Antibiotic Prescribing: Towards a reducTion during Urgent NHS Dental appointments in England (The APTiTUDE Study)

Informing a complex intervention development for behaviour change of dentists and their patients

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Intellectual Property and Publication Statement:

The candidate confirms that the work submitted is his/her own, except where work which has formed part of a jointly-authored publication has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

Jointly-authored publication:

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> "*Research in primary dental care is not for the faint of heart*."
> (Prof Nigel Pitts, International Association for Dental Research 2019).

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Abstract

Health problem: Slowing the development and spread of infections resistant to antibiotics is an urgent public health and patient safety need. Clinicians are encouraged to use antibiotics wisely but unnecessary antibiotic use by dentists remains high. In 2015, dentists issued 1-in-20 of all NHS antibiotic prescriptions, totalling 3.4 million per year. Approaches to date, such as issuing clinical guidance advising dental procedures rather than using antibiotics for toothache/infection, have been inadequate.

Aim of the research: To develop ways to support reduced antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England.

How did I approach it? To understand the factors associated with dentists' antibiotic prescribing behaviour, influences on treatment decisions were explored during urgent dental appointments in NHS high-street practices and out-of-hours dental clinics. Based on observations and follow-up interviews with patients, dentists and dental nurses, a list of factors influencing treatment decisions was produced. Next, people with experience of receiving urgent dental care, dental team members and service/policy managers prioritised the factors and identified those potentially amenable to modification. Finally, behavioural science was applied to underpin the development of an intervention to reduce dental antibiotic prescribing.

What was the outcome? A logic model was produced describing the theory of change and intervention components to reduce antibiotic prescribing by dentists for adults with acute conditions during urgent dental appointments in England. This will inform development of a complex intervention aimed at individual dentists and patients, the dentist-patient dyad and at organisational level for future evaluation after completion of this doctoral research.

Dissemination: Co-production with patients and key stakeholders has provided a wide network for disseminating the findings of this research, including addition to the national dental antimicrobial stewardship toolkit. Presentations at national and international dental, and antimicrobial stewardship conferences have generated extensive interest in the research.

Table of Contents

List of Tables

List of Figures

Abbreviations

A Level	Advance level qualification
ADC	Acute Dental Care (department of Leeds Dental Institute)
AMR	Antimicrobial Resistance
AMS	Antimicrobial Stewardship
APTiTUDE	Antimicrobial Prescribing: Towards a reducTion during Urgent dental care in England: Short title of the doctoral research
BAOS	British Association of Oral Surgeons
BCT	Behaviour Change Technique
BDA	British Dental Association
BNF	British National Formulary
BUPA	Corporate provider of dentistry
CASP	Critical Appraisal Skills Partnership
CBC	UCL's Centre for Behaviour Change
C. difficile	*Clostridoides difficile* (aka *Clostridium difficile*)
COM-B	Capability, Opportunity, Motivation – Behaviour Model
CQC	Care Quality Commission
CReDECI 2	Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: revised guideline
CRF	Case Report Form
CRN	Clinical Research Network (of the National Institute for Health Research)
DCLG	Department of Communities & Local Government
DH	Department of Health (rename as Department of Health & Social Care)
DHSC	Department of Health & Social Care
DREC	Dental Research Ethics Committee of the University of Leeds
DRI	Drug Resistant Infection
DRF	Doctoral Research Fellowship
EEA	European Economic Area
ePACT2	NHS Prescription Services on-line database for authorised users to access prescribing/dispensing data
ESPAUR	English Surveillance Programme for Antimicrobial Utilisation and Resistance
eThOS	British Library e-thesis on-line service
FDI	World Dental Federation
FGDP	Faculty of General Dental Practitioners (UK) of the Royal College of Surgeons of England
FP10D	NHS Prescription Form for Primary Dental Care

FP17	NHS Dental Treatment Plan Activity Record Form
FP17DC	NHS Personal Dental Treatment Plan Form
GCSE	General Certificate of Secondary Education qualification
GDC	General Dental Council
GDP	General Dental Practice
GDS	General Dental Services (One of the NHS dental contract types)
GMC	General Medical Council
GP	General Practice/Practitioner (medical)
GRACE/INTRO	Genomics to combat Resistance against Antibiotics for Community acquired RTI in Europe) (INternet Training for Reducing antibiOtic use)
GVAD	Professor Gail VA Douglas (Lead PhD supervisor, Chair in Dental Public Health, University of Leeds)
HBCP	Human Behaviour Change Project
HEE	Health Education England
HMG	Government of the United Kingdom
HPS	Health Protection Scotland
HRA	Health Research Authority of the National Health Service
HSCIC	NHS Health & Social Care Information Centre
HSCNI	Health & Social Care Services in Northern Ireland
IADR	International Association for Dental Research
IMD	Indices of Multiple Deprivation
IRAS	Integrated Research Application System
JATS	Dr Jonathan AT Sandoe (PhD supervisor, Associate Professor in Clinical Microbiology, University of Leeds & Leeds Teaching Hospitals NHS Trust)
JB	Jenny Boards, Independent Observer
JBI	Joanna Briggs Institute, evidence-based healthcare collaboration
LDI	Leeds Dental Institute
LMIC	Low- and Middle-Income Countries
MB	Marion Bowman, Independent Observer
MeSH	National Library of Medicine's controlled vocabulary thesaurus
MIDAS	Scottish Management Information and Dental Accounting System
MRC	Medical Research Council
{my}dentist	Corporate provider of dentistry
NGT	Nominal Group Technique
NHS	National Health Service
NHSBSA	NHS Business Services Authority (including NHS Prescription Services and NHS Dental Services)
NHSE	NHS England

NICE	National Institute for Health & Care Excellence
NIHR	National Institute for Health Research
OFT	Office of Fair Trading
ONS	Office of National Statistics
OOH	Out-of-hours
ORF	Observation Record Form
PDS	Personal Dental Services (One of the NHS dental contract types)
PhD	Doctor of Philosophy degree
PHE	Public Health England
PI	Principal Investigator (local for each research site)
PIN	Personal Identification Number
PIS	Participant Information Sheet
PPIE	Patient and Public Involvement & Engagement
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRISMS	Prescribing Information System for Scotland
PROSPERO	International Prospective Register of Systematic Reviews
QATSDD	Quality Assessment Tool for Studies with Diverse Design
RCGP	Royal College of General Practice
RCT	Randomised Controlled Trial
REC	Research Ethics Committee
RECORD	REporting of studies Conducted using Observational Routinely-collected health Data
RRCM	Dr Rosemary RC McEachan (PhD Supervisor, Programme Director for Born in Bradford, Bradford Institute for Health Research)
RTI	Respiratory Tract Infection
SDCEP	Scottish Dental Clinical Effectiveness Programme
SHP	Professor Sue H Pavitt (PhD Supervisor, Chair of Translational and Applied Health Research, University of Leeds)
SMILE AIDER	Stakeholder Meaningful InvoLvement & Engagement Aiding DEntal Research PPIE Forum
SRQR	Standards for Reporting Qualitative Research
ST-C	Dr Sarah Tonkin-Crine (Senior Researcher & Health Psychologist, University of Oxford)
TARGET	Treat Antibiotics Responsibly, Guidance, Education, Tools
TDF	Theoretical Domains Framework
TIDieR	Template for intervention description and replication
TRUCE	TReatment during Urgent dental Care: an Ethnographic Study (title of the study reported in Chapter 5)

