Diary study of adherence to antiretroviral therapy in people living with HIV

Delyth Sian James

Submitted in accordance with the requirements for the degree of
Doctor of Clinical Psychology (D. Clin. Psychol.)

The University of Leeds
School of Medicine
Academic Unit of Psychiatry and Behavioural Sciences

July, 2017

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

This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

The right of Delyth Sian James to be identified as Author of this work has been asserted by her in accordance with the Copyright, Designs and Patents Act 1988.

Acknowledgements

Firstly, thank you to my supervisors Gary, Hilary and Mark, I'm really grateful for their constant support, guidance and expertise throughout this project.

I would also like to thank all of the participants who gave up their time to take part. It felt a real privilege to gain insight into their experiences. Thanks also to the healthcare staff and service users who provided feedback during the development phase of the study. Again, I would like to thank the teams at Skyline and at the NHS site who went above and beyond to help not only in setting up but also in the recruitment phase of the project, it wouldn't have been able to go ahead without this support.

Finally, thank you to my family and friends for all of their support and encouragement. Special thanks to Joel, his wise words and cups of coffee kept me going in the final few months.

Abstract

Background. Current empirical understanding of adherence to antiretroviral therapy (ART) is limited and the majority of current research is cross-sectional. Diary methodology provides an opportunity to capture the fluctuating nature of variables influencing adherence, close to the time that they occur. A limited number of diary studies have been conducted with people living with HIV (PLHIV) and few have investigated patterns of treatment adherence and psychological variables simultaneously.

Aims. To investigate the day-to-day factors associated with adherence to ART in PLHIV. To investigate the feasibility of diary methodology used to investigate adherence to ART in PLHIV.

Method. A mixed methods design comprising 2 parts was used: a diary study, using multilevel diary methodology (study 1) and qualitative semi-structured interviews (study 2). Study 1: participants (n = 18) completed an initial questionnaire, and a 14-day diary, the diary recorded adherence to ART and day-to-day variables (such as mood and stressors).
Study 2: interviews were conducted with HIV service users (n = 4) and HIV healthcare staff (n = 5). The interviews explored factors influencing the general feasibility of diary methodology in HIV populations.

Results. Full adherence (100%) was reported in terms of taking tablets, however, there was variability in reported adherence in terms of taking medication at the correct time ('adherence timing'). Anticipatory negative affect associated with non-adherence and attitude (positive) towards treatment regime were the only two daily variables (measured in the diary) associated with optimal adherence timing. The relationships between adherence timing and the daily variables were moderated by a number of variables, including: illness perceptions, perceived stigma and beliefs about medications.

The majority of participants who completed the diaries were male (88.9%) and white (72.2%), females and ethnic minority groups were under-represented. The interviews resulted in the identification of multiple barriers and facilitators of diary methodology in HIV populations. In particular, barriers to study uptake and completion were identified.

Conclusions. A number of variables were found to be associated with optimal adherence timing. However, conclusions are limited due to the small sample size and under-representation of certain groups in the HIV population. Diary methodology may be more feasible within certain subgroups of the HIV population. Future research and clinical implications have also been considered.

Table of Contents

Acknowledgements **3**

Abstract **4**

Table of Contents **5**

List of Figures **7**

List of Tables **7**

Abbreviations **8**

Chapter 1: Introduction **9**

1.1 Adherence **9**

1.2 Human Immunodeficiency Virus (HIV) **9**

1.2.1 HIV treatment 10

1.3 Adherence to antiretroviral therapy **11**

1.3.1 Measuring adherence to antiretroviral therapy 11

1.3.2 Variables associated with antiretroviral therapy adherence 12

1.3.3 Variables associated with adherence to ART: Summary 17

1.4 Theoretical perspectives of adherence **18**

1.4.1 The Self-Regulatory Model 18

1.4.2 The Health Belief Model 19

1.4.3 The Theory of Planned Behaviour 19

1.4.4 Social Ecological Theory 20

1.5 Interventions for HIV treatment adherence **22**

1.5.1 Use of health behaviour theory in the development of adherence interventions 23

1.6 Diary Methods in Research **23**

1.6.1 Benefits and limitations of diary research 24

1.6.2 Paper versus electronic diary methods 25

1.6.3 Diary research and health behaviour 26

1.6.4 Diary research within physical illness contexts 26

1.6.5 Diary research and adherence 27

1.6.6 Diary research and people living with HIV 27

1.7 Rationale for study **29**

1.8 Research Aims **30**

Chapter 2: Methodology **31**

2.1 Investigating adherence to ART **31**

2.2 Ethical permission **31**

Study 1 - Diary Study **31**

2.3 Sample **31**

2.4 Sample size **32**

2.5 Materials **32**

2.5.1 Adaption of materials for use in HIV service 32

2.5.2 Initial Questionnaire 33

2.5.3 Daily Diary 35

2.5.4 Measure of viral load 37

2.6 Procedure **38**

2.6.1 Recruitment 38

2.6.2 Informed consent 38

2.6.3 Data collection 39

2.6.4 Ethical considerations 42

Study 2 - Staff and Service User Interviews **43**
2.7 Sample **43**
2.8 Materials **43**
2.9 Procedure **44**
2.9.1 Recruitment and data collection 44
2.9.2 Ethical considerations 44

Chapter 3: Study 1 - Diary Study **45**
3.1 Data analysis **45**
3.2 Results **45**
3.2.1 Participants 45
3.2.2 Participant characteristics 46
3.2.3 Variables included in the analysis 48
3.2.4 Descriptive Statistics 50
3.2.5 Hierarchical modelling 53
3.2.6 Effects of level 1 and 2 variables on medication adherence timing 56
3.2.7 Moderating effect of level 2 variables - cross level interactions 56
3.2.8 Interpreting the effect of level 2 variables - simple slopes analyses 59
3.2.9 Participant experience questions (PEQ) 63

Chapter 4: Study 2 - Staff and Service User Interviews **64**
4.1 Analysis method **64**
4.1.1 Quality control 66
4.2 Results **67**
4.2.1 Sample 67
4.2.2 Core categories 68
4.2.3 Summary of the themes 70

Chapter 5: Discussion **84**
5.1 Summary of findings **84**
5.1.1 Aim 1: To investigate the day-to-day factors influencing adherence to ART with PLHIV 84
5.1.2 Aim 2: To investigate the feasibility of diary methodology used to investigate adherence to ART in PLHIV. 87
5.2 Methodological considerations **92**
5.2.1 Strengths 92
5.2.2 Limitations 92
5.3 Future research **95**
5.4 Clinical Implications **97**
5.5 Conclusions **98**

References **99**

Appendices **124**
Appendix 1: Initial Questionnaire **124**
Appendix 2: Daily Diary **130**
Appendix 3: Interview topic guide **132**
Appendix 4: Ethical approval letter **133**
Appendix 5: Ethical approval for substantial amendment **137**

List of Figures

Figure 1: Recruitment flowchart Skyline 40
Figure 2: Recruitment flow chart NHS site 41
Figure 3: Recruitment flow chart for final sample 46
Figure 4: Impact of attitude on adherence timing at different levels of stigma 60
Figure 5: Impact of anticipatory negative affect on adherence timing at different levels of stigma 60
Figure 6: Impact of anticipatory negative affect on adherence timing at different levels of IPQ 61
Figure 7: Impact of anticipatory negative affect on adherence timing at different levels of BMQ-concerns 61
Figure 8: Impact of attitude on adherence timing at different levels of BMQ-overuse 62
Figure 9: Impact of anticipatory negative affect on adherence timing at different levels of BMQ-overuse 62
Figure 10: Barriers and facilitators of diary studies in HIV populations 69

List of Tables

Table 1: Characteristics of participants who completed the diary 47
Table 2: Study sample (participants who took part in the diary study) compared with UK HIV population 48
Table 3: Initial questionnaire (Level 2) subscales included in analysis 49
Table 4: Daily diary (Level 1) variables included in data analysis 50
Table 5: Level 2 variables, mean, SD, range 51
Table 6: Self-reported adherence per day 52
Table 7: Daily variables and response rates over the 14 days 53
Table 8: Effects of level 1 and 2 variables on medication adherence timing 57
Table 9: Moderating effect of level 2 variables on the interaction between attitude and anticipatory negative (ANA) affect and adherence timing 58
Table 10: Coding examples 65
Table 11: Staff demographics 67
Table 12: Service user demographics 68

Abbreviations

AIDS - Acquired Immunodeficiency Syndrome

ART - Antiretroviral Therapy

BME - Black and Minority Ethnic

BMQ - Beliefs about Medicines Questionnaire

CI - Chief Investigator

Cp/ml - Copies Per Millilitre

ED - Electronic diary

HBM - Health Belief Model

HIV - Human Immunodeficiency Virus

HRA - Health Research Authority

IPQ - Illness Perception Questionnaire

IPQ-R - Illness Perception Questionnaire Revised

ITR - Interactive Text Message Response

M - Mean

NICE - National Institute for Health and Care Excellence

OR - Odds ratio

PD - Paper diary

PEQ - Participant Experience Questions

PIQ - Personal Information Questionnaire

PLHIV - People Living with HIV

SPSS - Statistical Package for the Social Sciences

SRM - The Self Regulatory Model

SD - Standard Deviation

TA - Thematic Analysis

TPB - Theory of Planned Behaviour

Chapter 1: Introduction

This thesis aims to investigate the day-to-day factors influencing adherence to antiretroviral therapy (ART) in people living with Human Immunodeficiency Virus (PLHIV). Diary methodology has not been widely used with PLHIV. Therefore, the study also seeks to inform the literature in terms of investigating the feasibility of diary methodology used to investigate adherence to ART with PLHIV. The following chapter will provide an overview of HIV, the current empirical understanding of adherence to HIV treatment, theoretical perspectives of adherence, and current interventions used to promote ART adherence. It will also provide an overview of diary methods and their use in chronic disease populations, including PLHIV.

1.1 Adherence

The term adherence refers to "the extent to which the patient's medication taking matches the prescribed regimen" (Ingersoll and Cohen, 2008, p.213). 'Adherence' is often used interchangeably with terms such as 'compliance' and 'concordance' (Aronson, 2007; Segal, 2007). At present 'adherence' is the most frequently used term, both in the literature and in clinical guidelines (Gardner, 2015). Adherence in chronic disease management is an on-going issue, with average rates of adherence reported to be 50% (Sabate, 2003). Research has sought to understand the factors that influence adherence within numerous chronic disease populations. It is widely acknowledged that the factors influencing adherence are not well understood, and are likely to be numerous, complex and intertwining. They may also differ depending on the particular treatment regimen. Establishing insight into the underlying factors causing non-adherence is important in order to inform interventions used to promote adherence. It is acknowledged that promotion of adherence is important in order to maximise health outcomes, improve quality of life of individuals with health conditions, and reduce health system costs (Cohen-Cymberknoh, Shoseyov and Kerem, 2011; Dimatteo, Giordani, Lepper and Croghan, 2002; Roebuck, Liberman, Gemmill-Toyama and Brennan, 2011). Sabate (2003) summarised the importance of gaining an understanding of patient non-adherence, stating: "without a system that addresses the determinants of adherence, advances in biomedical technology will fail to realize their potential to reduce the burden of chronic illness" (p.23).

1.2 Human Immunodeficiency Virus (HIV)

HIV is a lifelong chronic condition. It attacks a type of white blood cell (CD4 cells) responsible for supporting the immune system in fighting infection (World Health Organisation, 2015). Acquired Immunodeficiency Syndrome (AIDS), which is the final stage of HIV, occurs when HIV has diminished CD4 cells to such a degree that the body can no longer successfully

fight off infections and disease, ultimately leading to death (World Health Organisation, 2015). HIV is transmitted through direct contact with bodily fluids, including: blood, breast milk and semen (World Health Organisation, 2015).

At the end of 2015, 36.7 million people worldwide were estimated to be living with HIV (World Health Organisation, 2016). Although global prevalence of HIV is declining, high numbers of new cases continue to be diagnosed each year (2.1 million in 2015) (UNAIDS, 2015). In 2015 an estimated 101,100 people in the UK were living with HIV, comprising 69,500 men and 31,600 women (Public Health England, 2016a). In the UK, groups in the population with the highest incidence of HIV are: men who have sex with men (MSM) and black African men and women (Public Health England, 2016a). In 2015, in the UK, of the individuals receiving ART treatment, 55.2% were white British, 31.6% were black African and 13.17% comprised other ethnic groups (Public Health England, 2015).

1.2.1 HIV treatment

There is no cure for HIV, however, advances in treatment mean that if treated properly, interventions extend life expectancy close to what would be expected in non-HIV populations (Losina and Freedberg, 2011; Nakagawa, May and Phillips, 2013; Samji et al., 2013). HIV treatments are referred interchangeably to as antiretroviral therapy (ART) or highly active antiretroviral therapy. ART involves taking a combination of at least 3 types of antiretrovirals. Although the specific combination of antiretrovirals is dependent on the individual, an individual receiving ART is likely to be prescribed between 1 to 4 tablets per day (British HIV Association, 2016). The British HIV Association provides National Institute for Health and Care Excellence (NICE) accredited guidelines for standards of HIV care in the UK. Current guidance states that ART should be prescribed to all individuals living with HIV; this is based on recent findings indicating improved outcomes for those who commence treatment immediately following their diagnosis (British HIV Association, 2016).

Viral load. Viral load refers to the number of HIV virus copies per millilitre () of blood. High viral load is likely to increase the likelihood of CD4 cells diminishing, and therefore increase the likelihood of illness due to HIV. Successful treatment (i.e. ART) results in a reduction in viral load, which can ultimately reach 'undetectable levels' (Asboe et al., 2012). Low viral load results in a reduced likelihood of illness due to HIV, as well as reduced likelihood of transmitting HIV to others (AIDS info, 2016). Depending on the test used, 'undetectable levels' are typically <50 HIV RNA cp/ml blood. In the UK, viral load measures are routinely recorded in order to provide an indication of the efficacy of treatment (British HIV association, 2016). Additionally, viral load recordings have been consistently associated with adherence and therefore provide insight into adherence behaviour (Bonner, Mezochow, Roberts, Ford, and Cohn, 2013).

1.3 Adherence to antiretroviral therapy

Optimal adherence to ART is cited as being between 90 to 95% (Carpenter et al., 2000; Malta, Magnanini, Strathdee and Bastos, 2010). Optimal adherence is required in order to prevent HIV replication and to slow its progression (Chesney Ickovics, Hecht, Sikipa and Rabkin, 1998). It is associated with reduced levels of viral load and increased CD4 count (Mannheimer et al., 2002). Optimal adherence involves taking the correct medication dose, in addition to taking medication at the correct time. Some ART regimens also require medication to be taken alongside food. Variable adherence has been associated with acceleration of HIV drug resistance and the development and transmission of drug resistant HIV virus strains (Chesney et al., 1998; Chesney, 2000a; Sethi, Celentano, Gange, Moore and Gallant, 2003; World Health Organisation, 2016).

Despite the importance of maintaining adherence to ART, adherence is often poor, with average rates of optimal adherence (>90%) reported to be 62% (Ortego et al., 2011). In the UK, Sherr et al's (2008) study investigating ART adherence in 502 participants, found that 79.1% of participants were adherent in terms of taking all of their medication. However, when specific components of adherence were measured (such as timing of dose and food requirements), reported adherence was 41.5%. Given the impact of sub-optimal adherence on disease progression, in addition to the wider consequences of non-adherence (i.e. the spread of drug resistant strains of the virus), as global availability of ART increases (Dutta, Barker and Kallarakal, 2015), gaining an understanding of factors that influence adherence to ART is imperative.

1.3.1 Measuring adherence to antiretroviral therapy

The challenge of gaining a reliable measure of adherence to medical treatment is widely acknowledged within the adherence literature, across disease groups. Self-report measures such as questionnaires, interviews and diaries are widely used adherence measures (Simoni, Kurth, Pearson, Pantalone, Merrill and Frick, 2006b). However, self-report measures face criticism as they are thought to be vulnerable to bias (e.g. memory bias and social desirability bias). Some findings have shown that when compared with non self-report measures of adherence (e.g. electronic event monitors) they provide an overestimated account of adherence (Berg, Dunbar-Jacob and Rohay, 1998; Krishnan et al., 2012).

Nevertheless, a number of reviews have found significant associations between self-report measures and objective indicators of adherence (e.g. plasma drug concentration measures); meaning that self-report measures may provide a relatively effective measure of adherence to ART (Nieuwkerk and Oort, 2005; Simoni et al., 2006b). The reviews also highlighted the benefits of using self-report measures, which included: ease and practicality of use, low cost and low participant burden.

Currently, across disease groups, there is variation in available self-report measures used to measure medication adherence. Of existing measures, few have been thoroughly assessed in terms of reliability and validity (Stirratt et al., 2015). The potential pros and cons of contrasting self-report methods have been discussed within the wider chronic disease literature. For example, the benefit of using diary methods compared with interviews or questionnaires as a measure of adherence has been highlighted. It has been argued that diary measures provide accurate findings due to being less reliant on retrospective recall, as they record events close to when they have occurred (Modi, Lim, Yu, Geller, Wagner and Quittner, 2006; Quittner, Modi, Lemanek, Ievers-Landis and Rapoff, 2008). Furthermore, Garber, Nau, Erickson, Aikens and Lawrence (2004) recommended that diary and questionnaire methods are preferable self-report measures, as they have greater associations with non self-report measures compared with other self-report measures, such as interviews.

Although it could be assumed that objective methods of measuring adherence (e.g. an electronic monitoring system) are more accurate, difficulties with objective measures have also been highlighted. For example, in a review of the literature, Quittner et al. (2008) noted that a number of studies report difficulty using electronic monitors to record adherence. These difficulties include: lost data, loss of electronic devices and errors in downloading data. Liu et al. (2001) compared three strategies for measuring ART adherence (electronic event monitoring system, pill count and interview). Findings highlighted differences in adherence rates depending on the adherence measure used. Electronic monitoring provided an underestimate of adherence, whereas pill count and interview provided an overestimate. Liu et al. (2001) suggested that several measures of adherence used together might be the best way to gain an accurate measure of adherence. They also argued that at present, all current strategies used to measure adherence have limitations. It has been suggested that a "gold standard" of adherence monitoring is yet to be established (Chesney et al., 2000b; Fabbiani et al., 2016).

1.3.2 Variables associated with antiretroviral therapy adherence

As with findings from the wider adherence literature, the variables associated with adherence to ART have been found to be numerous, multifaceted and difficult to predict (Fogarty, Roter, Larson, Burke, Gillespie and Levy, 2002; Langebeek et al., 2014; O'Neil et al., 2012, Sherr et al., 2008; Shubber et al., 2016). For example, Fogarty et al's (2002) review identified 200 variables associated with ART adherence. Fogarty et al. (2002) categorised the variables associated with adherence into: treatment regime (e.g. greater complexity of regime was linked to non-adherence); social and psychological factors (e.g. acceptance of HIV diagnosis and social support were associated with adherence); healthcare resources (e.g. more resources were associated with adherence); personal characteristics (e.g. substance abuse was associated with non-adherence, whereas gender was not reliably associated with adherence).

Mills et al.'s (2006) review of the literature provided further support for the multitude of factors influencing ART adherence. Factors identified included: fear of disclosing having HIV; substance abuse; forgetting; health beliefs; complex regime; and domestic responsibilities. Furthermore, Mills et al. (2006) concluded that identified barriers to adherence are consistent across developed and developing nations, in addition to between different nationalities. They did note that the majority of studies reviewed took place in developed nations, highlighting a need for further exploration of specific factors influencing adherence in developing nations.

Saberi et al's (2015) findings highlight the complexity of factors likely to impact ART adherence as their findings indicated that the most common barriers to ART adherence are not necessarily the most influential. They investigated the association between 14 reported barriers to adherence and HIV viral load (an indicator of treatment adherence). They found that the most commonly reported barriers such as forgetting, routine changes and sleeping through a dose were not the factors most likely to be associated with viral load. The factors most significantly associated with viral load were "too many pills to take", "felt depressed/ overwhelmed", "felt drug was toxic/harmful", "felt sick/ill" and "wanted to avoid side effects" (Saberi et al., 2015, p.111).

Demographic variables. There is limited agreement within the literature regarding demographic variables, such as ethnicity, gender, age and income, and their association with ART adherence (Noto, Vecchiet, Monforte and Wu, 2002; Singh, Squier, Sivek, Wagener, Nguyen and Yu, 1996). There has been particular discussion regarding the association between gender and ART adherence. Although a number of findings have found no association (Fogarty et al., 2002; McCoy, Waldrop-Valverde, Balderson, Mahoney and Catz, 2016; Noto et al., 2002), contrasting findings have shown that women living with HIV are more likely to have problems with medication adherence compared with men (Arnsten et al., 2002; Berg, Demas, Howard, Schoenbaum, Gourevitch and Arnsten, 2004; Delgado et al., 2003; Puskas et al., 2011).

Some studies have suggested that increased prevalence of depression in females living with HIV may be associated with increased difficulties with adherence (Turan et al., 2016; Turner, Laine, Cosler and Hauck, 2003). Gender specific barriers impacting adherence, particularly in developing nations have been discussed in the literature (Herstad, 2010; ICW, 2012; ICW, 2015). For example, according to Herstad (2010) women in Tanzania may be less inclined to disclose their HIV status due to fear of social rejection and violence. Herstad, (2010) also note that women may be more likely to experience stigma and discrimination, due to perceptions that having HIV contradicts socially valued attributes such as "female purity and virginity" (p.4). Although gender specific barriers to adherence may be important to consider, current research exploring the factors influencing gender differences is limited due to small samples and being reliant on qualitative methods.

Treatment regime variables. Factors associated with the burden of the ART treatment regimen (e.g. the difficulties integrating medication regimen into daily routine) are commonly cited reasons for non-adherence. Using survey methods, Chesney et al. (2000b) found that for 75 PLHIV in the USA the most commonly reported reasons for non-adherence were: forgetfulness, being away from home, conflicting demands on time and changes in daily routine. In relation to this, a number of findings have indicated that reduced pill burden (i.e. the number of pills taken per day) may be associated with improved adherence (Airoldi et al., 2010; Claxton, Cramer and Pierce, 2001; Nachega et al., 2014; Parienti, Bangsberg, Verdon and Gardner, 2009; Sax, Meyers, Mugavero and Davis, 2012). Despite findings associating treatment regime factors and adherence, the evidence is variable and contrasting studies have not found an association between adherence and treatment regime (Gianotti et al., 2013; Noto et al., 2002). ART side effects have been identified as an additional treatment factor contributing to poor adherence (Max and Sherer, 2000). Common side effects include: diarrhoea, nausea, skin rash, fatigue, mouth ulcers, nerve sensitivity, and lipodystrophy syndrome (Carr and Cooper, 2000; Montessori, Press, Harris, Akagi and Montaner, 2004).

Mental health difficulty. A number of mental health difficulties have been associated with ART non-adherence (DiMatteo, Lepper and Croghan, 2000; Gonzalez, Batchelder, Psaros and Safren, 2011; Nel and Kagee, 2011; Pence, 2009; Springer, Dushaj and Azar, 2012; Starace et al., 2002; Willie, Overstreet, Sullivan, Sikkema and Hansen, 2016). In particular, depression has been frequently associated with non-adherence. For example, Gonzalez et al.'s (2011) meta-analysis of 95 studies, found a significant association between depression and non-adherence (r = 0.19). Despite this, contrasting findings have not found an association between negative affect and adherence (Gonzalez et al., 2007). Findings have also shown an association between anxiety and non-adherence (Willie et al., 2016).

Nel and Kagee (2011) suggest that mental health difficulties are likely to be associated with problems such as: fatigue, concentration, lack of motivation and lack of self-efficacy, which subsequently impact adherence. In relation to the association between fatigue and adherence, Philips et al. (2005) reported an association between disturbed sleep and poor adherence in women living with HIV. However, it was highlighted that the impact of disturbed sleep on adherence may depend on whether an individual is also experiencing symptoms of depression (i.e. there was a reduced association between sleep and non-adherence when depression symptoms were not present).

Substance abuse. Alcohol and drug abuse are additional factors that have been associated with poor adherence to ART (Gonzalez, Mimiaga, Israel, Bedoya and Safren, 2013; Hinkin et al., 2004; Palepu, Horton, Tibbetts, Meli and Samet, 2004; Reback, Larkins and Shoptaw, 2003). Reback et al. (2003) suggest that drug and alcohol abuse disrupt day-to-day routine (e.g. sleep and eating patterns) and the cues associated with taking medication, thus increasing the likelihood of poor adherence. However, there are mixed findings associating

adherence and substance abuse. For example, Malta et al's (2010) meta-analysis concluded that ART adherence in drug users was comparable to adherence rates reported in non-drug users (average 60%).

Cognitive difficulties. As with substance abuse, neurocognitive difficulty (e.g. problems with memory, attention and executive functioning) may disrupt the ability to maintain day-to-day routine and is another factor thought to relate to poor adherence to ART (Andrade et al., 2013; Barclay, 2007; Hinkin et al., 2004). Although the development of ART has resulted in a reduction in the association between HIV and severe neurocognitive impairment (i.e. HIV associated dementia), HIV continues to be associated with milder forms of cognitive difficulty, particularly in older PLHIV (Sacktor et al., 2002; Watkins and Treisman, 2015). Therefore, cognitive impairment may be an important factor to consider when assessing the factors influencing adherence, especially because the population of PLHIV are living for longer.

Beliefs. A number of studies have investigated the association between beliefs and ART adherence. For example, Gao, Nau, Rosenbluth, Scott and Woodward (2000) found that patients who perceived a greater link between taking medication and prevention of illness were more likely to adhere to ART. They also found that individuals experiencing illness symptoms were more likely to adhere to ART compared with individuals who were not experiencing illness symptoms. In a study investigating the association between beliefs and adherence, Brown, Littlewood and Vanable (2013) found that a discrepancy between beliefs of the patient and healthcare provider, regarding what optimal levels of adherence comprise, negatively impacted adherence. Mistrust in the healthcare system is also a factor that has been associated with poor adherence, particularly in ethnic minority groups (Bogart, Wagner, Galvan and Banks, 2010; Bogart, et al., 2016; Gaston and Alleyne-Green, 2013).

The necessity-concern beliefs framework was proposed by Horne as a framework for explaining adherence to treatment in numerous health conditions including HIV (Clifford, Barber and Horne, 2008). From a necessity-concerns perspective, decisions to engage in a treatment regimen are dependent on a cost benefit analysis between beliefs regarding the necessity of the treatment regimen, doubts about treatment efficacy and fear of side effects. In other words, adherence is most likely to occur when the perceived benefits of adherence behaviour outweigh the costs. Kalichman, Pellowski, Kegler, Cherry and Kalichman (2015) investigated the utility of the necessity-concerns framework in predicting adherence to ART in individuals also taking medication for mental health difficulties. Findings indicated that the necessity-concerns framework accounted for 31% of variance in adherence behaviour, thus highlighting the potential importance of necessity beliefs in predicting ART adherence. Further studies have also shown a relationship between beliefs about the necessity of ART and improved adherence (Gonzalez et al., 2007; Langebeek et al., 2014).

General health behaviour. Pellowski and Kalichman, (2016) recently proposed that health behaviours do not occur in isolation, suggesting that individuals who have greater

concern for general overall health may also be more likely to adhere to ART. Their study of 422 PLHIV investigated the association between ART adherence (measured by unannounced pill counts over a 3 month period) and health behaviour (recorded before the 3 month period). They found that increased exercise and following a healthy diet were significantly associated with ART adherence, more so than variables commonly associated with adherence such as depression and stress. They suggested that the factors underlying general health behaviour also underlie adherence behaviour (e.g. motivation, conscientiousness and availability of resources). Despite these findings, Pellowski and Kalichman (2016) acknowledged a number of limitations of their study. Firstly, the sample was restricted to African American males, identified as having low health literacy. Secondly, the prospective nature of the study meant that the daily interactions between health behaviours and adherence were not assessed; they recommended the use of diary methodology for further exploration of this.

Specific barriers to adherence for individuals who were born abroad but live in the UK. It has been suggested in the literature that a proportion of newly diagnosed PLHIV in the UK were born abroad (Clark and Mytton, 2007; Orton, Griffiths, Green and Waterman, 2012). It has been argued that increased fear of difference, xenophobia, government policy regarding immigration, and the existence of journalism that incites fear of immigration and 'health tourism' are contributing to difficulties and confusion experienced by these individuals regarding accessing treatment and support, which may in turn impact treatment adherence (Chinouya, Hildreth, Goodall, Aspinall and Hudson, 2014; Orton et al., 2012; Thomas, Aggleton and Anderson, 2010; Whyte, Whyte and Hires, 2015).

Stigma. Receiving a diagnosis of HIV has been associated with experiences of stigma, rejection, prejudice and discrimination (Elford, Ibrahim, Bukutu and Anderson, 2008; Grossman and Stangl, 2013). Stigma has been referred to as "a 'process of devaluation' of people either living with or associated with HIV and AIDS…Discrimination follows stigma and is the unfair and unjust treatment of an individual based on his or her real or perceived HIV status" (UNAIDS, 2003). HIV related stigma has been described as internalised (i.e. self-stigma) and externalised (i.e. community based, at multiple levels: from community interactions to government policy) (Herek, Capitanio and Widaman, 2003; Orton et al., 2012; Smit et al., 2012). It has been associated with limiting and delaying access to treatment and support, as well as social isolation, and both general and mental health difficulties (Sayles, Wong, Kinsler, Martins and Cunningham, 2009; Turan et al., 2016). Stigma associated with having HIV has also been widely cited as contributing to problems with ART adherence (Dlamini et al., 2009; Langebeek et al., 2014; Peretti-Watel, Spire, Lert, Obadia and VESPA Group, 2006; Rao, Kekwaletswe, Hosek, Martinez and Rodriguez, 2007; Sumari-de Boer, Sprangers, Prins and Nieuwkerk, 2012).

Perceptions of stigma have been associated with a number of processes found to directly relate to adherence. For example, a number of studies have linked perceptions of

stigma with difficulties adjusting psychologically to a HIV diagnosis, which has in turn been associated with poor adherence (Rao et al., 2012; Vanable, Carey, Blair and Littlewood, 2006). Furthermore, Katz et al's (2013) review of the literature indicated that as a result of perceptions of stigma related to HIV, individuals may be less likely to seek social support and more likely to conceal their condition. Simoni, Frick and Huang (2006a), investigated the specific mechanisms through which social support is likely to impact adherence to ART. Findings indicated that social support was linked to spirituality and reduced occurrence of negative affect, which were subsequently related to self-efficacy, and self-efficacy was associated with improved adherence. Self-efficacy and social support are both factors that have also been linked to adherence in the wider adherence literature (DiMatteo, 2004, Tovar et al., 2015).

Rao et al. (2012, p.715) suggest that "depressive symptoms represent a mechanism by which HIV-related stigma affects poor HIV medication adherence". Rao et al's (2012) survey of 720 PLHIV found a direct association between depression and poor adherence. Interestingly, a direct association was not found between perceptions of HIV stigma and adherence. However, a strong association was found between perceptions of HIV related stigma and depression symptoms. Additionally, Turan et al's (2016) USA based, women only study, concluded that the relationship between stigma and adherence was mediated by depression, lack of social support and loneliness. These findings demonstrate the different mechanisms through which HIV stigma may impact adherence.

1.3.3 Variables associated with adherence to ART: Summary

Although there is evidence that numerous factors are likely to be associated with adherence to ART, empirical understanding of the factors that influence adherence continues to be limited. Specifically, understanding of the extent to which variables associated with adherence mediate each other (e.g. whether cognitions influence the extent to which disruptions to routine affect adherence behaviour) is particularly limited. Furthermore, the current evidence base is largely reliant on either survey or qualitative methods, which are cross-sectional in nature. As noted by Noto et al. (2002, p.126) when referring to ART adherence "adherence is a dynamic process and patients' behaviour can change over time". However, there are no studies exploring day-to-day fluctuations in ART adherence behaviour, and specifically the interaction between daily adherence and day-to-day variability in factors influencing adherence (e.g. mood).

1.4 Theoretical perspectives of adherence

So far, research investigating the variables that influence adherence to ART has been discussed. Based on existing research it is clear that there are multiple factors influencing adherence. As yet there is not a coherent predictive model of adherence that can be used to guide interventions. The next section will explore theoretical perspectives of adherence, which may offer a framework for understanding the influence of the variables discussed above.

1.4.1 The Self-Regulatory Model

The Self-Regulatory Model (SRM) views the individual as a problem solver; it suggests that health behaviour is guided by perceptions and representation of health (Leventhal, Brissette and Leventhal, 2003). According to the SRM, three stages regulate health behaviour. Firstly, an individual interprets their illness through generating an emotional response and cognitive representation. The cognitive representation relates to five dimensions: identity (description of illness), cause of illness, consequences (impact of illness), control (perceptions of whether illness can be cured/managed) and timeline (perception of duration of symptoms). Secondly, illness representations impact coping strategies (e.g. whether an individual copes actively through seeking advice and discussing symptoms or whether they avoid and deny their problem). Thirdly, the individual develops a cognitive representation of the success of coping strategies. A feedback loop is included within the model, enabling the individual to amend their cognitive representations and subsequent coping (Cameron and Leventhal, 2003; Leventhal et al., 2003).

Hagger and Orbell's (2003) meta-analysis provides support for use of the SRM as a framework for predicting adherence to treatment in acute and chronic health conditions. In the studies reviewed, the cognition dimensions of the SRM were associated with coping behaviour and outcome. Law, Tolgyesi and Howard's (2014) systematic review of 15 studies investigating illness self-management in children with chronic disease, provided evidence that control beliefs (i.e. perceptions of the extent to which illness can be managed) are associated with self-management. However, results failed to provide evidence that further dimensions of the SRM model were associated with illness self-management. Law et al. (2014) suggested that although the SRM is useful in understanding adherence behaviour, it should be considered within an individual's wider context. Furthermore, Brandes and Mullan's (2014) meta-analysis of 30 studies found only weak associations between the dimensions of the SRM and adherence to treatment in chronic illness (effect size between -0.02 and 0.12). Brandes and Mullan (2014) also highlighted that 28 of the 30 studies reviewed were cross-sectional, making it difficult to gain insight into the direction of the relationship between cognitive representations and adherence. For example, it is unknown whether adherence behaviour influences cognitive

representations or alternatively, whether cognitive representations influence adherence behaviour.

