived ease of use, Quality of care provided, Education (moderator for perceived usefulness). (Social influence, Computer self-efficacy, and Computer anxiety could not be assessed).	Variance: 41% Patients with venous thrombosis
Cimperman, Brenčič, and Trkman (2016)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Home Telehealth Services	Intention to use	Performance expectancy, Effort expectancy, Social influence, Facilitating conditions, Perceived security, Computer anxiety, Doctor's opinion influence, Age, Sex, and Education.	Performance expectancy, Effort expectancy, Facilitating conditions, Perceived security, Computer anxiety, and Doctor's opinion influence.	Variance: 77.6% Older adults
de Veer et al. (2015)	Unified Theory of Acceptance and Use of Technology (UTAUT)	e-health	Intention to use	Performance expectancy, Effort expectancy, Social influence, Self-efficacy, Age, Sex, and Educational level.	Performance expectancy, Effort expectancy, and Self-efficacy.	Variance: 41% Community dwelling older people
Mekawie (2013)	Unified Theory of Acceptance and Use of Technology (UTAUT)	e-health	Intention to use	Performance expectancy, Effort Expectancy, Social influence, Facilitating conditions, Online privacy, Online trust, Internet experience, Satisfaction with medical, and Internet experience and exposure.	Performance expectancy, Effort Expectancy, Privacy concerns, Facilitating conditions, Online trust, and Internet experience.	Variance: n/a

Or (2008)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Interactive web-based health information system	Use	Intention, Perceived usefulness, Perceived ease of use, Social influence, Facilitating conditions, Healthcare knowledge, Perceived upper extremity functional ability, Perceived visual functional status, and Health information seeking preference.	Intention, Perceived usefulness, Perceived ease of use (on perceived usefulness), Social influence (on perceived usefulness), and Healthcare knowledge (on use).	Variance: Use: 68.5% Intention: 53.9% Older adults with chronic cardiac disease
Chen and Chan (2014)	Technology Acceptance Model (TAM)	Gerontechnology	Use	Attitude, Perceived usefulness, Perceived ease of use, Gerontechnology self-efficacy, Gerontechnology anxiety, Facilitating conditions, Self-reported health conditions, Cognitive ability, Social relationships, Attitude to life and satisfaction, Physical functioning, Age, Sex, Education level, and Economic status.	Perceived usefulness, Perceived ease of use, Gerontechnology self-efficacy, Gerontechnology anxiety, Facilitating conditions, Self-reported health conditions, Cognitive ability, Social relationships, Attitude to life and satisfaction, Physical functioning, Age, Sex, Education level, and Economic status.	Variance: overall 68% but the variance is only 6.3% for health technology
Kim and Park (2012)	Technology Acceptance Model 3 (TAM3), Health Belief Model (HBM), Theory of Planned Behaviour	Health information technology (HIT)	Intention to use	Attitude, Perceived threat, Perceived usefulness, Perceived ease of use, Health status, Health belief and concerns, Social influence, HIT reliability, HIT self-efficacy, Perceived susceptibility, Perceived seriousness, and Perceived threat.	Attitude, Perceived threat, Perceived usefulness, Perceived ease of use, Health status, Health belief and concerns, Social influence, HIT reliability, HIT self-efficacy, Perceived susceptibility, Perceived seriousness, and Perceived threat.	Variance: 83%

Appendix 21: Invitation Letter for Pilot Testing



Dear PCC member,

I am Alaa Abd-Alrazaq, a PhD student at the University of Leeds. I am conducting a study about the factors that affect patients' use of Patient Online. It is a web-based tool provided by general practices in England to enable patients to view some information in their medical records, book appointments, and order repeat prescriptions.

It is necessary to pilot test the questionnaire that will be used to collect data. I need your help to test this questionnaire by completing it and, then, writing your comments regarding the simplicity and clarity of the language used, the length of the questionnaire, the order of the questions, etc.

The questionnaire and the feedback form are attached to this email.

Your comments will be very valuable to me.

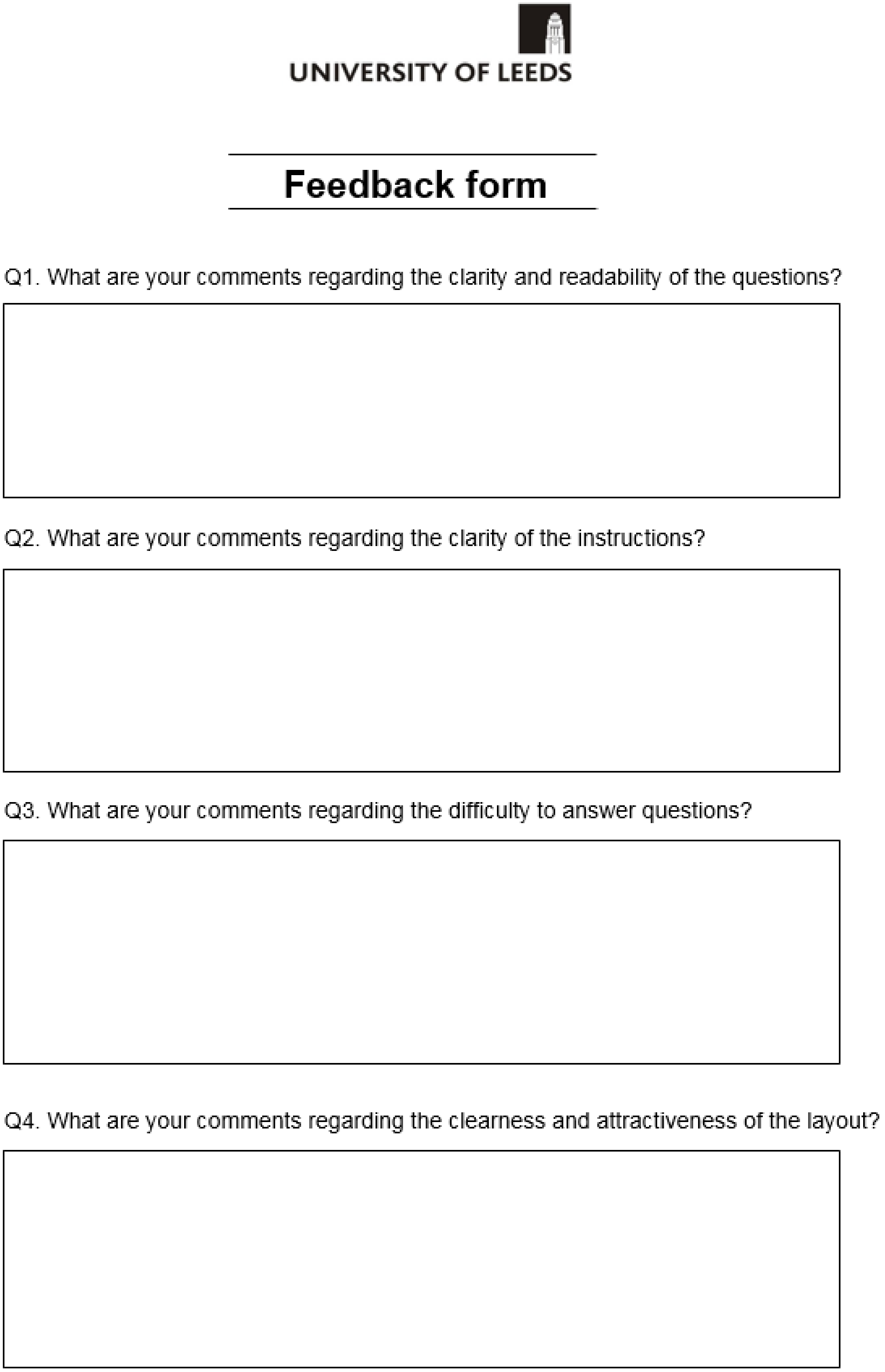
Best regards,

Alaa Abd-Alrazaq

PhD student
Leeds Institute of Health Sciences
Room 10.38
Worsley Building
Leeds
LS2 9NL

Phone: 0113 343 0896
E-mail:umaaea@leeds.ac.uk

Appendix 22: Feedback Form



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Feedback form

Q1. What are your comments regarding the clarity and readability of the questions?