TTT	Theory & Techniques Tool
UCL	University College London
UDA	Unit of Dental Activity – a measure within the NHS payment system
UoL	University of Leeds
UK	United Kingdom
VRA	Dr Vishal R Aggarwal (Clinical Associate Professor in Acute Dental Care and Chronic Pain
WHO	World Health Organisation
WT	Wendy Thompson (Author, NIHR Doctoral Research Fellow and General Dental Practitioner)
YD	Dr Yvonne Dailey (Consultant in Dental Public Health, Public Health England)

Chapter 1 - Introduction

1.1 Antimicrobial resistance – a global public health crisis

Antimicrobial resistance (AMR) occurs when micro-organisms such as bacteria, viruses, fungi and parasites change so that drugs used to treat infections caused by them become ineffective (WHO, 2018a). Since Fleming's discovery in 1928, antibiotics have become the cornerstone of modern medicine. As they become increasingly ineffective due to development and spread of resistant infections, even minor surgery and routine operations could become high-risk procedures, leading to prolonged illnesses and increased mortality. Although resistance occurs naturally, the inappropriate use of antimicrobials in both human and animal medicine is rapidly accelerating the pace at which it develops and spreads (HMG, 2019a). AMR is such a risk to public health that it has been compared to that from global terrorism and included on the national risk register of civil emergencies alongside climate change (CabinetOffice, 2017). Action is required across government and society including healthcare and agriculture to arrest its progress (O'Neill, 2016).

Antimicrobials of all types (antibacterial, antifungal, antiviral and antiparasitic) and all formulations (oral, parenteral and topical agents) are implicated. Without effective antimicrobials, the success of modern medicine such as cancer chemotherapy or major surgery would be compromised (WHO, 2018a). Life-threatening infections caused by *Klebsiella pneumoniae* resistant to the last resort treatment, carbapenems, have spread worldwide; treatment failure to the last resort of medicine for gonorrhoea has been confirmed in at least 10 countries (Australia, Austria, Canada, France, Japan, Norway, Slovenia, South Africa, Sweden, and the United Kingdom (UK)) (WHO, 2018a). By 2050, deaths from antimicrobial resistant infections are expected to outnumber those from cancer (O'Neill, 2016).

AMR is not confined, however, to healthcare. Given the interdependence between environmental, animal and human dimensions of AMR, a *One Health* approach has been developed to preserve their future effectiveness (Kahn, 2017). Pollution from inadequate treatment of industrial, residential, and farm waste is expanding the resistome (term used to describe a collection of antimicrobial resistant genes) in the environment (Wright, 2007). Intensive animal husbandry in the agricultural industries has seen a movement towards mass 'precautionary and growth-promoting' in-feed use of medically important antimicrobials of animals - this has critically important implications for humans. In the human sector, infection control and prevention of multi-resistant organisms is key, requiring adoption of antimicrobial stewardship (AMS)

including behaviour-change approaches to reduce overuse (unnecessary and inappropriate use) of antimicrobial medication (O'Neill, 2016).

Globally, dentists are major prescribers of antimicrobials, accounting for an estimated 7%–10% of all antibacterial prescriptions (Cleveland and Kohn, 1998). Worryingly, some countries, including the USA and Canada, are currently seeing increases in dental antibiotic use (Roberts et al., 2017) (Marra et al., 2016).

1.1.1 Patient safety and adverse outcomes

For patients with a spreading dental infection, effective antibiotics are vital (FGDP, 2012). Sepsis, Ludwig's angina and spread towards other vital structures may occur rapidly for patients with dental infections (CQC, 2019). Ensuring quick, appropriate and effective treatment is extremely important for these patients.

Risks to patient safety may occur if their infection is resistant to antibiotics or due to adverse events associated with dental antibiotic use. The contribution of dental antibiotic prescribing to the incidence of *Clostridium difficile/Clostridoides difficile (C.difficile)* in the community has been reported (Bye et al., 2017). Antibiotic-related colitis caused by *C. difficile* is associated with significant morbidity and can be life threatening, especially for elderly and medically compromised patients (Beacher et al., 2015). Increasing rates of allergy/anaphylaxis due to antibiotics have also been reported (Turner et al., 2015). Furthermore, incorrect labelling of patients as penicillin allergic has been evidenced as resulting in increased morbidity, mortality and healthcare costs due to the use of broad-spectrum alternatives (Savic et al., 2019) (West et al., 2019).

1.1.2 Antimicrobial stewardship - UK Government's strategy

In 2013, the UK Government published a 5-year AMR) strategy which identified seven key areas for action to reduce and contain the spread of drug resistant infections (DRI) (Davies, S. and Gibbens, 2013). National Institute for Health and Care Excellence (NICE) played a key role in delivering the strategy by producing AMS guidance in 2015 (NICE, 2015). It advocated healthcare-wide systems for promoting and monitoring the judicious use of antimicrobials, with actions for individual prescribers and commissioners of NHS healthcare services (Thompson, W. and Sandoe, 2016).

The success of the original 5-year strategy resulted in publication of a follow-on 20-year strategy in 2019. This made a series of commitments to combat AMR by taking local, national and global 'One-Health' approaches across humans, animals, the environment and food (HMG, 2019a). Protecting patients by reducing unnecessary use of antimicrobial drugs was one of its commitments. This is supported by a UK Government 5-year national action plan (2019-2024) which details targets for reducing

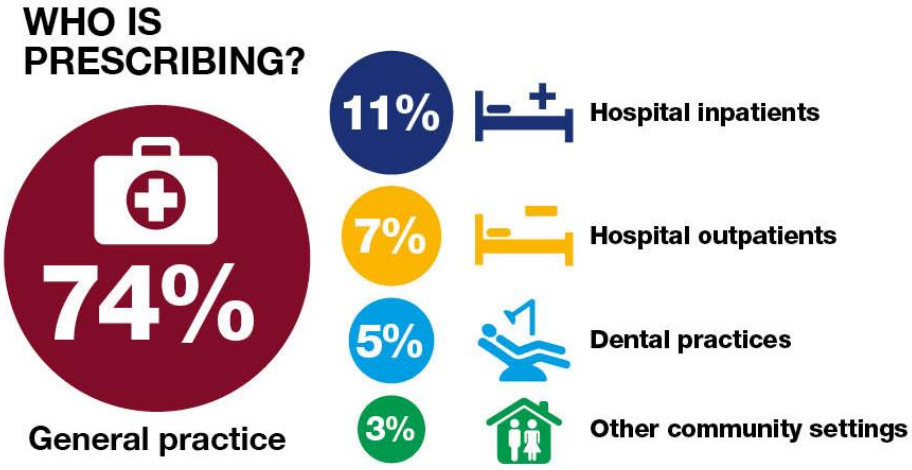
antimicrobial prescribing, including a reduction of 25% in community settings (primary care) between 2013 and 2024 (HMG, 2019b).