1.4.2 The Health Belief Model

According to the Health Belief Model (HBM), an individual's set of beliefs related to a given health behaviour can be used to predict that behaviour (Champion and Skinner, 2008). It is based on demographic variables which relate to four core concepts: perceived severity (i.e. greater perceived severity of a particular health condition increases the likelihood of carrying out a particular health behaviour); perceived susceptibility (i.e. perceptions of increased susceptibility to developing a particular health condition results in increased likelihood of carrying out an associated health behaviour); perceived benefits (i.e. perceptions of the benefits of a given health behaviour mean it is more likely to occur); perceived barriers (perceptions of difficulty and obstacles related to carrying out a health behaviour reduces the chances of it occurring) (Janz and Becker, 1984). The concepts of self-efficacy (i.e. confidence in ability to carry out a given behaviour) and cues to action (i.e. reminders prompting behaviour) have also been included within the model; however, they are not consistently acknowledged and examined within the literature (Carpenter, 2010; Rosenstock, Strecher and Becker, 1988).

A number of studies have investigated the utility of the HBM in predicting health behaviour. A meta-analysis incorporating 16 studies investigating the relationship between HBM dimensions and health behaviour found that HBM dimensions could predict up to only 10% of variance in behaviour (Harrison, Mullen and Green, 1992). More recently, Carpenter's (2010) meta-analysis found that perceptions of greater benefits and fewer barriers were the best predictors of health behaviour. Strong associations were not found between the susceptibility and severity dimensions of the HBM and health behaviour. Furthermore, findings indicated that a number of moderating variables influenced the utility of the HBM in predicting behaviour. For example, prolonged time between measurement of HBM dimensions and measure of behaviour resulted in reduced effect size. Carpenter (2010) concluded that the variables influencing health behaviour are more complex than those included in the HBM. They proposed that the influence of variables moderating the HBM dimensions require greater consideration. The HBM has faced further criticism for a lack of clarity in the definition of the individual constructs of the model, making reliable measurement of the model difficult (Munro, Lewin, Swart and Volmink, 2007).

1.4.3 The Theory of Planned Behaviour

According to the Theory of Planned Behaviour (TPB), attitudes (beliefs about the behaviour and evaluation of the outcome of the behaviour), subjective norms (beliefs about significant others view of the behaviour) and perceived behavioural control (perceptions of the

ease/ difficulty of engaging in behaviour) shape behavioural intentions, which in turn guide behaviour (Ajzen, 1991).

Empirical studies provide support that the components of TPB can be used to predict behavioural intentions and behaviour. McEachan, Conner, Taylor and Lawton's (2011) meta-analysis found that in the studies reviewed, the TPB accounts for 19.3% of variance in health related behaviour and 44.3% of variance in behavioural intentions. However, the nature of the behaviour influenced the extent to which the model could predict behaviour. For example, the model was more likely to predict positive behaviours (i.e. behaviours improving physical health) such as physical activity and diet, in comparison to risk behaviours such as safe sex and alcohol use.

Despite its popularity, a number of limitations of TPB have been identified. For example, it fails to account for the occurrence of variables that may mediate or moderate the influences on intention and behaviour (Sniehotta, Presseau and Araújo-Soares, 2014). Furthermore, TPB does not credit variables such as mood or past experience for the potential influence on behaviour and assumes that all decisions are logical (Ajzen, 2011). In order to account for the variance in behavioural intentions and behaviours that are unexplained by TPB, it has been suggested that components of the TPB should be extended (Conner and Armitage, 1998; Rivis, Sheeran, Armitage, 2009; Sandberg and Conner, 2008).

In particular, the construct of 'anticipatory affect' has been proposed as an addition to TPB (Rivis et al., 2009). 'Anticipatory affect' relates to the feelings that an individual anticipates that they will experience as a consequence of a decision to complete/not complete behaviour. Rivis et al's (2009) meta-analysis provided support that anticipatory affect may be a useful inclusion into TPB. Of the studies reviewed, anticipatory affect accounted for 5% of variance in behavioural intentions (in addition to the constructs of TPB). Sandburg and Conner (2008) proposed that the construct of 'anticipatory regret' alone could be included into TPB. They argue that experience of anticipatory regret is likely to strengthen behavioural intentions through increasing motivation to avoid the negative implications of regret. Providing support for this notion, Sandburg and Conner's (2008) meta-analysis found that in the studies reviewed, TPB accounted for 30% of variance in behavioural intentions, with anticipatory regret adding an additional 7% to the variance accounted for.

1.4.4 Social Ecological Theory

The concept of ecology originates from biology and "refers to the interrelations between organisms and their environment" (Sallis, Owen and Fisher, 2008, p.466). Socio-ecological perspectives have been used to understand individual behaviours within their wider context. They view behaviour as being governed by the interactions across multiple levels, including: the physical environment, social factors, the political context and individual factors (Sallis et al., 2008).

Socio-ecological perspectives have been used to provide a framework for understanding medication adherence behaviour (Berben, Dobbels, Engberg, Hill and De Geest, 2012). Berben et al. (2012) utilised Bronfenbrenner's ecological systems theory (Bronfenbrenner, 1979) to provide an overview of the multiple levels of influence on adherence. Berben et al. (2012) suggest that according to Bronfenbrenner's model, adherence behaviour is influenced on: the individual level (i.e. individual characteristics, beliefs and attitudes); the micro level (i.e. an individual's social support and relationship with health providers); the meso level (i.e. the local community, access to health care, social norms and characteristics of the healthcare organisation) and the macro level (i.e. local and national policies).

There is emerging acknowledgement of the utility of social ecological perspectives in explaining HIV related behaviour, including adherence to treatment, seeking care and risk of transmission (Baral, Logie, Grosso, Wirtz and Beyrer, 2013; Kaufman, Cornish, Zimmerman and Johnson, 2014; Mburu, Ram, Oxenham, Haamujompa, Iorpenda and Ferguson, 2014). Several recent studies have utilised a social ecological framework in order to highlight factors beyond the individual, associated with adherence, such as: relationships with health care provider, social support, experience of stigma and access to stable living accommodation (Castro, Santiago, Jiménez, Dávila-Vargas and Rosal, 2015; Kagee and Delport, 2010). However, the current evidence is limited due to small-scale studies and an emphasis on qualitative methods, in addition to studies that have investigated specific subgroups in the HIV population, meaning that generalisation is difficult.

Although social ecological perspectives provide a useful overview of the factors likely to impact health behaviour, they face criticism due to providing inadequate information regarding the mechanisms through and the extent to which different levels of the model impact behaviour. Furthermore, limited empirical support for ecological perspectives is thought to be associated with the difficulty and expense associated with assessing multiple levels of influence on health behaviours simultaneously, in addition to the complexity associated with establishing the interactions between different levels of influence. It has also been noted that the development of interventions within a social ecological framework is likely to be difficult due to the potential breadth of factors that an intervention may need to address (Kaufman et al., 2014). Kaufman et al. (2014) argue that socio-ecological perspectives "have been typically discussed as organizing frameworks rather than testable (i.e. falsifiable) empirical models" (p.245). Kaufman et al. (2014) also suggest that socio-ecological perspectives should be used when investigating adherence to identify variables to assess, however they acknowledge, "measuring or intervening at all levels will be too expensive and complex for comprehensive research" (p.255).

1.5 Interventions for HIV treatment adherence

This section will outline current understanding of interventions used to promote HIV treatment adherence. There is limited agreement within the chronic disease literature regarding established interventions to promote adherence (Hamine et al., 2015; Kripalani, Yao and Haynes, 2007; Viswanathan et al., 2012). In line with this, established interventions promoting adherence to ART are also limited (Kanters et al., 2016). Kanters et al's (2016) meta-analysis indicated that although a number of ART adherence interventions have had success in promoting adherence, the estimated effects of interventions are modest. Additionally, there is limited evidence for the success of interventions over time. Nevertheless, a number of interventions have been identified as having some success in promoting ART adherence, these include: educational interventions, interventions using mobile technologies (i.e. to provide reminders) and interventions based on motivational interviewing, cognitive behavioural skills building and promotion of medication self-management (Belzer et al., 2014; Goujard et al., 2003; Hill and Kavookjian, 2012; Parsons, Golub, Rosof and Holder, 2007; Safren et al., 2001; Smith, Rublein, Marcus, Brock and Chesney, 2003).

A number of studies have found associations between improved adherence and treatment of depression and emotional distress (Sin and DiMatteo, 2014; Turner et al., 2003). Cognitive Behavioural Therapy for adherence and depression (CBT-AD) is an adherence specific intervention combined with Cognitive Behavioural Therapy (CBT) approaches for depression (Newcomb et al., 2015). It has been used with some success with PLHIV (Safren et al., 2009; Safren, O'Cleirigh, Bullis, Otto, Stein and Pollack, 2012; Simoni et al., 2013). However, current studies investigating the efficacy of CBT-AD are limited due to their small sample sizes. Furthermore, when investigating the use of CBT-AD with drug users with a diagnosis of HIV, Safren et al. (2012) found that although improvements in depressive symptoms were maintained at 3 and 6 month follow up, improved adherence was not maintained, indicating that CBT-AD may have limitations.

Limitations of the current evidence base for HIV (and chronic disease in general) adherence interventions have been identified. These include: small scale studies, large variation in sampling and assessment strategies, variation in the measurement of adherence, lack of long term follow up, high attrition rates, lack of examination of interventions in specific groups and lack of analysis of the cost effectiveness of interventions (Chaiyachati, Ogbuoji, Price, Suthar, Negussie and Barnighausen, 2014; Simoni, Pearson, Pantalone, Marks, and Crepaz, 2006c). Furthermore, it has been identified that adherence interventions commonly comprise multiple components, however, there is limited evidence in order to determine which specific elements of interventions are most important for influencing adherence (Mannheimer and Hirsch-Moverman, 2015; McDonald, Garg and Haynes, 2002).

1.5.1 Use of health behaviour theory in the development of adherence interventions

According to Medical Research Council (2008) guidance, all interventions aimed at improving health should be evidence based and guided by theory. However, there is limited clarity within the literature regarding the use of theoretical perspectives in the development of adherence interventions. This may be the consequence of the heterogeneity of theoretical perspectives of adherence as well as the variability and complex nature of adherence interventions (Munro et al., 2007).

Nevertheless, within the wider chronic disease literature a number of studies have sought to gain insight into the use of health behaviour theory in treatment adherence interventions. For example, based on a review of the literature McCullough et al. (2016) concluded that interventions (for chronic pulmonary disease) based on health behaviour theory were most likely to be effective. However, reviews investigating the use of the Health Belief Model (HBM) and Self Regulatory Model (SRM) in guiding adherence interventions have highlighted methodological difficulties within the current literature (Jones, Smith and Llewellyn, 2014, 2016). Consequently, they did not draw firm conclusions regarding whether improved adherence was a consequence of interventions specifically addressing HBM and SRM constructs. Reported limitations of the included studies in each of the reviews were: failure to outline the intervention used in detail, failure to use either the HBM or SRM in full, and failure to measure theoretical model constructs pre and post interventions. Although improved adherence was reported in many of the studies included in each of the reviews, there was little clarity regarding the mechanisms through which adherence behaviours were influenced, once again making it difficult to establish the utility of the theoretical perspectives in the development of interventions.

There has been limited investigation of the utility of theoretical perspectives in the development of interventions specifically promoting ART adherence. Despite this, it has been suggested that existing health behaviour theories, including HBM and SRM, may have utility in the design of future adherence interventions (Munro et al., 2007). Munro et al. (2007) suggest that the current evidence is limited due to the existing multitude of theoretical perspectives available, as well as an overlap between the constructs of particular theories (i.e. those designing interventions may have difficulty in selecting which theoretical perspective to use to inform the design of an intervention).

1.6 Diary Methods in Research

In order to inform understanding of factors influencing adherence, and in turn identify how barriers to adherence can be targeted in interventions, research methodology that can provide insight into adherence behaviour is required. Diary methods have been identified as a way to provide insight into the factors influencing health behaviour close to the time that it

occurs and have been widely used to provide insight into health behaviours such as eating and exercise. However, diary methods have been used less frequently within populations living with physical illness. The next section will provide an overview of diary research in general, in addition to the specific use of diary research within HIV populations.

Diary methods are used in a number of domains of psychology, including occupational, health and social psychology (Bolger, Davis and Rafaeli, 2003; Ohly, Sonnentag, Niessen and Zapf, 2010; Quittner, Espelage and Drotar, 2000). Diary methods require research participants to provide repeated (i.e. daily) accounts of their experience (e.g. mood, thoughts and physical symptoms) over a specified time period. They aim to gain insight into participants' day-to-day experiences, capturing life "as it is lived" (Schneider and Stone, 2016, p.503). The format of diaries can vary, however, common versions include: pen and paper, telephone interview and electronic form (Iida, Shrout, Laurenceau and Bolger, 2012). Two types of diary design include event-based and time-based designs (Iida et al., 2012). Event based designs involve diary recordings after the occurrence of a specific event or experience. Time based designs refer to diary recordings that are scheduled at a set point in time, over a defined period (e.g. every day after 8pm).

1.6.1 Benefits and limitations of diary research

Diary studies aim to record experiences close to the time that they occur. As a result, it has been argued that they reduce limitations associated with retrospective recall and improve ecological validity (Bolger et al., 2003). Research that is cross sectional in nature is only able to provide "snapshots" of experience (O'Connor, Jones, Conner, McMillan and Ferguson, 2008, p.1), whereas diary studies are able to account for fluctuations in individual experience over time, therefore, gaining an understanding of individual experience within the context of daily life (O'Connor, Jones and Conner, 2011). Additionally, diary methods provide multiple measures of the same construct over time, providing "high-resolution data that can capture the dynamic ebb and flow of people's experiences" (Schneider and Stone, 2016, p.497). Diary methodology also provides an opportunity to explore the relationship between variables (i.e. can the occurrence of one variable predict the occurrence of another?). Furthermore, it allows for examination of both within person and between person differences (Iida et al., 2012).

Limitations of diary studies are often associated with the burden of taking part (i.e. due to the length of the diary period and the frequency of diary entries that are often required). This may impact recruitment and increase the likelihood of attrition. Iida et al. (2012) highlight the importance of gaining a balance between acquisition of information and managing participant burden.

Additionally, diary study participation may cause 'reactivity' which relates to a change in participant perceptions, experiences and behaviour. However, Iida et al. (2012) argue that

diary reporting leads to habituation, meaning that participants may be less reactive to participation in a diary study in comparison to taking part in a one off survey. Furthermore, a number of findings have not provided support for participant reactivity due to taking part in a diary study (Cook, McElwain and Bradley-Springer, 2010; Stone et al., 2003a; Wagner and Ghosh-Dastidar, 2002). For example, Wagner and Ghosh-Dastidar's (2002) investigation indicated that participation in a diary study did not alter participant's ART adherence. They investigated whether methods used (diary and electronic monitoring) to monitor ART adherence functioned as an intervention (i.e. does measurement of adherence influence actual adherence?). When three groups were compared (medication diaries, electronic monitoring of adherence and a control group) adherence did not differ significantly from baseline to the study end point (at four weeks) in all three groups.

1.6.2 Paper versus electronic diary methods

The advantages and disadvantages of electronic diaries (ED) versus paper diaries (PD) have been debated in the literature. It has been suggested that PD's are unreliable as they enable participants to falsify their responses (i.e. record responses simultaneously if they have forgotten about a diary entry). Consequently, some propose that ED's are superior because they are able to record the specific time and date of participants' responses (Tennen, Affleck, Coyne, Larsen and DeLongis, 2006). However, a criticism of ED's relates to technical difficulties impacting participant responses, which have been reported in a number of studies (Stinson et al., 2013).

There have been contrasting findings regarding whether PD's or ED's are superior (Broderick and Stone, 2006). Some studies indicate that PD's and ED's yield equivalent data (Green, Rafaeli, Bolger, Shrout and Reis, 2006; Wouters, Thewissen, Duif, Lechner and Jacobs, 2016). However, Stone, Shiffman, Schwartz, Broderick, Hufford (2003b) outline contrasting findings. They assessed participant completion of PD's using an electronic system, which recorded when the diary pages were opened and closed. Findings indicated inconsistencies between participants' self-reported PD completion and actual completion. Stone et al. (2003b) also compared PD completion to a comparison group completing ED and found that completion of ED's was greater than PD's. Despite the potential limitations of PD's they are a commonly used diary format (Shields, Shiffman and Stone, 2016), and continue to be used and reported within the literature (Feuerhahn, Sonnentag and Woll, 2014; Zautra, Fasman, Parish and Davis, 2007). Furthermore, it has been suggested that the advantages of a particular diary format may vary depending on the characteristics of the target population (i.e. a PD may be superior within a population unfamiliar with electronic devices) (Green et al., 2006).

1.6.3 Diary research and health behaviour

Diary methods have been used extensively to investigate the impact of daily experiences on health behaviour. For example, they have been used to investigate the impact of daily experiences (e.g. stress, working hours and affect) on health behaviours such as eating, alcohol use and smoking cessation (Freeman and Gil, 2004; Jones, O'Connor, Conner, McMillan and Ferguson, 2007; Lüscher, et al., 2015; Townshend and Duka, 2002). For instance, the impact of daily fluctuations in stress on eating behaviour has been shown in a number of daily diary studies (Conner, Fitter and Fletcher, 1999; O'Connor et al., 2008). O'Connor et al's (2008) diary study investigating eating behaviour, measured day-to-day stress events as 'daily hassles'. Daily hassles were defined as "events, thoughts or situations which, when they occur produce negative feelings such as annoyance, irritation, worry or frustration, and/or make you aware that your goals and plans will be more difficult or impossible to achieve" (O'Connor et al., 2008, p.20). Daily hassles were found to be associated with increased consumption of foods high in fat and sugar. Given the findings associating daily hassles with eating behaviour, daily hassles may have potential relevance in relation to other health behaviours, such as adherence, however, this has not been investigated.

1.6.4 Diary research within physical illness contexts

Although diary methodology has been widely used within healthy populations, fewer diary studies have been used to investigate behaviour and the experiences of individuals experiencing physical illness. Diaries may be useful in order to provide insight into the day-to-day life of those with physical illness, in turn contributing to improved treatment interventions. However, it could be suggested that given the treatment burden often associated with physical illness (particularly chronic conditions), the additional burden of taking part may impact participation in diary studies. Nevertheless, a number of studies have used diary methodology successfully in order to investigate day-to-day fluctuations of symptoms, experiences and behaviours (e.g. mood, symptoms, social experiences and engagement with treatment regime). These include studies within child and adult populations suffering from significant illness and chronic diseases such as: cancer, chronic obstructive pulmonary disease, sickle cell disease, cystic fibrosis, diabetes and rheumatic diseases (Berg et al., 2014; Blackwell and Quittner, 2015; Connelly, Bromberg, Anthony, Gil, Franks and Schanberg, 2012; Karlson et al., 2016; Sherliker and Steptoe, 2000; Walters, Walters, Wills, Robinson and Wood-Baker, 2012).

Sherliker and Steptoe (2000) assessed the feasibility of using diary studies with patients suffering from advanced metastatic cancer. Participants (n = 10) completed daily diaries assessing coping and adjustment over a 4-week period. Diary completion rates were high, over 95% of diaries were completed per participant. Additionally, interviews following participation within the study indicated that participants found completing a diary acceptable. A number of

participants highlighted (without prompting) that participation within the study had been rewarding and helpful, however, one participant did voice that participation had become a "chore". Although Sherliker and Steptoe's (2000) findings are promising, they are limited by the study's small sample size. An additional study by de Wit et al. (1999) evaluated the use of a pain diary in 159 cancer patients. Participants were asked to rate the intensity of their pain, twice daily, over a 2-month period; high completion rates were also reported in this study (86%).

Findings have indicated that illness severity and demographic factors (such as gender and location) do not impact daily diary completion in chronic illness populations (Walters et al., 2012). However, it has been found that diary completion is associated with educational attainment and older age (Gordon, Prohaska, Gallant and Siminoff, 2007; Walters et al., 2012). de Wit et al. (1999) recorded the reasons why individuals with a physical illness had chosen not to take part in a diary study, these included: burden of study, lack of motivation and feeling too ill.

1.6.5 Diary research and adherence

Daily diary studies have been used to obtain a measure of patient's adherence to treatment (Garber et al., 2004). They have also been used, in a small number of studies, to investigate day-to-day factors that may predict participants' adherence to treatment. For example, Petrov, Lichstein, Huisingh and Bradley (2014) investigated the variables associated with adherence to an insomnia behavioural treatment regime. Findings indicated that social support was associated with improved adherence. They also found that alcohol consumption was associated with poor adherence the following day. Findings did not indicate an association between adherence and variables such as mood, health, pain and fatigue.

Additionally, Blackwell and Quitter's (2015) daily diary study, completed by adolescents with cystic fibrosis, found that day-to-day variability in pain was associated with reduced mood and poor adherence. Furthermore, Gordon et al. (2007) utilised diary methodology to investigate the factors associated with kidney transplant recipients' self-reported non-adherence to medication. Results highlighted five key areas associated with non-adherence, these were: being outside of home, work factors, forgetfulness, sleeping through a dose time and attendance of other medical appointments.

1.6.6 Diary research and people living with HIV

Few studies have used diary methodology within HIV populations. It has been suggested that diary methods in HIV populations pose specific challenges. For example, Cook et al. (2010) suggest that in the USA these challenges are associated with: PLHIV often being economically deprived, a high proportion of PLHIV belonging to ethnic minority groups, and high rates of mental health difficulties in HIV populations. Furthermore, they suggest that stress

due to managing HIV and its associated difficulties (i.e. opportunistic infections) may impede completion of daily diaries, they also propose that the stigma associated with HIV prevents participation due to disclosure concerns.

Nevertheless, a small number of studies have utilised diary methods within HIV populations, though varied participant compliance with diaries has been reported. For example, Barta, Portnoy, Kiene, Tennen, Abu-Hasaballah and Ferrer, (2008) investigated the association between substance abuse and sexual behaviour in PLHIV using electronic diaries (an interactive voice response system), 116 participants completed the diaries 72.4% of the time. Additionally, Cook et al. (2010) concluded that diary methodology is acceptable to participants living with HIV (n = 21). This was based on a feasibility study investigating the utility of daily electronic surveys investigating HIV risk behaviours and their association with day-to-day factors such as stress and affect. 81% of participants completed the daily surveys for 2 months, 66% completed the surveys for 6 months. Cook et al. (2010) suggested studies with a shorter duration are likely to have reduced attrition. They also reported a higher proportion of attrition in ethnic minority groups, indicating there may be specific barriers to taking part in diary studies for ethnic minority participants.

Furthermore, Janda, Markowski, Derlega, Nezlek and McCain, (2006) used electronic diaries to investigate the association between daily events and mood in PLHIV, however, this study was limited due to the small sample size (n = 7). Dowshen, Kuhns, Gray, Lee and Garofalo's (2013) study investigated the feasibility of gaining a daily record of adherence using an interactive text message response (ITR), through this, participants were asked to respond to daily texts asking about their adherence. However, low rates of participant compliance with the ITR were reported, 25 participants responded to the texts 61% of the time, over a period of 24 weeks.

Cherenack, Wilson, Kreuzman and Price (2016) investigated the feasibility of daily diaries with men (aged between 16 and 24) who have sex with men. Participants (n = 67) completed diaries for 66 days (a 33 day internet diary and a 33 day voice diary). Participants deemed both diary formats as acceptable, and diary completion rates of 72% were reported. Following completion of the diaries, participants were interviewed regarding the barriers and facilitators to participation. Facilitators of diary completion included: diary being enjoyable, diary aiding self-reflection, positive relationships with study staff and monetary compensation. Barriers to diary completion were identified as: forgetfulness, technical issues, being unwell, lack of motivation and being too busy. Cherenack et al. (2016) acknowledged that reported diary compliance in the study was limited as it was only reflective of participants who were motivated and had the capacity to take part. This was because participants who did not have 100% completion rates in the first three days of the study were excluded. Additionally, the acceptability of the diary was assessed by participants who had been motivated and able to take part (i.e. acceptability for those who chose not to take part is unknown).

As noted by Cherenack et al. (2016), there is limited investigation of the specific facilitators and barriers of diary methodology in HIV populations. Furthermore, the majority of diary studies with PLHIV have relatively small samples, and have been conducted in Northern America. Consequently, the barriers and facilitators of diary methodology that have been discussed within the literature may be difficult to generalise (i.e. to a UK population). Furthermore, in the studies cited above, a number report providing participants with significant monetary compensation (up to $197 per participant). According to Cherenack et al. (2016, p.1752) "further studies are needed to examine daily diary compliance with different levels of support and monetary compensation".

1.7 Rationale for study

An enhanced understanding of adherence to ART is required in order to inform clinical practice and the development of interventions used to promote adherence. This diary study was informed by current theory and piloted a method that sought to examine the association between theoretical constructs and variables thought to influence adherence.

Use of diary methodology. Theoretical models have some utility in explaining chronic disease patients' adherence to treatment. However, it continues to be acknowledged that adherence to treatment in chronic disease is not well understood, and a large proportion of variance in non-adherence remains unaccounted for. The majority of current research investigating the factors influencing adherence to ART is cross-sectional and reliant on qualitative and survey methods. To our knowledge there are no studies that have specifically investigated patterns of adherence and psychological variables simultaneously over time. Diary methodology provides the opportunity to capture the fluctuating nature of psychological variables influencing adherence behaviour, close to the time that they occur. It also minimises the limitation of retrospective recall and enables the investigation of within and between person variability. Diary methodology allows adherence behaviour to be viewed within the context of every day experience.

Interviews with HIV staff and HIV service users (PLHIV). Although diary methods have potential to aid understanding of adherence to complex regimens, little is known about how to implement them successfully within HIV populations. This project was originally conceptualised as a feasibility study in anticipation of difficulties in translating a method developed in a healthy population for use with participants with a long-term condition. During the early stages of the diary study a lower proportion of participants than expected had returned the completed diaries. Therefore, in line with the original feasibility plan, interviews with HIV healthcare staff and PLHIV were undertaken. The interviews sought to ascertain the acceptability of diary methodology used within HIV populations. Staff perspectives in addition to PLHIV perspectives were obtained in order to gain an understanding of health system factors that may facilitate/impede diary research uptake in potential participants. Evaluating the process

of an intervention (i.e. the diary study) enables a thorough analysis of the specific components of the intervention that rendered it effective/ineffective (Senn et al., 2013). As Linnan and Steckler (2002) note, "thoughtful, comprehensive process evaluation efforts can shed light on questions that will inform improvements in theory, intervention design, and methods in the future" (p.3).

1.8 Research Aims

The first aim of the study is to investigate the day-to-day factors associated with adhering to ART in PLHIV. The second aim is to investigate the feasibility of diary methodology used to investigate adherence to ART with PLHIV.

The research questions are:

- What are the day-to-day variables associated with adherence to ART?
- Do any variables moderate the relationship between day-to-day variables and adherence to ART?
- What is the utility of a diary method used to elicit data from PLHIV?
- What are the barriers and facilitators of diary methodology used to investigate treatment adherence in a UK HIV population?

Chapter 2: Methodology

This chapter describes two linked study designs and methods. The first designed to investigate PLHIV's adherence to ART, the second to explore barriers and facilitators to using diaries as research tools to investigate adherence to ART with PLHIV.

2.1 Investigating adherence to ART

This survey design employed mixed methods. Study 1 was a diary study using multilevel diary methodology to assess the day-to-day variables influencing medication adherence with PLHIV; participants were asked to complete a 14-day daily diary, and an initial questionnaire. Study 2 reflected the status of study 1 as a feasibility study, and aimed to obtain more detailed information on the application of the method using qualitative semi-structured interviews.

2.2 Ethical permission

Ethical approval for this study was granted by the Proportionate Review Sub-committee of the North East-Newcastle and North Tyneside 2 Research Ethics Committee in September 2016. Full Health Research Authority (HRA) approval was also granted in September 2016 (Appendix 4). The research departments within the NHS trust (Leeds Teaching Hospitals Trust) subsequently provided approval for the project to commence in October 2016. Management approval was obtained in order for recruitment to take place at the third sector site in August 2016. Prior to the external approvals, two academic panels at the University of Leeds reviewed the project. In January 2017 a substantial amendment was submitted to the ethics committee in order to complete the utility of diary methods study. The amendment was granted HRA approval in February 2017 (Appendix 5).

Study 1 - Diary Study

2.3 Sample

Participants were eligible to participate if they met the following inclusion criteria: aged over 18; diagnosis of HIV; receiving ART treatment; sufficient comprehension of written and spoken English and capacity to provide informed consent.

2.4 Sample size

Guidance for calculating power estimations for multilevel analysis is limited (Schermbaum and Fetterer, 2009). However, it has been suggested that in order to provide adequate statistical power, at least 30 level 2 units may be optimal in order to gain statistical power (Maas and Hox, 2004). Level 2 units in this study relate to the number of initial questionnaires (i.e. number of participants). Level 1 related to the diary, and a level 1 unit related to a day of the diary. It has been proposed that statistical power is based on a "trade-off between the number of Level 1 and Level 2 responses" (O'Connor et al., 2008, p.23), meaning that as the number of level 2 units increase the number of level 1 units needed to obtain statistical power decreases (Hoffman, 1997). Within this study 30 participants would have been optimal.

2.5 Materials

A recruitment pack was developed specifically for this study and was given to potential participants. The pack comprised all the materials needed to take part in the study: participant invitation letter; information sheet; consent form; initial questionnaire; daily diary; participant experience questions; and free post envelopes.

2.5.1 Adaption of materials for use in HIV service

Although diary methodology may provide useful information regarding the day-to-day experiences of PLHIV, little is known about how the methodology can be successfully used within chronic illness populations. The study design was based on the diary study conducted by O'Connor et al. (2008), which explored the impact of daily hassles on eating behaviour in a healthy population. To our knowledge there is no standardised diary available in order to investigate the association between treatment adherence and day-to-day variables. Therefore, the diary used was devised specifically for this study, adapted from the diary used by O'Connor et al. (2008).

The initial stages of the study development involved a process of evaluation and adaption of the study design and the study materials. Staff and service user consultations were used to ensure that the measures were relevant and acceptable to PLHIV. Additionally, consultations informed the implementation of the study, for example, the recruitment process, the format of the diary, length of the diary and confidentiality given to participants.
Given that high proportions of PLHIV are from potentially difficult to reach groups (i.e. black and minority ethnic (BME) populations), in addition to stigma associated with having HIV (Grossman and Stangl, 2013), it was important to build relationships and work collaboratively with the services where participants would be recruited (an NHS HIV service and Skyline, a

third sector organisation). The services were instrumental, not only in the development phase of the project but also in supporting recruitment. Murray et al. (2010, p.1) note that for research to be successfully implemented within clinical settings it must be "feasible and compatible with clinical practice", underlying the importance of the study design and recruitment procedures being acceptable within the settings where participants are recruited.

In relation to the initial questionnaire, a number of questionnaires were initially considered and the final questionnaires included were those judged to have the strongest psychometric properties, in addition to being the scales identified by staff and service users as most relevant and appropriate for use in HIV populations. The diary items were selected based on existing theoretical perspectives of adherence, in addition to variables that have been associated with HIV adherence in the literature. Following the initial adaption, advice was sought from the staff (including a clinical psychologist, medical consultants and nurses) based at the NHS HIV service regarding all of the study materials (initial questionnaire, daily diary, consent form, information sheet and participant invite letter). Advice was then sought from staff at Skyline. Following this, advice regarding the study design was sought from service user representatives. This was to ensure that the measures were suitable and relevant to individuals living with HIV, in addition to ensuring that the questionnaire questions were worded in a sensitive manner with the hope of preventing distress to participants. The representatives were contacted through two support groups at Skyline: a support group for BME women and a support group for gay and bisexual men. Several drafts of the initial questionnaire and diary were developed prior to the final diary and questionnaire used.

2.5.2 Initial Questionnaire

Participants completed an initial questionnaire (Appendix 1). Inclusion of the questionnaire enabled investigation of the impact of potential moderating variables (i.e. variables measured in the questionnaire such as beliefs about HIV) on the relationship between within person factors and adherence (measured in the daily diary). The majority of the questionnaire was adapted from a number of validated measures based on the feedback from service providers and users, it comprised:

Personal Information Questionnaire (PIQ). The PIQ contained 16 items and was used to gain details regarding the demographic characteristics of the sample, as well as to gain information about participants HIV status, their HIV treatment regime, and social factors such as perceived social support.

Consultations with service users and HIV staff informed the development of the PIQ. In particular, the service user representatives proposed that the PIQ ask about the date of diagnosis and commencement of treatment due to suggestions that adherence behaviour and attitudes towards treatment change over time. Additionally, the HIV staff suggested including items

regarding use of mood medication, perceptions of involvement in treatment decisions and understanding of treatment.

Beliefs About Medicines Questionnaire (BMQ; Horne, Weinman and Hankins, 1999). The BMQ provides a measure of beliefs about medication. It has been used extensively within the literature, in a range of conditions, including HIV (Horne, Chapman, Parham, Freemantle, Forbes and Cooper, 2013). The BMQ comprises two parts (BMQ-Specific and BMQ-General).

The BMQ-Specific is made up of 10 items, asking participants about their beliefs about the specific medications that they are prescribed. It comprises two five item subscales: specific-necessity (perceptions of how necessary prescribed medication is) and specific-concerns (concerns about the dangers of prescribed medication). The BMQ-General is made up of eight items, asking participants about their beliefs about medicines in general. The BMQ-General comprises two four item subscales: general-harm (general beliefs about whether medicines cause harm) and general-overuse (general beliefs about whether doctors place too much emphasis on/overuse medications).

In terms of psychometric properties, in a number of chronic conditions, all of the BMQ subscales have been found to have acceptable internal consistency on each subscale (Cronbach's alpha from 0.51-0.86). Furthermore, BMQ scores have been found to correlate with treatment adherence in a number of health conditions (Horne et al., 1999).

Brief Illness Perception Questionnaire (Brief IPQ; Broadbent, Petrie, Main and Weinman, 2006). The Brief IPQ assesses illness beliefs through a nine item self-report measure. The items each assess a separate dimension of illness perception (consequences, timeline, personal control, treatment control, illness concern, identity, coherence, emotional representation and cause) (Broadbent et al., 2006). Participants are required to rate each item (range 0-10), with higher scores representing perceptions that an illness is more threatening. The psychometric properties of the Brief IPQ have been assessed in a number of illness groups. It has been found to have concurrent validity with the Illness Perception Questionnaire-Revised (a validated and more comprehensive version of the Brief IPQ) as well as good test-retest reliability (correlations from 0.43 to 0.75) (Broadbent et al., 2006).