Q2. What are your comments regarding the clarity of the instructions?

Q3. What are your comments regarding the difficulty to answer questions?

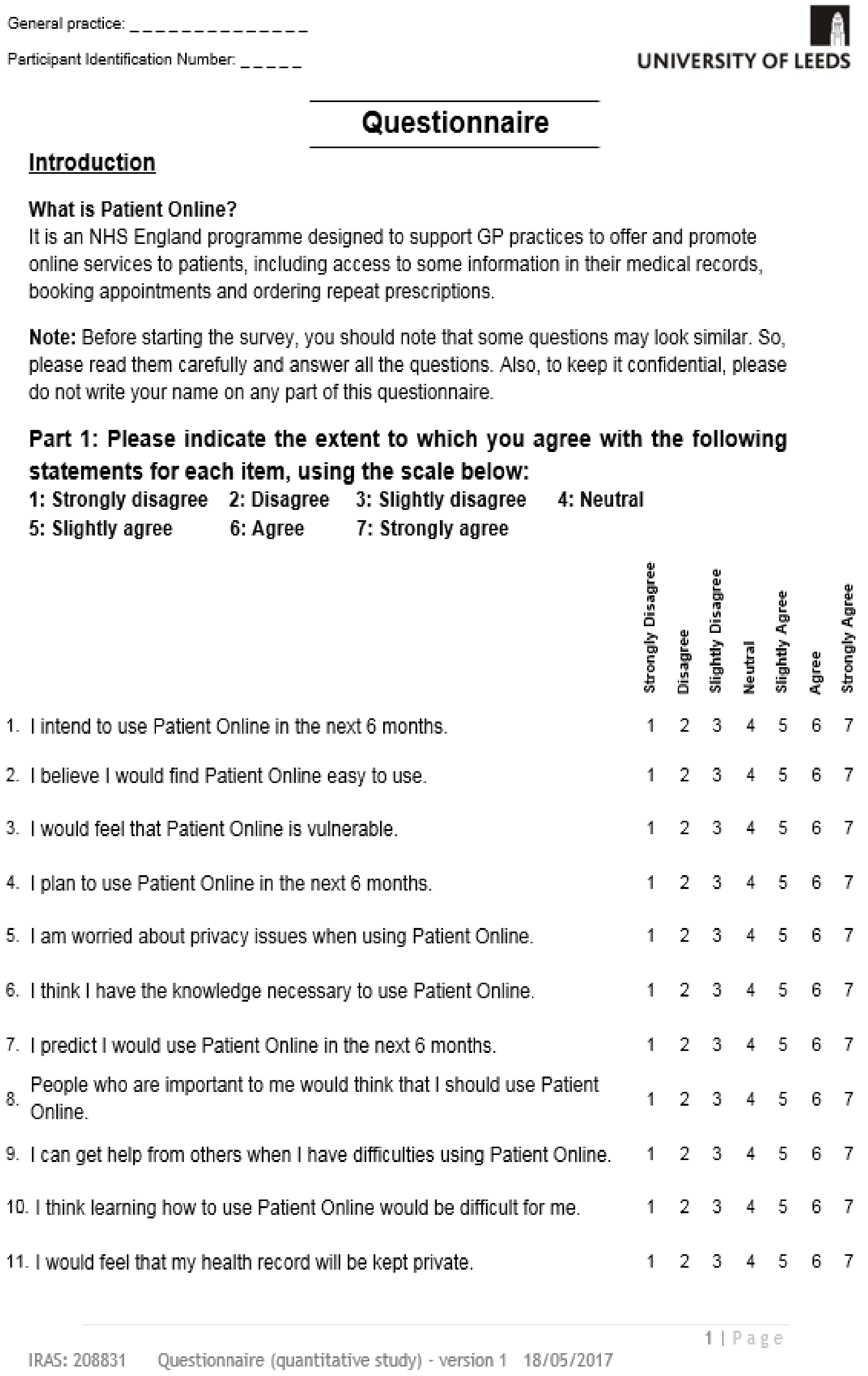
Q4. What are your comments regarding the clearness and attractiveness of the layout?

Q5. What are your comments regarding the time needed to complete the questionnaire?

Q6. What are your comments regarding the order of the question?

Q7. If you have any other comments regarding the questionnaire, please add them here.