1.1.3 Antimicrobial prescribing in England

The Health & Social Care Act 2008 provides the legal context for healthcare prescribing (Parliament, 2008a). Under provisions relating to 'safe care and treatment' in its Regulated Activities Regulations 2014 (Part 3 Section 2 Clause 12(2)(h)), registered healthcare providers and professions are required to '*assess the risk of, and prevent, detect and control the spread of, infections, including those that are health care associated*' (Parliament, 2014). More detail was provided in the Health & Social Care Act's Code of Practice on the Prevention and Control of Infections published in 2015. This aimed to support delivery by setting 10 criteria against which the Care Quality Commission (CQC) were required to judge all registered healthcare providers (including National Health Service (NHS) bodies and providers of independent healthcare in England such as primary dental services) (DH, 2015).

Primary care has consistently been responsible for the majority of human use of antimicrobials in England (PHE, 2016b) (PHE, 2018b). As shown in Figure 1-1, general medical practices were responsible for 74% of all antimicrobial prescribing within NHS England (NHSE) during 2014, compared to 19% from hospital-based secondary care (12% inpatients and 7% outpatients). Primary dental care was responsible for most of the remainder (5%) (PHE, 2016b). With up to 50% of dental treatments in England provided outside of the NHS, the English Surveillance Programme for Antimicrobial Utilisation & Resistance (ESPAUR) has recognised that this may be a significant underestimation of the total contribution made by dentists (PHE, 2014). Furthermore, it has been estimated that as many as 80% of patients in UK primary dental care may receive antibiotics inappropriately/unnecessarily (not in accordance with national guidelines) (Cope, A.L. et al., 2016b). For these reasons, this doctoral research focused on **reducing antimicrobial prescribing in primary dental care**.

Figure 1-1 Infographic from National Institute for Health & Care Excellence (NICE) showing where antimicrobial prescribing took place during 2014 in England. Source: NICE website (NICE, 2016b).



1.1.3.1 Antibiotic, antibacterial and antimicrobial prescribing

The term ‘antibiotic’ is commonly used as a term synonymous with ‘antibacterial’; this is the way that it has been generally used in this study. Confusingly, the precise meaning of ’antibiotic’ is actually closer to ‘antimicrobial’ (see Table 1-1). Wherever possible, the word ‘antibiotic’ has been used but, where essential to meaning, the more specific terms ‘antibacterial’ or ‘antimicrobial’ have been used, for example when describing sources of data.

Table 1-1 Definitions of antimicrobial and antibacterial. Sources: (HMG, 2019b; Chambers, 2014).

Terminology	Definition
Antimicrobial	A drug that selectively destroys or inhibits the growth of microorganisms (bacteria, fungi or viruses). Strategic documents such as the UK 20 year vision or 5-year action plan tend to refer to antimicrobial.
Antibacterial	A drug that selectively destroys or inhibits the growth of bacteria. Sometimes referred to as an ‘antibiotic’. NHS Prescription Services datasets and the British National Formulary refer to ‘antibacterial agents’.
Antibiotic	A substance produced by microorganisms which has the capacity to inhibit growth of, or to destroy, microorganisms causing infectious diseases. The UK 20-year Vision defines ‘antibiotic drugs’ as synonymous with ‘antibacterial agents’.

1.1.4 Dental antimicrobial prescribing in England

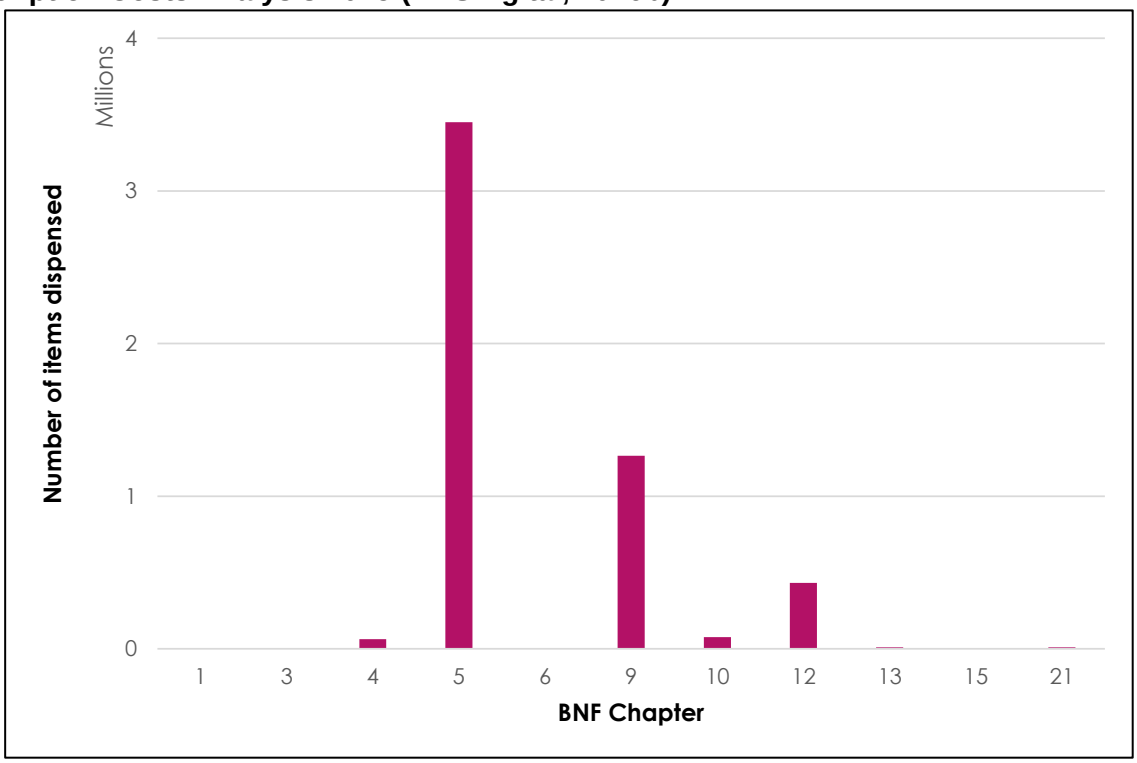
The Health & Social Care Act 2008 Code of Practice on the Prevention and Control of Infection provided examples of interpretation specifically for primary dental care (DH, 2015). Guidance for compliance with criterion 3 of the Code ('*Ensure appropriate antimicrobial use to optimise patient outcomes and to reduce the risk of adverse events and antimicrobial resistance*') states that '*systems should be in place to manage and monitor the use of antimicrobials to ensure inappropriate use is minimised….*' The guidance directly references the British National Formulary (BNF), Dental Practitioner's Formulary, NICE and the Faculty of General Dental Practitioners (UK) (FGDP) guidelines, monitoring and audit tools on antimicrobial prescribing for general dental practitioners (Joint Formulary Committee, 2018; FGDP, 2012; PHE, 2016a). It also states that all prescribers should receive induction and training.