Following advice from the HIV staff and service users, two items were removed from the original Brief IPQ, therefore seven items were used in this study. The items asking about 'cause' and 'timeline' of illness were removed due to concerns that they may cause distress and confuse participants. Within the questionnaire, following the manuals recommendation to replace the word 'illness' with suitable terminology for the condition being investigated, 'illness' was replaced with 'HIV'. The Illness Perception Questionnaire-Revised-HIV (IPQ-R-HIV; Moss-Morris, Weinman, Petrie, Horne, Cameron and Buick, 2002) was also considered for use, as this version of the IPQ has been devised specifically for use within HIV populations. However, the IPQ-R-HIV is lengthy and it was decided that the shorter Brief IPQ provided

adequate information regarding illness perceptions without the time burden associated with the longer questionnaire.

Stigma Scale. A measure of perceptions of internalised stigma was included following the staff and service users consultations. It was suggested that perceived stigma may be an important factor that influences PLHIV's mood and beliefs about treatment, which may in turn impact treatment adherence. The association between stigma and adherence has also been reported within the literature (Langebeek et al., 2014).

In order to gain this measure, eight items were taken from the Berger HIV stigma scale (Berger, Ferrans and Lashley, 2001). The complete questionnaire was not used in order to minimise participant burden. The Berger HIV stigma scale comprises 40 items which make up four subscales: personalised stigma subscale (perceived extent of personal consequences if other people are aware of HIV status); disclosure subscale (concerns regarding who knows about HIV status); negative self-image subscale (negative self-perceptions as a consequence of HIV status) and public attitudes subscale (perceptions of attitudes of the general population towards HIV). Two items from each subscale were selected for use in this study; items with the highest factor loadings on each subscale were selected. The psychometric properties of the Berger HIV stigma scale have been assessed within a diverse sample (Berger et al., 2001). It has been found to have internal consistency (Cronbach's alpha = 0.96) in addition to test-retest reliability (correlations from 0.87 - 0.92).

2.5.3 Daily Diary

The aim of the diary was to collect data regarding the day-to-day factors thought to predict adherence. It was intended that the diary would enable exploration of the factors that potentially predict adherence. The diary also included a self-report measure of adherence to medication. Participants were asked to complete a paper diary, every day for 14 days. They were provided two diary booklets, each containing seven days. They were asked to complete the diary at 'at the end of their day' for two consecutive weeks. See Appendix 2 for diary.

Given the lack of agreement within the literature regarding preferable diary format, alongside the suggestion that diary format should be guided by the characteristics of the study population (Green et al., 2006), the decision to use a paper diary over an electronic diary was guided by the advice of both the staff and service user representatives. It was reported that a proportion of the individuals that are supported by HIV services do not have smart phones or regular access to the Internet. For example, due to not having money to pay for phone and Internet access, or due to living in unstable accommodation. Therefore, paper diaries were used in order to maximise the accessibility of the study.

Diary Items were:

Adherence measure. Within the diary, three items assessed adherence to ART. The first two items asked participants to indicate whether they had taken their medications as prescribed. Given that optimal adherence requires ART to be taken at the correct time, the third item requested that participants indicate whether they had taken their medication at the correct time. The diary adherence measure was reliant on self-report, this is a widely reported method through which adherence to ART is measured (Simoni et al., 2006b).

During the service user consultations it was noted that for some individuals, adherence can be steady for a number of months/weeks and will then be disrupted by a stressful life event; this discussion resulted in the decision to include the item in the initial questionnaire asking 'in the last 6 months have you taken your HIV medications as prescribed?' in order to provide insight into whether adherence reported within the two week diary study was typical.

Exercise. This was measured by one item asking about exercise undertaken. If the responder had exercised they were asked to give details concerning the type and duration of exercise. This item was included due to recent study findings showing an association between improved adherence to ART and exercise (Pellowski and Kalichman, 2016).

Sleep. This was measured by items asking about quality of sleep and number of hours sleep the previous night. This item was included due to poor sleep and sleeping through a medication dose being factors that have been associated with adherence to treatment in both HIV and other chronic disease populations (Gordon et al., 2007; Phillips et al., 2005).

Stress. In order to assess daily stress, participants were asked to state stressors or problems experienced during the day, prior to diary completion. Participants were also asked to rate the severity of the stressful event from one (not stressful) to seven (very stressful). This item was selected due to reported associations between daily hassles and health behaviour in the wider literature (O'Connor et al., 2008). Daily hassles were measured in a diary study conducted by O'Connor et al. (2008), which found an association between the increased occurrence of daily hassles and unhealthy eating behaviour (increased consumption of foods high in fat). It was therefore hypothesised that daily stress/hassles may impact adherence behaviour.

Side effects of medications. This was measured by a single item, which asked participants to rate the severity of side effects of their medication from 1 (not at all) to 7 (very much). Medication side effects have also been frequently cited in the literature as a factor associated with non-adherence to ART (Max and Sherer, 2000).

Cognitions: Anticipation regarding the next day. Measurement of what was anticipated for the next day in terms of adherence comprised seven items. Participants were asked to rate the extent to which they agreed or disagreed with a number of statements (1 - strongly disagree, 7-strongly agree). The statements asked: whether they plan to take their medication (intentions), confidence in ability to take medication (self-efficacy), the extent they

anticipated that those close to them believed they should take their medication (subjective norms) and anticipated affect (e.g. regret/ pride) associated with not taking/taking medication.

The items measuring intentions and subjective norms were included because they are concepts identified in the Theory of Planned Behaviour (TPB) (Ajzen, 1991). Self-efficacy has also been associated with improved adherence within the chronic disease literature (Tovar et al., 2015). The items measuring anticipatory affect (e.g. regret/pride) were included due to proposals within the literature that the concept of anticipatory affect (either positive or negative) may influence health behaviour through influencing behavioural intentions, and could therefore have utility in extending TPB (Rivis et al., 2009).

Cognitions: Attitude to next day medication regime. Attitudes towards taking medication the following day were measured by four items. These items differ from the anticipatory affect items above, which relate to how an individual anticipates that they will feel if they adhere/do not adhere to their medication, instead, they relate to perceptions of what carrying out the behaviour (i.e. taking medication) will be like (i.e. the attitude dimension of TPB). Each item encompassed a positive and negative attitude dimension, namely: unpleasant-pleasant, not stressful-stressful, beneficial-harmful, not frustrating- frustrating. Participants were asked to rate each item from one to seven, a higher score equated to a more positive attitude.

Mood. Mood was measured using eight adjectives representing different emotional states (e.g. upset, cheerful, worried, frustrated). Participants were asked to rate the extent to which they had experienced the emotional state from 1 (not at all) to 7 (very much). Mood is a factor that has been frequently associated with non-adherence to ART (Nel and Kagee, 2011) and was therefore included within the diary. The individual mood items were generated following the staff and service user consultations.

Participant Experience Questions. Following completion of the diary participants were asked to answer some brief questions about their experiences of taking part in the study.

2.5.4 Measure of viral load

For a proportion of participants (participants recruited at the NHS site) a measure of their most recent viral load, which refers to the number of HIV virus copies per millilitre (cp/ml) of blood, was recorded at the time of recruitment into the study. This was intended to provide an additional indication of adherence to medication, through providing insight into the reliability of the self-reported adherence within the diary (i.e. to establish whether self-reported adherence in the diary was associated with a biomedical marker of adherence). There is agreement within the literature that viral load and adherence are associated (Bonner et al., 2013). The NHS clinicians involved in the study development suggested the inclusion of this measure. The inclusion of viral load was suggested because it is routinely recorded within the NHS clinic for all patients in order to provide an indication of adherence and treatment efficacy.

2.6 Procedure

2.6.1 Recruitment

Participants were recruited at two sites: an NHS HIV service (Leeds Teaching Hospitals Trust) and Skyline (a Leeds based third sector organisation providing support for individuals living with HIV). Recruitment took place between October 2016 and May 2017.

Recruitment process at Skyline site: The chief investigator (CI) attended Skyline support groups in order to provide information about the project. Recruitment packs were given to individuals who expressed interest in taking part and who met the study inclusion criteria. Potential participants at both sites were able to make contact with the CI via telephone and email in order to gain information about the project. See Figure 1 for summary of recruitment process at Skyline.

Recruitment process at NHS site: During routine appointments, clinic staff identified individuals who met the study criteria. These individuals were given brief details about the project and those interested in taking part were given a recruitment pack. The CI attended the clinics weekly, in order to be available to provide information about the project and to answer questions from potential participants. The CI also attended clinics in order to reduce the burden placed on the healthcare team when recruiting participants. See Figure 2 for summary of recruitment process at the NHS site.

2.6.2 Informed consent

All participants provided informed consent. Information sheets provided details about the study and information about what participation would involve. Participants were required to sign a consent form, confirming that they had understood the information sheet and what participation would involve. All participants were given the opportunity to contact the CI in order to gain information about the study. Participants were also made aware that they could withdraw from the study at any point without their care being compromised. The signed consent form could be returned via three options: (1) if participants opted to complete the questionnaire at the time of recruitment into the study the consent form was signed and returned at that point; (2) all participants whose most recent measure of HIV viral load was recorded (participants recruited through the NHS site) provided written consent at the time of recruitment into the study; (3) If participants opted to complete the questionnaires at home, consent forms were returned either in the post, or by hand to a member of staff at the recruitment sites.

2.6.3 Data collection

All individuals interested in taking part were given a 'recruitment pack'. The pack comprised all of the materials needed to take part in the study: participant invitation letter, information sheet, consent form, initial questionnaire, daily diary, participant experience questions and 3 free post envelopes. Potential participants were handed recruitment packs and given two options:

(1) Take the recruitment pack away and complete all of the questionnaires at home. Return all of the completed questionnaires to the researcher via freepost envelopes provided, or return them by hand to a member of staff at the recruitment site.

(2) Complete the initial questionnaire at the time of recruitment into the study (either at the NHS clinic or at Skyline) and return the questionnaire to a member of staff. They would then take only the diary away to complete at home (and return via post or hand). This option was suggested by service user representatives, due to consideration of the sensitive nature and stigma associated with having HIV. The initial questionnaire referred repeatedly to 'HIV', whereas there was no reference to 'HIV' within the daily diary. By allowing participants to complete the questionnaires immediately, the amount of HIV identifiable information that participants were required to take home/carry was limited (i.e. only required to take the diary home). The staff and service users consulted also highlighted that the questionnaire needed to be short in length so that it could be completed within clinic in a short period of time.

Measure of viral load (at the NHS site only). Following obtaining written consent, a member of the healthcare team, through accessing the participant's medical record, recorded the measure. Participants were not required to provide this measure in order to participate in the study (i.e. they could opt out of providing the measure but still participate in the remainder of the study). It was decided that this measure would be obtained from only a proportion of participants (those recruited from the NHS clinic) because this allowed recruitment of participants to occur at multiple sites (i.e. sites where viral load could not be recorded). Furthermore, recording viral load for only a proportion of participants reduced the burden on staff at the NHS clinic, for example, during busy periods, as they did not need to record viral load for every participant.

Use of a reminder system. The use of a reminder system (i.e. contacting participants with prompts to complete the diary each day/return their diaries) was also considered, however following consultation with staff and service users the decision was taken not to implement one. Some service users commented that they would not wish to give out contact information, which would be required in order to receive a reminder. It was also questioned whether a reminder would interfere with participants usual routine (and impact the diaries ability to provide insight into participants 'usual' day-to-day routines). Additionally, if a reminder system had been

implemented the CI would have been reliant on the staff at the recruitment sites to record the contact details of participants, placing additional burden on the staff teams during recruitment.

Figure 1. Recruitment flowchart Skyline

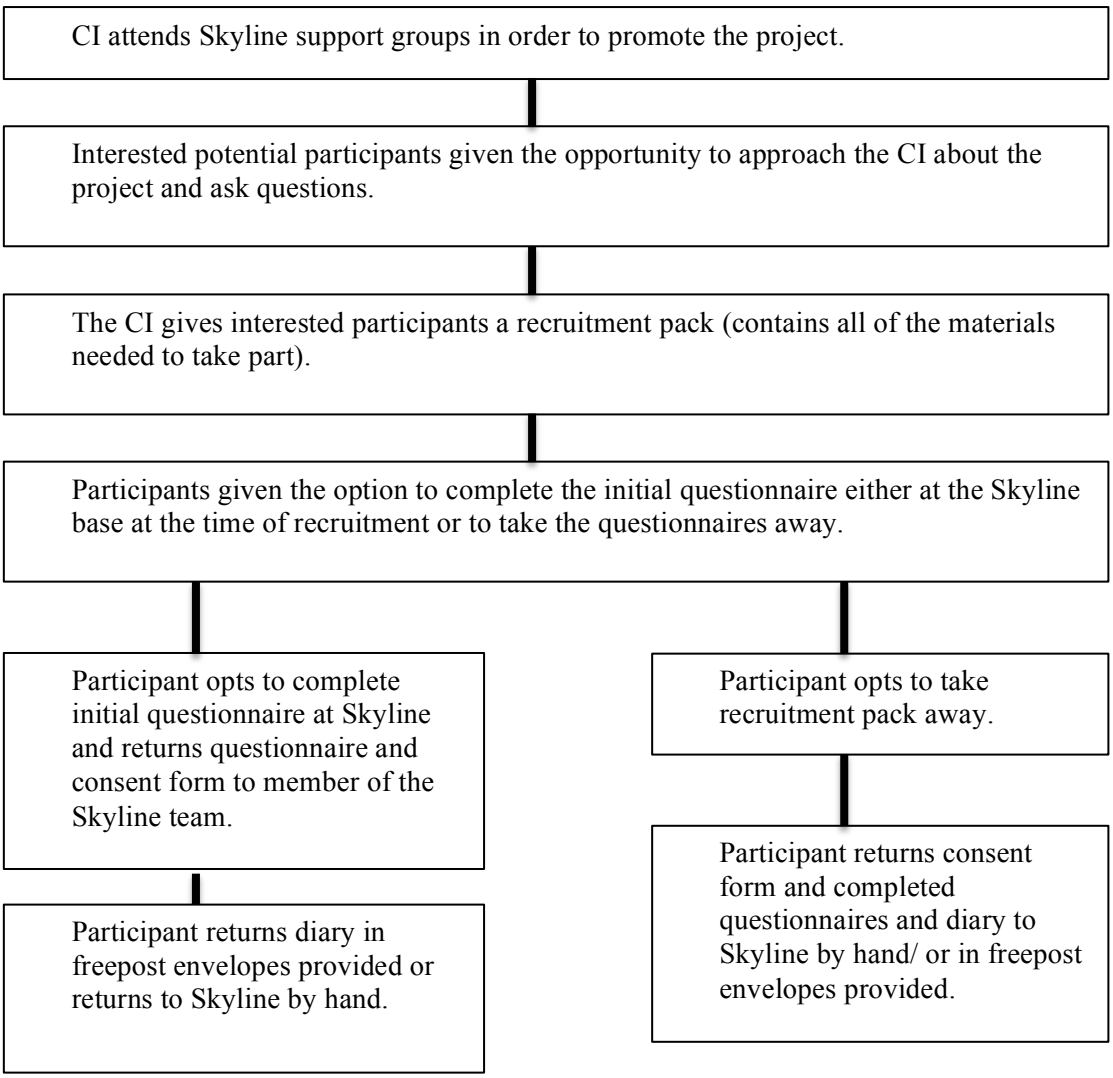
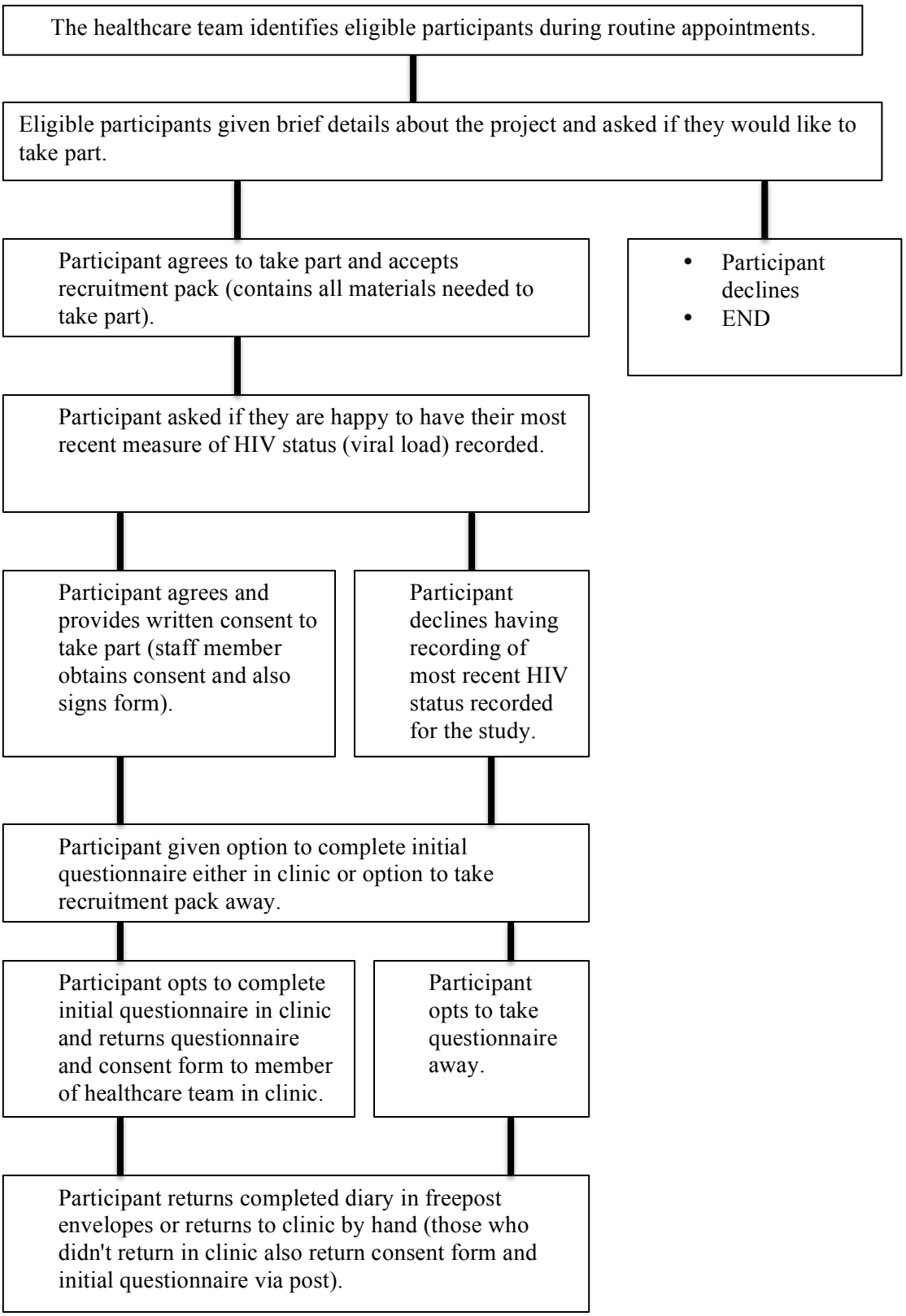


Figure 2. Recruitment flow chart NHS site



2.6.4 Ethical considerations

Participant wellbeing

Study Burden. Diary studies require participation over a prolonged period, which may place burden on participants. In order to minimise burden, the majority of the diary comprised a tick box questionnaire (two A4 sides) reducing the time taken to complete it. It was not anticipated that it would take longer than 10 minutes per day to complete. The initial questionnaire was not expected to take longer than 15 minutes to complete. The time demands of participation were outlined in the information sheet, ensuring that participants were aware of the nature of participation prior to taking part. Additionally, in order to thank participants, those who returned completed diaries and questionnaires were given the opportunity to be included in a prize draw to win £50 of shopping vouchers.

The duration of the diary (i.e. 14 days) was considered in the staff and service user consultations. A seven day diary was deemed too short to gain sufficient information regarding adherence behaviour and a 28-day diary was seen as placing significant burden on participants. Therefore a 14-day diary was selected due to being able to provide sufficient information about adherence behaviour without the associated burden of a longer diary.

Distress/risk. The study required participants to disclose information about both their overall experience and day-to-day experiences of having HIV; this had potential to cause upset. Procedures were in place to appropriately manage participant distress. If a distressed participant had contacted the CI, one of the project supervisors (a consultant clinical psychologist) would have assisted in establishing appropriate support options.

Confidentiality

In order to ensure participants anonymity they were not required to provide their name or any other personally identifiable information, instead, participants were assigned an identification number. If they opted to take part in the prize draw they were required to provide contact details (an email address, postal address or telephone number), however, this was optional.

All completed questionnaires and diaries were stored securely at the University of Leeds. Questionnaire data was stored on university access controlled computers. In order to maximise confidentiality the contact details for the prize draw were stored separately from the other project documents. Questionnaires returned to the recruitment sites by hand, were stored securely at the recruitment sites prior to being transported at the earliest opportunity to the University of Leeds by the CI.

In order to ensure confidentiality of the questionnaires returned via post, participants were provided with three envelopes per recruitment pack, meaning that personal details provided for participation in the prize draw could be sent separately to the questionnaires.

Participants were also given the opportunity to return their completed questionnaires by hand to the recruitment sites (i.e. if they did not wish to send them in the post).

Consideration of participant confidentiality and anonymity was highlighted as essential during consultations with staff and service user representatives. This was due to stigma associated with having HIV, and disclosure concerns of PLHIV. At the two recruitment sites PLHIV are not required to provide any personally identifiable information in order to access the service. Furthermore, at the NHS site, patient medical records are kept separately from other health records in order to maximise confidentiality. Consequently, it was seen as important that participation within this study afforded participants the same level of confidentiality and anonymity as the services that they access. The ethics committee who reviewed the project also suggested that participants should not be required to give their name in order to take part.

Study 2 - Staff and Service User Interviews

The second survey employed qualitative methods using semi-structured interviews to explore service users and providers views about the diary methodology used in study 1. The interviews aimed to provide information on the barriers and facilitators to using diary methodology in research with PLHIV. The interviews took place at the service delivery sites and were audio recorded, transcribed and analysed by the CI.

2.7 Sample

In order to be interviewed, PLHIV were not required to have completed the diary (i.e. participated in study 1) but would be shown/reminded about the tools used in the study. PLHIV were eligible to take part if they were aged over 18, they had a diagnosis of HIV and were receiving ART therapy treatment. All participants were required to provide informed consent and have sufficient comprehension of written and spoken English.

2.8 Materials

The interviews were conducted using an interview schedule (see Appendix 3). The initial section of the interview schedule was adjusted to be either service user or staff specific. The questions asked about diary research in general and the potential facilitators and barriers of taking part in diary research for PLHIV. The interviews also asked specific questions about the methodology used in study 1. For example, ways in which the diary could have been improved in terms of the questions asked, in addition to how the implementation of the diaries may have been adapted. Prior to taking part participants were given an information sheet outlining what participation would involve, they were also required to provide written consent.

2.9 Procedure

2.9.1 Recruitment and data collection

PLHIV: A member of the healthcare team approached eligible participants. Interested participants were given information about the project and asked to contact the CI by either telephone or email in order to take part. Alternatively, they were able to meet with the CI in person at the time of recruitment if the CI was available.

Staff: Staff members were given information about taking part. Those interested in taking part were able to approach the CI in order to gain more information.

When participants had decided to take part they could arrange a convenient time with the CI to be interviewed.

2.9.2 Ethical considerations

Confidentiality. Interviews were audio recorded on an MP3 device that was password protected. They were immediately transferred to the University of Leeds secure 'M-DRIVE' on the same day and deleted from the MP3 device. The recordings were transcribed by the CI, anonymised, and stored on the secure university 'M-DRIVE'.

Staff members were asked to provide their name and professional title on the consent form. As with the diary study component of this research, in order to protect confidentiality, PLHIV interviewed were not required to provide any personally identifiable information. They were not required to provide their name and were instead given a participant ID number.

Participant burden and managing distress. It was not anticipated that the interviews would cause participants any distress. However, there was a plan in place if participants became distressed in the interview: the CI (with the participant's permission) would contact a member of the HIV clinic team at the NHS Leeds clinic in order to gain additional support and advice for the participant. In order to thank PLHIV for their time they were given a £15 shopping voucher. It has been argued that providing participants with a monetary reward (i.e. a shopping voucher) is a good way to thank participants in addition to providing a way to promote research participation (Russell, Moralejo and Burgess, 2000).

Chapter 3: Study 1 - Diary Study

This chapter will describe the findings of the diary study. The diary study was intended to investigate the influence of day-to-day factors posited as potentially important in the literature on behaviour change on adherence. Few such studies have been attempted with populations with a chronic illness; therefore, it was also intended as a feasibility study to ascertain the applicability of using diary methods to understand adherence behaviour in HIV populations.

3.1 Data analysis

Data analysis was conducted using IBM Statistical Package for the Social Sciences (SPSS) and HLM 7 software. Data files were initially created in SPSS. As per Field's (2013) recommendation, missing data were identified and coded. In order to ensure that errors were corrected, the data were also inspected visually, in addition to the minimum and maximum scores being viewed. The data comprised two levels: level 1 data, the data collected in the diary (e.g. adherence, mood and side effects); and level 2 data, the data collected in the initial questionnaire (e.g. beliefs about medication and demographic information). As described by O'Connor et al. (2008, p.23) level 1 data represents "within person variation", whereas level 2 data represents "between person variability".

The first stage of the analysis involved exploration of the response rates and participant demographic characteristics using SPSS. The mean (M), standard deviation (SD) and range were then calculated for level 1 and level 2 variables. Due to the small sample size and uneven numbers of individuals within subgroups of the sample (e.g. gender and age) it was not possible to explore differences between subgroups on the various measures. For the same reason, differences between participants who returned all of the questionnaires and participants who returned incomplete data were not explored. The second stage of the analysis involved multilevel modeling using HLM 7, in order to assess the impact of the level 1 and level 2 variables on the outcome variable (adherence).

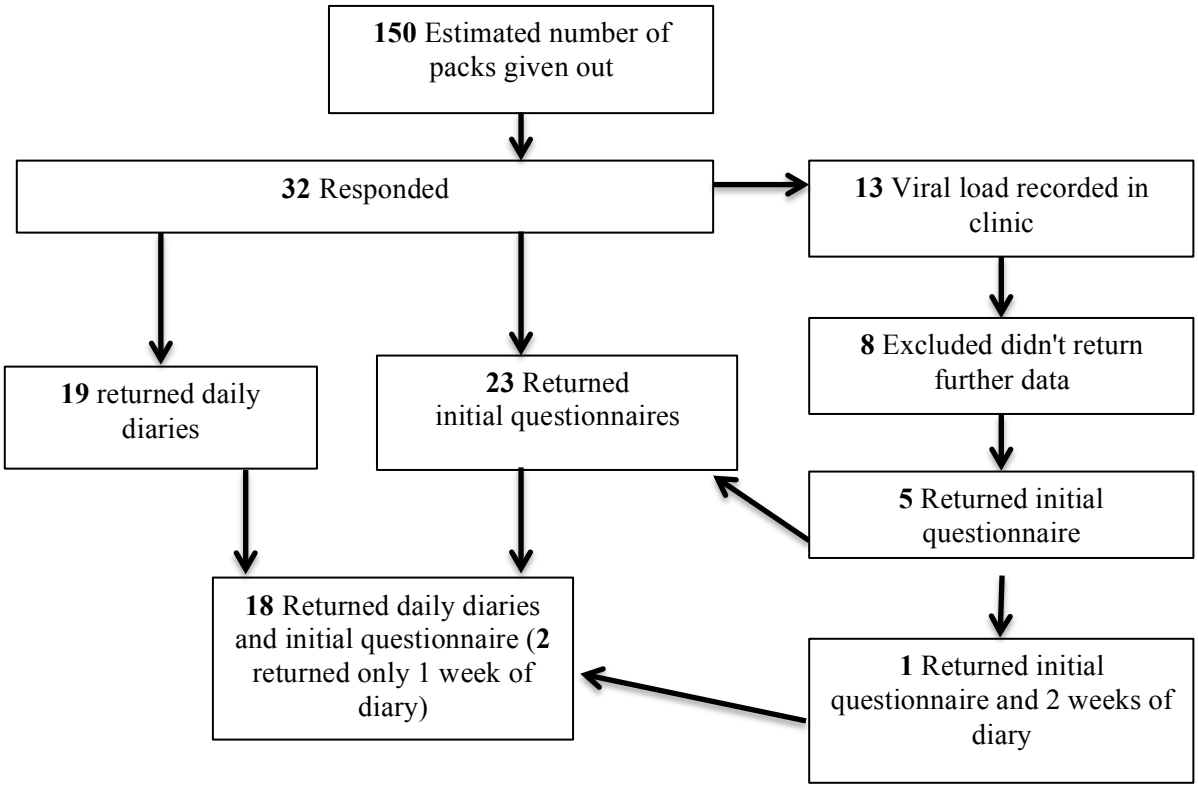
3.2 Results

3.2.1 Participants

A total of 32 participants responded. Of the 32 initial participants, 13 had their viral load recorded in clinic. Of these 13, only one returned complete data, therefore viral load was not included in further analysis. Twenty-three participants returned the initial questionnaire, of these, 18 also returned daily diaries. An additional participant returned two weeks of the daily diary without the initial questionnaire, this diary was not included in the final analysis (due to

the missing questionnaire). The 18 diaries used in the final analysis provided 238 days of data. See Figure 3 for summary of recruitment process.

Figure 3. Recruitment flow chart for final sample



3.2.2 Participant characteristics

The characteristics of the final sample included in the analysis (n = 18) are summarised in Table 1. The mean age of the sample was 43.94 years (SD = 12.52), the majority were male (n = 16), white British (n = 13) and identified as being men who have sex with men (n = 13). The mean amount of years since HIV diagnosis was 10.09 years (SD = 8.97); the mean amount of time prescribed ART was 8.07 years (SD = 7.62). Participants reported an ART regimen of taking tablets between 1 and 3 times per day; they reported having to take between 1 and 5 tablets per day.

Table 1. Characteristics of participants who completed the diary

Characteristic	Category	Final sample n=18(%)
Gender	Male	16 (88.9)
	Female	2 (11.2)
Age	15-24	1 (5.6)
	25-34	4 (22.2)
	35-49	4 (22.2)
	50-64	8 (44.4)
	Not stated	1 (5.6)
Ethnicity	White British	13 (72.2)
	Black African	3 (16.7)
	Other ethnic group	1 (5.6)
	Not stated	1 (5.6)
Sexuality	Men who have sex with men	13 (72.2)
	Heterosexual	3 (16.7)
	Sex with men and women	1 (5.6)
	Not stated	1 (5.6)
Religion	No religion	10 (55.6)
	Christian	5 (27.8)
	Jewish	1 (5.6)
	Not stated	2 (11.2)
Prescribed mood medication	Yes	4 (22.2)
	No	14 (77.8)
Number of years living with HIV	<1	3 (16.8)
	1-5	4 (22.3)
	5-10	3 (16.8)
	>10	7 (39.2)
	Not stated	1 (5.6)
Number of years taking ART medication	<1	2 (12.5)
	1-5	5 (31.5)
	5-10	2 (12.5)
	>10	8 (37.8)
	Not stated	1 (5.6)
Times per day ART tablets taken	1	16 (88.9)
	2	1 (5.6)
	3	1 (5.6)
Number of tablets taken per day	1	6 (33.3)
	2	5 (27.8)
	3	4 (22.2)
	>3	3 (16.7)

Characteristics of sample compared to national HIV population

The characteristics of the study sample (participants included in the diary analysis) were compared with the wider UK HIV population (see Table 2 for summary). The median age of the UK HIV population was the same as the median age of the study sample (45 years), meaning that the age of the study sample was comparable to the UK HIV population. However, there were a higher proportion of men who have sex with men within the sample compared with the UK HIV population. There were also a higher proportion of males and white British participants.

Table 2. Study sample (participants included in the diary analysis) compared with UK HIV population

Characteristic	Category	Study Sample % (n=18)	UK HIV Population* % (n=101,100)
Gender	Male	88.9%	68.7%
	Female	11.2%	31.3%
Ethnicity	White British	72.2%	55.2%
	Black African	16.7%	31.6%
	Other ethnic group	5.6%	13.1%
Sexuality	Men who have sex with men	72.2%	40.6%
	Heterosexual	16.7%	59.4%
Age	15-24	5.6%	2.73%
	25-34	22.2%	14.7%
	35-49	22.2%	48.5%
	50-64	44.4%	29.9%
	>65	0%	4.81%

*Public Health England (2016a); Public Health England (2016b)

3.2.3 Variables included in the analysis

Level 2 data (initial questionnaire)

Personal Information Questionnaire (PIQ) items. PIQ items were included in the analysis as individual items (seven items).

Beliefs about Medicines Questionnaire (BMQ). The BMQ subscales (necessity, concern, harm and overuse) were calculated in line with the manual recommendation: by dividing the sum of items by the number of items in the scale (Horne, 2000). The manual also recommends calculation of the internal consistency of each of the subscales. Both subscales of the BMQ-Specific scale (necessity and concerns subscales) showed acceptable internal consistency (Cronbach's alpha's of 0.83 and 0.65 respectively). The internal consistency of both

the BMQ-General subscales (harm and overuse) were low. As a result, following the manual recommendation, item four on the BMQ-general scale was moved from the 'overuse' to the 'harm' subscale, as it resulted in a better Cronbach's alpha for the scales. Although the internal consistency for the overuse subscale was acceptable (Cronbach's alpha = 0.71), the internal consistency for harm beliefs remained low (Cronbach's alpha = 0.34).

Brief Illness Perception Questionnaire (Brief IPQ). The IPQ included seven items from the original nine item standardised Brief IPQ. According to the manual, a total score for the IPQ items can be used to indicate overall perceived threat of an illness, however, it recommends checking the internal consistency of the scale prior to its use. The seven item IPQ scale internal consistency (Cronbach's alpha = 0.60) was judged as acceptable to use in the analysis.

Stigma scale. For the stigma scale score a mean score of the items was calculated. The internal consistency of the stigma scale was high (Cronbach's alpha = 0.79), indicating that it was appropriate to create a scale from the items. The level 2 scales are presented in Table 3.