Appendix 23: Questionnaire



General practice: _______________

Participant Identification Number: _____

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Questionnaire

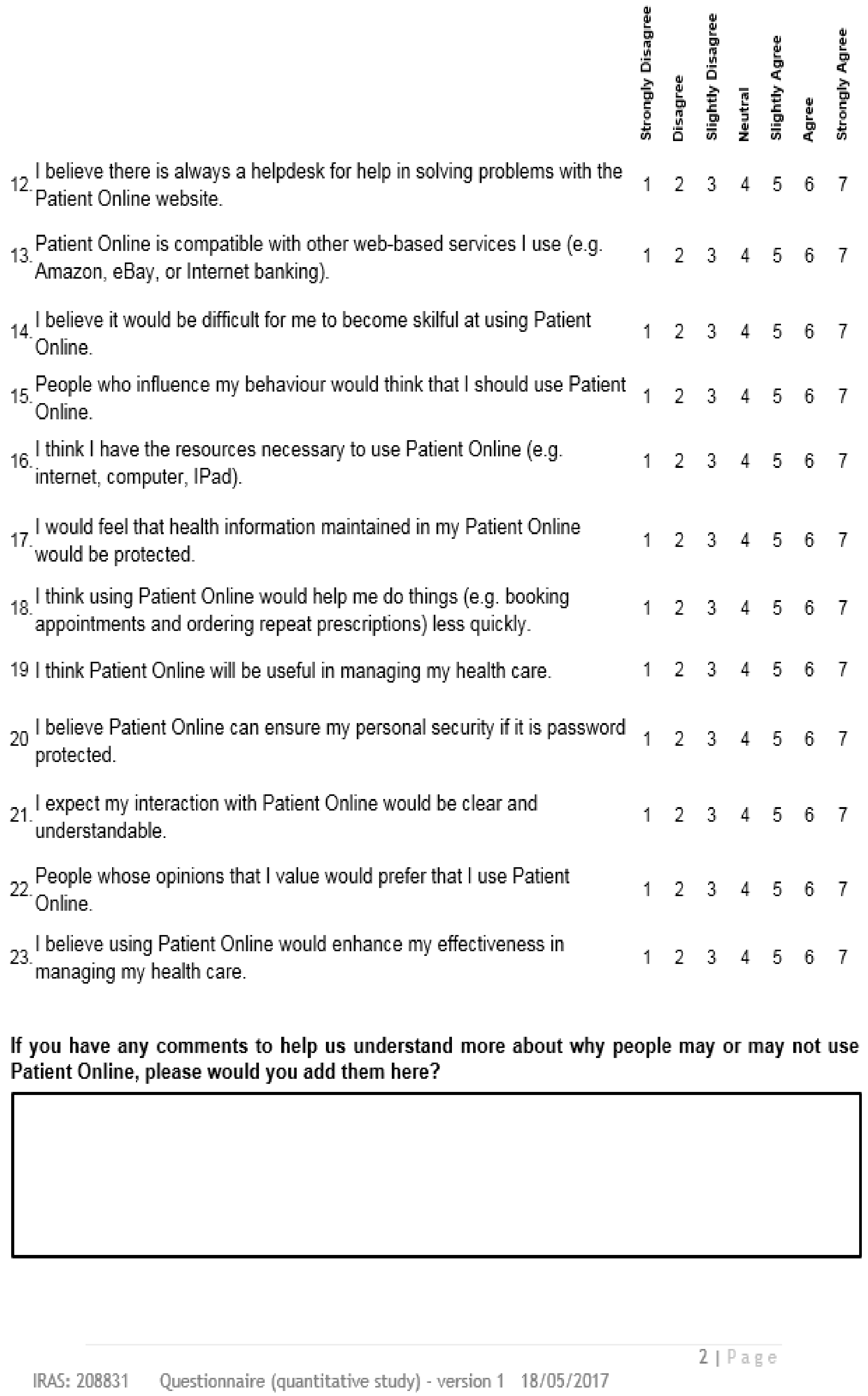
Introduction

What is Patient Online?
It is an NHS England programme designed to support GP practices to offer and promote online services to patients, including access to some information in their medical records, booking appointments and ordering repeat prescriptions.

Note: Before starting the survey, you should note that some questions may look similar. So, please read them carefully and answer all the questions. Also, to keep it confidential, please do not write your name on any part of this questionnaire.

Part 1: Please indicate the extent to which you agree with the following statements for each item, using the scale below:
1: Strongly disagree 2: Disagree 3: Slightly disagree 4: Neutral
5: Slightly agree 6: Agree 7: Strongly agree

	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
1. I intend to use Patient Online in the next 6 months.	1	2	3	4	5	6	7
2. I believe I would find Patient Online easy to use.	1	2	3	4	5	6	7
3. I would feel that Patient Online is vulnerable.	1	2	3	4	5	6	7
4. I plan to use Patient Online in the next 6 months.	1	2	3	4	5	6	7
5. I am worried about privacy issues when using Patient Online.	1	2	3	4	5	6	7
6. I think I have the knowledge necessary to use Patient Online.	1	2	3	4	5	6	7
7. I predict I would use Patient Online in the next 6 months.	1	2	3	4	5	6	7
8. People who are important to me would think that I should use Patient Online.	1	2	3	4	5	6	7
9. I can get help from others when I have difficulties using Patient Online.	1	2	3	4	5	6	7
10. I think learning how to use Patient Online would be difficult for me.	1	2	3	4	5	6	7
11. I would feel that my health record will be kept private.	1	2	3	4	5	6	7



	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
12. I believe there is always a helpdesk for help in solving problems with the Patient Online website.	1	2	3	4	5	6	7
13. Patient Online is compatible with other web-based services I use (e.g. Amazon, eBay, or Internet banking).	1	2	3	4	5	6	7
14. I believe it would be difficult for me to become skilful at using Patient Online.	1	2	3	4	5	6	7
15. People who influence my behaviour would think that I should use Patient Online.	1	2	3	4	5	6	7
16. I think I have the resources necessary to use Patient Online (e.g. internet, computer, IPad).	1	2	3	4	5	6	7
17. I would feel that health information maintained in my Patient Online would be protected.	1	2	3	4	5	6	7
18. I think using Patient Online would help me do things (e.g. booking appointments and ordering repeat prescriptions) less quickly.	1	2	3	4	5	6	7
19 I think Patient Online will be useful in managing my health care.	1	2	3	4	5	6	7
20 I believe Patient Online can ensure my personal security if it is password protected.	1	2	3	4	5	6	7
21. I expect my interaction with Patient Online would be clear and understandable.	1	2	3	4	5	6	7
22. People whose opinions that I value would prefer that I use Patient Online.	1	2	3	4	5	6	7
23. I believe using Patient Online would enhance my effectiveness in managing my health care.	1	2	3	4	5	6	7

If you have any comments to help us understand more about why people may or may not use Patient Online, please would you add them here?

2 | Page

IRAS: 208831 Questionnaire (quantitative study) - version 1 18/05/2017

Part 2: Personal Information (Please tick the relevant box; one tick on each question).

1. What is your sex?

☐ Male ☐ Female

2. What is your age? ______

3. What is the highest level of education that you have completed?

☐ Up to secondary school ☐ Secondary school ☐ College Degree
☐ Bachelor Degree ☐ Master Degree ☐ Doctoral Degree

4. What is your ethnicity?

☐ White ☐ Asian or Asian British ☐ Black or Black British
☐ Mixed or Multiple ☐ Others

5. Do you have internet access where you live?

☐ Yes ☐ No

6. What is your household income level (£/year)?

☐ Less than 20,000 ☐ 20,000-29,999 ☐ 30,000-39,999
☐ 40,000-49,999 ☐ 50,000-59,999 ☐ 60,000 or more
☐ Prefer not to say

Thank you for your time to complete this questionnaire.

If you have any comments regarding the survey do not hesitate to contact me on the following contact details:

Phone: 0113 343 0896

Email: umaaea@leeds.ac.uk

Appendix 24: Participant Information Sheet

Participant information sheet

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Factors that affect patients' use of electronic personal health records (Patient Online)

We would like to invite you to take part in our research

Before you decide whether to take part, it is important for you to understand why the research is being done and what it will involve. Please the take time to read the following information carefully. Discuss it with friends and relatives if you wish. Your participation is entirely up to you. Your participation or nonparticipation will not affect the care you receive in any way. Please do ask us if anything is not clear or if you would like more information.

- **What is the purpose of the study?**

This study is part of my PhD research at the University of Leeds. We want to understand factors that make patients use electronic personal health records (ePHRs) such as Patient Online. Patient Online is a free secure website provided by most GP practices in England that allows patients to access some information in their medical records (e.g. prescription & allergies), to book appointments, and to order repeat prescriptions.

- **Why am I being invited to take part?**

We are inviting you to take part because your participation may help us to develop the system so that it better suits patients' needs and preferences.

- **Am I eligible to participate?**

You are eligible if you meet all the following criteria: (1) you are 18 years old and older (2) you are able to understand verbal explanations or written information (3) you are English-language literate (4) you are registered in the GP practice (5) you have not used Patient Online before.

- **How do I take part?**

To take part in the study, you should complete the consent form and return it to us. Then, you will be asked to fill in a questionnaire that takes about 10 minutes of your time and hand it to the researcher or send it by the post using prepaid envelop given by the researcher. You also can fill in the questionnaire online. Further, you need to give a permission for a member of your GP practice to access your electronic health records to check your use of Patient Online.

- **What are the benefits of taking part?**

Potential benefits from your participation are minimal in the immediate future. But, in the longer term, you and other patients may get benefits if the study results lead to the Patient Online system being modified and made more appropriate for patients.

Please turn over the next page

• What are possible risks and burdens for taking part?

It is thought that risks to you due to participation in the study are minimal. This is because the questions do not ask you about your clinical information. Further, the questionnaire does not ask you potentially distressing or embarrassing questions. Moreover, the University of Leeds has insurance to cover any unlikely event happens in this study.