Protecting patient safety is one of the main roles of the General Dental Council (GDC) and in order to deliver this it sets Standards for the Dental Team (GDC, 2015b). Additional guidance relating to prescribing of medicines has been published by the GDC (GDC, 2013a). For dentists providing care for NHS patients, additional requirements on the supply of drugs and prescribing were included within The National Health Service (General Dental Services (GDS) Contracts) Regulations 2005 Schedule 3 Part 3 (HMG, 2005b).

During 2015 in England, NHS dentists prescribed more antimicrobial drugs than any other medication. As shown in Figure 1-2, 3.4 million prescriptions were for antimicrobials taken orally to treat infections (BNF Chapter 5. By comparison, 1.3 million were for fluoride (toothpaste, mouthwash or tablets – Chapter 9), 0.4 million for drugs acting on the ear, nose & oropharynx (mainly chlorhexidine mouthwash – Chapter 12) and 0.1 million for analgesics/anxiolytics (Chapters 4 and 10 combined) (NHSDigital, 2016b).

More than 99% of the antimicrobials prescribed for treating infections (BNF Chapter 5) were for antibacterial drugs (hitherto referred to as antibiotics). Just 10,670 were for antifungals and 1,776 were for antivirals (NHSDigital, 2016b). For this reason, the research focused specifically on **antibiotic prescribing in primary dental care**.

Figure 1-2 Number of dental prescription items dispensed to NHS dental patients in England during 2015 by chapter of the British National Formulary. Source: Prescription Costs Analysis 2015 (NHSDigital, 2016b)



Key to BNF Chapters:

1 Gastro-intestinal system (including proton pump inhibitors e.g. omeprazole)
3 Respiratory system (including antihistamines)
4 Central nervous system (including paracetamol)
5 Infections (including antibacterials, antivirals and antifungals taken orally)
6 Endocrine system (including steroids)
9 Nutrition & blood (including fluoride toothpaste, mouthwash and tablets)
10 Musculoskeletal & joint diseases (including non-steroidal anti-inflammatory drugs)
12 Ear, nose & oropharynx (including chlorhexidine mouthwash)
13 Skin (including antibacterial, antifungal and antiviral creams and gels)
15 Anaesthesia (including topical analgesics)
21 Appliances (including dry mouth products)

1.1.4.1 Dental antibiotic prescribing guidance

Antibiotics are only necessary where dental patients have both:1) evidence of bacterial infection; AND 2) signs of it spreading systemically, or if referral is required (such as for sedation), or there is a relevant medical history (such as immunocompromise). Antibiotics are not appropriate for the treatment of dental pain, in conditions such as pulpitis or periapical periodontitis, which are of an inflammatory nature (FGDP, 2012) (Joint Formulary Committee, 2018) (Cope, A. et al., 2018) (Agnihotry et al., 2019b). Guidance on treating acute dental infections has been provided by FGDP, BNF and the Scottish Dental Clinical Effectiveness Programme (SDCEP) (FGDP, 2012) (Joint Formulary Committee, 2018) (SDCEP, 2016). All three guidelines share the same premise: antibiotics may be used in conjunction with (but not as an alternative to) other appropriate measures, such as providing drainage of pus, removal/extirpation of the

dental pulp or extraction of a tooth. Cochrane systematic reviews exploring antibiotic use for the treatment of toothache have confirmed that antibiotics do not appear to significantly reduce toothache caused by irreversible pulpitis or periapical periodontitis (Cope, A. et al., 2018) (Agnihotry et al., 2019b). Yet evidence shows that dentists still prescribe antibiotics for these reasons.(Ihimekpen and Thompson, 2018; Agnihotry et al., 2019a)

1.2 Primary dental care

This section provides pertinent background to the context of primary care dentistry in the UK. It covers how it is defined, configured, commissioned and reimbursed. This context focuses in on unscheduled/urgent dental care services provided in primary dental care settings in the UK and specifically England

1.2.1 Settings vs services

Acting as the 'front door' of the NHS, primary care services are the first point of contact into the healthcare system (NHSE, 2018c). In dentistry, however, primary care is a phrase used interchangeably to mean the clinician setting and/or the service provided. Primary care settings are commonly known as community settings by medical healthcare providers (NHSE, 2018c) whereas in dentistry community dental services (CDS) provide care to patients with particular dental and/or medical needs, such as people who are dentally phobic. Around 95% of individuals experiencing dental conditions are treated in primary dental care settings, such as general dental practice (GDP) or out-of-hours (OOH) dental clinics (NIHR, 2015).

For clarity, secondary care services are those to which patients are referred by primary care providers in order to obtain specialty care which is beyond the scope of the primary care provider. In line with aspirations set out in the NHS Five Year Forward View, NHS commissioning strategies for the dental specialties have been produced to ensure the delivery of consistent and excellent services (NHSE, 2014). Notably, they detail 'the mandatory clinical competencies required to deliver the various levels of specialist care rather than prescribing the clinical setting in which it must be delivered.' Increasingly, therefore, specialty services (such as minor oral surgery services) are being provided in primary care settings.

In order to be clear about the context for this research, it was agreed with the supervisory team that this study would focus on **primary dental care services provided in primary dental care settings**. For this reason, GDPs and CDSs (such as OOH dental clinics) providing members of the general public with direct access to care were included in the study. Dental services provided in primary care/community settings but available only upon referral from another clinician and/or secondary care

services providing direct access to acute dental care (such as dental hospitals) were excluded.

1.2.2 General dental practitioners

The provision of dental care services has been restricted to qualified, registered dentists since enactment of the Dentists Act (1921) (Gelbier, 2005). Upon graduation from dental school in the UK, all dentists are deemed '*fit to practise at the level of a safe beginner*' and are qualified to work as general dental practitioners once registered with the GDC (GDC, 2015a). The workforce is further boosted by dentists who trained outside of the UK (estimated to be around a third of registered dentists in 2017 (eVenture, 2018)). All dentists working within the NHS also need to obtain entry on the National Performers list, usually following a year of Dental Foundation Training (NHSE, 2018b).