Table 3. Initial questionnaire (Level 2) subscales included in analysis

Level 2 Scales	Cronbach's alpha
BMQ specific: necessity scale (5 items)	0.83
BMQ specific: concern scale (5 items)	0.65
BMQ general: harm scale (5 items)	0.34
BMQ general: overuse scale (3 items)	0.71
Illness perception questionnaire (Brief IPQ; 7 items)	0.60
Stigma scale (8 items)	0.79

Level 1 data (diary items)

Adherence measure (outcome variable). All participants reported 100% adherence in terms of taking all of their prescribed medication. However, there was variability in reports regarding whether medication was taken at the correct time. Therefore, due to lack of variability in adherence in terms of tablet taking, this measure was not used in the analysis. Instead, the adherence measure relating to accuracy of timing of the medication, referred to as 'adherence timing' was used (item scored between 1 and 7, with a lower score indicating suboptimal timing). However, because a high proportion of the sample reported they took their medication on time, the 'adherence timing' variable was highly skewed. As a result, the decision was taken to dichotomise (median splits) the variable consistent with Raudenbush et al's (2011) recommendation. The timing of adherence was scored either '1' or '0' (1 = score of 7, optimal adherence timing; 0 = score below 7, suboptimal adherence timing).

Daily diary variables. The diary variables (individual items and scales) included in the analysis are presented in Table 4. Prior to including each scale, the internal consistency was calculated to check reliability; scales considered to have adequate internal consistency were

included. Scaled scores were devised by calculation of the mean score of the items in each scale. The 'neutral' mood item was not included in either of the mood scales because the internal consistency indicated increased reliability for each of the mood scales when it was removed. The stress intensity score was calculated by dividing the total intensity of stressors (each stressor scored between 1-7 for intensity) scored per day, divided by the number of stressors identified per day.

Table 4. Daily diary (Level 1) variables included in data analysis

Daily diary Variable	Cronbach's alpha
Minutes exercise (1 item)	n/a
Hours sleep (1 item)	n/a
Perceived stress (1 item)	n/a
Side effects of medication (1 item)	n/a
Cognitions:	
Attitude to next day medication regime (4 items)	0.65
Plans for next day adherence (1 item)	n/a
Confidence in next day adherence (1 item)	n/a
Anticipatory negative affect (2 items)	0.87
Anticipatory positive affect (2 items)	0.88
Subjective norms (1 item)	n/a
Mood:	
Positive mood (2 items)	0.70
Negative mood (5 items)	0.88

3.2.4 Descriptive Statistics

Level 2 measures (initial questionnaire)

Personal Information Questionnaire (PIQ). Mean ratings for beliefs about perceived social support, perceived involvement in treatment decisions, understanding of medication, and adherence and life stability in the last six months were all above 4.5 (all scored between 1-7, where a higher score indicated a stronger belief). The mean number of years living with a HIV diagnosis was 10.09 years (SD = 8.97), and the mean number of years prescribed ART was 8.07 years (SD = 7.62)

Beliefs about Medications Questionnaire (BMQ). Higher BMQ scaled scores (ranging from 1-5) indicate stronger beliefs in the dimension measured. Overall, responses to the BMQ general subscales did not indicate that participants had strong beliefs related to the harm caused by medications (M = 2.18, SD = 0.62), or related to whether doctors place too much emphasis (BMQ-overuse) medications (M = 2.85, SD = 0.94). Responses to the BMQ specific subscales indicated that participants had more concerns about the dangers of their HIV medication (M = 3.20, SD = 0.87), in addition to having strong beliefs about the necessity of HIV medication (M = 4.26, SD = 0.87).

Brief Illness Perception Questionnaire (Brief IPQ). Brief IPQ items were scored between 0-10, a higher score indicating an increased view of threat associated with illness. Participants' scores were highest on the illness consequence (M = 6.11, SD = 3.12) and concern (M = 6.22, SD = 3.29) items. The items with the lowest scores were treatment control (M = 1.00, SD = 1.32) (low score indicates perception of increased control over HIV) and coherence (M = 1.89, SD = 2.13) (low score indicates increased understanding of HIV). The overall score indicated a low perceived threat of the illness in the sample (M = 4.04, SD = 1.47).

Stigma scale. Stigma items were scored between 1-4, a higher score indicating an increased perception of HIV stigma. The mean stigma score was 2.79 (SD = 0.63). The level 2 measures are summarised in Table 5.

Table 5. Level 2 variables, mean, SD, range

Measure	Mean (n =18)	SD	Range
PIQ item			
Years with diagnosis	10.09	8.97	28.00
Years prescribed ART	8.07	7.62	23.00
Life stability in the last 6 months (1-7)	5.78	1.80	6.00
Medication adherence in last 6 months (1-7)	6.33	1.28	5.00
Perceived social support (1-7)	4.94	2.10	6.00
Understanding of medication (1-7)	5.50	1.69	5.00
Involvement in treatment decisions (1-7)	6.16	1.54	6.00
BMQ Subscale			
BMQ General: Overuse (scaled score 1-5)	2.85	0.94	3.00
BMQ General: Harm (scaled score 1-5)	2.18	0.62	2.20
BMQ Specific: Necessity (scaled score 1-5)	4.26	0.87	2.80
BMQ Specific: Concern (scaled score 1-5)	3.20	0.87	2.80
Brief IPQ item			
IPQ: Illness consequence (0-10)	6.11	3.12	10.00
IPQ: Control (0-10)	3.75	2.62	8.00
IPQ: Treatment control (0-10)	1.00	1.32	8.00
IPQ: Experience of side effects (0-10)	4.23	3.29	9.00
IPQ: Concern (0-10)	6.22	3.29	9.00
IPQ: Coherence (0-10)	1.89	2.13	9.00
IPQ: Emotional representation (0-10)	5.11	3.01	10.00
IPQ overall score	4.04	1.47	4.67
Stigma Scale			
Perceived stigma score (scaled score 1-4)	2.79	0.63	2.13

Level 1 measures (daily diary)

Adherence. The three measures assessing self-reported adherence are shown in Table 6. All participants reported that they took 100% of their prescribed tablets each day (M = 100, SD = 0.00), indicating 100% adherence in terms of taking tablets. There was variability in participants' scores for timing of medication adherence ('adherence timing') and general perceptions of adherence (higher scores indicated better adherence). However, the mean scores

for perceptions that medication had been taken as prescribed (M = 6.68, SD = 1.12) and perceptions that medication had been taken on time (M = 6.39, SD = 1.96) did also indicate relatively high adherence rates.

As stated above, for the purpose of the HLM 7 analysis, the medication taken on time variable 'adherence timing' was dichotomised and scored as either '1' or '0' (1 = score of 7, optimal adherence timing; 0 = score below 7, suboptimal adherence timing). Participants scored '1' 73.16% of the time and '0' 26.84% of the time.

Table 6. Self-reported adherence per day

Adherence measure	Mean	SD	Minimum value	Maximum value	Response rate (%)
Percentage of tablets taken	100.0	0.00	100.0	100.0	86.5
Perception that medication has been taken as prescribed (1-7)	6.68	1.12	1.00	7.00	86.5
Medication taken on time (1-7)	6.39	1.96	1.00	7.00	86.5

Exercise, sleep, stress, side effects. Participants reported carrying out on average 53.96 (M; SD = 39.15) minutes of exercise per day, however the high SD indicated variability within the sample. Relatively high stress intensity scores were reported (M = 5.00, SD = 1.78); participants also reported low levels of side effects (M = 2.25, SD = 2.09). Participants slept for on average 6.39 (M; SD = 1.93) hours per night.

Cognitions. Participants reported high rates of planning to take their medication (M = 6.50, SD = 1.45) and high levels of confidence in next day adherence (M = 6.37, SD=1.50). Participants also reported high levels of anticipatory negative affect as a consequence of next day non-adherence (M = 6.31, SD = 2.86) and high levels of anticipatory positive affect as a consequence of next day adherence (M = 6.25, SD = 0.98). Scores for subjective norms (perceptions that others think I should take my medication) and attitude toward next day medication taking were also high (high score = positive attitude) (subjective norms: M = 5.79, SD = 1.92; attitude: M = 5.89, SD = 1.12).

Affect. Participants reported low levels of negative mood (M = 2.44, SD = 1.55) and higher levels of positive mood (M = 4.49, SD = 1.47). A summary of the diary variables is presented in Table 7.

Table 7. Daily variables and response rates over the 14 days

Daily Measure	Mean	SD	Minimum value	Maximum value	Response rate (%)
Minutes exercise	53.96	39.15	0.00	340.00	n/a
Hours sleep	6.68	1.93	1.00	14.00	71.42
Perceived Stress (1-7)	5.00	1.78	1.00	7.00	n/a
Side effects of medication (1-7)	2.25	2.09	1.00	7.00	88.10
Cognitions (all scored 1-7):					
Attitude to next day medication regime (1-negative, 7-positive)	5.89	1.12	2.50	7.00	94.02
Plans for next day adherence	6.50	1.45	1.00	7.00	94.02
Confidence in next day adherence	6.37	1.50	1.00	7.00	94.02
Anticipatory negative affect	6.31	2.86	1.00	7.00	94.02
Anticipatory positive affect	6.25	0.98	3.00	7.00	88.89
Subjective norms	5.79	1.92	1.00	7.00	92.86
Mood (scored 1-7):					
Positive mood	4.49	1.47	1.00	7.00	88.89
Negative mood	2.44	1.55	1.00	7.00	85.32

3.2.5 Hierarchical modelling

When data contains multiple levels, multilevel (hierarchical linear and nonlinear) modeling provides a way to assess the impact of predictor variables (i.e. level 1 and 2 variables in this study) on the outcome variable (i.e. 'adherence timing' in this study), whilst accounting for the fact that they occur at different levels (i.e. level 1 is measured daily and level 2 is measured in the initial questionnaire). Hofmann (1997, p.726) outlined the advantage of hierarchical modeling, stating "they allow one to simultaneously investigate relationships within a particular hierarchical level, as well as relationships between or across hierarchical levels". Therefore, hierarchical modeling as outlined by Raudenbush, Bryk, Cheong, Congdon and du Toit (2011) was conducted using HLM 7. Following inspection of the descriptive statistics of the variables, they were judged to have adequate variability to include in the analysis. Hierarchical modeling enabled the investigation of the relationship between level 1 variables and adherence, in addition to the relationship between level 2 variables and adherence. It also enabled the investigation of the moderating role of level 2 variables, in terms of the extent to which level 2 variables influenced the interaction between level 1 variables and adherence.

Hierarchical modeling is able to handle missing data at level 1, however, at level 2 groups with missing data are removed. Within this study in order to maximize the number of level 2 units (i.e. prevent deletion due to missing values) the group means were imputed for missing values following Raudenbush et al's (2011) recommendation (data was only imputed at level 2).

Level 1 models

HLM 7 was used to create level 1 models in order to explore which level 1 variables were associated with adherence timing; the level 1 model is represented in the equation below (O'Conner et al., 2008; Raudenbush et al., 2011):

$$y_{ij} = \beta_{oj} + \beta_i + r_{ij}$$

y_{ij} = outcome variable (e.g. adherence), i = level 1 unit (i.e. days for person) j = level 2 unit (e.g. person j), β_{oj} = the intercept, β_i = the slope representing the level 1 predictor variable (e.g. negative affect) and r_{ij} = amount of error

An example of a level 1 model depicting the relationship between negative affect (measured in the daily diary) and adherence is shown in the equation below:

Adherence = $\beta_{oj} + \beta_i$ (daily negative affect) + r_{ij}

Level 2 models

In order to explore the relationship between level 2 variables and adherence, in addition to whether level 2 variables were moderators of the relationship between day-to-day variables and adherence, HLM 7 was used to create level 2 models, where the level 2 variable is entered into the equation below (O'Conner et al., 2008; Raudenbush et al., 2011):

$$y_{ij} = \beta_{oj} + \beta_i + r_{ij}$$

y_{ij} = outcome variable i.e. adherence, i= level 1 unit (i.e. days for person), j =level 2 unit (i.e. person j), β_{oj} represents the intercept for the level 2 variable, (e.g. stigma), β_i = the slope representing the level 1 variable i.e. negative affect and r_{ij} = amount of error.

An example of a level 2 model devised to investigate the relationship between adherence and negative affect and the moderating impact of beliefs about the necessity of medication is shown in the equation below:

y_{ij} (adherence) = β_{oj} (beliefs about necessity of medication)+ β_i (daily negative affect) + r_{ij}

Use of the Bernoulli model

Due to the dichotomous outcome variable, logistic regressions (rather than linear regressions) were run within HLM 7, using a Bernoulli model. The Bernoulli model provides odds ratios (OR), which give an indication of the odds of the outcome occurring. Within this study the Bernoulli model provided an OR which indicated the odds of '1' (optimal adherence timing) occurring.

Several separate models were run in the analysis. This was because there were too many variables to run a single analysis, therefore similar measures were grouped together for testing. The order of the models was arbitrary. The first model included health related variables: sleep, exercise, side effects and stress. The second model included the remaining level 1 variables measuring cognition and affect. The third model included all of the level 1 variables that had been significantly associated (or were close to significance) with adherence in the first two models. The fourth model included the remaining level 2 variables (individual items measured in the PIQ). The fifth model included all of the level 2 variables that were measured as scales (i.e. stigma, BMQ-necessity etc.).

The final stage of the analysis involved investigating the moderating impact of each of the level 2 scales on the relationship between the level 1 variables and adherence. Only the level 1 variables found to be significantly associated with adherence in the earlier analyses (anticipatory negative affect and attitude) were included at this stage. All of the scales within the initial questionnaire were selected to explore as potential moderators; single items measured in the PIQ were not included. Demographic variables were not explored as potential moderators due to lack of variability within the sample. Four level 1 variables that had been significantly associated with adherence, in addition to predictors that were marginally significant, were initially selected (anticipatory negative affect, attitude, side effects and negative affect). However, when the analysis was re-run (third model above) only anticipatory negative affect and attitude remained significant predictors of adherence; as a result only the two significant predictors were included in the subsequent analysis.

A number of level 2 variables were found to significantly interact with the level 1 variables (anticipatory negative affect and attitude). The nature of the significant interactions between these level 2 moderators and level 1 variables was explored using simple slopes analysis; this was conducted using Preacher's software (Preacher, Curran, Bauer, 2003a). Simple slopes analysis enables decomposition of the interaction between level 2 variables and level 1 variables, in terms of the impact of the level 2 variable on the relationship between the level 1 variable (e.g. attitude) and the outcome variable (e.g. 'adherence timing') (Preacher et al., 2003a). After establishing a significant interaction, simple slopes analyses help to identify the impact of the level 1 predictor on the outcome variable at different levels of the level 2 moderator. Simple slopes have been referred to as "the regression of the outcome y on the predictor at a specific value of the moderator" (Preacher, Curran, Bauer, 2003b, p.2). Within

the current study these values would relate to: y = adherence timing, predictor = level 1 variable, moderator = level 2 variable. In order to calculate the simple slopes analysis Preacher's software requires selection of different values (conditional values) of the moderator. As suggested by Preacher, Curran, and Bauer (2006), within this analysis, the mean values of the moderator (i.e. of the level 2 variable) were selected, in addition to values 1 SD above and 1 SD below the moderator. This enabled 3 simple slopes to be calculated for each significant cross level interaction (one for mean level of moderator, one 1 SD below the moderator, and one 1 SD above the moderator).

3.2.6 Effects of level 1 and 2 variables on medication adherence timing

Three level 1 predictor variables in the first two models were significantly associated with adherence (side effects, negative mood, anticipatory negative affect). No other variables were significantly associated with adherence. However, when the significant predictors, in addition to one marginally significant predictor (attitude) were entered into a new level 1 model (model 3), side effects ($p = 0.316$) and negative affect ($p = 0.364$) were no longer significantly associated with adherence, whereas anticipatory negative affect ($p = 0.033$) and attitude ($p = 0.036$) were significantly associated with adherence. Both increased anticipatory negative affect and increased attitude to adhering (higher score = positive attitude) were associated with increased odds of optimal adherence timing (anticipatory negative affect: B = 0.099, $p = 0.033$, OR=1.103, 95% CI[1.01, 1.21]; attitude: B = 0.523, $p = 0.036$, OR = 1.687, 95% CI[1.04, 2.74]).

BMQ-overuse was the only level 2 variable significantly associated with adherence. Overuse beliefs (belief that too much trust is placed in medications) were associated with increased odds of optimal adherence timing (B = 1.171, $p = 0.003$, OR = 3.224, 95% CI[1.61, 6.47]). See summary of level 1 and level 2 models in Table 8.

3.2.7 Moderating effect of level 2 variables - cross level interactions

Further analysis was conducted to investigate whether the level 2 scale measures moderated the relationship between anticipatory negative affect and attitude (the two significant level 1 predictors) and adherence timing. There were six significant interactions between the level 2 and level 1 variables, all other interactions were not significant. The significant interactions are presented in Table 9. Stigma, illness threat (IPQ), concerns about medications (BMQ-concerns) and overuse beliefs (BMQ-overuse) interacted with anticipatory negative affect; stigma and overuse beliefs (BMQ-overuse) interacted with attitude.

Table 8. Effects of level 1 and 2 variables on medication adherence timing

Predictor Variables	Medication adherence timing				
	B	**SE**	**OR**	**95% CI**	***p***
Model 1: level 1 variables - health related					
Intercept	1.128	0.309	3.088	[1.60, 6.00]	0.003**
Hours sleep	0.776	0.418	2.172	[0.89, 5.33]	0.085
Exercise	-0.001	0.011	0.999	[0.98, 1.02]	0.948
Side effects	1.061	0.428	2.890	[1.16, 7.24]	0.026*
Stress	0.190	0.386	1.209	[0.53, 2.77]	0.631
Model 2: level 1 variables - psychological					
Intercept	0.933	0.232	2.542	[1.56, 4.15]	<0.001***
Attitude	0.501	0.253	1.650	[0.96, 2.82]	0.066
Positive mood	0.133	0.077	1.142	[0.97, 1.34]	0.103
Negative mood	0.196	0.086	1.216	[1.01, 1.46]	0.038*
Plan to take medication tomorrow	-0.162	0.144	0.851	[0.63, 1.16]	0.279
Anticipatory positive affect	0.069	0.250	1.071	[0.63, 1.82]	0.787
Anticipatory negative affect	0.286	0.102	1.331	[1.07, 1.65]	0.013*
Confidence	-0.104	0.181	0.901	[0.62, 1.32]	0.572
Social norms	-0.290	0.312	0.748	[0.39, 1.14]	0.366
Model 3: level 1 variables significant in model 1 and 3					
Intercept	1.00	0.244	2.725	[1.63, 4.57]	0.002**
Side effects	-0.060	0.058	0.942	[0.83, 1.07]	0.316
Negative affect	0.050	0.054	1.052	[0.94, 1.54]	0.364
Anticipatory negative affect	0.099	0.042	1.103	[1.01, 1.21]	0.033*
Attitude	0.523	0.229	1.687	[1.04, 2.74]	0.036*
Model 4: Level 2 items					
Intercept	1.056	0.447	2.874	[1.59, 5.21]	0.003**
Years with diagnosis	0.257	0.158	1.294	[0.91, 1.84]	0.134
Years prescribed ART	-0.302	0.174	0.739	[0.50, 1.09]	0.112
Life stability in the last 6 months	0.018	0.207	1.018	[0.64, 1.61]	0.932
Adherence in last 6 months	0.109	0.261	1.115	[0.62, 2.00]	0.686
Perceived social support	0.124	0.146	1.132	[0.82, 1.57]	0.416
Understanding of medication	0.250	0.206	1.284	[0.81, 2.03]	0.253
Involvement in treatment	0.476	0.816	1.609	[0.43, 6.05]	0.573
Model 5: Level 2 scales					
Intercept	1.223	0.249	3.40	[1.97, 5.88]	<0.001***
BMQ-necessity	-0.159	0.479	0.853	[0.30, 2.45]	0.747
BMQ-concerns	-0.273	0.295	0.761	[0.40, 1.46]	0.374
BMQ-harm	0.734	0.445	2.083	[0.78, 5.55]	0.128
BMQ-overuse	1.171	0.316	3.224	[1.61, 6.47]	0.003**
Perceived stigma	-0.874	0.520	0.417	[0.13, 1.31]	0.121
Illness perceptions questionnaire	0.178	0.222	1.195	[0.73, 1.95]	0.439

B=unstandardised coefficient, SE = Standard Error, OR= Odds ratio
* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 9. Moderating effect of level 2 variables on the interaction between attitude and anticipatory negative (ANA) affect and adherence timing

Moderator *(level 2 variable)*	**Predictor** *(level 1 variable)*	**Medication adherence timing**				
		B	**SE**	**OR**	**95% CI**	***p***
BMQ-necessity	**Intercept**	0.996	0.263	2.707	[1.55, 4.73]	0.002**
	BMQ-necessity	0.080	0.296	1.083	[0.59, 2.03]	0.790
	Attitude	0.475	0.235	1.608	[0.98, 2.65]	0.060
	ANA	0.145	0.045	1.156	[1.05, 1.27]	0.005*
	BMQ-necessity x attitude	-0.084	0.249	0.919	[0.54, 1.56]	0.739
	BMQ-necessity x ANA	-0.146	0.102	0.864	[0.70, 1.07]	0.173
BMQ-concerns	**Intercept**	1.005	0.263	2.732	[1.56, 4.78]	0.002**
	BMQ-concerns	0.001	0.244	1.001	[0.60, 1.68]	0.997
	Attitude	0.470	0.250	1.601	[0.94, 2.72]	0.078
	ANA	0.186	0.126	1.025	[0.92, 1.57]	0.161
	BMQ-concerns x attitude	0.025	0.222	1.023	[0.64, 1.64]	0.912
	BMQ-concerns x ANA	-0.482	0.144	0.617	[0.46, 0.84]	0.004**
BMQ-harm	**Intercept**	1.009	0.273	2.744	[1.54, 4.90]	0.002**
	BMQ-harm	0.277	0.432	1.320	[0.53, 3.30]	0.530
	Attitude	0.465	0.242	1.593	[0.95, 2.66]	0.073
	ANA	0.179	0.095	1.196	[0.98, 1.46]	0.078
	BMQ-harm x attitude	0.009	0.500	1.009	[0.35, 2.91]	0.986
	BMQ-harm x ANA	-0.288	0.343	0.750	[0.36, 1.55]	0.414
BMQ-overuse	**Intercept**	1.070	0.226	2.914	[1.80, 4.70]	<0.001**
	BMQ-overuse	0.720	0.226	2.053	[1.27, 3.32]	0.006**
	Attitude	0.539	0.229	1.715	[1.06, 2.79]	0.032*
	ANA	0.416	0.164	1.516	[1.07, 2.15]	0.022*
	BMQ-overuse x attitude	-0.620	0.243	0.538	[0.32, 0.90]	0.021*
	BMQ-overuse x ANA	-0.345	0.136	0.708	[0.53, 0.94]	0.022*
Stigma	**Intercept**	1.003	0.259	2.727	[1.57, 4.72]	0.001**
	Stigma	0.231	0.297	1.260	[0.67, 2.37]	0.448
	Attitude	0.677	0.241	1.969	[1.18, 3.28]	0.013*

	ANA	0.134	0.091	1.143	[0.94, 1.39]	0.163
	Stigma x attitude	-1.040	0.331	0.353	[0.18, 0.71]	0.006*
	Stigma x ANA	-0.366	0.148	0.693	[0.51, 0.95]	0.025*
Illness	**Intercept**	1.006	0.265	2.735	[1.56, 4.80]	0.002**
perceptions	IPQ	0.029	0.131	1.029	[0.78, 1.36]	0.830
(IPQ items)	Attitude	0.489	0.224	1.631	[1.01, 2.63]	0.044*
	ANA	0.118	0.035	1.125	[1.05, 1.21]	0.004**
	IPQ x attitude	-0.206	0.165	0.814	[0.57, 1.16]	0.231
	IPQ x ANA	-0.238	0.090	0.789	[0.65, 0.96]	0.018*

B = unstandardised coefficient, SE = Standard Error, OR = Odds ratio, 95% CI = 95% Confidence Interval, * $p < .05$; ** $p < .01$; *** $p < .001$.

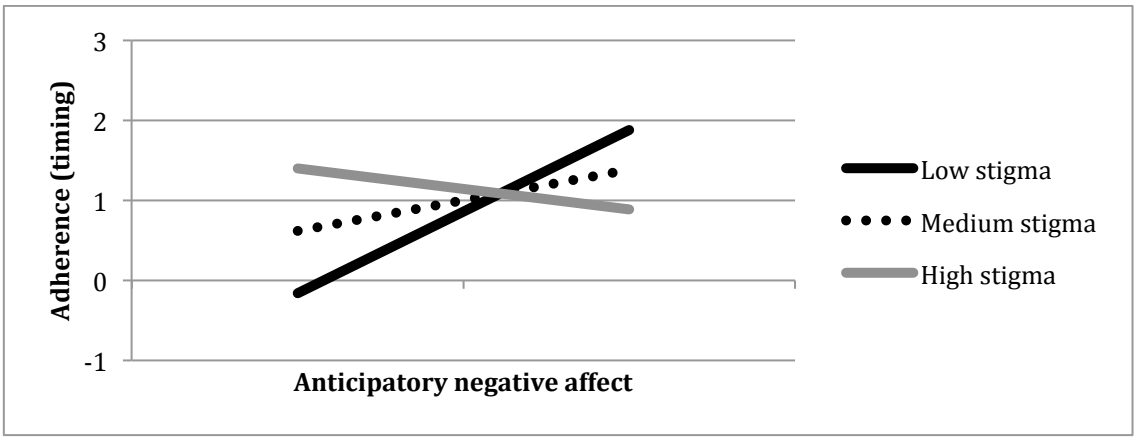
3.2.8 Interpreting the effect of level 2 variables - simple slopes analyses

Stigma. Simple slopes analysis indicated that the effect of attitude on optimal adherence (timing) increased as stigma decreased (a negative interaction). The effect of attitude on adherence timing was significant only at the low and moderate levels of stigma. The effect of attitude on adherence timing was strongest at the lowest level of stigma (B = 1.311, $p = 0.004$), weaker at the moderate level of stigma (B = 0.677, $p = 0.0126$) and weakest at the highest levels of stigma (B = 0.043, $p = 0.836$) (see Figure 4).

Simple slopes analyses also indicated that the effect of anticipatory negative affect on optimal adherence (timing) increased as stigma decreased (a negative interaction). The effect of anticipatory negative affect on adherence timing was significant only at the lowest level of stigma. The effect of anticipatory negative affect on adherence timing was strongest at the lowest level of stigma (B = 0.357, $p = 0.001$), weaker at the moderate levels of stigma (B = 0.134, $p = 0.163$) and weakest at the highest levels of stigma (B = -0.090, $p = 0.607$) (see Figure 5).

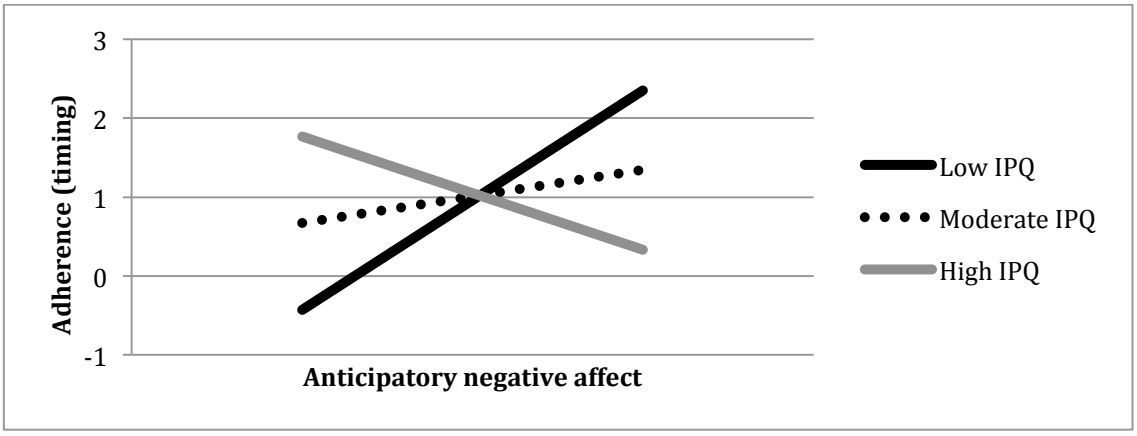
Figure 4. Impact of attitude on adherence timing at different levels of stigma

Figure 5. Impact of anticipatory negative affect on adherence timing at different levels of stigma



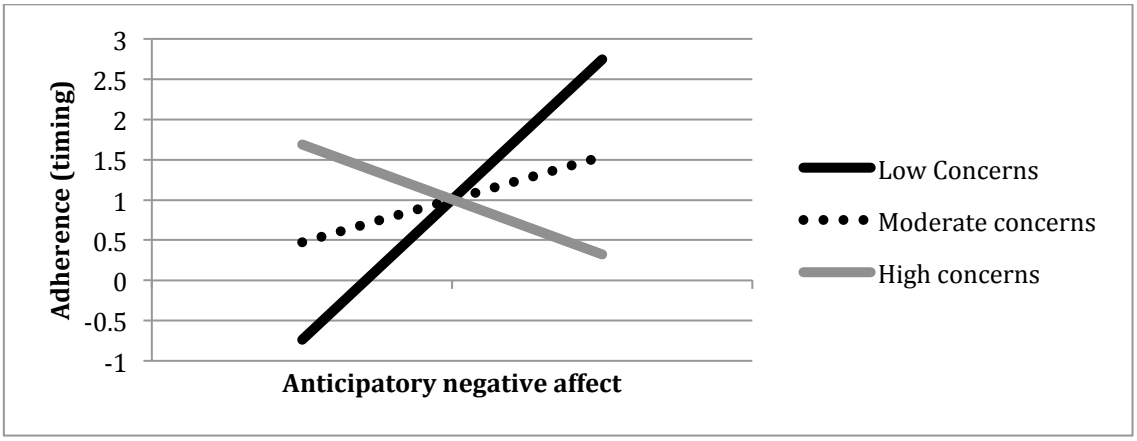
IPQ items (perceptions of threat of illness). Simple slopes analyses indicated that the effect of anticipatory negative affect on optimal adherence (timing) increased as IPQ (perceptions of threat of illness) decreased (a negative interaction). The effect of anticipatory negative affect on adherence timing was significant at all levels of IPQ. The effect of anticipatory negative affect on optimal adherence timing was strong at the low level of IPQ (B = 0.486, $p = 0.013$) and weaker at the moderate level of IPQ (B = 0.118, $p = 0.004$). At the highest level of IPQ there was a negative interaction between anticipatory negative affect and adherence timing (B = -0.251, $p = 0.032$), at this level as anticipatory affect increased, adherence timing reduced (see Figure 6).

Figure 6. Impact of anticipatory negative affect on adherence timing at different levels of IPQ



BMQ-concerns (concerns about medication). Simple slopes analyses indicated that the effect of anticipatory negative affect on optimal adherence timing increased as BMQ-concerns decreased (a negative interaction). The effect of anticipatory negative affect on adherence timing was significant at all levels of BMQ-concerns. The effect of anticipatory negative affect on optimal adherence timing was strongest at the lowest level of BMQ-concerns (B = 0.610, p = 0.0167) and weaker at the moderate level (B = 0.186, p = 0.160). At the highest level of BMQ-concerns there was a negative interaction between anticipatory negative affect and adherence timing (B = -0.239, p = 0.044), indicating that at this level, as anticipatory negative affect increased, adherence timing reduced (see Figure 7).

Figure 7. Impact of anticipatory negative affect on adherence timing at different levels of BMQ- concerns



BMQ-overuse (belief that too much trust is placed in medications). Simple slopes analyses indicated that the effect of attitude on optimal adherence (timing) increased as overuse beliefs decreased (a negative interaction). The effect of attitude on adherence timing was significant only at the low and moderate levels of overuse beliefs. The effect of attitude on adherence timing was strongest at the lowest (B = 1.128, p = 0.006), and moderate levels (B = 0.539, p = 0.032) of overuse beliefs, and weakest at the high level (B = -0.050, p = 0.865) (see Figure 8).

Simple slopes analysis also indicated that the effect of anticipatory negative affect on optimal adherence (timing) increased as overuse beliefs decreased (a negative interaction). The effect of anticipatory negative affect on adherence timing was significant only at the low and moderate levels of overuse beliefs. The effect of anticipatory affect on adherence timing was strongest at the lowest level of overuse beliefs (B = 0.734, p = 0.013), weaker at the moderate level (B = 0.416, p = 0.021) and weakest at the highest level (B = 0.098, p =0.471) (see Figure 9).