• What will happen to my responses?

Your responses will be kept strictly confidential and used only for achieving the aim of this study. Additionally, only the research team can link your responses in the questionnaire with your identifiable data (i.e. your name) in the consent form. Moreover, the confidentiality of your data will be assured by reporting only aggregated results in the final research paper. Moreover, the collected data will not be used for any purpose other than the purpose of this study or disclosed them to any third parties. In addition, your responses (questionnaires) and personal data (consent forms) will be stored in two different cabinets within a locked office in the secure building at the University of Leeds, and electronic data will be stored in a password protected computer within a secure servers at the University of Leeds. Lastly, your responses and electronic data will be stored up to 2 years and then destroyed, and your personal data (consent forms) will be destroyed after linking your responses and extracted data about your use of the system and starting data analysis.

• What if I want to withdraw from the study after completing the questionnaire?

You can withdraw from the study at any time before analysing data without giving any reason. Your withdrawal will not affect the care you receive in any way. To withdraw from the study, you need to contact us using the contact details at the end of this page.

• What if I have a complaint about the study?

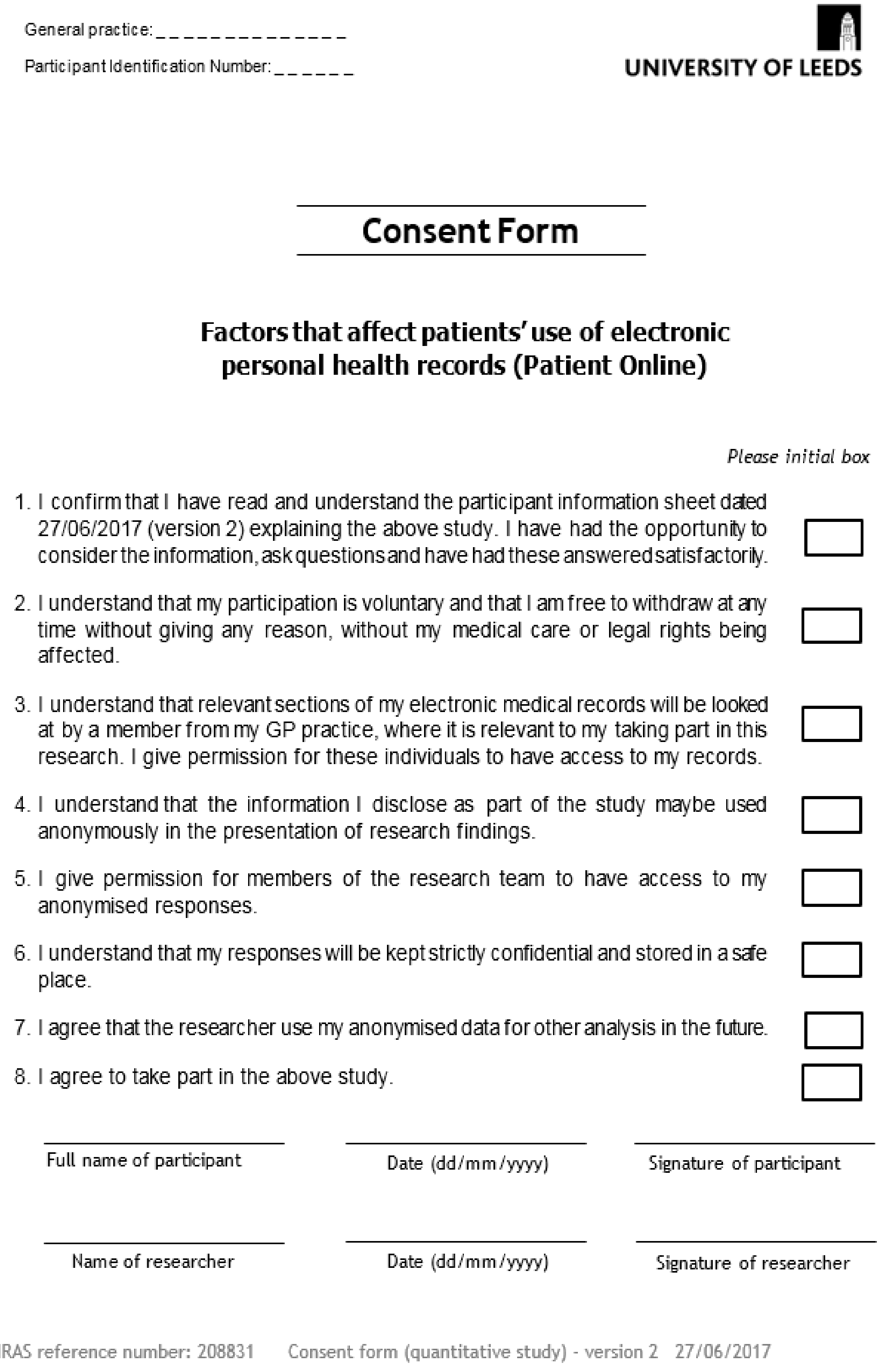
If you want to make a complaint at any point about any aspect of the study you can contact Prof. Hamish Fraser (0113 343 6940) or Dr. Peter Gardner (0113 343 6678) at the University of Leeds.

• What if I have questions about the study?

If you have any questions about the study, or you would like to be updated with the results of the study, you can ask Alaa Abd-Alrazaq who will be available in the practice or by telephone on 0113 343 0896 or email umaaea@leeds.ac.uk.

Thank you for considering taking part.

Appendix 25: Consent Form



General practice: _ _ _ _ _ _ _ _ _ _ _ _ _ _

Participant Identification Number: _ _ _ _ _ _

UNIVERSITY OF LEEDS

Consent Form

Factors that affect patients' use of electronic personal health records (Patient Online)