Opportunities for further training to gain entry to one of the General Dental Council's 13 dental specialties are more limited (GDC, 2019b). Most dentistry in the UK is, therefore, provided by general dental practitioners (HEE, 2019).

For this reason, the research focused on **general dental practitioners delivering primary dental care services in primary dental care settings**.

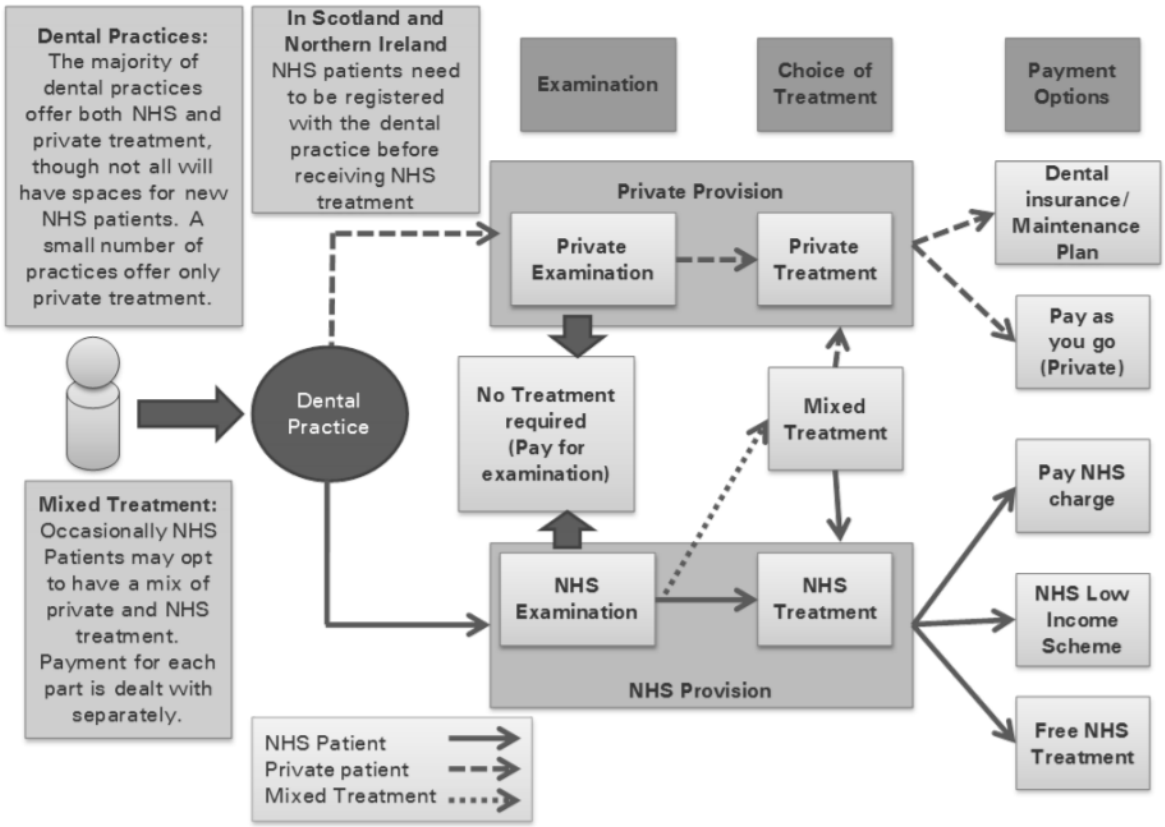
1.2.3 Evolution of primary dental care in the UK

With the establishment of the NHS in 1948, came the availability of 'free at the point of use' dental care. This resulted in a significant demand for dental treatment, including removing decayed teeth and providing replacement dentures (Bivins et al., 2018). The cost of providing around a million dentures in the first nine months led the Government to change its principle of all services being free according to need. Charges for dentures were introduced in 1951 and a general charge for dental treatment was introduced from 1952 (Parliament, 2008b).

The Dentists Act (1984) required that only dentists registered with the GDC could practice dentistry in the UK and defined the 'business of dentistry' as being where an individual received payment for services rendered in the course of the practice of dentistry (HMG, 1984). General dental practices are independent businesses or corporate bodies providing dental services in what has been described as a 'mixed economy' through contracts with the NHS and/or directly to patients through private arrangements (see Figure 1-3) (OFT, 2012). Practice owners need to maintain commercially viable businesses whilst associate dentists are self-employed and work under cost/risk sharing contracts with the dental practice (Parliament, 2008b). Unlike in medical care, dentists delivering primary dental care are rarely salaried and the 'significant majority' are 'associates' working as self-employed subcontractors for a dental practice owner, principal dentist or limited company (NHSE, 2019b). Since the

2005 Amendment to the Act, ownership of practices by Dental Bodies Corporate (practices using the structure of a limited company) has steadily grown (HMG, 2005a). In 2018, over 21% of the dental practice population was under corporate ownership (BDJ, 2019). For this reason, the sampling strategy for selection of GDPs for inclusion in the study included **both independent and corporate practices**.

Figure 1-3 Typical patient journey in UK primary dental care. Source: Office of Fair Trading Report (OFT, 2012).
N.B. 'Pay as your go (Private)' is more usually referred to within dentistry as 'private fee for service'



Primary dental care in the UK is recognised as a market by the Office of Fair Trading (OFT). As shown in the patient journey portrayed in Figure 1-3, OFT identified the range of choices typically available to people seeking routine dental care, including: which dental practice/dentist they attend, which particular dental treatment(s) to have, whether to accept NHS and/or private dental treatment, and how to pay for dental treatment (OFT, 2012). It has been found that only around 60% of people in England access routine dental care, whilst nearly 30% choose to see a dentist only when they have a dental problem (Steele et al., 2012) (PHE, 2016c) (NHSE, 2018a). When choosing the context for this research, careful thought was given to the specific context, including whether it would be private and/or NHS care and whether for routine and/or urgent appointments.

1.2.4 Private versus NHS dental care

When deciding whether to include private and/or NHS dental care in the study, consideration was first given to whether factors motivating dentists and patients might be sufficiently different between the contexts to require separate investigations. Theorising motives of individuals towards the welfare state, Le Grand suggested three roles: 1) altruistic 'knights'; 2) passive recipient 'pawns' or 3) self-interested 'knaves' (Le Grand, 1997). Applying this theory to dentistry, Taylor-Gooby *et al* suggested that dentists moving from providing NHS dental care to private dental care were acting knavishly, leaving a higher proportion of altruistic knights to provide NHS general dental services (Taylor-Gooby et al., 2000) (Calnan et al., 2000).