Figure 8. Impact of attitude on adherence timing at different levels of BMQ-overuse

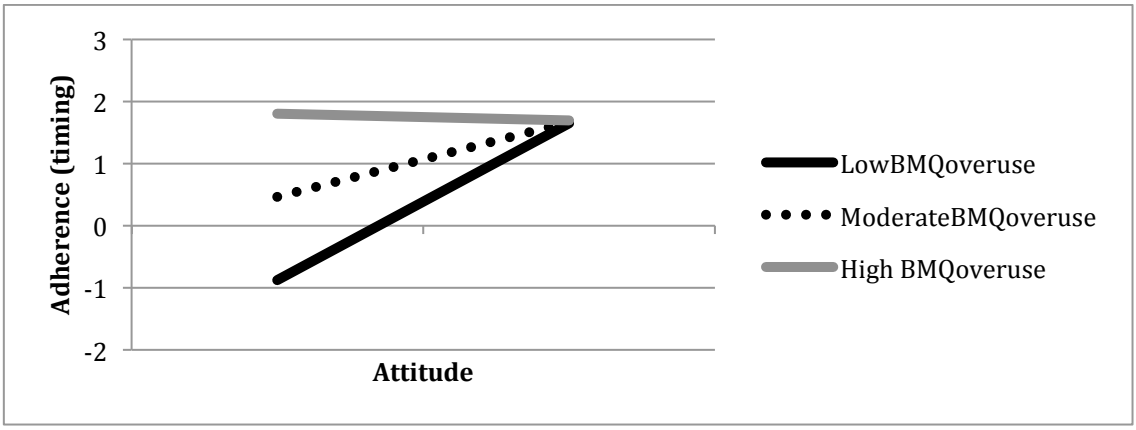
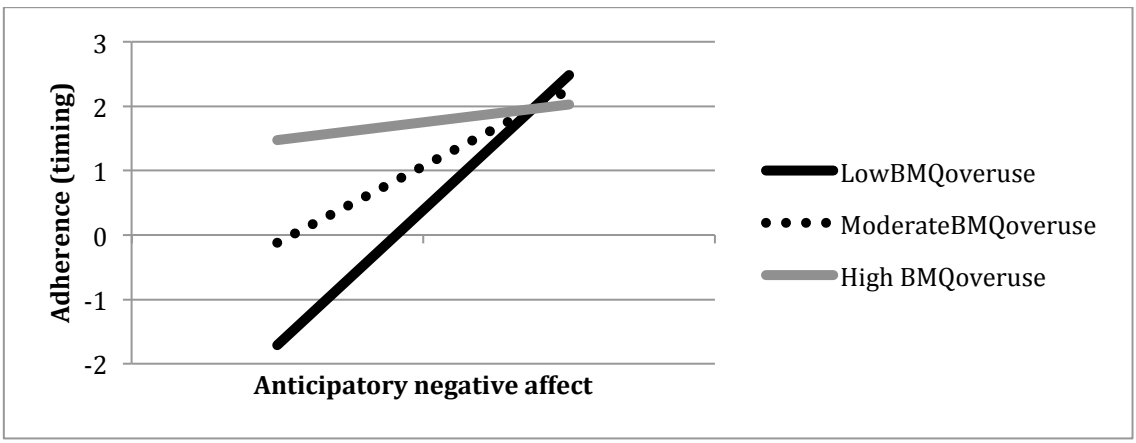


Figure 9. Impact of anticipatory negative affect on adherence timing at different levels of BMQ-overuse



3.2.9 Participant experience questions (PEQ)

16 participants who completed the daily diaries also completed the PEQ. Participants rated their experiences of taking part between 1 and 7, with a higher score indicating negative experience. Scores indicated positive experiences of taking part for the sample (M = 2, SD = 1.31). 14 out of the 16 responders indicated that they would take part in similar research again. One participant stated that they 'probably' would and one participant indicated that they would 'if less paperwork'.

Most participants did not indicate any difficulty associated with taking part (n = 9). However, they did describe some difficulties including remembering to complete the diaries (n = 3), one participant identified that completing the diaries was 'tedious' and one participant noted that completing the diary was harder on days when they felt low in mood. An additional participant noted that they had co-morbid health conditions and had found it difficult to separate their experience of having HIV from other conditions.

Having the opportunity to assist with research (n = 5) was identified as a positive aspect of taking part. Participants also identified benefits associated with becoming more aware of emotions (n = 5). Three participants identified that a positive of taking part related to becoming more aware of the importance of adherence, in addition to the importance of looking after health in general.

In terms of improving the study, three participants highlighted that they would have liked greater clarity regarding the items used in the daily diary (n = 3). One participant suggested conducting the study over two non-consecutive weeks and an additional participant suggested use of an electronic diary.

Chapter 4: Study 2 - Staff and Service User Interviews

This chapter will describe findings from the staff and service user interviews. The qualitative study was carried out to help understand the feasibility of using diary methods used to investigate variables that are expected to fluctuate daily and which may be associated with adherence behaviour, such as mood, as was attempted in study 1. The semi-structured interviews were conducted with four HIV service users (PLHIV) and five HIV staff, lasting between 25 and 40 minutes. The interviews took place at the service delivery sites. Prior to the interview taking place participants were provided with information about the diary study (study 1) and were shown the materials used in the study. All interviews were audio recorded, transcribed and analysed by the CI.

4.1 Analysis method

Thematic analysis (TA) was selected because it can be used flexibly in order to answer a range of questions (Braun and Clarke, 2006). Braun and Clarke (2006, p.6) describe TA as "identifying, analysing, and reporting patterns (themes) within data. It minimally organises and describes your data set in (rich) detail". An inductive approach to the analysis was used, meaning, "the themes identified are strongly linked to the data themselves" Braun and Clarke (2006, p.12). The six steps used to develop the coding frame were informed by the six stages outlined by Braun and Clarke (2006):

Stage 1 - Familiarising yourself with your data. Transcribing the audio recordings enabled me to start this process. I also listened back to the recordings in order to check the accuracy of the transcripts. Furthermore, I re-read the transcripts and highlighted the sections that were relevant to the research question. I also started making notes regarding initial thoughts and impressions of the data.

Stage 2 - Generating initial codes. This stage began with the process of coding each transcript. The transcripts were analysed separately so that both differences and similarities between staff and service views could be identified. Given the specific nature of the research question, only the sections of the transcripts that had been highlighted as relevant to the question were coded. The process of coding relates to labelling segments of the data based on their meaning, with the view to these codes being organised into categories later in the process of analysis. Table 10 provides a sample of the coding from extracts of the transcript.

Table 10. Coding examples

Data extract	Code
"Probably knowing how beneficial its actually going to be, knowing why you're doing it and where the information is going to go and what that might result in...so I don't think anyone with HIV particularly likes living with it erm and I think people and I think the worry is the exposure"	Perceiving that there are benefits to taking part. Having an understanding of the purpose of the research. Being clear about where information is going. Living with HIV is difficult. Fear of HIV exposure.
"You are conscious that you are positive but it is not something... you kind of put behind your mind you know what I mean, you don't want to kind of bring some remembrance you know that sort of thing and if you are to do that (points to diary) its like you have so much conscious that you are HIV positive. You actually want to deal with it and kind of forget when you take your medication"	Don't want to have to think about HIV status. The diary is a reminder of HIV status. Want to take medication and get on with life. You can take medication quickly and forget about HIV.
"A lot of people are working they are healthy and er they are busy so and they've got children and young families... yeah so I think that's perhaps a bit of a barrier"	Many people with HIV lead busy lives. People with HIV are healthy and busy. Children and family may be priority.

Stage 3 - Searching for themes. According to Braun and Clarke (2006) this stage involves starting to combine the codes into themes. The process started with the staff codes. Codes were firstly grouped together into categories. Associated categories were then organised together to form 'subthemes'. Attempts were then made to label the subthemes with a theme that captured the essence of what they represented. The same process was then conducted with the service user codes. I created several visual 'mind maps' during this phase whereby different categories of codes were organised and reorganised. Although the staff and service user codes were analysed separately (staff first), in the subsequent analysis of the service user transcripts many of the same categories devised from the staff data could be used to organise the service user data.

Stage 4 - Reviewing themes. Braun and Clarke (2006) outline two levels within this phase. The first level involved reviewing all of the codes within each of the identified subthemes

to ensure that they formed a "coherent pattern". The second level involved assessing whether the themes represented the coded data. If the themes were not considered to be representative, the labels were adjusted and subcategories were also moved around. For example, 'disclosure concerns' was originally identified as an overall theme, with subthemes of 'fear of paperwork being found' and 'fear of where information is going'. However, it was identified that disclosure concerns was a narrow theme. Additionally, because disclosure concerns related to an emotional response to the diary (e.g. fear of HIV being exposed), it was decided that it should be categorised alongside two other subthemes relating to an emotional response to the diary ('taking part is a reminder of illness' and 'taking part is a reminder of non-adherence') under the overall theme of 'emotions'.

Stage 5 - Defining and naming themes. The themes and subthemes were assessed further to ensure they provided an accurate picture of the data. The themes were initially organised into two overarching categories 'barriers' and 'facilitators', a third category 'acceptability' was identified in relation to themes in the data regarding participants' perceptions of the feasibility of the specific study used in study 1.

Stage 6 - Producing a report. Braun and Clarke (2006, p.23) outline that through producing a written report you can "tell the complicated story of your data". The themes and subthemes were therefore presented as a written account of the data. The written account included quotations the interviews, ensuring that the themes were 'grounded' in the data. As there was overlap between the views of staff and service users, the decision was made to present the staff and service user accounts together, however the similarities and differences between the views of the two groups were made clear.

4.1.1 Quality control

Researcher reflexivity. This relates to continually reflecting on the research process and thinking about different ways that the researcher might influence the process (Tracy, 2010). In particular, I reflected upon potential bias in relation to my role in the interviews (and the subsequent analysis). Furthermore, I was mindful of the fact that I conducted and designed the diary study and I therefore held my own personal views and opinions about the facilitators and barriers of the study. I was aware that this had potential to impact participants in different ways. For example, participants may have felt less able to share criticism of the project given that I designed it. Additionally, they may have been influenced by my views and opinions about the project if I had shared them, given my role in implementing the study. I was therefore aware that it was important to maintain a neutral stance in the interviews (i.e. being careful not to share my own ideas and opinions), at the same time as encouraging participants to share their honest opinions about the project (positive and negative).

Supervision. Regular supervision was utilised at all stages of implementing the qualitative study. Supervision was important for promoting reflexivity. It was also used to reflect

upon my initial ideas regarding the completed interviews, the coding process and the later generation of themes and subthemes.

Audit trail. Audit trails have been identified as important ways to ensure the accountability of the researcher during the process of analysis (Carcary, 2009). The decisions made throughout the process of analysis were logged, enabling the development of an audit trail. I also used a decisions log to reflect upon the process of interpretation and my changing understanding of the data, this was particularly important in the stages of reviewing and refinement of the final themes.

Additional consideration. The option of participant validation was also considered in order to assess the quality of the interpretation of the data. However, this option was not used as contact details were not taken from service users; therefore, it would not have been representative of all of the interviewees.

4.2 Results

4.2.1 Sample

Of the service users interviewed, two reported recent difficulties with medication adherence (service user 2 and service user 3), the remaining two (service user 1 and service user 4) reported no present adherence difficulties. However, service user 1 reported historical difficulties with adherence. Of the staff interviewed, both the support workers and two out of the three doctors had been involved in supporting recruitment of participants into the diary study (the third doctor had recently started work in the clinic and was not involved). Participant demographics are outlined in Tables 11 and 12.

Table 11. Staff demographics

Participant	Job title	Years working with PLHIV	Involvement in study 1 Y/N
Professional 1	Support worker	13	Y
Professional 2	Support Worker	7	Y
Professional 3	Doctor (Specialist Trainee year 7)	6	N
Professional 4	Consultant in HIV and sexual health	13	Y
Professional 5	Consultant in genitourinary medicine	12	Y

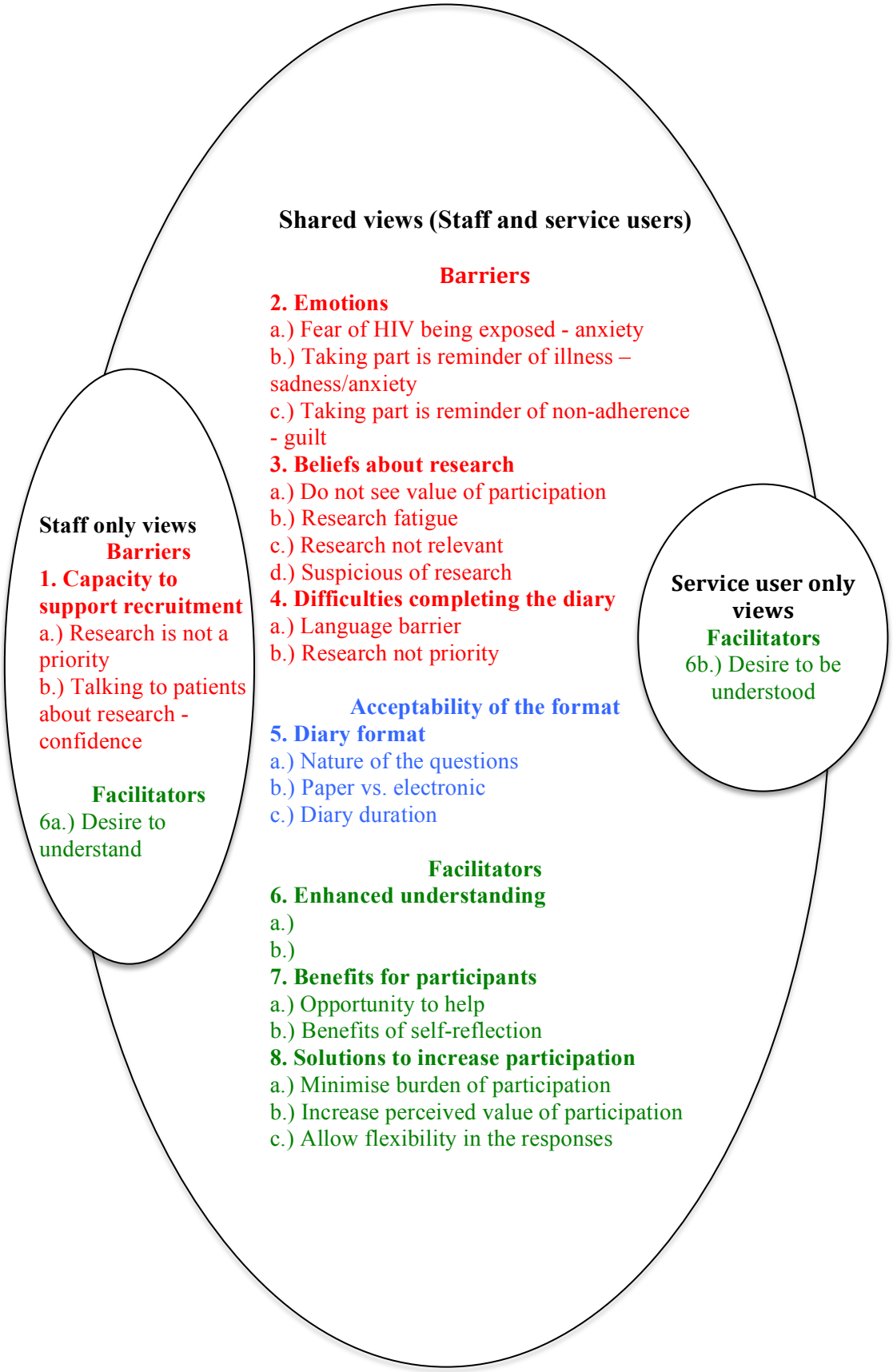
Table 12. Service user demographics

Participant	Age	Years living with HIV diagnosis	Years taking medication	Involvement in study 1 Y/N
Service user 1	63	34	27	N
Service user 2	58	13	13	N
Service user 3	35	11	Unknown (due to periods of non-adherence)	N
Service user 4	48	15	11	N

4.2.2 Core categories

The initial coding process generated 220 and 217 codes from the staff and service user transcripts respectively. These were then organised into 41 staff and 49 service user categories. From these, 8 higher order themes and 21 subthemes were generated. The themes were also organised into 3 overarching categories: 'barriers', 'facilitators' and 'acceptability'. The themes are presented in Figure 10, it also indicates which themes represent the views of both staff and service users (shared views) and which themes are unique to staff (staff only views) or unique service users (service user only views).

Figure 10. Barriers and facilitators of diary studies in HIV populations



4.2.3 Summary of the themes

Barriers

Theme 1 - Capacity to support recruitment

Sources: 3/5 staff *staff only

Description: All three of the doctors provided accounts of the factors that may influence their decisions to recruit participants into the diary study. These were divided into two subthemes.

Subtheme 1a - Research is not a priority

Sources: 3/5 staff *staff only

Description: The doctors reported that clinics are time limited, PLHIV have complex needs and within clinic the need of the individual comes before the research needs of the general HIV population, meaning that clinicians do not prioritise research activity:

"Because actually if you want to broach something quite sensitive, like you feel like this is the week we want to ask them about testing their children for HIV, or this is the week that we want to suggest to them that they change drugs, they are actually the priority things and tacking onto the end of that...oh there's a research study going on here" ***Professional 3***

Subtheme 1b- Talking to patients about research - confidence

Sources: 2/5 staff *staff only

Description: Two of the doctors reported that there are times where they feel hesitant or less confident about talking to patients about taking part in research.

It was reported that clinicians already feel that they are asking a lot of their patients, they have an awareness of the stress that attending clinic can cause for some of their patients and therefore feel hesitant about potentially increasing patient stress by asking them to take part in research (2/5):

"They are getting their bloods done and then you throw something else at them and some patients are a bit like, 'I've only just managed to get myself here I can't do anything else today'" ***Professional 4***

In specific relation to this diary study, one of the doctors reported that clinicians might be less confident about asking a patient to take part if the patient is known to have difficulties with adherence, due to fears of being perceived as monitoring or policing adherence:

"I think again because we often challenge patients about their adherence and they tell us, not always we feel, the whole truth... and I think then maybe saying: 'well you're struggling with your adherence but you're saying everything is okay... are you happy to fill in this diary?'. It's almost like we're checking on you. We know we're not because it's through the research but whether it's a more difficult conversation to have with a patient" ***Professional 4***

Additionally, it was reported that they might be less likely to ask patients to take part if they do not feel that they themselves have a good understanding of the research project (2/5):

"I've been in the position of trying to recruit a patient into a study that's nothing to do with me but just in my department, but not fully understanding the study and then you get yourself tied up in knots because the patient suddenly asks you a question" ***Professional 3***

Theme 2 - Emotions

Sources: 5/5 staff; 4/4 service users

Description: The potential emotional impact of taking part in diary research was reported as a barrier to participation by all staff and service users; this theme was divided into three subthemes.

Subtheme 2a - Fear of HIV being exposed - anxiety

Sources: 5/5 staff; 3/4 service users

Description: Fear of HIV status being exposed was reported as a barrier to participation by both staff and service users. It was reported that many service users often choose not to disclose their HIV status even to close family. Anxiety related to potential participants having fears of the paper diary being found, in addition to having fears about where information recorded about them will go was a barrier to taking part:

"Because of the disclosure bit you know, not disclosing to their family members or partners they couldn't take these forms home in case somebody... so they were scared so that is one of the reasons why some people didn't take part or take it home, because they didn't want anybody to know that they are HIV positive" ***Professional 2***

"I think that people are often concerned about where that information is going to go, who's going to see it" ***Professional 4***

"Perhaps I'm too private you know, I know it's all private if that's how to put it and inconspicuous and so forth but even so I'm still as I said from the old school, I'm still a bit terrified all of the time" ***Service user 1***

"I think a lot of people tend to go to clinics in the area that they don't live because they don't want to be seen and things like that, so that would effect research as well" ***Service user 3***

Subtheme 2b - Taking part is a reminder of illness - sadness/anxiety

Sources: 4/5 staff; 3/4 service users

Description: It was reported by 4/5 staff that having to think about and answer questions about HIV on a daily basis had the potential to be distressing:

"If someone is struggling with a diagnosis, if it's a fairly new diagnosis it might be just too much for them emotionally that constant reminder" ***Professional 2***

"Just it's having the ability to set the time aside each day and honestly ask yourself these questions, because a lot of the time you may just do things and not think about it so actually pausing and thinking about it might have an impact on you" ***Professional 1***

Service user perspectives (3/4) were also included in this theme, it was recognised that taking part could be a difficult reminder of HIV status:

"Sometimes you know you have to give your time to that (research), you know you need to do the best thing but sometimes you know you cannot. Sometimes it's just because you don't want to deal with this HIV, even though you are positive, it's not a good topic to talk about it's like reminding yourself of a bad story, a bad dream" ***Service user 4***

Subtheme 2c - Taking part is a reminder of non-adherence - guilt

Sources: 2/5 staff; 2/4 service users

Description: It was suggested by 2/5 staff that facing non-adherence could result in internal conflict, resulting in distress:

"People who are generally not good at taking their medication I think would have struggled with that more perhaps, kind of you wonder how much of the time they and we all do it don't we; we kind of kid ourselves a little bit as to how good we are at brushing our teeth every day or having 5 fruit and veg or doing our exercise, but if you are actually asked to you know write it down it's a bit more in your face isn't it" ***Professional 4***

Two service users also reported that the act of writing down non-adherence could be difficult in terms of admitting non-adherence both to professionals and to self:

"I think because of my personal experiences of not being able to adhere to my medication very well I think for me it would be kind of a denial thing. Because it does ask you to recognise your medication and your routine and stuff, and I think if you're not accepting or ready to acknowledge that, it will just be an avoidance tactic to not want to be honest with yourself as be honest to the actual daily diary" ***Service user 3***

Theme 3 - Beliefs about the research

Sources: 5/5 staff; 4/4 service users

Description: Both staff and service users reported beliefs about the research as a factor likely to impact decisions to participate; these were divided into two subthemes.

Subtheme 3a - Do not see value of participation

Sources: 4/5 staff; 2/4 service users

Description: It was reported that if potential participants do not see the value of taking part, in terms of what they may gain from or be able to contribute to, they would be less likely to take part:

"Because it wasn't directly impacting their HIV health they didn't feel the need to look at it as it wasn't very important to them" ***Professional 2***

"Sometimes there is a lack of understanding of what it is for (i.e. the research) seeing no reason for it" ***Service user 4***

Also included in this theme was the view of one doctor who suggested that some PLHIV may not fully understand the value of research, particularly individuals from African communities, due to being unfamiliar with the process of research participation:

"I think sometimes that people from Africa the doctors just they're told...I think it's very different when they come here, there is an element of trying to engage them in the care but equally they're used to being told what to do and not being given choices. So I think for them, not for everybody obviously from those countries. But the majority find that quite difficult to get their heads round, do you want to take part in research? I think sometimes it's difficult for them to know what the right answer is. They want to please the doctor but equally they are anxious about all the other stuff so I guess that there is a bit of conflict there for them" ***Professional 5***

This view was supported by the view of one service user who reported that a lack of encouragement to take part in research could be confusing:

"Sometimes it's lack of encouragement if people say I don't want to (take part) people just go along with it, you know groups are like that, people are easily influenced, so sometimes people really don't know, you know what I mean" ***Service user 4***

Subtheme 3b - Research fatigue

Sources: 4/5 staff; 1/4 service users

Description: It was reported by staff (4/5) that many service users are tired of being asked to take part in research, meaning that it may have been a factor impacting recruitment:

"We ask our patients to fill in quite a lot of questionnaires so I think there is a bit of fatigue within clinic about filling in questionnaires" ***Professional 5***

"One of the patients had said every time I come here I get asked to fill in a survey so I think some of our patients were feeling a bit surveyed out" ***Professional 4***

The report of one service user also supported this subtheme:

"Sometimes it's just, sometimes we feel like we just being used for research and so forth....like for us (name of support group) we are the only group that anyone interested in HIV will come to, like last time some student from (name of) university came so it's kind of enough (laughs)" ***Service user 4***

However, the perception of 'research fatigue' was not supported by the account of one service user:

"To be fair, in all the time I've been diagnosed I've never been asked to take part in any research" ***Service user 3***

Subtheme 3c - Research not relevant

Sources: 2/5 staff; 2/5 service users

Description: It was reported that many PLHIV are good adherers, meaning that they may not have perceived a research project about adherence as relevant to them:

"I guess some people are just very very stable and well controlled. They only come to clinic twice a year and yeah so it just isn't a big part of their life" ***Professional 3***

This subtheme was supported by the report of two service users. Both reported having been diagnosed for a long period of time and not having problems with adherence to their medication, therefore they did not perceive the research to be relevant to them:

"All I could really put on there would be you know everything is okay, okay or cheerful it wouldn't be worth my while or your while" ***Service user 1***

Subtheme 3d- Suspicious of research

Sources: 3/5 staff; 2/4 service users

Description: Within this subtheme staff reported that service users feeling wary and mistrusting of healthcare professionals may be a barrier to participation (3/5 staff):

"I think people could make time if they wanted it's not that long a survey....Some people are just suspicious of anything like this" ***Professional 1***

This subtheme was also supported by service user reports that it can be difficult to share personal information with researchers due to feeling wary about the perceptions of researchers (2/4):

"I think it is the kind of not even though you know you know the research is for a positive reason, I think there is just this underlying feeling of people being judgy and its always there this feeling of people being judgy or looking at you or and that stops people from really talking about HIV or taking part in research" ***Service user 3***

Theme 4 - Difficulties completing the diary

Sources: 5/5 staff; 4/4 service users

Description: It was reported that the HIV population is diverse and that some groups were more likely than others to take part in diary research, making gaining a representative sample difficult. This theme was divided into 3 subthemes.

Subtheme 4a- Language barrier

Sources: 3/5 staff ; 1/4 service users

Description: Language was identified as a barrier to participation for individuals who do not speak English as a first language:

"The diaries in my view depending on the clients that I support mainly the migrant communities, mainly Africans and other nationalities outside of Europe or England I didn't think it was a good method because of the different constraints that these communities face...Number 1: language barrier, literacy...." ***Professional 2***

One service user identified language as a barrier to participation (English was not service user's first language):

"For some people English is not even their second language.... when I have to read I see a sentence and it's too long, but when you talk its shorter you know what I mean its easier to understand and all that" ***Service user 4***

English was the first language of the remaining three service users interviewed, providing an explanation for why they did not identify language as a barrier to participation.

Subtheme 4b- Research not priority
Sources: 5/5 staff; 4/4 service users
Description: Different reasons relating to the lifestyle of potential participants were reported for why research would not be their priority.

It was reported that many PLHIV lead stable, healthy, and busy lives, resulting in research not being a priority (5/5 staff):

"The women that I work with, they are mothers, they have children, so they have other things going on in their lives, others are working, so other priorities and yeah just life gets in the way of things" ***Professional 2***

"A lot of people are working, they are healthy and they are busy and they've got children and young families yeah so I think that's perhaps a bit of a barrier" ***Professional 3***

Staff (3/5) also identified difficult social circumstances as a reason for why some PLHIV may not be able to prioritise research participation:

"Some of our patients are struggling a lot financially, some are asylum seekers waiting for their claims to be processed; they don't have a lot of money, they are struggling to feed themselves" ***Professional 3***

"Some people just have chaotic lives and when you're addicted to drugs you know what I mean, anything other than drugs just isn't important" ***Professional 1***

"We have people in shared houses who don't have a secure place to live" ***Professional 1***

This subtheme was also supported by service user reports that the responsibilities and stresses associated with daily life were likely to take priority over diary completion (4/4):

"I think for me if I had took part it would have been the task itself. You know you're already tied into a routine of having to take your medication at a certain time and work around all the other issues of it, balancing it with a normal life, going to work you know having a family and doing things you know and having to fill out daily diaries is like an added task" ***Service user 3***

Acceptability of the format

Theme 5: Diary format

Sources: 4/5 staff; 4/4 service users

Description: There were contrasting views regarding the factors that increased and reduced the acceptability of the format of the diary used in study 1. These have been summarised within 3 subthemes.

Subtheme 5a - Nature of the questions

Sources: 4/5 staff; 4/4 service users

Description: The majority of staff members considered the diary questions in terms of the language used to be straightforward and acceptable (4/5):

"I think I could talk to my patients about this, it makes sense to me having briefly read through it" ***Professional 3***

"No I like it (the questions in diary). It's not too condescending. It's okay" ***Professional 1***

The majority of service users also reported that the language was straightforward (3/4), it was also reported that the questions fitted with experiences of having HIV (3/4):

"All the questions - they're not hard questions, they apply to everything about you, you know" ***Service user 1***

"No clear, all of it was very clear" ***Service user 2***

However, it was also highlighted by both staff members (3/5) and service users (1/4) that there may have been too many questions and that the number of questions on each diary page may have been overwhelming. One service user reported that the layout of the questions on the page of the diary was overwhelming and therefore reduced its acceptability:

"It doesn't seem like there is too much work it is only the presentation of the paper that gives that idea that it's a lot" ***Service user 4***

"Repetitiveness. Too many words. It's a big book. It's scary. People look at it as too much. Probably if it was just on two sheets, people would have probably considered it" ***Professional 2***

Subtheme 5b- Paper versus electronic
Sources: 5/5 staff; 3/4 service users
Description: All 5 staff reported that an electronic diary may have reduced disclosure concerns and been more convenient to PLHIV:

"Nowadays people use technology so probably most people spend time on their phone, probably if there was an e-version just specific to people's phones it probably would have been easier. Somebody could do it on the bus" ***Professional 2***

However, one of the doctors reported that paper based studies have worked better in previous studies conducted at the clinic and the limitations of electronic versions were recognised:

"Paper based has worked best for us for a survey that is just a one-off survey but don't know whether a diary would be different. Then again even with electronic you've got to login, switch on your computer, fill it in. Whereas almost with paper its easier to pick it up and fill it in...but it will be interesting to see what patients say about that" ***Professional 4***

One service user did not comment on whether paper or electronic diary format was more acceptable, 3/4 service users reported that a paper diary was preferable for them:

"I think paper based is probably good because I suppose if it was electronic it's remembering to log in or to go to it and do it. I mean this one would be quite easy for me" ***Service user 3***

"I always prefer doing that as opposed to filling it in or buying online that kind of thing and I think you will find a lot of people my age they're wary again of computers" ***Service user 2***

Subtheme 5c- Diary duration

Sources: 5/5 staff; 2/4 service users

Description: There was uncertainty about the acceptability of the duration of the diary. Some staff (3/5) and one service user reported that 2 weeks was a relatively short time period to capture patterns of adherence:

"Personally for me it's taken me a very long time to get to that point where I understand the importance of adherence and actually recognise it, so actually the cons might be it might need to be a bit of a longer-term study, it might be a bit too short term" ***Service user 3***

However, it was reported by both staff (4/5) and service users (1/4) that completing the diary for 2 weeks was a relatively big commitment. One staff member reported that commitment to a two-week diary was not feasible for the majority of the population she supported (BME migrant women):

"And I think the commitment, the daily commitment is again too much as well, it was too much for people to commit" ***Professional 2***

Facilitators

Theme 6 - Enhanced understanding

Sources: 5/5 staff; 3/4 service users

Description: There was a perception that adherence is an important area of investigation, the views of service users and staff were separated into two subthemes.

Subtheme 6a - Desire to understand

Sources: 5/5 staff only *staff only

Description: It was reported by all staff that non-adherence is a complex issue that is difficult to understand; a desire to have an increased understanding of adherence behaviour was reported:

"Because we know that big life events will impact somebody's ability to take their medication and what this study was looking at was more those day-to-day things that effect peoples' ability to take their medication on a day-to-day basis, so I think that was teasing out those things that

are a little bit less obvious to us as clinicians but I think would be useful to have an idea about how that does impact" ***Professional 5***

"I think that compliance with medication is still a problem so it's still a big part of being a HIV clinician" ***Professional 3***

"It can be a very difficult thing to understand, particularly as a clinician as to why people aren't taking their tablets" ***Professional 4***

Subtheme 6b - Desire to be understood

Sources: 3/4 service users *service users only

Description: Service users expressed wanting staff involved in their HIV care to have an understanding of the challenges of adherence:

"I've had some doctors that I've seen through various clinics that I've felt have been quite insensitive or not able to understand exactly why when I've not taken medication so its quite, I think it's quite useful to understand" ***Service user 3***

Theme 7 - Benefits for participants

Sources: 5/5 staff; 4/4 service users

Description: Potential benefits of taking part for PLHIV were reported, this was organised as two subthemes.

Subtheme 7a - Opportunity to help

Sources: 5/5 staff; 4/4 service users

Description: Staff reported that many PLHIV are motivated to contribute to improving HIV treatment and to help other people living with HIV:

"People want to improve HIV care that they may receive in the future so they think their experiences will impact new technology or new systems that come up in the future" ***Professional 2***

It was also reported that PLHIV like to have the opportunity to 'give back' to services:

"Because they might feel grateful to the staff for still being here after 30 years you know want to give something back" ***Professional 1***

The statements of the service users also supported this subtheme (4/4):

"I think it's hard to say no to somebody when they're so good down here in this clinic. I've been coming here for years, I've got to know them all, I've seen them come and go. If they ask you to do something you would feel not guilty but they do so much for you, well for me personally they've done so much that I would feel what is it a bit of time and I could help somebody else understand because everybody's different aren't they" ***Service user 2***

Subtheme 7b - Benefits of self-reflection

Sources: 3/5 staff; 2/4 service users

Description: It was also reported that the diary might increase self-reflection, which may benefit PLHIV:

"They may have thought that they were really adherent and realised they were not 100% adherent and you know if they weren't adherent it may have made them think about whether they took tablets each day or not, so I guess for an individual it may have been a very useful exercise" ***Professional 4***

Service users also identified that increased self-reflection may have benefits (2/4):

"It helps you to think in your own mind what the situation is with your medication. You know if you've missed it you might not realise you've missed it and think oh it don't matter, but if you fill it in and look for a week you might think oh I've been late with my tablets" ***Service user 2***

Theme 8 - Solutions to increase participation

Sources: 4/5 staff; 3/4 service users

Description: Different ways to maximise participation in future diary studies were reported. These were divided into three subthemes.

Subtheme 8a - Minimise burden of participation

Sources: 4/4 staff; 3/4 service users

Description: All staff suggested adaptions to the study format in order to reduce participant burden and increase the acceptability of the project:

It was suggested that using a text reminder system may have reduced burden (2/5). It was also suggested that a reduction in the size of the diary may have reduced burden (3/5):

"It was maybe looking at what could have come out rather than what needed to be added in" ***Professional 4***

"A bit littler might seem more attractive that you could put in your pocket or your handbag" ***Professional 3***

Service users also had suggestions that could be included in this subtheme. Service users did not suggest use of a text reminder system. However, they did suggest that having increased contact with the researcher and support to complete the diary might have reduced burden (3/4):

"I think it would have to be some kind of specific support I mean when you talk about the format maybe kind of an option as you know maybe it would be better if somebody contacted you on a daily basis or completed it on the phone with you" ***Service user 3***

Subtheme 8b - Increase perceived value of participation

Sources: 5/5 staff; 3/4 service users

Description: As previously stated (see subtheme 3a), it was reported by all staff that if potential participants have an understanding that the research is of value in terms of what it is contributing to (i.e. improved HIV care) in addition to what they may get out of it (i.e. personal benefits of participation), they are more likely to take part.