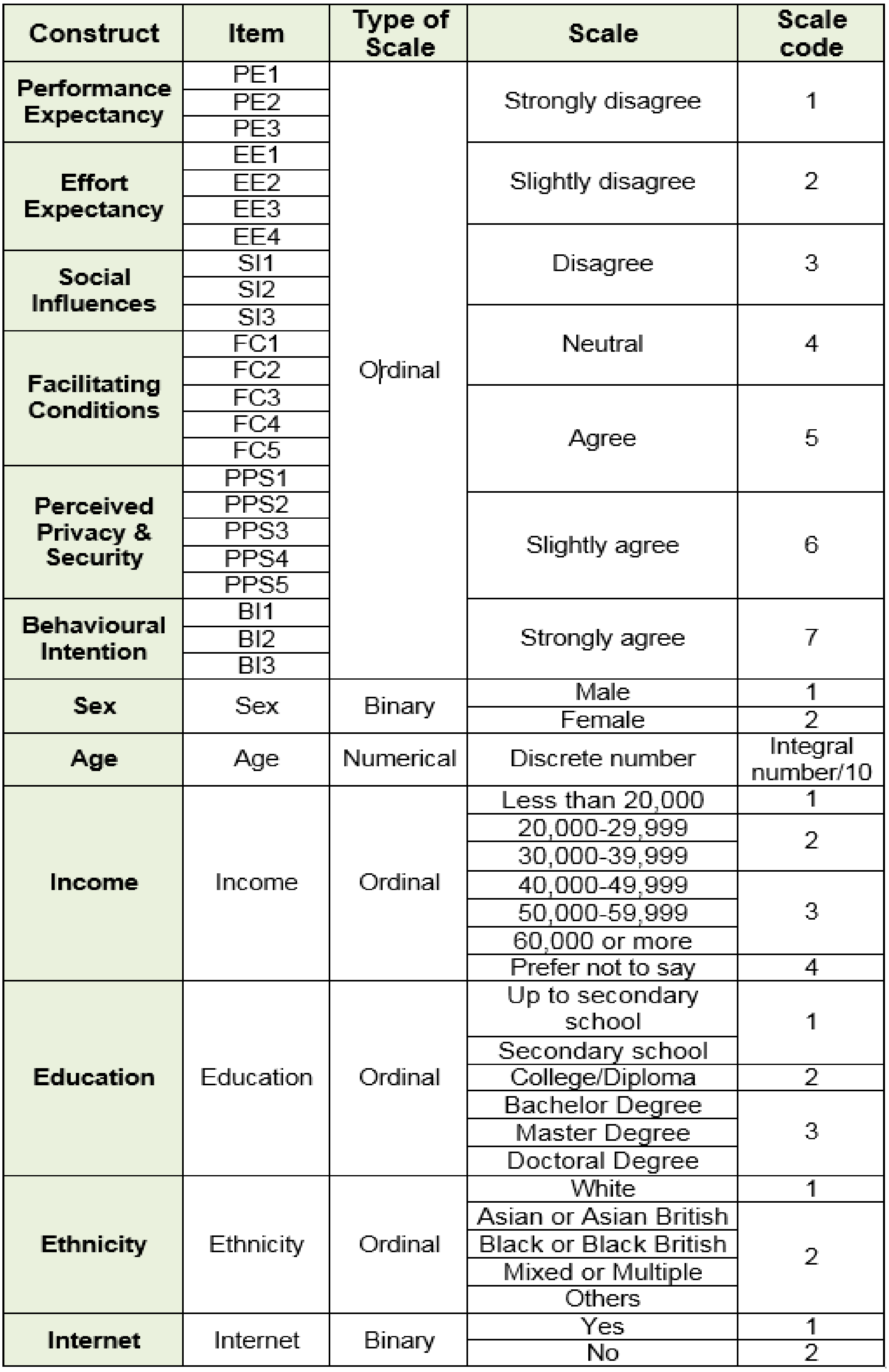
Please initial box

1. I confirm that I have read and understand the participant information sheet dated 27/06/2017 (version 2) explaining the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐
3. I understand that relevant sections of my electronic medical records will be looked at by a member from my GP practice, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. ☐
4. I understand that the information I disclose as part of the study maybe used anonymously in the presentation of research findings. ☐
5. I give permission for members of the research team to have access to my anonymised responses. ☐
6. I understand that my responses will be kept strictly confidential and stored in a safe place. ☐
7. I agree that the researcher use my anonymised data for other analysis in the future. ☐
8. I agree to take part in the above study. ☐

Full name of participant	Date (dd/mm/yyyy)	Signature of participant
Name of researcher	Date (dd/mm/yyyy)	Signature of researcher

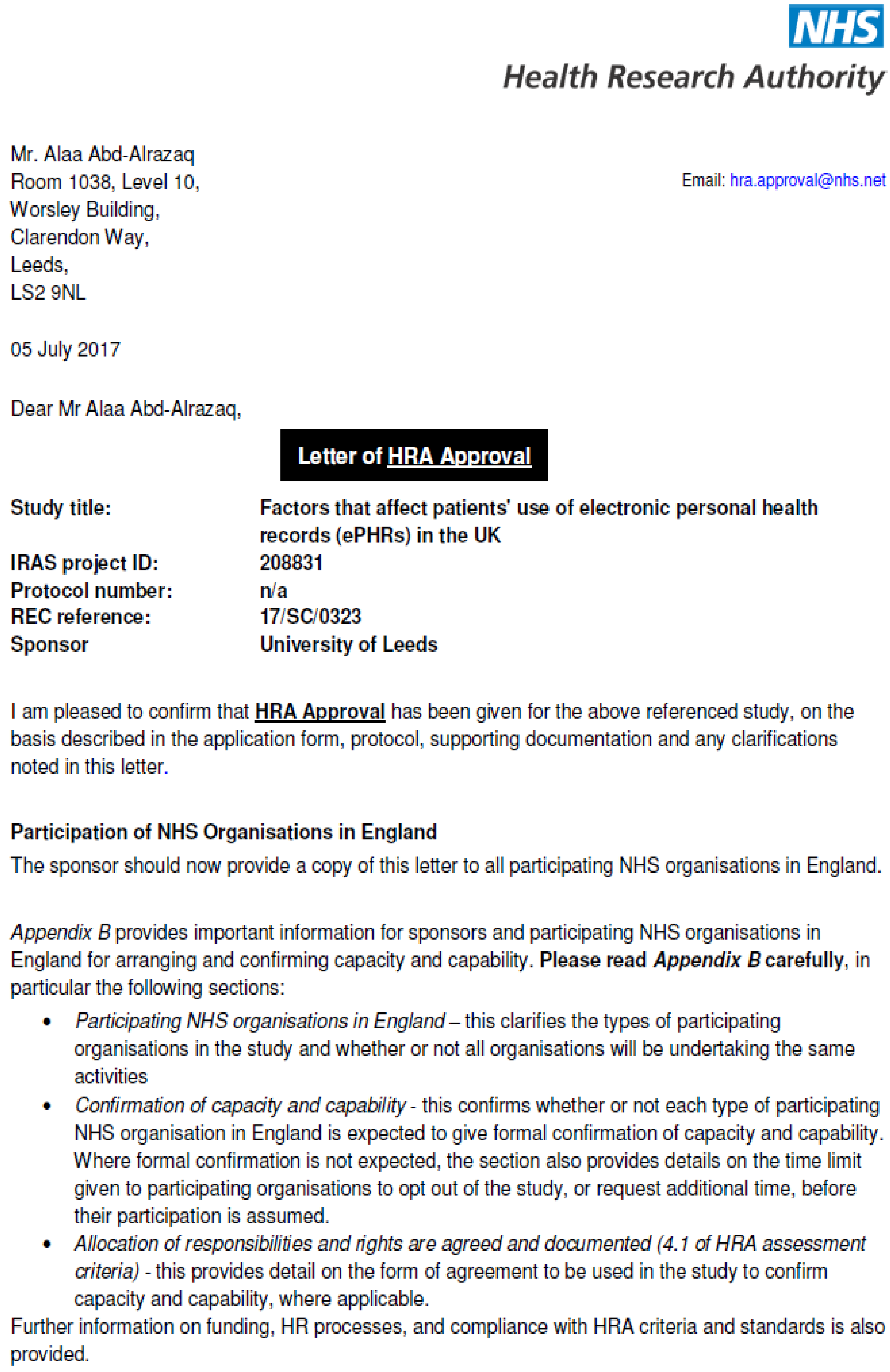
IRAS reference number: 208831 Consent form (quantitative study) - version 2 27/06/2017