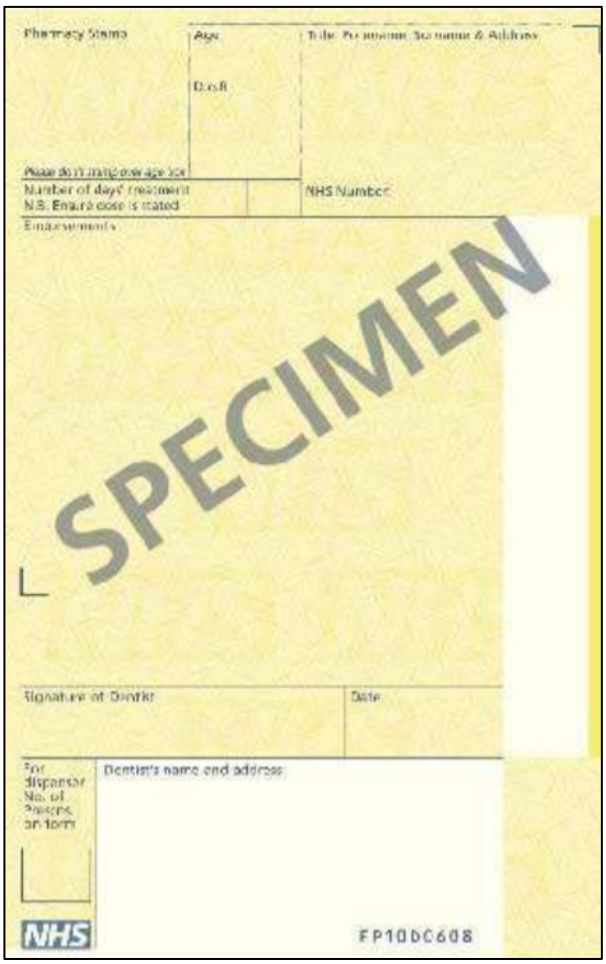
In 1990, a change to the NHS general dental services contract was introduced across the UK (Parliament, 2008b). Whilst remuneration of dentists continued to be based on 'fee-for-item', greater emphasis was placed on the provision of continuing, preventative dental care (Tickle, 2012) (HSCNI, 2019) (TheScottishGovernment, 2019). Prior to this, dentists' responsibilities had been to restore a patient back to dental fitness. Finding this new emphasis uncomfortable, some dentists chose to move away from the constraints of the NHS towards providing care for patients privately (Taylor-Gooby et al., 2000). A significant movement of dentists from NHS to the private sector since the early 1990s has been described in a Parliamentary report as the '*haemorrhage of dentists away from the NHS*.'(Parliament, 2008b). In 2018, for the first time, the value of private dental care (£3.6 billion) exceeded the value of NHS dentistry (£3.5 billion) (BDJ, 2019).

In discussion with the supervisory team, it was agreed that there is evidence that the factors motivating dentists and patients are different between private and NHS, so this doctoral research should focus on just one of these. Published data relating to private dental prescriptions could not be found and investigation revealed that data are not currently routinely collected for private practices. Furthermore, private dental prescriptions for patients receiving a course of private dental treatment can be dispensed either by the dentist themselves directly to the patient, or by a pharmacist under the prescription of a dentist. Whilst it was recognised that there is a gap in the literature concerning antibiotic prescribing/dispensing in private dental practice, it was concluded that focusing this research on private dental care would have required too much time collecting data, with large uncertainty about feasibility.

By contrast, national data relating to NHS dental prescriptions (FP10D forms – see Figure 1-4) dispensed by pharmacists in England since 2015 have been published by the NHS annually as part of the Prescription Costs Analysis and before that as a separate publication: Prescribing by Dentists (NHSDigital, 2016b) (HSCIC, 2009). This was one reason for focusing this research on NHS dental prescribing. In addition, the

research was funded by the National Institute for Health Research (NIHR) through a Doctoral Research Fellowship (reference: DRF-2016-09-148). NIHR is the research arm of the NHS and favours an NHS perspective. For these reasons, this research focused on **reducing antibiotic prescribing by dentists providing NHS primary dental care services in primary dental care settings**, including both GDPs and OOHs dental clinics.

Figure 1-4 Image of a specimen FP10D form for NHS dental prescriptions. Source: (NHSBSA, 2016a).



1.2.5 NHS primary dental care services across the UK

Since devolution in 1998, the health policy and systems of the four nations of the UK have been diverging (Tickle, 2012). Whilst Scotland and Northern Ireland adapted the 1990 contract, a new general dental services contract for England and Wales was introduced in 2006, aimed at: enhancing access to NHS dentistry, improving the quality of care, providing clarity for patients about the cost of treatment and capping the open-ended NHS dental budget (HMG, 2005a) (Tickle, 2012). It has been shown that adjustment of financial incentives when the 2006 general dental services contract was introduced resulted in a reduction in delivery of time-consuming dental treatments and

an increase in the provision of simpler procedures (Tickle et al., 2011) (Davies, B. and Macfarlane, 2010) (McDonald et al., 2012). Capacity freed up by reducing the complexity of NHS work was filled with private workload, often to provide the high quality and more profitable patient care valued by dentists (Whittaker and Birch, 2012) (Sellars, 2019). The professional behaviour of dentists is known to be particularly sensitive to method of remunerations as they operate their practices as businesses and take the full financial risk of the provision of services (Brocklehurst, P. et al., 2013). During a recent rapid realist review, dentists reported struggling with the tension between wanting to practise ethically and wanting to maintain/maximise profitability as a business (Goodwin et al., 2018). With different financial incentives known to influence NHS dentists' behaviours between the devolved nations, it was necessary to focus this doctoral research on just one of the nations.