It was suggested that having somebody carrying out recruitment on a full-time basis in order to emphasise the value of the research to clarify the nature of the research, the purpose, and what participation will involve might have increased participation (4/5):

"I know that you were restricted with the time that you could spend with us but I think having somebody in the service kind of more full time to be able to talk to patients about it in a bit more depth and answer any questions or concerns with a bit more time than clinicians were able to and again it would be interesting to see how many patients completed it because you spoke to them versus just one of the doctors" ***Professional 4***

Service users also suggested that having a good understanding of the value of the research would increase the likelihood of taking part (3/4):

"Probably knowing how beneficial its actually going to be, knowing why you're doing it" ***Service user 3***

It was also suggested that individual monetary compensation might increase the perceived value of participation (3/5 staff):

"Others wanted to be paid for it. They didn't understand why not" ***Professional 2***

One service user suggested monetary compensation as a possible facilitator of recruitment:

"Sometimes people might choose if they are given a little bit of money" ***Service user 4***

Subtheme 8c- Allow flexibility in the responses

Sources: 3/5 staff; 3/4 service users

Description: It was reported that the 'tick box' nature of the diary may have been restrictive in terms of allowing participants to provide an in-depth account of their experience. Including space for participants to provide an explanation for non-adherence was suggested:

"I think you know it doesn't leave much room for adding your own comments and feelings I would say you know anything that came to their mind on what may have impacted adherence" ***Professional 4***

"Maybe there could have been room for people to put down why they've missed or a specific reason for why they've missed instead of putting agree or disagree" ***Service user 2***

"From a person who's got HIV it does feel quite ticky boxy and not really giving you the opportunity to kind of suggest why really around the adherence side of things" ***Service user 3***

Chapter 5: Discussion

This study had two main aims, first, to investigate the day-to-day factors influencing adherence to ART; and second, given that diary methods have rarely been used with clinical populations, to investigate the feasibility of diary methodology used to investigate adherence with PLHIV. Within this section the results will be summarised and discussed. There will also be a discussion of the study strengths and limitations, in addition to discussion of the clinical and research implications.

5.1 Summary of findings

5.1.1 Aim 1: To investigate the day-to-day factors influencing adherence to ART in PLHIV

Within this study all participants who returned diaries reported that they took all of their tablets 100% of the time. The lack of variability in this adherence measure meant that it could not be used as an outcome measure in the analysis. However, 'adherence timing' could be used as a substitute outcome measure of adherence, as there was variability in participants' reports of whether they took their medications at the correct time. Participants reported optimal adherence timing 73.16% of the time, and suboptimal adherence timing 26.84% of the time. Although they report lower adherence levels, Sherr et al (2008) also report a disparity between dose adherence and timing of adherence. Sherr et al's (2008) finding reported (in a larger but cross-sectional UK sample) high dose adherence to ART (79.1% in terms of taking tablets) but much lower adherence to the correct timing of medication (57.2%). Overall, participants who took part in this diary study reported being good adherers in terms of taking their tablets, therefore all conclusions relate to a group of participants who do not report significant difficulty with adherence. However, it should be noted that taking tablets does not indicate 100% adherence given that taking tablets on time is included within what would be considered optimal adherence.

The characteristics of the sample were representative of what may be expected of a sample of 'good adherers' in that the average responses to both the questionnaire and diary items were in line with variables in the literature that have been associated with optimal adherence. For the level 1 variables (measured in the daily diary) there were high levels of: positive attitude towards next day medication, confidence in adherence, plans for next day adherence, anticipatory negative affect associated with next day non-adherence and anticipatory positive affect associated with next day adherence. There were low reported levels of: side effects and negative mood. Although there was significant variability within the sample with regard to daily sleep and exercise, the average number of hours slept per night was within

national recommended limits (Hirshkowitz et al., 2015) and the average number of minutes exercised per day (M = 53.96) was higher than recommended in national guidelines (30mins) (Department of Health, 2011).

Similarly, the level 2 variables (measured in the initial questionnaire) for the sample were also in line with findings in the literature regarding the variables associated with optimal adherence. Within the sample there were low scores for BMQ-overuse and BMQ-harm beliefs, moderate scores for concern about medication (BMQ-concerns) and higher scores for beliefs about the necessity of medication (BMQ-necessity). There were also low scores within the sample for overall IPQ (threat of illness). Furthermore, there were high scores for life stability in the last six months, medication adherence in the last six months, understanding of medication, feeling involved in treatment decisions and perceived social support. There was a moderate score for perceived HIV stigma within the sample (mean score was 2.8 out of a possible 5).

Exploring whether day-to-day variables predict adherence timing to ART

Daily anticipatory negative affect associated with non-adherence was associated with optimal adherence timing. This may support arguments in the literature that the construct of 'anticipatory affect' strengthens behavioural intentions through increasing motivation to avoid or gain the anticipated affect associated with a behaviour (Rivis et al., 2009). Although anticipatory negative affect was associated with adherence timing, anticipatory positive affect (positive anticipatory affect associated with optimal adherence) was not associated with adherence timing. This may indicate that the perceived negative implications of non-adherence (i.e. feeling guilty) may be a more important factor influencing adherence timing than the perceived positive implications of adherence (i.e. feeling satisfied). Within this study 'anticipatory negative affect' incorporated the constructs of regret and guilt. This may provide support for Sandberg and Conner's (2008) argument that the construct of anticipatory regret alone should be included as an addition to the theory of planned behaviour rather than the general construct of 'anticipatory affect'.

The finding that a positive attitude towards taking medication the next day was associated with optimal adherence timing may also lend support to the TPB construct of attitude, regarding the role of attitude in influencing behaviour (Ajzen, 1991). It could be posited that an individual with a positive attitude towards their treatment regimen the next day perceives the complexities of their medication regime to be integrated into their everyday life. This may indicate that they do not anticipate the treatment regime to be disruptive, which may also mean that in turn, it is less likely to be disrupted.

Variables moderating the relationship between day-to-day variables and adherence timing to ART

The moderating impact of level 2 variables on level 1 variables was explored only for the level 1 variables found to be significantly associated with adherence timing (attitude and anticipatory regret). BMQ-overuse i.e. the belief that doctors place too much emphasis/trust in treatment regimes (Horne et al., 1999) was the only level 2 variable found to be directly associated with adherence timing. The finding that BMQ-overuse was positively associated with adherence timing was surprising. It was not in line with previous findings (in various chronic illness groups) whereby overuse beliefs were negatively associated with adherence timing (i.e. stronger beliefs were associated with poor adherence) (Horne et al., 1999). One explanation for this finding is that it was a spurious result. However, this result was found in two separate models run. An additional explanation may relate to the specific HIV clinical context. Unlike other chronic illness populations, HIV treatment adherence is mostly reliant on taking a tablet/s (rather than multifaceted regimes required for some chronic conditions); therefore PLHIV may have different perceptions of clinician's views of medications compared with other illness groups (i.e. there is significant emphasis on medication taking in HIV settings). This perhaps explains the positive association between overuse beliefs and adherence timing in this particular population. Furthermore, this was a relationship between beliefs about medication overuse and timing rather than overall medication adherence; therefore the result may have differed if there had been more variability in reported adherence within the sample.

Two level two variables, perceived HIV stigma and beliefs that doctors place too much trust in and rely on medicines too much (BMQ-overuse) negatively moderated the interaction between attitude and adherence timing. This meant that as these moderators increased, the association between attitude and optimal adherence timing weakened. In relation to BMQ-overuse this may mean that at high levels of BMQ-overuse, having a positive attitude to medication is less likely to be a relevant variable associated with optimal adherence. In relation to stigma this may mean that if perceived HIV stigma is high, positive attitude is less likely to be associated with optimal adherence timing. This may provide support for findings that those who perceive high levels of stigma are more likely to conceal their condition and postpone taking their medication to prevent HIV disclosure (Katz et al, 2013; Peretti-Watel et al., 2006); both factors that may impact optimal medication timing despite a positive attitude towards the regime.

A number of level 2 variables also moderated the interaction between anticipatory negative affect and adherence timing. Perceived stigma (stigma scale), perceived illness threat (IPQ scale), concerns about medication (BMQ-concerns) and beliefs that medications are overused (BMQ-overuse) all negatively moderated the interaction between anticipatory negative affect and adherence timing. This meant that as these variables increased, the association

between anticipatory negative affect and optimal adherence timing decreased. Interestingly, at the highest level of stigma, concern beliefs and illness threat, the interaction between anticipatory negative affect and adherence timing was negative (significant for IPQ and BMQ-concerns). This indicated that at these high levels of the moderator, increased anticipatory negative affect was associated with reduced adherence timing. This finding may suggest that there is an optimal level of concern about medications/ threat related to having HIV, which is associated with adherence, in that when it is low or moderate it can be motivating when anticipating regret/guilt but if the threat level is too high, the effect reverses. The variables found to weaken the association between day-to-day variables (positive attitude and anticipatory negative affect associated with non-adherence) and adherence timing have all been associated with suboptimal adherence within the literature (Horne, et al., 1999; Langebeek et al., 2014)

5.1.2 Aim 2: To investigate the feasibility of diary methodology used to investigate adherence to ART in PLHIV

The response rate was low when compared to estimates of responses to questionnaire and survey methods (Cook, Heath and Thompson, 2000). It is estimated that 150 recruitment packs were given out to potential participants; based on this a response rate of 21.3% was estimated. It is acknowledged in the literature that motivation to take part in diary studies compared to cross-sectional studies is likely to be lower due to the additional burden associated with participation (Ohly et al., 2010). However, compliance with diaries (in relation to the proportion of diary items completed) for participants who did return diaries was between 71.42% and 94.02%. Cherenack et al's (2016) study using daily diaries completed by PLHIV reported compliance to be 72.4%; within Cherenack et al's (2016) study the duration of the diary was longer (66 days) meaning that a direct comparison with this study is not possible. Nevertheless, ease of completing the diary in this study may be similar to previous diary studies.

The majority of participants who completed diaries were male (88.9%) and white British (72.2%). The higher proportion of white British and male participants in the sample compared with proportions reported in the UK HIV population (male 68.7%, white British 55.2%), suggest that certain groups within the UK HIV population were under-represented. Participation in this diary study, although possible may have been less feasible for particular groups (i.e. BME groups and females). However, because the characteristics of those who declined participation were not recorded, comparisons between those who took part and those who chose not to take part could not be made. Additionally, information regarding the characteristics of individuals who started the diary, but dropped out part way through (i.e. individuals who took a pack home, started the questionnaires but did not return any measures) was not recorded; therefore the characteristics of individuals who chose to take part but were unable or chose not to complete the diary are unknown. The lack of variability within the

sample in terms of the participant demographics, in addition to the finding that all of the participants reported full dose adherence may mean that the sample of participants within this sample do not provide a 'true' picture of the experiences of the wider HIV population, making the findings difficult to generalise.

For those who did take part in the diary study, the majority reported a positive experience of taking part. This finding was in line with reports of previous diary research with PLHIV and supportive of the notion that diary studies with PLHIV can be feasible and acceptable (Cook et al., 2010). However, given the under-representation of particular groups within the sample, for future diary studies to be representative of the HIV population, greater consideration of the barriers to participation may be required. It may be that uniform diaries should not be used; instead specific diary studies may need to be designed for different subgroups within the HIV population (i.e. a diary study seeking to gain insight into the experiences of black African females may be different to a diary designed to understand the experiences of white British males).

As part of the present study, interviews were undertaken with staff members and service users to gain their perspective on the use of diary methodology and, in particular, barriers and facilitators to its use with HIV populations.

The barriers and facilitators of diary methodology in HIV populations

Several barriers and facilitators for the use of diary methodology in HIV populations were identified from the interviews. The barriers and facilitators were presented within 7 key themes, with an additional theme identified in relation to the acceptability of the format of the specific diary used in study 1. The majority of the themes incorporated the views of both staff and service users. Given the extensive experience of the staff members interviewed (minimum of 6 years) this result is perhaps expected.

Summary of barriers. Multiple barriers were identified that may influence why PLHIV feel unable/choose not take part in diary research. These included barriers to uptake, including reluctance to approach PLHIV about research (staff specific barriers) and initial perceptions by PLHIV of research not being relevant or important, and barriers to participation i.e. barriers to diary completion once in the study. The latter includes both practical and emotional factors. For example, some PLHIV may feel psychologically able to complete the diaries (i.e. to think about and reflect on their experiences of HIV) but their lifestyle or unwillingness to prioritise the diary may lead to incomplete data being collected. Alternatively, some may lead stable lifestyles and would be able to complete the diary on a practical level but may find the emotional impact of taking part (i.e. being reminded of HIV status) too difficult.

The reluctance to approach PLHIV to participate in research was obviously only mentioned by staff interviewees, and was specific to the three doctors interviewed. The main reason given for reluctance was lack of capacity to support recruitment. The support workers

interviewed were not involved in the direct recruitment of participants into the study (rather they supported the CI to attend groups within Skyline during the recruitment period), and this may explain why they did not contribute to this theme. The lack of capacity mentioned by the doctors reflects the pressures that the NHS HIV service is currently experiencing and this may well be true of many such services. However, it may also be that the complexity of the method i.e. completing a diary rather than a survey may have required increased time for explanation and therefore more staff resource. This highlights that recruitment of PLHIV into future diary research may need to be completed by non-clinical staff. In addition, as the focus of the current study was adherence, for the staff this introduced a further complication of a perceived lack of confidence in talking to patients about adherence. The finding that staff felt hesitant to ask their patients to take part in studies investigating adherence, for fear of being perceived as 'policing adherence', was interesting and highlights the complex and sensitive nature of conversations about suboptimal adherence between clinicians and service users.

Service user interviewees contributed to a theme around the diaries having the potential to evoke negative emotions in PLHIV, which may be a potential barrier. In particular, it was reported that the diary had the potential to be a difficult, frequent reminder of living with HIV; this is not a barrier that has been identified in previous investigations of the barriers of diary research with PLHIV. Cherenack et al's (2016) study explored the facilitators and barriers of diary research with PLHIV who had actually been able to take part in diary research i.e. potentially a different sample to the people interviewed in the current study, and meaning that there are likely to be different barriers identified when exploring barriers and facilitators within the wider HIV population (i.e. including groups that have not taken part in a diary study).

The finding that fear of HIV being exposed (i.e. that others would see that the diary relates to HIV) is a barrier to participation is supported by previous research on the stigma that is still associated with HIV, in that many PLHIV often choose to hide their HIV status (Katz et al., 2013) and may not choose to participate in research that they fear risks exposure of HIV status. Although they did not directly investigate the barriers and facilitators, during discussion of their diary findings, Cook et al. (2010) also suggested that stigma associated with living with HIV might be an important factor that prevents PLHIV participation in diary research.

A number of the barriers identified appeared to relate to the specific barriers that marginalised groups may face, for example, a language barrier, in addition to research not being a priority due to living in difficult social circumstances. Furthermore, it was suggested that some groups might be less likely to trust research due to a lack of familiarity with UK health systems (i.e. groups who may not be originally from the UK). Therefore, there may have been more barriers associated with diary methodology for marginalised groups compared with white British PLHIV. Given that 44.7% of the UK HIV population are from ethnic minority groups (Public Health England, 2016a), in addition to suggestions in the literature that in the UK a large proportion of newly diagnosed individuals were not born in the UK (Clark and Mytton,

2007), there may have been specific barriers to participation for a large proportion of the target sample.

Summary of facilitators. Despite the multiple barriers associated with participation in diary research for PLHIV, a number of facilitators were also identified. These related to factors that were likely to increase uptake such as perceptions that taking part will have benefits for the wider HIV population, in addition to perceptions of the individual benefits of participation. The facilitator category also incorporated factors that may increase diary completion i.e. taking part in the diary may result in benefits for participants in terms of increased self-reflection. The category also included views regarding future facilitators of diary methods in HIV populations named 'solutions to enhance participation'.

In terms of facilitators of diary study uptake, there was a consensus that increasing understanding of adherence to ART was an important area of research. It was acknowledged by both staff and service users that adherence to ART is complex; both groups expressed a desire for research to be conducted in order to increase understanding of the day-to-day factors associated with adherence. The staff had a 'desire to understand' whereas the service users expressed a 'desire to be understood'. This finding fits with the agreement within the literature regarding a lack of clarity regarding ART adherence interventions, lack of clarity regarding the variables associated with adherence, in addition to a lack of a coherent predictive model of adherence (Kanters et al., 2016; Langebeek et al., 2014).

In terms of facilitators relating to individual benefits of participation, both staff and service users recognised that participation was an opportunity for service users to help others with HIV, in addition to being an opportunity to 'give back' to services. The subtheme regarding perceptions that participants may benefit from taking part due to increased self-reflection was also identified as a facilitator of participation by Cherenack et al. (2016). It perhaps links to the idea that for some participants i.e. those who have few difficulties with adherence, the process of participation may be positive and confidence boosting. Alternatively, for those who have difficulty with adherence it provides an opportunity to gain increased insight into day-to-day experiences and which factors are contributing towards difficulty. This theme may also contradict the barrier that for some, the completion of the diary can have a negative impact i.e. it is a frequent reminder of HIV status. The contradictory themes highlight the variety of experiences of living with HIV within the HIV population. This may provide an additional explanation for why some groups perceived the diary to be acceptable and positive whereas some groups were unable/ chose not to participate. Nevertheless, given that the opportunity for self-reflection was identified as a potential facilitator of diary methodology, it may be important for future studies to emphasise this potential benefit during recruitment.

Solutions to increase participation related to taking steps to minimise participant burden, and emphasising the benefits of participation i.e. individual benefits in addition to benefits for the wider HIV population. This may be important in the recruitment phase in future

studies. It may also link to the perceptions of staff that more resource was required in the recruitment phase of the diary study outlined in study 1, staff felt that more conversations between potential participants and the recruiter that incorporated discussion about the benefits of participation may have aided recruitment. The final subtheme regarding the suggestion that participants have more space to provide views about their own experiences contradicts the earlier subtheme regarding minimising participant burden. These contrasting themes relating to the need to minimise burden at the same time as providing participants with adequate opportunity to share their experiences link to discussions within the literature regarding the difficulty when conducting diary studies associated with the trade off between obtaining adequate information and minimising participant burden (Iida et al., 2012).

Monetary compensation was suggested as a potential facilitator in terms of individual benefits for participants. The monetary compensation offered within this study was significantly less than that offered in previous HIV diary studies (Cherenack et al., 2016), therefore lack of monetary compensation may have been a barrier to participation in this particular study but if used could be a facilitator in future studies.

Acceptability of the format. Overall, the comments relating to the acceptability of the specific diary format used in study 1 related to the individual questions used in the initial questionnaire and the diary, the burden of the diary, in addition to views regarding the pros and cons of a paper diary. A number of participants wondered whether there were too many questions; in addition to highlighting that for some participants (particularly individuals for whom English is not a first language) the paper work and number of questions may have been overwhelming.

The individual questions used were deemed to be acceptable and relevant to the experience of having HIV. This was perhaps reflective of the extensive process of service user and staff involvement in the design phase of the questionnaires. Furthermore, the questions used were selected based on factors that had been posited within the literature as potentially important in influencing behaviour change and adherence, providing an explanation for why the questions were judged as being relevant to experiences of having HIV.

There were differing opinions between the staff and service users regarding whether or not the paper diary format was a barrier to participation. The majority of staff members suggested that the paper diary was a barrier due to the inconvenience of needing to carry it around, in addition to the paper diary resulting in increased risk of HIV exposure. It was suggested that a diary that could be completed electronically would have been preferable for many service users. Contrastingly, all of the service users who discussed the topic of paper versus electronic diary indicated a preference for the paper format, however, all of these participants were aged over 35, therefore, it is possible that a younger age group hold a different view. Additionally, one person who participated in the diary study suggested that an electronic diary might have improved their experience of participation.

5.2 Methodological considerations

5.2.1 Strengths

A key strength of this study was the significant amount of staff and service user involvement in the development of the methodology. An additional strength of the measures used in the initial questionnaire was that the majority were based on standardised questionnaires that have been used previously in similar populations. A further strength of this study relates to the use and subsequent evaluation of a methodology that has not been frequently used with PLHIV, particularly in the UK. Furthermore, to our knowledge no diary studies with PLHIV have explored daily variance in adherence and the variables associated with adherence simultaneously. The outcomes of the study contribute to the literature in two ways. Firstly, the outcomes of the diary study have provided insight into the factors that may impact day-to-day fluctuation in adherence (timing) behaviour. Secondly, the outcomes of both the diary study component and the interview component will contribute to the literature in terms of how this methodology can be adjusted and used more successfully in future studies with HIV populations. Cherenack et al's (2016) study utilised interviews to explore the barriers and facilitators of diary methods for PLHIV, however the study was restricted to individuals who had just completed a diary study. The interviews within this study therefore extend the existing literature through investigating the barriers and facilitators of diary methodology with service users who had not participated in the diary study, in addition to gaining staff views.

5.2.2 Limitations

Recruitment

Participants for both parts (1 and 2) of the study were recruited at two sites covering the same area (urban area in the north of England), meaning that it may be difficult to generalise the results beyond this area. In relation to the diary study, it was difficult to estimate a response rate because the CI was reliant on the staff teams at the recruitment sites in providing potential participants information about the project and therefore it was not possible to estimate the number of participants given information about the project (i.e. the step before receiving a 'recruitment pack'). Furthermore, the staff teams involved in recruitment reported having limited time available to engage in research activity, meaning that there were likely to have been times during the recruitment period when potential participants were not given information about the study. Additionally, only participants who were engaging with services and attending appointments were recruited, meaning that individuals experiencing difficulties with adherence were unlikely to have been invited to take part.

Limitations of the diary study

Sample. Despite efforts to recruit a large sample, the final number of diaries that could be used in the analysis (n = 18) was lower than hoped for. This meant that the statistical analysis was underpowered, it also limits generalisation of the findings to the wider HIV population. As stated above, certain groups (i.e. females and BME groups) were under-represented. This finding is similar to Cook et al's (2010) USA based diary study of PLHIV, which reported high attrition rates and under-representation of ethnic minority groups.

There may also have been bias within the sample relating to the possibility that individuals who took part in this study (i.e. who were adherent to the diary) are also likely to be adherent to their medication compared with those who did not take part. For example, the factors that made it possible for individuals to take part may also be factors that enable better adherence to medication (e.g. stability in home life, time, adjustment to HIV diagnosis). Although steps were taken to minimise the burden of taking part on participants (e.g. option to complete initial questionnaire in clinic, different modes of returning completed questionnaires/diaries, and efforts to keep all of the measures short), taking part was still likely to place a certain level of burden on participants. It may be that potential participants leading stressful lives/ who had multiple responsibilities were less likely to take part.

Measures. Both the initial questionnaire and the diary were reliant on self-report, therefore responses may have been influenced by social desirability bias, in addition to variation in how participants interpreted and responded to the scales. All of the questionnaires and diaries used were paper based; this format was selected to minimise the chances of some groups being excluded from taking part (i.e. those without access to the internet). However, there were mixed opinions within the interviews, with some holding the view that an electronic diary would have been more convenient, in addition to reducing disclosure concerns. An additional limitation of the paper-based diary was that there was no way to control whether participants completed their diaries as intended. For example, it is unknown whether some participants 'back filled' the diaries. Although this is a limitation frequently reported in the diary study literature, paper diaries continue to be used (Feuerhahn et al., 2014). Diary methodology provides more insight into adherence behaviour over time in comparison to a cross-sectional study design, however, this diary was limited to 14 days. It provided only a 'snapshot' of adherence behaviour, it may be that diaries over extended periods (i.e. 6 months) provide differing outcomes.

The diary. There were a number of limitations associated with the diary. Firstly, there is not an existing standardised diary to measure adherence and the variables associated with adherence simultaneously, therefore the diary was devised specifically for this study. Although the diary items were based on theory, in addition to variables that have been previously associated with adherence, it is difficult to conclude that the concepts that were intended to be measured were actually measured. Furthermore, a number of the constructs measured in the diary (i.e. confidence in taking medication and perceived side effects) were reliant on a single

item rather than a scale; therefore the extent that the single items are able to measure the intended construct may be limited. The sleep measure included in the diary was potentially limiting due to only allowing sleep to be reported as 'good' or 'poor'. One participant commented that their sleep was somewhere in between this. The inclusion of a scale i.e. for participants to rate their sleep on a scale of 1-10 between good and poor may have provided more in-depth information regarding participants' sleep.

Adherence measure. The measure of adherence was reliant on self-report, which as previously stated may have been vulnerable to social desirability bias. Although the majority of participants reported optimal adherence in terms of whether they had taken all of their tablets, a number of participants reported that they had not taken their medications at the correct time. The diary did not require participants to provide an objective measure of the extent of the incorrect timing (i.e. incorrect time by how many minutes) but rather the extent that they agreed or disagreed that the medication had been taken at the correct time. This was therefore based on subjective interpretation. It may be useful for a future measure of adherence to require participants to indicate the incorrect timing of their medication dose by minutes.

Furthermore, the calculation of adherence assumes that participants are correct in reporting the number of tablets they are required to take per day, for example, it does not allow for the possibility that a participant may be incorrect when they report the number of tablets that they are required to take. In the study development process the possibility of a member of the staff team recording the medications that the participant is prescribed and then matching this with the participants' self-reported medication was discussed, however, this was not possible due to limited staff time. In the initial study design a measure of participants recent viral load was intended to corroborate the reliability of participants self-reported adherence. However, as only one participant returned diaries and had a viral load recording it was not possible to include viral load recordings in the final analysis. There are a number of explanations for the high rates of reported adherence within the sample. For example, it may be that the attributes required to take part in the diary (e.g. commitment, organisation, stable lifestyle) are similar to those required for good adherence. It is also possible that individuals who are interested in and believe in the importance of adherence may have been attracted to taking part and are also more likely to be adherent.

The reliability and validity of the adherence measure should also be considered. Despite findings in the literature that participation in diary research does not influence usual behaviour (Cook et al., 2010), it is also possible that participation in the diary resulted in better adherence during that period. It may have been useful to include a question at the end of the diary asking whether taking part influenced usual adherence. Furthermore, although steps were taken to reduce the likelihood of social desirability bias (i.e. making all responses anonymous) some participants may not have reported their true adherence due to perceptions of poor adherence being undesirable. Additionally, participants may have found non-adherence difficult to report.

This may link to the finding in the qualitative interviews that facing non-adherence is difficult, in addition to some reports in the literature that self-reports of adherence provide an overestimated measure of adherence (Krishnan et al., 2012). This could provide an explanation for why those who took part did not report poor adherence, or alternatively why only good adherers participated.

Initial Questionnaire. In order to minimise participant burden, efforts were made to ensure that the initial questionnaire was short in length. The full version of the BMQ was used meaning that one full standardised questionnaire was included. However, of the other validated questionnaires used (the brief IPQ and Berger Stigma Scale) only items taken from each of the questionnaires were used, this may limit the extent to which these scales can be reported as reliable and valid.

Limitations of the staff and service user interviews

The small sample of participants interviewed makes the generalizability of the interview findings difficult. However, this is a common limitation of qualitative research and the benefits of the interviews relate to the opportunity for in depth exploration of the potential barriers and facilitators of diary methodology with PLHIV. Another limitation relates to the recruitment strategy, as participants were individuals who had volunteered to take part. It is possible that those who took part had a particular interest in HIV research. It is also possible that those who took part had a particular view regarding diary methodology (i.e. positive or negative) meaning that the topic was discussed from an existing viewpoint. Furthermore, the majority of the staff members interviewed had been involved with study one, either at the development or recruitment phase and therefore had an existing view and understanding of diary methodology used in HIV populations. It may also be important to acknowledge that the researcher conducting and analysing the interviews had developed and implemented the original diary study, highlighting an additional area of possible bias. To minimise bias it may have been preferable for a researcher who had not been involved in the diary study to complete the interviews, however available resources did not allow for this.

5.3 Future research

Recruitment/sample. Future diary research with PLHIV should aim for a larger, more diverse sample. It may be that HIV diary research requires additional resources that were unavailable for this project; for example, time spent recruiting participants, in addition to available monetary compensation to give to participants. As already suggested by Cherenack et al. (2016) further research is required to assess differing levels of monetary compensation and the subsequent impact of this on recruitment into HIV diary studies. Within this study, recruitment took place at two sites, future diary research may need to take place at multiple sites

in order to maximise participation. Given constraints on staff time in order to support recruitment, it may also be beneficial for future studies (with available resources) to have researchers at the recruitment site at all times in order to support recruitment. Future research should also monitor the number of potential participants who are given information about the project so that uptake rates can be monitored accurately. It may also be useful for future research to record the reasons why eligible participants choose not to take part. This would provide further insight into barriers to participation. It was not possible to do this within this study due constraints on the recruiters' (HIV staff) time.

A larger sample may have resulted in greater variability in adherence being reported, enabling increased exploration of the factors influencing adherence. It would also enable firmer conclusions regarding the day-to-day variables associated with the timing of medication. A larger sample may have also allowed comparisons between different subgroups in the HIV population (i.e. age, gender or ethnicity) and therefore identification of different patterns of adherence in different groups. Nevertheless, the fluctuating nature of accurate timing of medication even within a group that are likely to be relatively good adherers was interesting and highlights the difficulties associated with adherence even within a group of 'good adherers'.

In future research more may need to be done to accommodate difficult to reach groups i.e. through translating diaries into different languages for non-English speakers. It may also be that diary studies are not feasible in some groups and alternate ways to gain information regarding the day-to-day factors influencing health behaviours need to be explored. For example, through collecting retrospective information about daily experiences every three days, or with data collected verbally (i.e. over the phone) rather than asking participants to record their experiences in writing.

Diary format. Many suggestions for future diary research were made by participants (both PLHIV and HIV staff) highlighting the importance of involving the target population and staff teams within the development of future studies. Future diary studies within HIV populations should explore differing diary formats. For example, as previously stated, it may be that only diaries conducted over a longer period of time will gain true insight into factors influencing fluctuating adherence. Additionally, a shorter diary format, for example, 1 A4 page per day may reduce participant burden and therefore increase participation. It may also be useful for future studies to compare the use of electronic versus paper formats within HIV populations. The suggestion by one participant for the two-week diary to be completed over two non-consecutive weeks may also provide a way to gain insight into day-to-day adherence over time without the associated burden of participants completing, for example, a six month diary. It may also be useful for future studies to consistently collect participants recent viral load recordings in order to ensure the reliability of self-report.

5.4 Clinical Implications

The discussion of the clinical implications of this study is limited and therefore tentative due to the limitations associated with the generalisability of the sample. The aim of exploring the factors that influence daily fluctuation in adherence was limited due to the high dose adherence rates reported by participants (i.e. all participants reported that they took their prescribed tablets each day). Nevertheless, there was variation in reported timing of medication (i.e. whether medication was taken at the correct time), which can be discussed.

The finding that optimal timing of medication taking varied even within a sample that could be viewed as 'good adherers' may highlight the importance of adherence support for all HIV service users rather than just those identified as at risk of poor adherence. This finding may lend support for the question regarding whether optimal adherence is possible and that despite its importance, the potential need to acknowledge and perhaps 'normalise' that suboptimal adherence may sometimes be unavoidable (O'Toole, 2012). This point may also link to the difficulties reported by staff within the qualitative interviews regarding having conversations with service users about adherence. In that they can feel as though they are 'policing' adherence, it could be posited that if non-adherence was more easily acknowledged the difficulty associated with conversations about adherence may be reduced.

The finding that anticipatory negative affect was associated with optimal adherence at low and moderate levels of illness threat, concern about medication, but at the highest levels of these variables it was associated with suboptimal adherence, may have clinical relevance. Although a tentative suggestion, it may be that there is an optimal level of concern/threat regarding HIV but when this is too high the impact of anticipatory negative affect on adherence becomes counterproductive (rather than motivating at lower levels). This finding may lend support for the use of interventions such as Cognitive Behavioural Therapy, which assist individuals in identifying and overcoming problematic cognitions and beliefs that may impact adherence.

It was also of note that both staff and service users expressed a desire for research within the area of adherence so that an increased understanding of the intricacies (i.e. the day to day factors) of non-adherence could be established. This highlighted the importance of further exploration of how this research method can be translated effectively to clinical populations. The difficulty translating this method to a HIV population has added complexity compared with other chronic conditions due to the high level of stigma associated with living with HIV. Nevertheless, it is important that when future diary studies are implemented the needs of all members of the target group are considered in order to maximise the likelihood of representative participation. If research fails to provide insight into the experiences of marginalised groups, services and clinical guidelines that are often based on research will fail to meet the needs of under-represented groups.

5.5 Conclusions

The small sample size (n = 18) and under-representation of certain groups (i.e. women, BME groups and individuals with difficulties adhering) indicated that the diary methodology used within this study was feasible for some groups but not others. This also means that the results from the diary study are limited and conclusions tentative. Within the diary study, the day-to-day variables attitude (positive) and anticipatory negative affect associated with non-adherence were associated with optimal adherence timing. The associations between these daily variables and optimal adherence timing were moderated by a number of variables. Firstly, the association between anticipatory negative affect and optimal adherence timing was weaker at high scores on the following four moderating variables: IPQ scale (illness threat), perceived HIV stigma, overuse beliefs (belief that doctors place too much emphasis on medications) and concerns about medication. Second, the association between attitude and optimal adherence timing was weaker at high scores on two moderating variables: overuse beliefs and perceived HIV stigma. These results enable the tentative conclusion that having a positive attitude towards treatment regime, in addition to anticipating feeling guilty/regretful about not taking medications contribute to improved adherence timing. Additionally, the results indicate that as beliefs about the threat associated with HIV increase (i.e. increased concern, stigma and illness threat) the ability of attitude and anticipatory regret/guilt to predict optimal adherence timing reduces.

The interviews conducted with HIV staff and service users resulted in the identification of a number of facilitators and barriers to using diary methodology in HIV populations. Identified barriers to completing diaries included barriers on a practical level (e.g. time and willingness to prioritise taking part) in addition to barriers on an emotional level (e.g. diaries being a difficult reminder of HIV). This study extends the literature regarding the feasibility of translating a methodology most commonly used within healthy populations for use within a chronic illness, and specifically a HIV population.

References

AIDS info: Panel on Antiretroviral Guidelines for Adults and Adolescents. (2016). *Guidelines for the use of antiretroviral agents in HIV-1-infected adults and adolescents.* [on-line].http://www.aidsinfo.nih.gov/ContentFiles/AdultandAdolescentGL.pdf. Accessed 17th January 2017.

Airoldi, M., Zaccarelli, M., Bisi, L., Bini, T., Antinori, A., Mussini, C., ... & Suter, F. (2010). One-pill once-a-day HAART: A simplification strategy that improves adherence and quality of life of HIV-infected subjects. *Patient Preference and Adherence*, *4*, 115-125.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211.

Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychology & Health*, *26*(9), 1113-1127.

Andrade, A. S., Deutsch, R., Celano, S., Duarte, N. A., Marcotte, T. D., Umlauf, A., ... & McArthur, J. (2013). Relationships among neurocognitive status, medication adherence measured by pharmacy refill records, and virologic suppression in HIV-infected persons. *Journal of Acquired Immune Deficiency Syndromes (1999)*, *62*(3), 282-292.