Appendix 26: Code Book



Construct	Item	Type of Scale	Scale	Scale code
Performance Expectancy	PE1	Ordinal	Strongly disagree	1
	PE2			
	PE3			
Effort Expectancy	EE1		Slightly disagree	2
	EE2			
	EE3			
	EE4			
Social Influences	SI1		Disagree	3
	SI2			
	SI3			
Facilitating Conditions	FC1		Neutral	4
	FC2			
	FC3		Agree	5
	FC4			
	FC5			
Perceived Privacy & Security	PPS1			
	PPS2		Slightly agree	6
	PPS3			
	PPS4			
	PPS5			
Behavioural Intention	BI1		Strongly agree	7
	BI2			
	BI3			
Sex	Sex	Binary	Male	1
			Female	2
Age	Age	Numerical	Discrete number	Integral number/10
Income	Income	Ordinal	Less than 20,000	1
			20,000-29,999	2
			30,000-39,999	
			40,000-49,999	3
			50,000-59,999	
			60,000 or more	
			Prefer not to say	4
Education	Education	Ordinal	Up to secondary school	1
			Secondary school	
			College/Diploma	2
			Bachelor Degree	3
			Master Degree	
			Doctoral Degree	
Ethnicity	Ethnicity	Ordinal	White	1
			Asian or Asian British	2
			Black or Black British	
			Mixed or Multiple	
			Others	
Internet	Internet	Binary	Yes	1
			No	2

Appendix 27: Health Research Authority Approval



NHS
Health Research Authority

Email: hra.approval@nhs.net

Mr. Alaa Abd-Alrazaq
Room 1038, Level 10,
Worsley Building,
Clarendon Way,
Leeds,
LS2 9NL

05 July 2017

Dear Mr Alaa Abd-Alrazaq,

Letter of HRA Approval

Study title:	**Factors that affect patients' use of electronic personal health records (ePHRs) in the UK**
IRAS project ID:	**208831**
Protocol number:	**n/a**
REC reference:	**17/SC/0323**
Sponsor	**University of Leeds**

I am pleased to confirm that **HRA Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications noted in this letter.

Participation of NHS Organisations in England

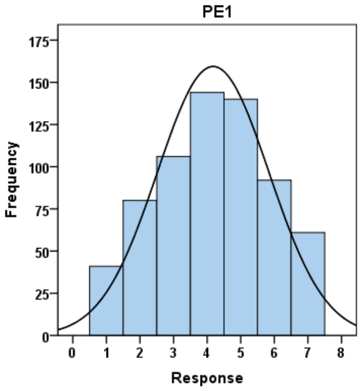
The sponsor should now provide a copy of this letter to all participating NHS organisations in England.

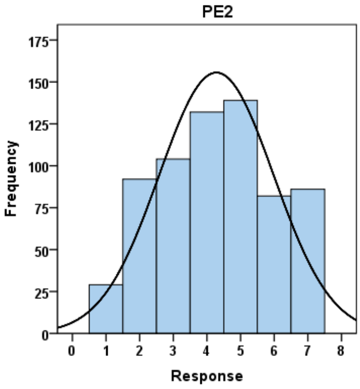
Appendix B provides important information for sponsors and participating NHS organisations in England for arranging and confirming capacity and capability. **Please read *Appendix B* carefully**, in particular the following sections:

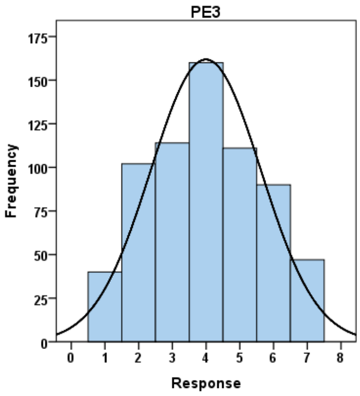
- *Participating NHS organisations in England* – this clarifies the types of participating organisations in the study and whether or not all organisations will be undertaking the same activities
- *Confirmation of capacity and capability* - this confirms whether or not each type of participating NHS organisation in England is expected to give formal confirmation of capacity and capability. Where formal confirmation is not expected, the section also provides details on the time limit given to participating organisations to opt out of the study, or request additional time, before their participation is assumed.
- *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* - this provides detail on the form of agreement to be used in the study to confirm capacity and capability, where applicable.

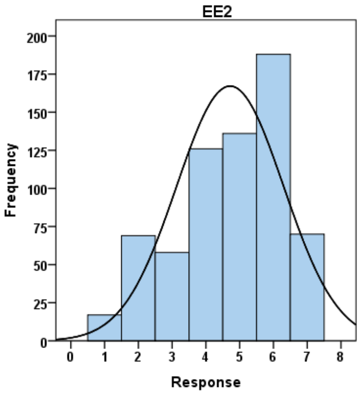
Further information on funding, HR processes, and compliance with HRA criteria and standards is also provided.