The decision about where to focus the research was informed by consideration of the volume of antibiotic use by NHS dentists in each nation. As shown in Table 1-2, England had the largest volume of dental antibiotic prescribing and so had the greatest potential for impact in relation to reduced antibiotic prescribing by dentists. For these reasons, this doctoral research focused on **reducing antibiotic prescribing by dentists providing NHS primary dental care in England.**

Table 1-2 Comparing NHS dental prescribing between the devolved nations

	Number of NHS dental antibiotics in 2016
England	3.2 million (PHE, 2018a).
Scotland	0.3 million (HPS, 2017).
Northern Ireland	0.2 million (McBride, 2017).
Wales	0.1 million (Karki, 2019)

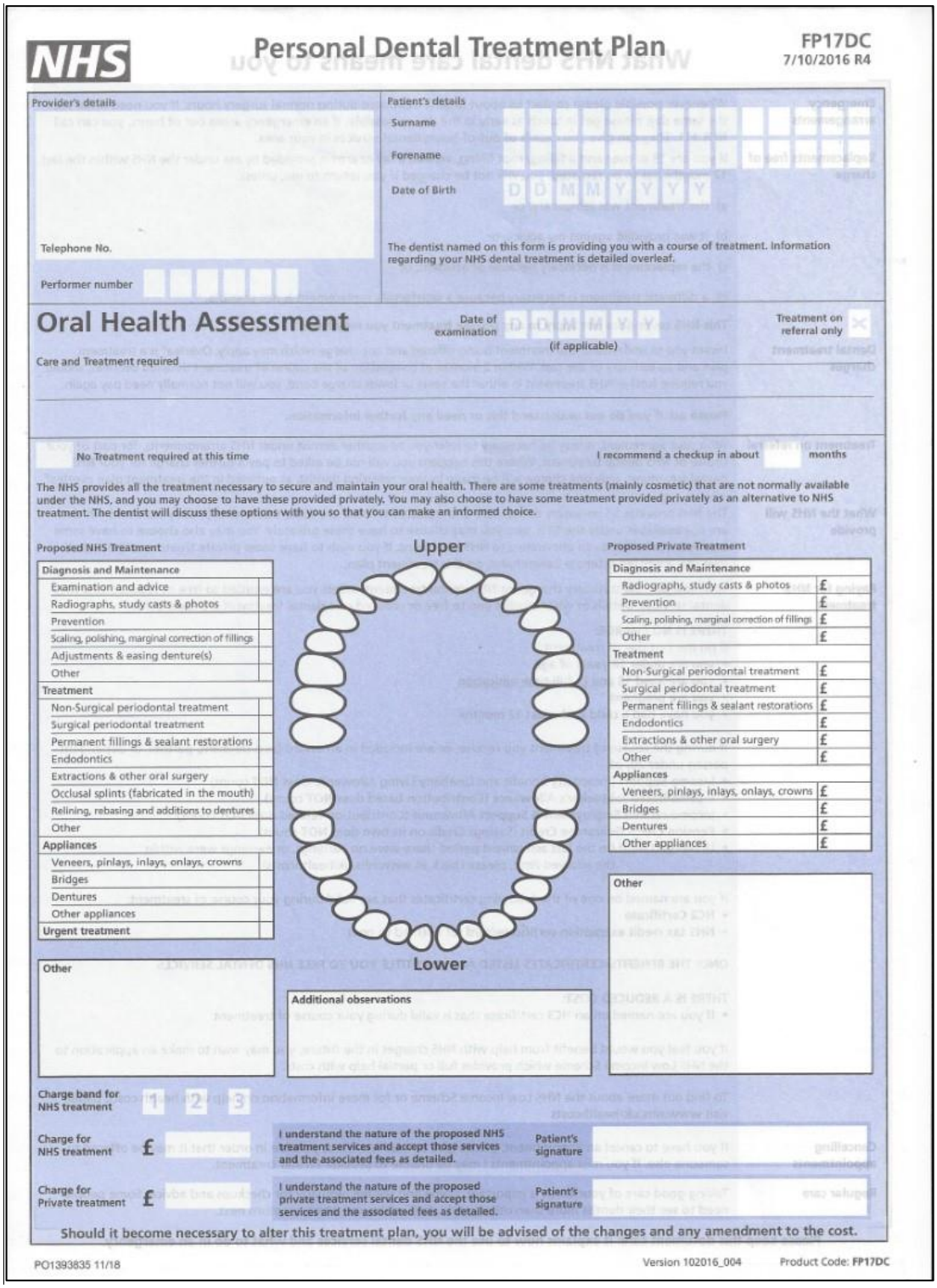
NHS primary dental care in England is commissioned by NHSE direct from 'Providers' which may comprise: individual small-business dental practice owners, larger corporate businesses or NHS Trusts (Parliament, 2008b). Providers subcontract Associate or Locum general dental practitioners ('Performers') to deliver dental care to patients. Practices range from single-handed to multi-surgery clinics and the majority provide a mix of NHS and private care (BDA, 2019). In order to provide patients with the full range of care options and associated costs, each NHS patient must be provided with a personal dental treatment plan form (see Figure 1-5) which includes both NHS and private elements of the treatment plan to be offered (NHSE, 2018d).

Banding of NHS treatment plans in England was introduced as part of the 2006 dental contract. This determines the cost of a full course of treatment co-payable by the patient and also the remuneration to the dentist:

- Band 1 – Diagnosis & maintenance
- Band 2 – Treatment (such as extractions)
- Band 3 – Appliances (such as dentures)

Details about treatments to be provided within each band were set out within the NHS (Dental Charges) Regulations 2005 (HMG, 2005b).

Figure 1-5 NHS Personal Dental Treatment Plan Form (FP17DC) showing 'Proposed NHS Treatment' (left) and 'Proposed Private Treatment' (right)


NHS

Personal Dental Treatment Plan

FP17DC
7/10/2016 R4

Provider's details

Telephone No.

Performer number

Patient's details

Surname

Forename

Date of Birth D D M M Y Y Y Y

The dentist named on this form is providing you with a course of treatment. Information regarding your NHS dental treatment is detailed overleaf.

Oral Health Assessment

Date of examination D D M M Y Y (if applicable)

Treatment on referral only

Care and Treatment required

No Treatment required at this time

I recommend a checkup in about months

The NHS provides all the treatment necessary to secure and maintain your oral health. There are some treatments (mainly cosmetic) that are not normally available under the NHS, and you may choose to have these provided privately. You may also choose to have some treatment provided privately as an alternative to NHS treatment. The dentist will discuss these options with you so that you can make an informed choice.

Proposed NHS Treatment

Diagnosis and Maintenance
Examination and advice
Radiographs, study casts & photos
Prevention
Scaling, polishing, marginal correction of fillings
Adjustments & easing denture(s)
Other
Treatment
Non-Surgical periodontal treatment
Surgical periodontal treatment
Permanent fillings & sealant restorations
Endodontics
Extractions & other oral surgery
Occlusal splints (fabricated in the mouth)
Relining, rebasing and additions to dentures
Other
Appliances
Veneers, pinlays, inlays, onlays, crowns
Bridges
Dentures
Other appliances
Urgent treatment

Upper

Lower

Proposed Private Treatment

Diagnosis and Maintenance	
Radiographs, study casts & photos	£
Prevention	£
Scaling, polishing, marginal correction of fillings	£
Other	£
Treatment	
Non-Surgical periodontal treatment	£
Surgical periodontal treatment	£
Permanent fillings & sealant restorations	£
Endodontics	£
Extractions & other oral surgery	£
Other	£
Appliances	
Veneers, pinlays, inlays, onlays, crowns	£
Bridges	£
Dentures	£
Other appliances	£

Other

Other

Additional observations

Charge band for NHS treatment 1 2 3

Charge for NHS treatment £

I understand the nature of the proposed NHS treatment services and accept those services and the associated fees as detailed.