Arnsten, J. H., Demas, P. A., Grant, R. W., Gourevitch, M. N., Farzadegan, H., Howard, A. A., & Schoenbaum, E. E. (2002). Impact of active drug use on antiretroviral therapy adherence and viral suppression in HIV-infected Drug Users. *Journal of General Internal Medicine*, *17*(5), 377-381.

Aronson, J. K. (2007). Compliance, concordance, adherence. *British Journal of Clinical Pharmacology*, *63*(4), 383-384.

Asboe, D., Aitken, C., Boffito, M., Booth, C., Cane, P., Fakoya, A., ... & Murphy, G. (2012). British HIV Association guidelines for the routine investigation and monitoring of adult HIV-1-infected individuals 2011. *HIV Medicine*, *13*(1), 1-44.

Baral, S., Logie, C. H., Grosso, A., Wirtz, A. L., & Beyrer, C. (2013). Modified social ecological model: a tool to guide the assessment of the risks and risk contexts of HIV epidemics. *BMC Public Health*, *13*(1), 482- 490.

Barclay, T. R., Hinkin, C. H., Castellon, S. A., Mason, K. I., Reinhard, M. J., Marion, S. D., ... & Durvasula, R. S. (2007). Age-associated predictors of medication adherence in HIV-

positive adults: health beliefs, self-efficacy, and neurocognitive status. *Health Psychology*, *26*(1), 40-49.

Barta, W. D., Portnoy, D. B., Kiene, S. M., Tennen, H., Abu-Hasaballah, K. S., & Ferrer, R. (2008). A daily process investigation of alcohol-involved sexual risk behavior among economically disadvantaged problem drinkers living with HIV/AIDS. *AIDS and Behavior*, *12*(5), 729-740.

Belzer, M. E., Naar-King, S., Olson, J., Sarr, M., Thornton, S., Kahana, S. Y., ... & Adolescent Medicine Trials Network for HIV/AIDS Interventions. (2014). The use of cell phone support for non-adherent HIV-infected youth and young adults: An initial randomized and controlled intervention trial. *AIDS and Behavior*, *18*(4), 686-696.

Berben, L., Dobbels, F., Engberg, S., Hill, M. N., & De Geest, S. (2012). An ecological perspective on medication adherence. *Western Journal of Nursing Research*, *34*(5), 635-653.

Berg, C. A., Wiebe, D. J., Suchy, Y., Hughes, A. E., Anderson, J. H., Godbey, E. I., ... & King, P. S. (2014). Individual differences and day-to-day fluctuations in perceived self-regulation associated with daily adherence in late adolescents with type 1 diabetes. *Journal of Pediatric Psychology*, *39*(9), 1038-1048.

Berg, J., Dunbar-Jacob, J., & Rohay, J. M. (1998). Compliance with inhaled medications: The relationship between diary and electronic monitor. *Annals of Behavioral Medicine*, *20*(1), 36-38.

Berg, K. M., Demas, P. A., Howard, A. A., Schoenbaum, E. E., Gourevitch, M. N., & Arnsten, J. H. (2004). Gender differences in factors associated with adherence to antiretroviral therapy. *Journal of General Internal Medicine*, *19*(11), 1111-1117.

Berger, B. E., Ferrans, C. E., & Lashley, F. R. (2001). Measuring stigma in people with HIV: Psychometric assessment of the HIV stigma scale. *Research in Nursing & Health*, *24*(6), 518-529.

Blackwell, L. S., & Quittner, A. L. (2015). Daily pain in adolescents with CF: Effects on adherence, psychological symptoms, and health-related quality of life. *Pediatric Pulmonology*, *50*(3), 244-251.

Bogart, L. M., Wagner, G., Galvan, F. H., & Banks, D. (2010). Conspiracy beliefs about HIV are related to antiretroviral treatment nonadherence among African American men with HIV. *Journal of Acquired Immune Deficiency Syndromes, 53*, 648–655.

Bogart, L. M., Wagner, G. J., Green, H. D., Mutchler, M. G., Klein, D. J., McDavitt, B., ... & Hilliard, C. L. (2016). Medical mistrust among social network members may contribute to antiretroviral treatment nonadherence in African Americans living with HIV. *Social Science & Medicine*. *164*, 133-140.

Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology*, *54*(1), 579-616.

Bonner, K., Mezochow, A., Roberts, T., Ford, N., & Cohn, J. (2013). Viral load monitoring as a tool to reinforce adherence: A systematic review. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, *64*(1), 74-78.

Brandes, K., & Mullan, B. (2014). Can the common-sense model predict adherence in chronically ill patients? A meta-analysis. *Health Psychology Review*, *8*(2), 129-153.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101.

British HIV association. (2016). British association guidelines for the treatment of HIV-1-positive adults with antiretroviral therapy 2015 (2016 interim update). http://www.bhiva.org/documents/Guidelines/Treatment/2016/treatment-guidelines-2016-interim-update.pdf Accessed November 13th 2016

Broadbent, E., Petrie, K. J., Main, J., & Weinman, J. (2006). The brief illness perception questionnaire. *Journal of Psychosomatic Research*, *60*(6), 631-637.

Broderick, J. E., & Stone, A. A. (2006). Paper and electronic diaries: Too early for conclusions on compliance rates and their effects--Comment on Green, Rafaeli, Bolger, Shrout, and Reis (2006). *Psychological Methods*, *11*(1), 106-111.

Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by nature and Design*. Cambridge: Harvard University Press.

Brown, J. L., Littlewood, R. A., & Vanable, P. A. (2013). Social-cognitive correlates of antiretroviral therapy adherence among HIV-infected individuals receiving infectious disease care in a medium-sized northeastern US city. *AIDS Care*, *25*(9), 1149-1158.

Cameron, L. D., & Leventhal, H. (Eds.). (2003). *The self-regulation of health and illness behavior*. New York: Routledge.

Carcary, M. (2009). The research audit trial–enhancing trustworthiness in qualitative inquiry. *The Electronic Journal of Business Research Methods*, *7*(1), 11-24.

Carpenter, C. C., Cooper, D. A., Fischl, M. A., Gatell, J. M., Gazzard, B. G., Hammer, S. M., ... & Richman, D. D. (2000). Antiretroviral therapy in adults: Updated recommendations of the International AIDS Society–USA Panel. *JAMA*, *283*(3), 381-390.

Carpenter, C. J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Communication*, *25*(8), 661-669.

Carr, A., & Cooper, D. A. (2000). Adverse effects of antiretroviral therapy. *The Lancet*, *356*(9239), 1423-1430.

Castro, E. M., Santiago, L. E., Jiménez, J. C., Dávila-Vargas, D., & Rosal, M. C. (2015). A Social-Ecological View of Barriers and Facilitators for HIV Treatment Adherence: Interviews with Puerto Rican HIV Patients. *PloS One*, *10*(9), [on-line]. http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0125582&type=printable Accessed 6th December 2016.

Chaiyachati, K. H., Ogbuoji, O., Price, M., Suthar, A. B., Negussie, E. K., & Barnighausen, T. (2014). Interventions to improve adherence to antiretroviral therapy: A rapid systematic review. *Aids*, *28* [on-line]. http://www.who.int/hiv/pub/journal_articles/13_improve_arv_adherence.pdf Accessed 7th November 2016.

Champion, V. L., & Skinner, C. S. (2008). The Health Belief Model. *Health Behavior and Health Education: Theory, Research, and Practice*, *4*, 45-65.

Cherenack, E. M., Wilson, P. A., Kreuzman, A. M., Price, G. N., & Adolescent Medicine Trials Network for HIV/AIDS Interventions. (2016). The Feasibility and Acceptability of

Using Technology-Based Daily Diaries with HIV-Infected Young Men Who have Sex with Men: A Comparison of Internet and Voice Modalities. *AIDS and Behavior*, 1-10.

Chesney, M. A., Ickovics, J., Hecht, F. M., Sikipa, G., & Rabkin, J. (1998). Adherence: A necessity for successful HIV combination therapy. *AIDS, 13*, 271-278.

Chesney, M. A. (2000a). Factors affecting adherence to antiretroviral therapy. *Clinical Infectious Diseases*, *30* (Supplement 2), 171-176.

Chesney, M. A., Ickovics, J. R., Chambers, D. B., Gifford, A. L., Neidig, J., Zwickl, B., & Patient care committee and adherence working group of the outcomes committee of the adult aids clinical tials group (AACTG). (2000b). Self-reported adherence to antiretroviral medications among participants in HIV clinical trials: the AACTG adherence instruments. *AIDS Care*, *12*(3), 255-266.

Chinouya, M., Hildreth, A., Goodall, D., Aspinall, P., & Hudson, A. (2014). Migrants and HIV stigma: findings from the Stigma Index Study (UK). *Health & Social Care in the Community*, *25* (1), 35-42.

Clark, R. C., & Mytton, J. (2007). Estimating infectious disease in UK asylum seekers and refugees: A systematic review of prevalence studies. *Journal of Public Health*, *29*(4), 420-428.

Claxton, A. J., Cramer, J., & Pierce, C. (2001). A systematic review of the associations between dose regimens and medication compliance. *Clinical Therapeutics*, *23*(8), 1296-1310.

Clifford, S., Barber, N., & Horne, R. (2008). Understanding different beliefs held by adherers, unintentional nonadherers, and intentional nonadherers: application of the necessity–concerns framework. *Journal of Psychosomatic Research*, *64*(1), 41-46.

Cohen-Cymberknoh, M., Shoseyov, D., & Kerem, E. (2011). Managing cystic fibrosis: Strategies that increase life expectancy and improve quality of life. *American Journal of Respiratory and Critical Care Medicine*, *183*(11), 1463-1471.

Connelly, M., Bromberg, M. H., Anthony, K. K., Gil, K. M., Franks, L., & Schanberg, L. E. (2012). Emotion regulation predicts pain and functioning in children with juvenile idiopathic arthritis: An electronic diary study. *Journal of Pediatric Psychology*, *37*(1), 43-52.

Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenues for further research. *Journal of Applied Social Psychology*, *28*, 1429-1464.

Conner, M., Fitter, M., & Fletcher, W. (1999). Stress and snacking: A diary study of daily hassles and between-meal snacking. *Psychology and Health*, *14*(1), 51-63.

Cook, P. F., McElwain, C. J., & Bradley-Springer, L. A. (2010). Feasibility of a daily electronic survey to study prevention behavior with HIV infected individuals. *Research in Nursing & Health*, *33*(3), 221-234.

Cook, C., Heath, F., & Thompson, R. L. (2000). A meta-analysis of response rates in web or internet-based surveys. *Educational and psychological measurement*, *60*(6), 821-836.

de Wit, R., van Dam, F., Hanneman, M., Zandbelt, L., van Buuren, A., van der Heijden, K., ... & Abu-Saad, H. H. (1999). Evaluation of the use of a pain diary in chronic cancer pain patients at home. *Pain*, *79*(1), 89-99.

Delgado, J., Heath, K. V., Yip, B., Marion, S., Alfonso, V., Montaner, J. S., ... & Hogg, R. S. (2003). Highly active antiretroviral therapy: Physician experience and enhanced adherence to prescription refill. *Antiviral Therapy*, *8*(5), 471-478.

Department of Health. (2011). *Physical activity guidelines in the UK: review and recommendations.* [on-line]. https://www.gov.uk/ government/publications/uk-physical-activity-guidelines Accessed 29th June 2017

DiMatteo, M. R., Lepper, H. S., & Croghan, T. W. (2000). Depression is a risk factor for noncompliance with medical treatment: Meta-analysis of the effects of anxiety and depression on patient adherence. *Archives of Internal Medicine*, *160*(14), 2101-2107.

DiMatteo, M. R., Giordani, P. J., Lepper, H. S., & Croghan, T. W. (2002). Patient adherence and medical treatment outcomes: A meta-analysis. *Medical Care*, *40*(9), 794-811.

DiMatteo, M. R. (2004). Social support and patient adherence to medical treatment: A meta-analysis. *Health Psychology*, *23*(2), 207-218.

Dlamini, P. S., Wantland, D., Makoae, L. N., Chirwa, M., Kohi, T. W., Greeff, M., ... & Holzemer, W. L. (2009). HIV stigma and missed medications in HIV-positive people in five African countries. *AIDS Patient Care and STDs*, *23*(5), 377-387.

Dowshen, N., Kuhns, L. M., Gray, C., Lee, S., & Garofalo, R. (2013). Feasibility of interactive text message response (ITR) as a novel, real-time measure of adherence to antiretroviral therapy for HIV+ youth. *AIDS and Behavior*, *17*(6), 2237-2243.

Dutta, A., Barker, C., & Kallarakal, A. (2015). The HIV treatment gap: Estimates of the financial resources needed versus available for scale-up of antiretroviral therapy in 97 Countries from 2015 to 2020. *PLoS Med*, *12*(11) [on-line] http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001907 Accessed 16th August 2016.

Elford, J., Ibrahim, F., Bukutu, C., & Anderson, J. (2008). HIV-related discrimination reported by people living with HIV in London, UK. *AIDS and Behavior*, *12*(2), 255-264.

Fabbiani, M., Di Giambenedetto, S., Cingolani, A., Fanti, I., Colafigli, M., Tamburrini, E., ... & Murri, R. (2016). Relationship between self-reported adherence, antiretroviral drug concentration measurement and self-reported symptoms in patients treated for HIV-1 infection. *Infectious Diseases*, *48*(1), 48-55.

Feuerhahn, N., Sonnentag, S., & Woll, A. (2014). Exercise after work, psychological mediators, and affect: A day-level study. *European Journal of Work and Organizational Psychology*, *23*(1), 62-79.

Field, A. (2013). *Discovering Statistics using IBM SPSS Statistics. (*4th ed*.).* London: Sage.

Fogarty, L., Roter, D., Larson, S., Burke, J., Gillespie, J., & Levy, R. (2002). Patient adherence to HIV medication regimens: A review of published and abstract reports. *Patient Education and Counseling*, *46*(2), 93-108.

Freeman, L. M. Y., & Gil, K. M. (2004). Daily stress, coping, and dietary restraint in binge eating. *International Journal of Eating Disorders*, *36*(2), 204-212.

Gao, X., Nau, D. P., Rosenbluth, S. A., Scott, V., & Woodward, C. (2000). The relationship of disease severity, health beliefs and medication adherence among HIV patients. *AIDS Care*, *12*(4), 387-398.

Garber, M. C., Nau, D. P., Erickson, S. R., Aikens, J. E., & Lawrence, J. B. (2004). The concordance of self-report with other measures of medication adherence: a summary of the literature. *Medical Care*, *42*(7), 649-652.

Gardner, C. L. (2015). Adherence: A concept analysis. *International Journal of Nursing Knowledge*, *26*(2), 96-101.

Gaston, G. B., & Alleyne-Green, B. (2013). The impact of African Americans' beliefs about HIV medical care on treatment adherence: a systematic review and recommendations for interventions. *AIDS and Behavior*, *17*(1), 31-40.

Gianotti, N., Galli, L., Bocchiola, B., Cahua, T., Panzini, P., Zandona, D., ... & Lazzarin, A. (2013). Number of daily pills, dosing schedule, self-reported adherence and health status in 2010: A large cross-sectional study of HIV-infected patients on antiretroviral therapy. *HIV Medicine*, *14*(3), 153-160.

Gonzalez, J. S., Penedo, F. J., Llabre, M. M., Durán, R. E., Antoni, M. H., Schneiderman, N., & Horne, R. (2007). Physical symptoms, beliefs about medications, negative mood, and long-term HIV medication adherence. *Annals of Behavioral Medicine*, *34*(1), 46-55.

Gonzalez, J. S., Batchelder, A. W., Psaros, C., & Safren, S. A. (2011). Depression and HIV/AIDS treatment nonadherence: A review and meta-analysis. *Journal of Acquired Immune Deficiency Syndromes, 58*(2), 181-187.

Gonzalez, A., Mimiaga, M. J., Israel, J., Bedoya, C. A., & Safren, S. A. (2013). Substance use predictors of poor medication adherence: The role of substance use coping among HIV-infected patients in opioid dependence treatment. *AIDS and Behavior*, *17*(1), 168-173.

Gordon, E. J., Prohaska, T. R., Gallant, M. P., & Siminoff, L. A. (2007). Adherence to immunosuppression: A prospective diary study. *Transplantation Proceedings*, *39*(10), 3081-3085.

Goujard, C., Bernard, N., Sohier, N., Peyramond, D., Lançon, F., Chwalow, J., ... & Delfraissy, J. F. (2003). Impact of a patient education program on adherence to HIV medication. *Journal of Acquired Immune Deficiency Syndromes*, *34*(2), 191-194.

Green, A. S., Rafaeli, E., Bolger, N., Shrout, P. E., & Reis, H. T. (2006). Paper or plastic? Data equivalence in paper and electronic diaries. *Psychological Methods*, *11*(1), 87-105.

Grossman, C. I., & Stangl, A. L. (2013). Global action to reduce HIV stigma and discrimination. *Journal of the International AIDS Society*, *16*(3) [on-line].

http://www.jiasociety.org/index.php/jias/article/view/18881 Accessed 22nd December 2016.

Hagger, M. S., & Orbell, S. (2003). A meta-analytic review of the common-sense model of illness representations. *Psychology and Health*, *18*(2), 141-184.

Hamine, S., Gerth-Guyette, E., Faulx, D., Green, B. B., & Ginsburg, A. S. (2015). Impact of mHealth chronic disease management on treatment adherence and patient outcomes: A systematic review. *Journal of Medical Internet Research*, *17*(2) [on-line]. http://www.jmir.org/2015/2/e52/ Accessed on 27th December 2016.

Harrison, J. A., Mullen, P. D., & Green, L. W. (1992). A meta-analysis of studies of the health belief model with adults. *Health Education Research*, *7*(1), 107-116.

Herek, G. M., Capitanio, J. P., & Widaman, K. F. (2003). Stigma, social risk, and health policy: Public attitudes toward HIV surveillance policies and the social construction of illness. *Health Psychology*, *22*(5), 533-540.

Herstad, B. (2010). *Addressing Gender Issues Related to HIV Treatment Adherence Programs.* Washington, DC: Futures Group, Health Policy Initiative, Task Order 1. [on-line]. http://www.healthpolicyinitiative.com/Publications/Documents/1287_1_Gendertreatment_activity_report_FINAL_acc.pdf Accessed 17th January 2017.

Hill, S., & Kavookjian, J. (2012). Motivational interviewing as a behavioral intervention to increase HAART adherence in patients who are HIV-positive: A systematic review of the literature. *AIDS Care*, *24*(5), 583-592.

Hinkin, C. H., Hardy, D. J., Mason, K. I., Castellon, S. A., Durvasula, R. S., Lam, M. N., & Stefaniak, M. (2004). Medication adherence in HIV-infected adults: Effect of patient age, cognitive status, and substance abuse. *AIDS (London, England)*, *18*(Supplement 1), 19-25.

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., ... & Neubauer, D. N. (2015). National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health*, *1*(1), 40-43.

Hofmann, D. A. (1997). An overview of the logic and rationale of hierarchical linear models. *Journal of Management*, *23*(6), 723-744.

Horne, R., Weinman, J., & Hankins, M. (1999). The Beliefs About Medicines Questionnaire: The development and evaluation of a new method for assessing the cognitive representation of medication. *Psychology and Health*, *14*(1), 1-24.

Horne, R. (2000). Assessing perceptions of medication: Psychological perspectives. *Handbook of drug research methodology. Newcastle upon Tyne: United Kingdom Drug Utilisation Research Group*, 299-319.

Horne, R., Chapman, S. C., Parham, R., Freemantle, N., Forbes, A., & Cooper, V. (2013). Understanding patients' adherence-related beliefs about medicines prescribed for long-term conditions: A meta-analytic review of the Necessity-Concerns Framework. *PloS One*, *8*(12). [on-line]. http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0080633&type=printable Accessed 21st January 2017.

ICW, 2012. Positive Women: Voices and Choices, London: International Community of Women Living with HIV/AIDS (ICW). [on-line]. https://www.icw.org/icw/files/VoicesChoices.pdf Accessed 22nd November 2016

ICW, 2015. ICW Vision Paper 2: Access to Care, Treatment and Support (ACTS). [on-line]. http://www.hivlawandpolicy.org/sites/www.hivlawandpolicy.org/files/ICW%20Vision%20Paper%202.pdf Accessed 22nd November 2016

Iida, M., Shrout, P. E., Laurenceau, J.-P., & Bolger, N. (2012). Using diary methods in psychological research. In H. Cooper, P. Camic, D. Long, A. T. Panter, D. Rindskopf & K. Sher (Eds.), *APA Handbook of Research Methodology in Psychology.* Washington, DC: APA Books.

Ingersoll, K. S., & Cohen, J. (2008). The impact of medication regimen factors on adherence to chronic treatment: A review of literature. *Journal of Behavioral Medicine*, *31*(3), 213-224.

Janda, L. H., Markowski, E., Derlega, V. J., Nezlek, J., & McCain, N. (2006). Daily events and mood state among individuals living with HIV: Examination of the within-persons approach to data collection using daily diary methodology. *Journal of Nursing Measurement*, *14*(2), 116-128.

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education & Behavior*, *1*, 1-47.

Jones, C. J., Smith, H., & Llewellyn, C. (2014). Evaluating the effectiveness of health belief model interventions in improving adherence: A systematic review. *Health Psychology Review*, *8*(3), 253-269.

Jones, C. J., Smith, H. E., & Llewellyn, C. D. (2016). A systematic review of the effectiveness of interventions using the Common Sense Self-Regulatory Model to improve adherence behaviours. *Journal of Health Psychology*, *21*(11), 2709-2724.

Jones, F., O'Connor, D. B., Conner, M., McMillan, B., & Ferguson, E. (2007). Impact of daily mood, work hours, and iso-strain variables on self-reported health behaviors. *Journal of Applied Psychology*, *92*(6), 1731-1740.

Kagee, A., & Delport, T. (2010). Barriers to adherence to antiretroviral treatment: The perspectives of patient advocates. *Journal of Health Psychology*. 1001-1011.

Kalichman, S. C., Pellowski, J., Kegler, C., Cherry, C., & Kalichman, M. O. (2015). Medication adherence in people dually treated for HIV infection and mental health conditions: test of the medications beliefs framework. *Journal of Behavioral Medicine*, 1-10.

Kanters, S., Park, J. J., Chan, K., Socias, M. E., Ford, N., Forrest, J. I., ... & Mills, E. J. (2016). Interventions to improve adherence to antiretroviral therapy: A systematic review and network meta-analysis. *The Lancet HIV*. 4(1). [on-line]. http://www.sciencedirect.com/science/article/pii/S2352301816302065 Accessed 27th December 2016.

Karlson, C. W., Baker, A. M., Bromberg, M. H., Elkin, T. D., Majumdar, S., & Palermo, T. M. (2016). Daily pain, physical activity, and home fluid intake in pediatric sickle cell disease. *Journal of Pediatric Psychology*, *41*(10). [on-line]. http://jpepsy.oxfordjournals.org/content/early/2016/06/29/jpepsy.jsw061.short Accessed 21st January 2017.

Katz, I. T., Ryu, A. E., Onuegbu, A. G., Psaros, C., Weiser, S. D., Bangsberg, D. R., & Tsai, A. C. (2013). Impact of HIV-related stigma on treatment adherence: Systematic review and meta-synthesis. *Journal of the International AIDS Society*, *16*, [on-line]. http://www.jiasociety.org/jias/index.php/jias/article/view/18640/3254 Accessed 14th February 2016.

Kaufman, M. R., Cornish, F., Zimmerman, R. S., & Johnson, B. T. (2014). Health behavior change models for HIV prevention and AIDS care: practical recommendations for a

multi-level approach. *Journal of Acquired Immune Deficiency Syndromes (1999)*, *66*(3), [on-line]. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4536982/ Accessed 16th November 2016.

Kripalani, S., Yao, X., & Haynes, R. B. (2007). Interventions to enhance medication adherence in chronic medical conditions: A systematic review. *Archives of Internal Medicine*, *167*(6), 540-549.

Krishnan, J. A., Bender, B. G., Wamboldt, F. S., Szefler, S. J., Adkinson, N. F., Zeiger, R. S., Wise, R.A., Bilderback, A.L. & Rand, C.S. (2012). Adherence to inhaled corticosteroids: An ancillary study of the Childhood Asthma Management Program clinical trial. *Journal of Allergy and Clinical Immunology*,*129*(1), 112-118.

Langebeek, N., Gisolf, E. H., Reiss, P., Vervoort, S. C., Hafsteinsdóttir, T. B., Richter, C., ... & Nieuwkerk, P. T. (2014). Predictors and correlates of adherence to combination antiretroviral therapy (ART) for chronic HIV infection: A meta-analysis. *BMC Medicine*, *12*(1), 142. [on-line]. http://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-014-0142-1 Accessed 29th November 2016.

Law, G. U., Tolgyesi, C. S., & Howard, R. A. (2014). Illness beliefs and self-management in children and young people with chronic illness: A systematic review. *Health Psychology Review*, *8*(3), 362-380.

Leventhal, H., Brissette, I., Leventhal, E., A. (2003). The common sense model of self regulation of health and illness. In I.D. Cameron and H. Leventhal (Eds.), *The Self Regulation of Health and Illness Behaviour* (p. 42-65). London: Routledge.

Linnan, L. & Steckler A.,B. (2002). Process evaluation for public health interventions and research. In L. Linnan & A.B. Steckler (Eds.) *Process evaluation for public health interventions and research.* San Francisco: Jossey-Bass.

Liu, H., Golin, C. E., Miller, L. G., Hays, R. D., Beck, C. K., Sanandaji, S., ... & Wenger, N. S. (2001). A comparison study of multiple measures of adherence to HIV protease inhibitors. *Annals of Internal Medicine*, *134*(10), 968-977.

Losina, E., & Freedberg, K. A. (2011). Life expectancy in HIV. *BMJ*, *343*. [on-line]. http://www.bmj.com/content/343/bmj.d6015.extract Accessed 18th August 2016.

Lüscher, J., Stadler, G., Ochsner, S., Rackow, P., Knoll, N., Hornung, R., & Scholz, U. (2015). Daily negative affect and smoking after a self-set quit attempt: The role of dyadic invisible social support in a daily diary study. *British Journal of Health Psychology*, *20*(4), 708-723.

Maas, C. J., & Hox, J. J. (2004). Robustness issues in multilevel regression analysis. *Statistica Neerlandica*, *58*(2), 127-137.

Malta, M., Magnanini, M. M., Strathdee, S. A., & Bastos, F. I. (2010). Adherence to antiretroviral therapy among HIV-infected drug users: A meta-analysis. *AIDS and Behavior*, *14*(4), 731-747.

Mannheimer, S., Friedland, G., Matts, J., Child, C., Chesney, M., & Terry Beirn Community Programs for Clinical Research on AIDS. (2002). The consistency of adherence to antiretroviral therapy predicts biologic outcomes for Human Immunodeficiency Virus—infected persons in clinical trials. *Clinical Infectious Diseases*, *34*(8), 1115-1121.

Mannheimer, S., & Hirsch-Moverman, Y. (2015). What we know and what we do not know about factors associated with and interventions to promote antiretroviral adherence. *Current Infectious Disease Reports*, *17*(4), 1-8.

Max, B., & Sherer, R. (2000). Management of the adverse effects of antiretroviral therapy and medication adherence. *Clinical Infectious Diseases*, *30*(Supplement 2), 96-116.

Mburu, G., Ram, M., Oxenham, D., Haamujompa, C., Iorpenda, K., & Ferguson, L. (2014). Responding to adolescents living with HIV in Zambia: a social–ecological approach. *Children and Youth Services Review*, *45*, 9-17.

McCoy, K., Waldrop-Valverde, D., Balderson, B. H., Mahoney, C., & Catz, S. (2016). Correlates of antiretroviral therapy adherence among HIV-Infected older adults. *Journal of the International Association of Providers of AIDS Care (JIAPAC)*, *15*(3), 248-255.

McCullough, A. R., Ryan, C., Macindoe, C., Yii, N., Bradley, J. M., O'Neill, B., ... & Hughes, C. M. (2016). Behavior change theory, content and delivery of interventions to enhance

adherence in chronic respiratory disease: A systematic review. *Respiratory Medicine*, *116*, 78-84.

McDonald, H. P., Garg, A. X., & Haynes, R. B. (2002). Interventions to enhance patient adherence to medication prescriptions: Scientific review. *The Journal of the American Medical Association, 288*(22), 2868-2879.

McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the Theory of Planned Behaviour: A meta-analysis. *Health Psychology Review*, *5*(2), 97-144.

Medical Research Council. (2008). Developing and Evaluating Complex Interventions: New Guidance. [on-line]. https://www.mrc.ac.uk/documents/pdf/complex-interventions-guidance Accessed 23rd December 2016.

Mills, E. J., Nachega, J. B., Bangsberg, D. R., Singh, S., Rachlis, B., Wu, P., ... & Cooper, C. (2006). Adherence to HAART: A systematic review of developed and developing nation patient-reported barriers and facilitators. *PLoS Med*, *3*(11), 2040-2064.

Modi, A. C., Lim, C. S., Yu, N., Geller, D., Wagner, M. H., & Quittner, A. L. (2006). A multi-method assessment of treatment adherence for children with cystic fibrosis. *Journal of Cystic Fibrosis*, *5*(3), 177-185.

Montessori, V., Press, N., Harris, M., Akagi, L., & Montaner, J. S. (2004). Adverse effects of antiretroviral therapy for HIV infection. *Canadian Medical Association Journal*, *170*(2), 229-238.

Moss-Morris, R., Weinman, J., Petrie, K. J., Horne, R., Cameron, L.D., & Buick, D. (2002). The Revised Illness Perception Questionnaire (IPQ-R). *Psychology and Health. 17*, 1-16.

Munro, S., Lewin, S., Swart, T., & Volmink, J. (2007). A review of health behaviour theories: How useful are these for developing interventions to promote long-term medication adherence for TB and HIV/AIDS? *BMC Public Health*, *7*(1), 104. [on-line]. http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-7-104 Accessed 15th September 2016.

Murray, E., Treweek, S., Pope, C., MacFarlane, A., Ballini, L., Dowrick, C., ... & Ong, B. N. (2010). Normalisation process theory: A framework for developing, evaluating and implementing complex interventions. *BMC medicine*, *8*(1), 63. [on-line]. https://bmcmedicine.biomedcentral.com/articles/10.1186/1741-7015-8-63 Accessed 17th January 2017.

Nachega, J. B., Parienti, J. J., Uthman, O. A., Gross, R., Dowdy, D. W., Sax, P. E., ... & Giordano, T. P. (2014). Lower pill burden and once-daily dosing antiretroviral treatment regimens for HIV infection: A meta-analysis of randomized controlled trials. *Clinical Infectious Diseases*, *58*(9), 1297-1307.

Nakagawa, F., May, M., & Phillips, A. (2013). Life expectancy living with HIV: Recent estimates and future implications. *Current Opinion in Infectious Diseases*, *26*(1), 17-25.

Nel, A., & Kagee, A. (2011). Common mental health problems and antiretroviral therapy adherence. *AIDS Care*, *23*(11), 1360-1365.

Newcomb, M. E., Bedoya, C. A., Blashill, A. J., Lerner, J. A., O'Cleirigh, C., Pinkston, M. M., & Safren, S. A. (2015). Description and demonstration of cognitive behavioral therapy to enhance antiretroviral therapy adherence and treat depression in HIV-infected adults. *Cognitive and Behavioral Practice*, *22*(4), 430-438.

Nieuwkerk, P.T., Oort, F.J. (2005). Self-reported adherence to antiretroviral therapy for HIV-1 infection and virologic treatment response: a meta-analysis. *Journal of Acquired Immune Deficiency Syndromes. 38*, 445-448.

Noto, T., Vecchiet, J., Monforte, H. D. A., & Wu, A. W. (2002). Correlates and predictors of adherence to highly active antiretroviral therapy: Overview of published literature. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, *51*, 8123-5127.

O'Connor, D. B., Jones, F., Conner, M., McMillan, B., & Ferguson, E. (2008). Effects of daily hassles and eating style on eating behavior. *Health Psychology*,*27*, 20-31.

O'Connor, D. B., Jones, F., & Conner, M. (2011). Psychological stress, diary methods, and eating behavior. *Handbook of Behavior, Food and Nutrition* (p. 1619-1633). New York: Springer.

Ohly, S., Sonnentag, S., Niessen, C., & Zapf, D. (2010). Diary studies in organizational research. *Journal of Personnel Psychology*, *9*(2), 79-93.

O'Neil, C. R., Palmer, A. K., Coulter, S., O'Brien, N., Shen, A., Zhang, W., ... & Hogg, R. S. (2012). Factors associated with antiretroviral medication adherence among HIV-positive adults accessing highly active antiretroviral therapy (HAART) in British Columbia, Canada. *Journal of the International Association of Physicians in AIDS Care (JIAPAC)*, *11*(2), 134-141.

Ortego, C., Huedo-Medina, T. B., Llorca, J., Sevilla, L., Santos, P., Rodríguez, E., ... & Vejo, J. (2011). Adherence to highly active antiretroviral therapy (HAART): a meta-analysis. *AIDS and Behavior*, *15*(7), 1381-1396.

Orton, L., Griffiths, J., Green, M., & Waterman, H. (2012). Resilience among asylum seekers living with HIV. *BMC Public Health*, *12*(1) [on-line]. http://www.biomedcentral.com/1471-2458/12/926 Accessed 22nd December 2016.

O'Toole, D.P.H. (2012). *The process of adhering to aerosol therapy in adolescents with cystic fibrosis: Patient and parent perspectives.* (Doctoral thesis, University of Leeds, Leeds, UK). [online]. http://etheses.whiterose.ac.uk/3125/1/Thesis_-_Danny_O%27Toole_-_Final_submission_-_14th_September_2012.pdf Accessed 15th July 2017

Palepu, A., Horton, N. J., Tibbetts, N., Meli, S., & Samet, J. H. (2004). Uptake and adherence to highly active antiretroviral therapy among HIV-infected people with alcohol and other substance use problems: The impact of substance abuse treatment. *Addiction*, *99* (3), 361-368.

Parienti, J. J., Bangsberg, D. R., Verdon, R., & Gardner, E. M. (2009). Better adherence with once-daily antiretroviral regimens: A meta-analysis. *Clinical Infectious Diseases*, *48*(4), 484-488.

Parsons, J. T., Golub, S. A., Rosof, E., & Holder, C. (2007). Motivational interviewing and cognitive-behavioral intervention to improve HIV medication adherence among hazardous drinkers: A randomized controlled trial. *Journal of Acquired Immune Deficiency Syndromes (1999)*, *46*(4), 443-460.