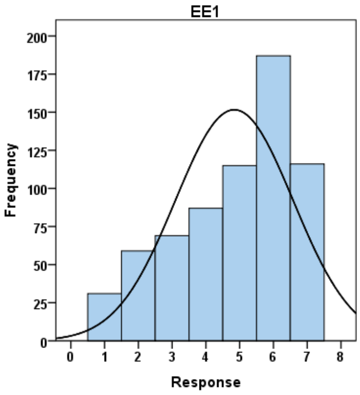
Appendix 28: Normality of Variables

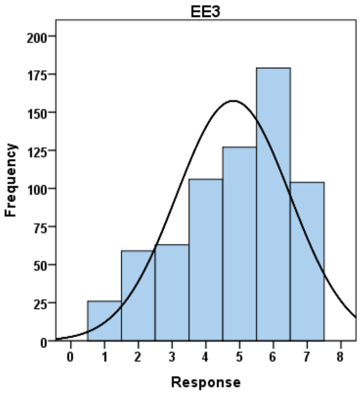


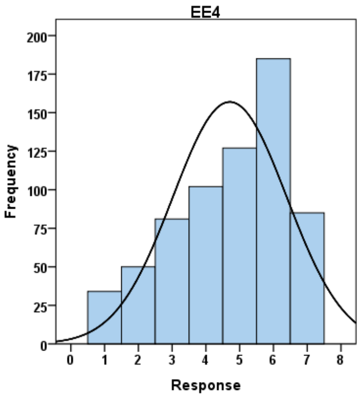


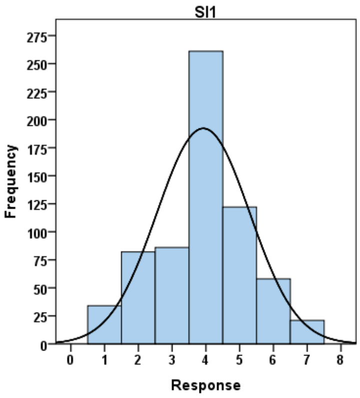


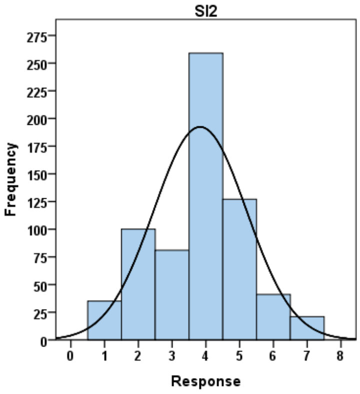


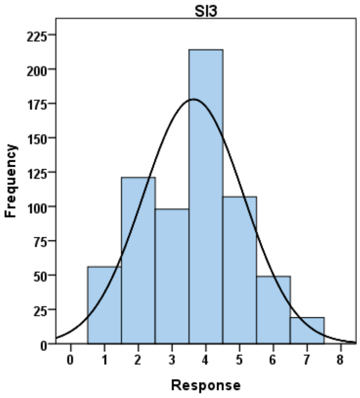


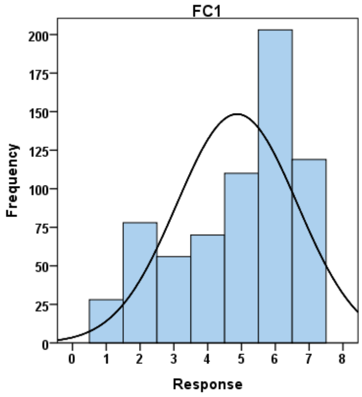


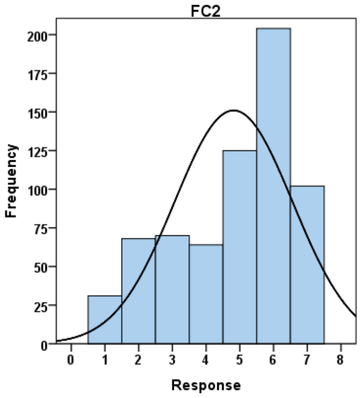


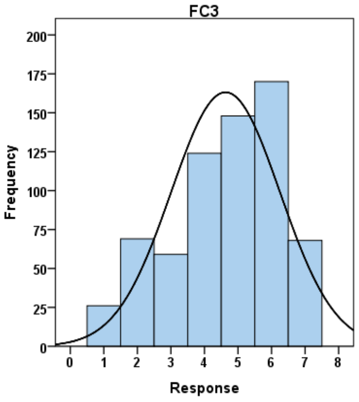


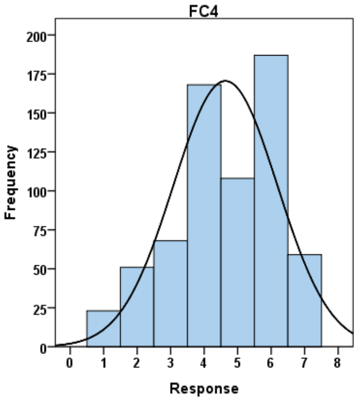









FC3
Frequency
200
175
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


FC4
Frequency
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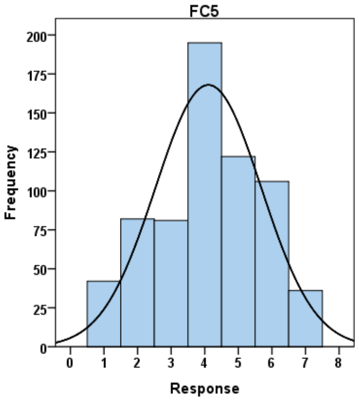
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


FC5
Frequency
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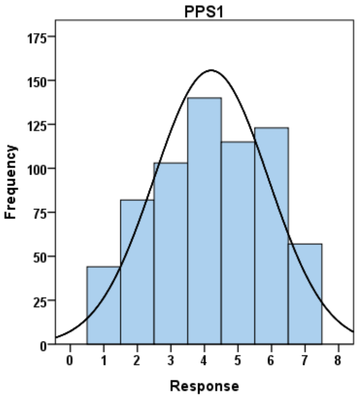
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


PPS1
Frequency
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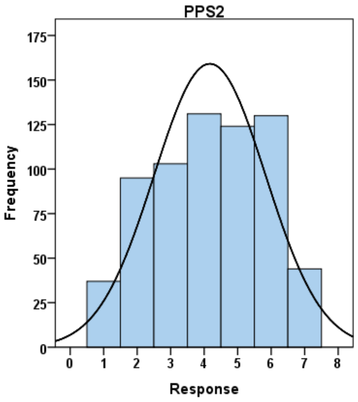
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


PPS2
Frequency
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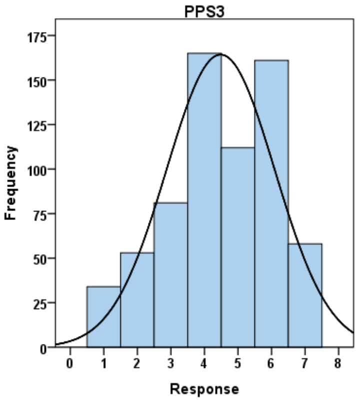
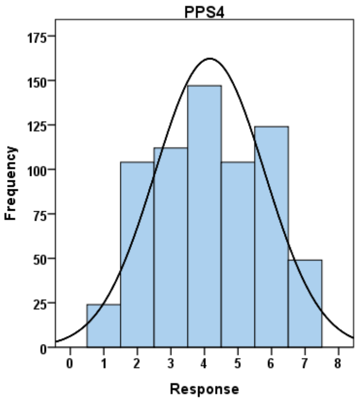
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


PPS3
Frequency
175
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


PPS4
Frequency
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150
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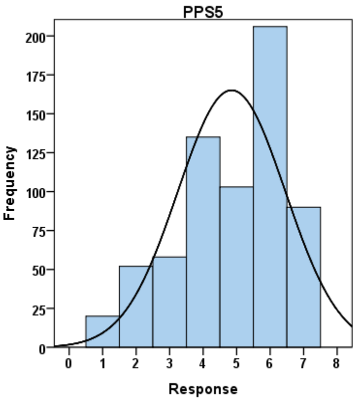
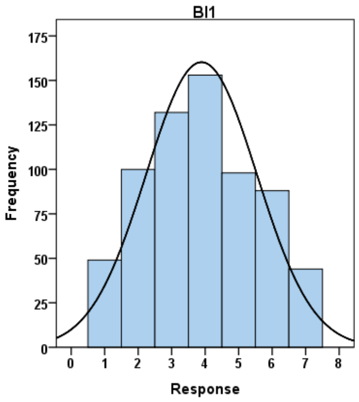
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


PPS5
Frequency
200
175
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


BI1
Frequency
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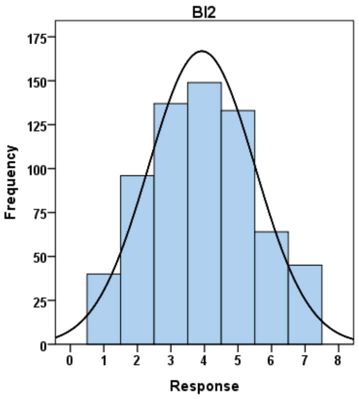
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


BI2
Frequency
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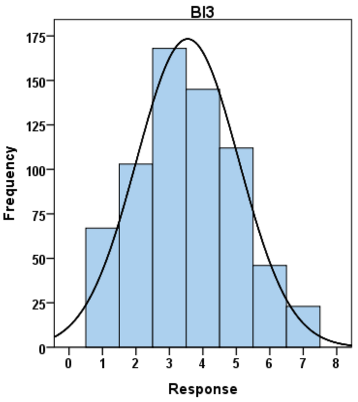
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


BI3
Frequency
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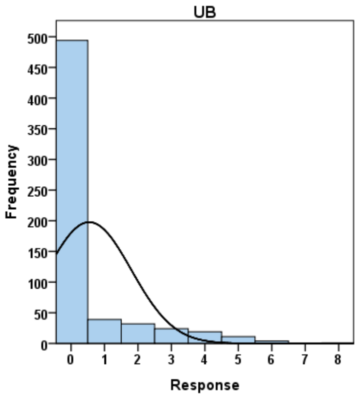
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8
Response