Pellowski, J. A., & Kalichman, S. C. (2016). Health behavior predictors of medication adherence among low health literacy people living with HIV/AIDS. *Journal of Health Psychology*, 21(9), 1981-1991.

Pence, B. W. (2009). The impact of mental health and traumatic life experiences on antiretroviral treatment outcomes for people living with HIV/AIDS. *Journal of Antimicrobial Chemotherapy*, *63*(4), 636-640.

Peretti-Watel, P., Spire, B., Pierret, J., Lert, F., Obadia, Y., & Vespa Group. (2006). Management of HIV-related stigma and adherence to HAART: Evidence from a large representative sample of outpatients attending French hospitals (ANRS-EN12-VESPA 2003). *AIDS Care*, *18*(3), 254-261.

Petrov, M. E. R., Lichstein, K. L., Huisingh, C. E., & Bradley, L. A. (2014). Predictors of adherence to a brief behavioral insomnia intervention: Daily process analysis. *Behavior Therapy*, *45*(3), 430-442.

Phillips, K. D., Moneyham, L., Murdaugh, C., Boyd, M. R., Tavakoli, A., Jackson, K., & Vyavaharkar, M. (2005). Sleep disturbance and depression as barriers to adherence. *Clinical Nursing Research*, *14*(3), 273-293.

Preacher, K.J., Curran, P.J., Bauer, D.J. (2003a). *Simple intercepts, simple slopes, and regions of significance in HLM 2-way interactions.* [on-line]. http://www.quantpsy.org/interact/hlm2.htm Accessed June 1st 2017

Preacher, K. J., Curran, P. J., & Bauer, D. J. (2003b). *Simple intercepts, simple slopes, and regions of significance in MLR 2-way interactions.* [on-line]. http://www.quantpsy.org/interact/ Accessed July 3rd 2017

Preacher, K. J., Curran, P. J., & Bauer, D. J. (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics*, *31*(4), 437-448.

Public Health England. (2015). HIV in the UK - Situation Report 2015 Incidence, prevalence and prevention. [on-line]. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/477702/HIV_in_the_UK_2015_report.pdf Accessed November 11th 2016.

Public Health England. (2016a). HIV in the UK: 2016 report. [on-line]. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/574667/HIV_in_the_UK_2016.pdf Accessed 26th March 2017

Public Health England. (2016b). HIV diagnoses, late diagnoses and numbers accessing treatment and care: 2016 report. [on-line]. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/602945/HIV_diagnoses_late_diagnoses_and_numbers_accessing_treatment_and_care.pdf Accessed 17 April 2017

Puskas, C. M., Forrest, J. I., Parashar, S., Salters, K. A., Cescon, A. M., Kaida, A., ... & Hogg, R. S. (2011). Women and vulnerability to HAART non-adherence: A literature review of treatment adherence by gender from 2000 to 2011. *Current HIV/AIDS Reports*, *8*(4), 277.

Quittner, A. L., Espelage, D. L., & Drotar, D. (2000). Measuring adherence to medical treatments in childhood chronic illness: Considering multiple methods and sources of information. *Journal of Clinical Psychology in Medical Settings*,*7*(1), 41-54.

Quittner, A. L., Modi, A. C., Lemanek, K. L., Ievers-Landis, C. E., & Rapoff, M. A. (2008). Evidence-based assessment of adherence to medical treatments in pediatric psychology. *Journal of Pediatric Psychology*, *33*(9), 916-936.

Rao, D., Kekwaletswe, T. C., Hosek, S., Martinez, J., & Rodriguez, F. (2007). Stigma and social barriers to medication adherence with urban youth living with HIV. *AIDS Care*, *19*(1), 28-33.

Rao, D., Feldman, B. J., Fredericksen, R. J., Crane, P. K., Simoni, J. M., Kitahata, M. M., & Crane, H. M. (2012). A structural equation model of HIV-related stigma, depressive symptoms, and medication adherence. *AIDS and Behavior*, *16*(3), 711-716.

Raudenbash, S., Bryk, A., Cheong, Y.F., Congdon, R., du Toit, M. (2011). *HLM7 Hierarchical Linear and Nonlinear Modelling.* Illinois: Scientific Software International, Inc.

Reback, C. J., Larkins, S., & Shoptaw, S. (2003). Methamphetamine abuse as a barrier to HIV medication adherence among gay and bisexual men. *AIDS Care*, *15*(6), 775-785.

Rivis, A., Sheeran, P., & Armitage, C. J. (2009). Expanding the affective and normative components of the Theory of Planned Behavior: A meta-analysis of anticipated affect and moral norms. *Journal of Applied Social Psychology*, *39*(12), 2985-3019.

Roebuck, M. C., Liberman, J. N., Gemmill-Toyama, M., & Brennan, T. A. (2011). Medication adherence leads to lower health care use and costs despite increased drug spending. *Health Affairs*, *30*(1), 91-99.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education & Behavior*, *15*(2), 175-183.

Russell, M. L., Moralejo, D. G., & Burgess, E. D. (2000). Paying research subjects: Participants' perspectives. *Journal of Medical Ethics*, *26*(2), 126-130.

Sabate E. *Adherence to Long-Term Therapies: Evidence for Action.* Geneva: World Health Organization, 2003. [on-line] http://www.who.int/ chronic_conditions/en/adherence_report.pdf Accessed on 20th August 2015.

Saberi, P., Neilands, T. B., Vittinghoff, E., Johnson, M. O., Chesney, M., & Cohn, S. E. (2015). Barriers to antiretroviral therapy adherence and plasma HIV RNA suppression among AIDS clinical trials group study participants. *AIDS Patient Care and STDs*, *29*(3), 111-116.

Sacktor, N., McDermott, M. P., Marder, K., Schifitto, G., Selnes, O. A., McArthur, J. C., ... & De Marcaida, J. A. (2002). HIV-associated cognitive impairment before and after the advent of combination therapy. *Journal of Neurovirology*, *8*(2), 136-142.

Safren, S. A., Otto, M. W., Worth, J. L., Salomon, E., Johnson, W., Mayer, K., & Boswell, S. (2001). Two strategies to increase adherence to HIV antiretroviral medication: life-steps and medication monitoring. *Behaviour Research and Therapy*, *39*(10), 1151-1162.

Safren, S. A., O'Cleirigh, C., Tan, J. Y., Raminani, S. R., Reilly, L. C., Otto, M. W., & Mayer, K. H. (2009). A randomized controlled trial of cognitive behavioral therapy for adherence and depression (CBT-AD) in HIV-infected individuals. *Health Psychology*, *28*(1), 1-10.

Safren, S. A., O'Cleirigh, C. M., Bullis, J. R., Otto, M. W., Stein, M. D., & Pollack, M. H. (2012). Cognitive behavioral therapy for adherence and depression (CBT-AD) in HIV-infected injection drug users: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*, *80*(3), 404-415.

Sallis, J.F., Owen, N. & Fisher, E.B. (2008). Ecological Models of Health Behavior. In Glanz, K., Rimer, B.K., Viswanath, K. (4th Ed). *Health Behavior and Health Education: Theory, Research and Practice*. US: Wiley and Sons.

Samji, H., Cescon, A., Hogg, R. S., Modur, S. P., Althoff, K. N., Buchacz, K., ... & Justice, A. (2013). Closing the gap: Increases in life expectancy among treated HIV-positive individuals in the United States and Canada. *PloS One*,*8*(12), [on-line]. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0081355 Accessed 12th December 2015.

Sandberg, T., & Conner, M. (2008). Anticipated regret as an additional predictor in the theory of planned behaviour: A meta-analysis. *British Journal of Social Psychology*, *47*(4), 589-606.

Sax, P. E., Meyers, J. L., Mugavero, M., & Davis, K. L. (2012). Adherence to antiretroviral treatment and correlation with risk of hospitalization among commercially insured HIV patients in the United States. *PloS One*, *7*(2). [on-line]. http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0031591&type=printable Accessed 17th January 2017.

Sayles, J. N., Wong, M. D., Kinsler, J. J., Martins, D., & Cunningham, W. E. (2009). The association of stigma with self-reported access to medical care and antiretroviral therapy adherence in persons living with HIV/AIDS. *Journal of General Internal Medicine*, *24*(10), 1101-1108.

Schermbaum, C. A., & Fetterer, J. M. (2009). Estimating statistical power and required sample sizes for organizational research using multilevel modeling. *Organizational Research Methods, 12*(2), 347-367.

Schneider, S., & Stone, A. A. (2016). Ambulatory and diary methods can facilitate the measurement of patient-reported outcomes. *Quality of Life Research*, *25*(3), 497-506.

Segal, J. Z. (2007). "Compliance" to "concordance": A critical view. *Journal of Medical Humanities*, *28*(2), 81-96.

Senn, B., Kirsch, M., Sanz, C. C., Karlou, C., Tulus, K., De Leeuw, J., & Ringner, A. (2013). Developing and evaluating complex interventions: The new Medical Research Council guidance. *Studies*, *59*, 587-592.

Sethi, A. K., Celentano, D. D., Gange, S. J., Moore, R. D., & Gallant, J. E. (2003). Association between adherence to antiretroviral therapy and human immunodeficiency virus drug resistance. *Clinical Infectious Diseases*, *37*(8), 1112-1118.

Shields, A. L. Shiffman, S. Stone, A. (2016). Recall bias: Understanding and reducing bias in PRO data collection. In B. Byrom and B. Tiplady (Eds.). *EPRO: Electronic Solutions for Patient-Reported Data*. New York: Routledge.

Sherr, L., Lampe, F., Norwood, S., Leake Date, H., Harding, R., Johnson, M., ... & Anderson, J. (2008). Adherence to antiretroviral treatment in patients with HIV in the UK: A study of complexity. *AIDS Care*, *20*(4), 442-448.

Sherliker, L., & Steptoe, A. (2000). Coping with new treatments for cancer: A feasibility study of daily diary measures. *Patient Education and Counseling*, *40*(1), 11-19.

Shubber, Z., Mills, E. J., Nachega, J. B., Vreeman, R., Freitas, M., Bock, P., ... & Ford, N. (2016). Patient-reported barriers to adherence to antiretroviral therapy: A systematic review and meta-analysis. *PLoS medicine*, *13*(11). [on-line]. http://journals.plos.org/plosmedicine/article/file?id=10.1371/journal.pmed.1002183&type=printable Accessed 5th June 2017

Simoni, J. M., Frick, P. A., & Huang, B. (2006a). A longitudinal evaluation of a social support model of medication adherence among HIV-positive men and women on antiretroviral therapy. *Health Psychology*, *25*(1), 74-81.

Simoni, J. M., Kurth, A. E., Pearson, C. R., Pantalone, D. W., Merrill, J. O., & Frick, P. A. (2006b). Self-report measures of antiretroviral therapy adherence: A review with recommendations for HIV research and clinical management. *AIDS and Behavior*, *10*(3), 227-245.

Simoni, J. M., Pearson, C. R., Pantalone, D. W., Marks, G., & Crepaz, N. (2006c). Efficacy of interventions in improving highly active antiretroviral therapy adherence and HIV-1 RNA viral load: a meta-analytic review of randomized controlled trials. *Journal of Acquired Immune Deficiency Syndromes*, *43*(01), 23-35.

Simoni, J. M., Wiebe, J. S., Sauceda, J. A., Huh, D., Sanchez, G., Longoria, V., ... & Safren, S. A. (2013). A preliminary RCT of CBT-AD for adherence and depression among HIV-positive Latinos on the US-Mexico border: the Nuevo Dia study. *AIDS and Behavior*, *17*(8), 2816-2829.

Sin, N. L., & DiMatteo, M. R. (2014). Depression treatment enhances adherence to antiretroviral therapy: A meta-analysis. *Annals of Behavioral Medicine*, *47*(3), 259-269.

Singh, N. I. N. A., Squier, C., Sivek, C., Wagener, M., Nguyen, M. H., & Yu, V. L. (1996). Determinants of compliance with antiretroviral therapy in patients with human immunodeficiency virus: Prospective assessment with implications for enhancing compliance. *AIDS Care*, *8*(3), 261-270.

Smit, P. J., Brady, M., Carter, M., Fernandes, R., Lamore, L., Meulbroek, M., ... & Thompson, M. (2012). HIV-related stigma within communities of gay men: A literature review. *AIDS Care*, *24*(4), 405-412.

Smith, S. R., Rublein, J. C., Marcus, C., Brock, T. P., & Chesney, M. A. (2003). A medication self-management program to improve adherence to HIV therapy regimens. *Patient Education and Counseling*, *50*(2), 187-199.

Sniehotta, F. F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the Theory of Planned Behaviour. *Health Psychology Review*, *8*(1), 1-7.

Springer, S. A., Dushaj, A., & Azar, M. M. (2012). The impact of DSM-IV mental disorders on adherence to combination antiretroviral therapy among adult persons living with HIV/AIDS: A systematic review. *AIDS and Behavior*,*16*(8), 2119-2143.

Starace, F., Ammassari, A., Trotta, M. P., Murri, R., De Longis, P., Izzo, C., ... & Antinori, A. (2002). Depression is a risk factor for suboptimal adherence to highly active antiretroviral therapy. *Journal of Acquired Immune Deficiency Syndromes*, *31*, 136-139.

Stinson, J. N., Huguet, A., McGrath, P., Rosenbloom, B., Soobiah, C., White, M., & Coburn, G. (2013). A qualitative review of the psychometric properties and feasibility of electronic headache diaries for children and adults: Where we are and where we need to go. *Pain Research and Management*, *18*(3), 142-152.

Stirratt, M. J., Dunbar-Jacob, J., Crane, H. M., Simoni, J. M., Czajkowski, S., Hilliard, M. E., ... & Ogedegbe, G. (2015). Self-report measures of medication adherence behavior: Recommendations on optimal use. *Translational Behavioral Medicine*, *5*(4), 470-482.

Stone, A. A., Broderick, J. E., Schwartz, J. E., Shiffman, S., Litcher-Kelly, L., & Calvanese, P. (2003a). Intensive momentary reporting of pain with an electronic diary: Reactivity, compliance, and patient satisfaction. *Pain*, *104*(1), 343-351.

Stone, A. A., Shiffman, S., Schwartz, J. E., Broderick, J. E., & Hufford, M. R. (2003b). Patient compliance with paper and electronic diaries. *Controlled Clinical Trials*, *24*(2), 182-199.

Sumari-de Boer, I. M., Sprangers, M. A., Prins, J. M., & Nieuwkerk, P. T. (2012). HIV stigma and depressive symptoms are related to adherence and virological response to antiretroviral treatment among immigrant and indigenous HIV infected patients. *AIDS and Behavior*, *16*(6), 1681-1689.

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry*, *16*(10), 837-851.

Tennen, H., Affleck, G., Coyne, J. C., Larsen, R. J., & DeLongis, A. (2006). Paper and plastic in daily diary research: Comment on Green, Rafaeli, Bolger, Shrout, and Reis (2006). *Psychological Methods, 11*, 112-118.

Thomas, F., Aggleton, P., & Anderson, J. (2010). "If I cannot access services, then there is no reason for me to test": The impacts of health service charges on HIV testing and treatment amongst migrants in England. *Aids Care*, *22*(4), 526-531.

Tovar, E. G., Dekker, R. L., Chung, M. L., Gokun, Y., Moser, D. K., Lennie, T. A., & Rayens, M. K. (2015). Self-efficacy mediates the relationship of depressive symptoms and social support with adherence in patients with heart failure. *Journal of Health Psychology*, *21*(11), 2673-2683.

Townshend, J. M., & Duka, T. (2002). Patterns of alcohol drinking in a population of young social drinkers: A comparison of questionnaire and diary measures. *Alcohol and Alcoholism*, *37*(2), 187-192.

Turan, B., Smith, W., Cohen, M. H., Wilson, T. E., Adimora, A. A., Merenstein, D., ... & Tien, P. C. (2016). Mechanisms for the negative effects of internalized HIV-related stigma on antiretroviral therapy adherence in women: The mediating roles of social isolation and depression. *Journal of Acquired Immune Deficiency Syndromes (1999)*, *72*(2), 198-205.

Turner, B. J., Laine, C., Cosler, L., & Hauck, W. W. (2003). Relationship of gender, depression, and health care delivery with antiretroviral adherence in HIV-infected drug users. *Journal of General Internal Medicine*, *18*(4), 248-257.

UNAIDS (2003). UNAIDS fact sheet on stigma and discrimination. [on-line]. http://data.unaids.org/publications/FactSheets03/fs_stigma_discrimination_en.pdf Accessed 21st January 2016.

UNAIDS (2015). *Aids by the Numbers 2015.* [on-line]. http://www.unaids.org/sites/default/files/media_asset/AIDS_by_the_numbers_2015_en.pdf Accessed 21st January 2016

Vanable, P. A., Carey, M. P., Blair, D. C., & Littlewood, R. A. (2006). Impact of HIV-related stigma on health behaviors and psychological adjustment among HIV-positive men and women. *AIDS and Behavior*, *10*(5), 473-482.

Viswanathan, M., Golin, C. E., Jones, C. D., Ashok, M., Blalock, S. J., Wines, R. C., ... & Lohr, K. N. (2012). Interventions to improve adherence to self-administered medications for chronic diseases in the United States: A systematic review. *Annals of Internal Medicine*, *157*(11), 785-795.

Wagner and Ghosh-Dastidar. (2002). Electronic Monitoring: Adherence assessment or intervention? *HIV Clinical Trials, 3*(1), 45-51.

Walters, E. H., Walters, J., Wills, K. E., Robinson, A., & Wood-Baker, R. (2012). Clinical diaries in COPD: Compliance and utility in predicting acute exacerbations. *International Journal of Chronic Obstructive Pulmonary Disease*, *7*, 427-435.

Watkins, C. C., & Treisman, G. J. (2015). Cognitive impairment in patients with AIDS–prevalence and severity. *HIV/AIDS Research and Palliative Care*, *7*, 35-47.

Whyte, J., Whyte, M. D., & Hires, K. (2015). A study of HIV positive undocumented African migrants' access to health services in the UK. *AIDS Care*, *27*(6), 703-705.

Willie, T. C., Overstreet, N. M., Sullivan, T. P., Sikkema, K. J., & Hansen, N. B. (2016). Barriers to HIV medication adherence: Examining distinct anxiety and depression symptoms among women living with HIV who experienced childhood sexual abuse. *Behavioral Medicine*, *42*(2), 120-127.

World Health Organisation (2015). HIV/AIDS fact sheet No 360. [on-line]. http://www.who.int/mediacentre/factsheets/fs360/e Accessed 15th January 2016.

World Health Organisation, 2016. Global report on early warning indicators of HIV drug resistance: Technical report. [on-line]. http://www.who.int/hiv/pub/drugresistance/ewi-hivdr-2016/en/Accessed November 13th 2016.

Wouters, S., Thewissen, V., Duif, M., Lechner, L., & Jacobs, N. (2016). Assessing energy intake in daily life: Signal-contingent smartphone application versus event-contingent paper and pencil estimated diet diary. *Psychologica Belgica*, *56*(4), 357-369.

Zautra, A. J., Fasman, R., Parish, B. P., & Davis, M. C. (2007). Daily fatigue in women with osteoarthritis, rheumatoid arthritis, and fibromyalgia. *Pain*, *128*(1), 128-135

Appendices

Appendix 1: Initial Questionnaire

Personal information questionnaire

Please complete the following questions:

How old are you?	
What is your gender?	Male ☐ Female ☐ Transmale ☐ Transfemale ☐ Other ☐
Do you have sex with,,	Men only ☐ Women only ☐ Men & women ☐
What is your ethnicity?	☐ White British ☐ Black African ☐ Black Caribbean ☐ Asian ☐ White Non-British, please describe ☐ Mixed ethnicity, please describe _____ ☐ Other ethnic group, please describe
What is your religion?	No religion ☐ Christian ☐ Roman Catholic ☐ Muslim ☐ Sikh ☐ Buddhist ☐ Hindu ☐ Jewish ☐ Any other religion, please describe:_____
Do you currently take medication to help you with your mood (i.e. anti-depressant medication)?	Yes ☐ No ☐
When were you diagnosed with HIV? (year)	
When did you start taking HIV medication? (year)	
What HIV medication are you prescribed at the moment?	
How many tablets do you have to take per day?	
How many times per day do you need to take tablets?	
Do you feel involved in decisions about your HIV treatment?	Not at at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very much
Do you feel that you understand your HIV medication?	Not at at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very much

Do you feel involved in decisions about your HIV treatment?	Not at at all	☐	☐	☐	☐	☐	☐	☐	Very much
Do you feel that you understand your HIV medication?	Not at at all	☐	☐	☐	☐	☐	☐	☐	Very much
Do you feel supported by those around you to take your prescribed medications?	Not at at all	☐	☐	☐	☐	☐	☐	☐	Very much
In the last 6 months have you taken your HIV medications as prescribed?	Never	☐	☐	☐	☐	☐	☐	☐	Always
Do you consider the last 6 months to be a stable part of your life?	Never	☐	☐	☐	☐	☐	☐	☐	Always

IPQ Items

Your views on living with HIV...

How much does your HIV affect your life?												
No affect at all	0	1	2	3	4	5	6	7	8	9	10	*Severely affects my life*
How much control do you feel you have over your HIV?												
Absolutely no control	0	1	2	3	4	5	6	7	8	9	10	*Extreme amount of control*
How much do you think your treatment can help your HIV?												
Not at all	0	1	2	3	4	5	6	7	8	9	10	*Extremely helpful*
How much do you experience side effects of your HIV medication?												
No symptoms at all	0	1	2	3	4	5	6	7	8	9	10	*Severely affects my life*
How concerned are you about your HIV?												
Not at all concerned	0	1	2	3	4	5	6	7	8	9	10	*Extremely concerned*
How well do you feel you understand your HIV?												
Don't understand at all	0	1	2	3	4	5	6	7	8	9	10	*Understand very clearly*
How much does your HIV affect you emotionally? (e.g. does it make you angry, scared, upset or depressed?)												
Not at all affected emotionally	0	1	2	3	4	5	6	7	8	9	10	*Extremely affected emotionally*

BMQ Specific - necessity and concerns subscales

Your views about your HIV medication....

We would like to ask you about your personal views about medicines prescribed for your HIV.
These are statements other people have made about their medicines.
Please show how much you agree or disagree with them by ticking the appropriate box. Please tick one box on each row.

There are no right or wrong answers.
We are interested in your personal views.

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1. My health at present, depends on my medicines					
2.Having to take medicines worries me					
3.My life would be impossible without my medicines					
4.Without my medicines I would be very ill					
5.I sometimes worry about the long-term effects of my medicines					
6. My medicines are a mystery to me					
7. My health in the future will depend on my medicines					
8.My medicines disrupt my life					
9. I sometimes worry about becoming too dependent on my medicines.					
10. My medicines protect me from becoming worse					

BMQ General - overuse and harm subscales

Your views about medicines in general...
We would like to ask you about your personal views about medicines in general.
These are statements other people have made about medicines in general.
Please show how much you agree or disagree with them by ticking the appropriate box. Please tick one box on each row.

There are no right or wrong answers.
We are interested in your personal views.

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1. Doctors use too many medicines					
2. People who take medicines should stop their treatment for a while every now and again					
3. Most medicines are addictive					
4. Natural remedies are safer than medicines					
5. Medicines do more harm than good					
6. All medicines are poisons					
7. Doctors place too much trust on medicines					
8. If doctors had more time with patients they would prescribe fewer medicines					

Stigma scale

For the following questions, please circle the number that best corresponds to your views:

Your views on living with HIV…

This first set of questions asks about some of your experiences, feelings, and opinions as to how people with HIV feel and how they are treated. Please do your best to answer each question. Please show how much you agree or disagree with the following statements by ticking the appropriate box. Please tick one box on each row.

	Strongly disagree	Disagree	Agree	Strongly agree
I never feel the need to hide the fact that I have HIV				
Having HIV makes me feel that I'm a bad person				
I feel I am not as good a person as others because I have HIV				
Most people with HIV are rejected when others find out				
People with HIV lose their jobs when their employers find out				

The items in this next section assume that you have told other people that you have HIV, or that others know. This may not be true for you. If the item refers to something that has not actually happened to you, please imagine yourself in that situation. Then give your answer ("strongly disagree," "disagree," "agree," "strongly agree") based on how you think you would feel or how you think others would react to you.

I worry that people who know I have HIV will tell others				
I have lost friends by telling them I have HIV				
I have been hurt by how people reacted to learning I have HIV				

Thank you for completing this questionnaire!

Appendix 2: Daily diary -example day (1st page)

Day:	Today's date :	Current time:

Taking your medication...	How many tablets did you take? _____	How many tablets were you supposed to take? _____
I took my medication as prescribed....	Strongly agree ☐ ☐ ☐ ☐ ☐ ☐ ☐	Strongly disagree
I took all of my tablets at the correct time....	Strongly agree ☐ ☐ ☐ ☐ ☐ ☐ ☐	Strongly disagree

Was your sleep last night...	Good ☐	Poor ☐	No. hours:	_____
Did you exercise today?	Yes ☐	No ☐	No. minutes: _____	Doing what? _____

Did you experience any problems or stressful events today....

Please list any stressful events you experienced today, and how stressful each was.

Stressful event	Not stressful 1	2	3	4	5	6	Very stressful 7
	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐

How was your mood today? *Tick one box for each line...*

		1	2	3	4	5	6	7	
Upset	Not at all	☐	☐	☐	☐	☐	☐	☐	Very much
Cheerful	Not at all	☐	☐	☐	☐	☐	☐	☐	Very much
Neutral	Not at all	☐	☐	☐	☐	☐	☐	☐	Very much
Worried	Not at all	☐	☐	☐	☐	☐	☐	☐	Very much
Frustrated	Not at all	☐	☐	☐	☐	☐	☐	☐	Very much
Optimistic	Not at all	☐	☐	☐	☐	☐	☐	☐	Very much
Resentful	Not at all	☐	☐	☐	☐	☐	☐	☐	Very much
Disgust	Not at all	☐	☐	☐	☐	☐	☐	☐	Very much

Daily diary -example day (2nd page)

Did you experience any medication side effects today?

I experienced side effects today…	Not at all	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Very much

Looking ahead to tomorrow….

I plan to take all of my prescribed medication tomorrow.	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
I am confident that I will take all my medication as planned tomorrow.	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
If I don't take my medication tomorrow I will regret it.	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
If I don't take my medication tomorrow I will feel guilty.	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
If I take my medication tomorrow I will be pleased.	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
If I take my medication tomorrow I will be satisfied.	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly Agree
People who are important to me think I should take all my prescribed medication tomorrow.	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree

How I feel about taking all of my medication tomorrow…

It will be	Unpleasant	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Pleasant
It will be	Not Stressful	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Stressful
It will be	Not beneficial	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Beneficial
It will be	Not frustrating	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Frustrating

Thank you for completing today's diary. Please remember to fill in tomorrow's daily diary!

Appendix 3: Interview topic guide

Background information

- **Start of interview - questions specific to PLHIV:**

>Gender > Age >When diagnosed with HIV >When started antiretrovirals

- **Start of interview - questions specific to staff:**

>Professional title >How long working with PLHIV >What does current role involve?

The research

Brief explanation of research method

Q What are your views on the pros and cons of this research…in general

- Will it contribute to understanding?
- Is it asking the right questions?
- What else might we ask?
- What are the factors that you think might influence whether or not people living with HIV choose to take part in research?

Q about diary studies in particular

(ask whether they took part -service users)

- What do you think are the **Barriers** and **Facilitators** (things that make it easier/harder) to take part in diary studies such as this?

- What are your views about the diary being used within this research study?

  Prompts: *views on: length of diary, duration of diary, language used, individual items, how the study has been implemented, the factors that are being investigated (i.e. adherence to medication, mood, daily hassles).*

- What factors might influence participant's living with HIV decisions to take part in this diary study?

  Prompts: *what factors might increase the likelihood of somebody deciding to take part? What factors might decrease the likelihood of somebody taking part?*

- What factors might influence the likelihood of participants (living with HIV) **completing** the daily diary?

  Prompts: *what factors might help somebody to complete the diary? Factors that make it difficult for the diary to be completed.*

Appendix 4: Ethical approval letter

NHS
Health Research Authority

Miss Delyth James
Clinical Psychology Training Programme
Leeds Institute of Health Sciences
Charles Thackrah Building
101 Clarendon Road
Leeds
LS2 9LJ
umdja@leeds.ac.uk

Email: hra.approval@nhs.net

28 September 2016

Dear Miss James

Letter of HRA Approval

Study title:	**Diary study of adherence to antiretroviral therapy in people living with HIV**
IRAS project ID:	**205834**
REC reference:	**16/NE/0302**
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.

It is critical that you involve both the research management function (e.g. R&D office) supporting each organisation and the local research team (where there is one) in setting up your study. Contact details and further information about working with the research management function for each organisation can be accessed from www.hra.nhs.uk/hra-approval.

Appendices

The HRA Approval letter contains the following appendices:

- A – List of documents reviewed during HRA assessment
- B – Summary of HRA assessment

After HRA Approval

The document *"After Ethical Review – guidance for sponsors and investigators"*, issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

In addition to the guidance in the above, please note the following:

- HRA Approval applies for the duration of your REC favourable opinion, unless otherwise notified in writing by the HRA.
- Substantial amendments should be submitted directly to the Research Ethics Committee, as detailed in the *After Ethical Review* document. Non-substantial amendments should be submitted for review by the HRA using the form provided on the HRA website, and emailed to hra.amendments@nhs.net.
- The HRA will categorise amendments (substantial and non-substantial) and issue confirmation of continued HRA Approval. Further details can be found on the HRA website.

Scope

HRA Approval provides an approval for research involving patients or staff in NHS organisations in England.

If your study involves NHS organisations in other countries in the UK, please contact the relevant national coordinating functions for support and advice. Further information can be found at http://www.hra.nhs.uk/resources/applying-for-reviews/nhs-hsc-rd-review/.

If there are participating non-NHS organisations, local agreement should be obtained in accordance with the procedures of the local participating non-NHS organisation.

IRAS project ID	205834

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please email the HRA at hra.approval@nhs.net. Additionally, one of our staff would be happy to call and discuss your experience of HRA Approval.

HRA Training

We are pleased to welcome researchers and research management staff at our training days – see details at http://www.hra.nhs.uk/hra-training/

Your IRAS project ID is **205834**. Please quote this on all correspondence.

Yours sincerely

Gemma Oakes
Assessor

Email: hra.approval@nhs.net

Copy to: University of Leeds [Sponsor Contact]
Governance-ethics@leeds.ac.uk
Ms Anne Gowing, Leeds Teaching Hospitals NHS Trust [Lead NHS R&D Contact]
Leedsth-tr.lthtresearch@nhs.net
Dr Hillary Bekker, University of Leeds [Academic Supervisor]
h.l.bekker@leeds.ac.uk
Dr Gary Latchford, University of Leeds [Academic Supervisor]
g.latchford@leeds.ac.uk
Professor Mark Conner, University of Leeds [Academic Supervisor]
m.t.conner@leeds.ac.uk

IRAS project ID	205834

Appendix A - List of Documents

The final document set assessed and approved by HRA Approval is listed below.

Document	*Version*	*Date*
Contract/Study Agreement [Statement of Activities - Bradford Site]	1	22 September 2016
Contract/Study Agreement [Schedule of Events - Bradford Site]	1	22 September 2016
Contract/Study Agreement [Statement of Activities - Leeds Site]	1	22 September 2016
Contract/Study Agreement [Schedule of Events - Leeds Site]	1	22 September 2016
Covering letter on headed paper [Covering letter]	1	08 August 2016
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Evidence of Leeds university insurance cover]	1	22 September 2015
IRAS Application Form [IRAS_Form_22082016]		22 August 2016
IRAS Application Form XML file [IRAS_Form_22082016]		22 August 2016
IRAS Checklist XML [Checklist_19082016]		19 August 2016
Letters of invitation to participant [Letter of invitation to participant]	1	08 August 2016
Participant consent form [Bradford Site (Tracked Copy)]	1	08 August 2016
Participant consent form [Leeds Site (Clean Copy)]	2	08 August 2016
Participant consent form [Leeds Site (Tracked Copy)]	2	08 August 2016
Participant consent form [Bradford Site (Clean Copy)]	1	08 August 2016
Participant information sheet (PIS) [Skyline participant information sheet]	1	08 August 2016
Participant information sheet (PIS) [Bradford Participant information sheet]	2	08 August 2016
Participant information sheet (PIS) [Leeds participant information sheet]	3	08 August 2016
Research protocol or project proposal [Protocol]	1	08 August 2016
Sample diary card/patient card [Daily diary]	1	08 August 2016
Summary CV for Chief Investigator (CI) [Chief investigator CV]	1	08 August 2016
Summary CV for student [Student CV]	1	08 August 2016
Summary CV for supervisor (student research) [Supervisor CV]	1	08 August 2016
Summary CV for supervisor (student research) [Supervisor CV HB]	2	08 August 2016
Summary CV for supervisor (student research) [Supervisor CV MC]	3	08 August 2016
Summary, synopsis or diagram (flowchart) of protocol in non-technical language [Recruitment flochart]	1	08 August 2016
Summary, synopsis or diagram (flowchart) of protocol in non-technical language [Recruitment flochart]	1	08 August 2016
Validated questionnaire [Initial questionnaire]	1	08 August 2016

Appendix 5 - Ethical approval for substantial amendment

From: AMENDMENTS, Hra (HEALTH RESEARCH AUTHORITY) <hra.amendments@nhs.net>
Sent: 14 February 2017 14:19
To: Delyth James
Cc: Medicine and Health Research Governance; lthtresearch (LEEDS TEACHING HOSPITALS NHS TRUST)
Subject: RE: IRAS 205834. Confirmation of REC Validation and Categorisation of Amendment

Dear Delyth

Further to the below, I am pleased to confirm that HRA Approval has been issued for the referenced amendment, following assessment against the HRA criteria and standards.

The sponsor should now work collaboratively with participating NHS organisations in England to implement the amendment as per the below categorisation information. This email may be provided by the sponsor to participating organisations in England to evidence that the amendment has HRA Approval.

Please contact hra.amendments@nhs.net for any queries relating to the assessment of this amendment.

Yours sincerely,

Michael Higgs

Michael Higgs | Assessor
Health Research Authority
Ground Floor, Skipton House, 80 London Road, London SE1 6LH
E: hra.amendments@nhs.net