UB
Frequency
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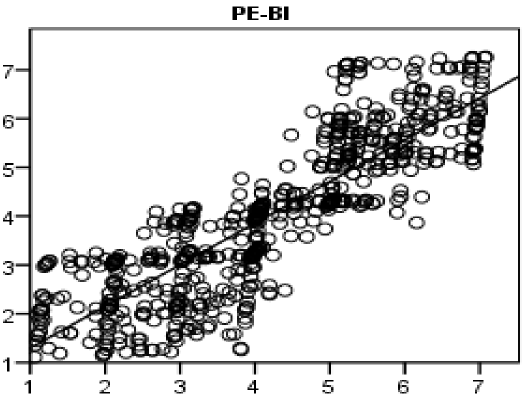
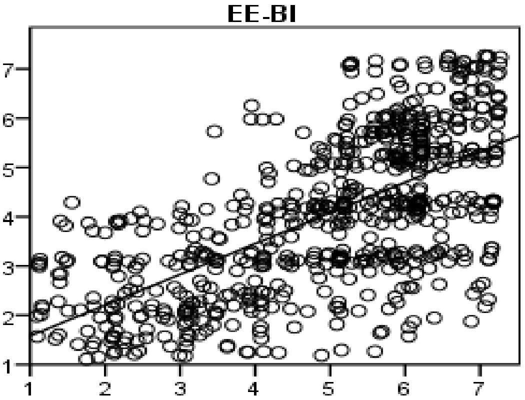
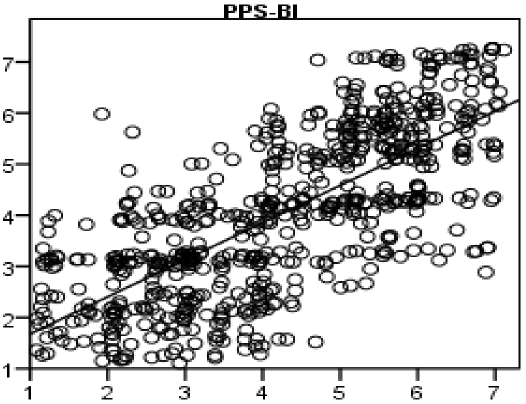
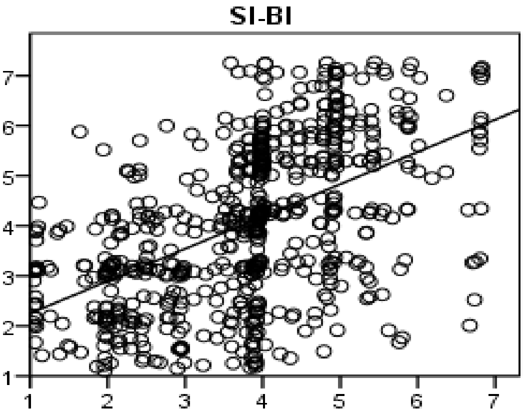
450
400
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8
Response

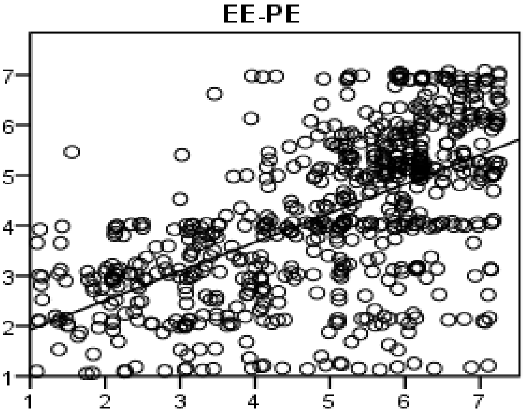
Appendix 29: Linearity of Proposed Relationships

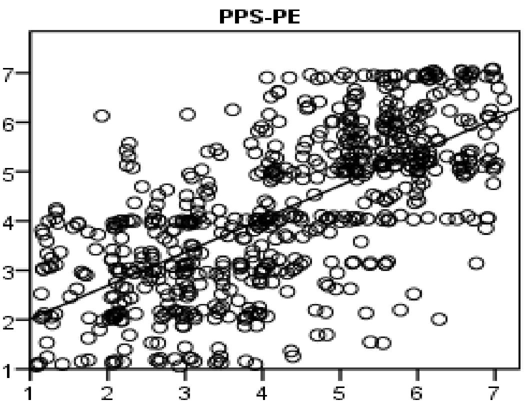


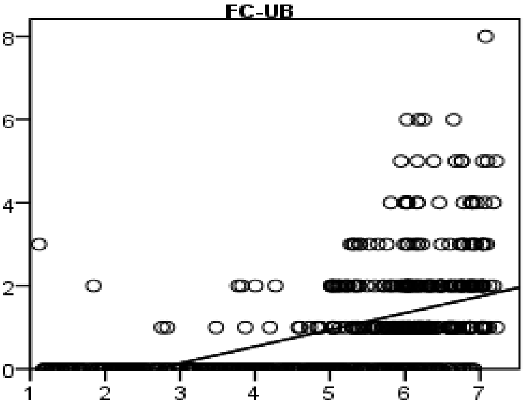


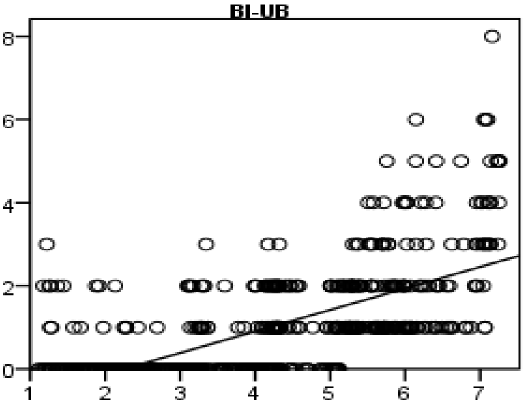












Appendix 30: Standardized Residual Covariance Matrix

	BI1	BI2	BI3	SI1	SI2	SI3	PE1	PE2	PE3	FC1	FC2	FC3	EE1	EE2	EE3	EE4	PPS1	PPS2	PPS4
BI1	.000																		
BI2	.040	.000																	
BI3	-.069	-.018	.000																
SI1	.179	-.065	.810	.000															
SI2	.008	-.344	.438	-.017	.000														
SI3	-.385	-.419	.140	-.013	.043	.000													
PE1	.090	-.153	.188	.334	-.126	-.481	.000												
PE2	.110	-.041	-.022	-.093	-.477	-.668	-.002	.000											
PE3	-.084	-.550	.294	1.168	.698	.283	.002	.002	.000										
FC1	.305	-.481	1.423	.244	.087	-.580	.119	.021	.956	.000									
FC2	-.218	-.788	.979	.083	.088	-.684	-.165	-.492	.319	-.010	.000								
FC3	-.674	-1.353	.856	.342	-.108	-.520	-.867	-.869	.356	.006	.032	.000							
EE1	-.126	-.380	.527	.581	-.006	-.775	-.277	.327	-.175	.091	.655	.193	.000						
EE2	.180	-.067	.935	.326	.070	-.503	-.073	.301	.292	-.405	.166	-.287	-.129	.000					
EE3	-.147	-.322	.580	.428	-.217	-.755	-.499	.244	-.136	-.387	.375	.116	.102	-.026	.00				
EE4	.006	-.070	.725	.461	-.124	-.623	.189	.563	.509	-.249	.506	-.212	-.047	.294	-.147	.000			
PPS1	-.185	.026	.582	.220	-.039	.329	.106	-.159	.148	.003	-.115	-.322	-.508	.247	-.490	.036	.000		
PPS2	-.308	-.005	.806	.047	-.071	.187	-.153	-.107	-.034	.251	-.090	-.035	-.093	.552	-.066	.407	.003	.000	
PPS4	-.019	.126	.525	-.342	-.464	-.222	.195	.302	.224	.024	.013	-.794	.498	.893	.251	.561	-.007	-.001	.000