Patient's signature

Charge for Private treatment £

I understand the nature of the proposed private treatment services and accept those services and the associated fees as detailed.

Patient's signature

Should it become necessary to alter this treatment plan, you will be advised of the changes and any amendment to the cost.

PO1393835 11/18

Version 102016_004

Product Code: FP17DC

Remuneration to the dentist for NHS care is based on Units of Dental Activity (UDAs), which are defined by treatment plan band as shown in Table 1-3 (NHSE, 2018e). Payment to Performers in GDP is generally based on total UDAs completed (capitation

elements are restricted to new 'prototype NHS contracts') whilst OOH clinics tend to pay a flat-rate per session.

Table 1-3 NHS treatment plan bandings, including cost to the patient and Unit of Dental Activity (UDA) accrual by the dentist. Source: (NHSE, 2018e)

Treatment plan band	Cost to the patient (2017/18 prices)	UDAs accrued by the dentist
Band 1	£20.60	1
Band 2	£56.30	3
Band 3	£244.30	12

1.2.6 Urgent NHS dental appointments

Urgent care may be delivered in GDP or OOH/emergency dental clinics. Patients requiring urgent care are defined by the NHS as requiring attention for severe dental and facial pain not controlled by over-the-counter preparations or who have acute dental or soft tissue infections (NHSE, 2015). The aim of treatment provided in urgent dental care is to address pain and stabilise the condition, usually within a single appointment (NHSE, 2018d). For example, appropriate treatment for a dental abscess usually involves tooth extraction or starting a root-canal treatment (FGDP, 2012). Patients pay the same Band 1 fee as for a routine examination (see Table 1-4) and receive urgent care restricted to the treatments shown in Table 1-4, over as many appointments as necessary. Dentists accrue 1.2 UDAs per urgent Band 1 plan (HMG, 2005b). Whilst the list of treatments provides a fine level of detail, including for example ‘treatment of sensitive cementum’ or ‘vital pulpotomy’, prescribing drugs such as antibiotics or analgesics is not explicitly included.

Table 1-4 Urgent treatments under Band 1 charge as detailed in The National Health Service (Dental Charges) Regulations 2005(HMG, 2005b).

a. Examination, assessment and advice b. Radiographic examination and radiological report c. Dressing of teeth and palliative treatment d. Pulpectomy or vital pulpotomy e. Re-implantation of a luxated or subluxated permanent tooth following trauma including any necessary endodontic treatment f. Repair and refixing of inlays and crowns g. Refixing a bridge h. Temporary bridges i. Extraction of not more than 2 teeth i. Provision of post-operative care including treatment of infected sockets k. Adjustment and alteration of dentures or orthodontic appliances l. Urgent treatment for acute conditions of the gingivae or oral mucosa, including treatment for pericoronitis or for ulcers and herpetic lesions, and any necessary oral hygiene instruction in connection with such treatment m. Treatment of sensitive cementum or dentine n. Incising an abscess o. Other treatment immediately necessary as a result of trauma p. Not more than 1 permanent filling.

1.3 Antibiotics and urgent dental appointments

Clinical audits consistently show that most antibiotics prescribed by dentists in the UK are systemic drugs prescribed for adult patients presenting at urgent appointments with pain and/or acute infection (Palmer, N. et al., 2001) (Palmer, N.O. and Batchelor, 2004) (Chopra et al., 2014) (Cope, A.L. et al., 2016a) (Ihimekpen and Thompson, 2018). Furthermore, NHS dental activity records linked antibiotic prescribing more often with urgent than routine dental care plans and with adult than child patients. Eleven percent of urgent treatments included an antibiotic, compared to 1.5% of routine types and 88% of the treatment plans which reported including an antibiotic prescription were for adult patients (NHSDigital, 2016a). Therefore, this doctoral research focused on **urgent dental appointments for adults in primary dental care in England**.

1.3.1 Approach to appropriateness of dental antibiotic prescribing

Judging the appropriateness of each antibiotic prescription is a complex decision as it requires clinicians to apply clinical judgement when using guidelines(NICE, 2012). The Chair of NICE, Professor David Haslam summarised this as:

> "*They're guidelines and not tramlines. Doctors have a fundamental responsibility to use guidelines with their experience and with patients' individual needs to get the best possible overlap between patient-centred medicine and evidence-based medicine. It's not either/or."(Haslam, 2016).*

Inappropriate prescribing of dental antibiotics, based on the extent to which prescriptions conformed to national guidelines has been reported in various studies

(Cope, A.L. et al., 2016b) (Palmer, N. et al., 2001). For example, Cope et al (2016) deemed as inappropriate 13.7% of cases which had the diagnosis 'acute apical abscess with no systemic involvement.' However, whilst antibiotic prescribing may not have been 'necessary' according to guidelines for these cases, a more recent definition of the word 'inappropriate' included within the UK Government's 5-year national action plan would not have classified many of them as 'inappropriate,' as they were associated with a documented bacterial infection (i.e. acute apical abscess):

> '*Inappropriate prescribing is defined as: Prescribing an antibiotic for a patient in the absence of (documented) evidence of bacterial infection. Prescribing a critical broad-spectrum antibiotic (piperacillin-tazobactam or carbapenems in secondary care; co-amoxiclav, cephalosporins and quinolones in primary care) to patients in the absence of a (documented) rationale. Continuing an antibiotic prescription beyond the course length recommended in local or national guidelines, in the absence of a (documented) rationale*.'(HMG, 2019b).

The UK 5-year national action plan on AMR recognised variation in antibiotic prescribing rates between organisations and identified priority actions to reduce variation (HMG, 2019b). As the targets in both this and the previous national plan related only to reduction in the total amount of antibiotic use rather than 'inappropriate' use, this research focused on reducing the **total number of antimicrobial items prescribed by dentist for patients with acute conditions during urgent NHS dental appointments.**

To reduce the total number of antibiotic items prescribed by dentists for adults with acute conditions, the research specifically addressed the initial **decision whether to prescribe antibiotics**, rather than any subsequent decisions about the choice of regimen (e.g. type of drug or dose/duration of treatment).

1.3.2 Only dentists can prescribe dental antibiotics

Within the scope of practice for members of the dental team, only dentists may prescribe medicines (GDC, 2013b). For this reason, the intervention to reduce dental antibiotic prescribing is focused specifically on the behaviour of dentists.

Whilst the ultimate decision about whether to prescribe antibiotics remains with the dentist, the principles of patient-centred care mean that it should be a shared decision with patients (GDC, 2015b) (Main and Adair, 2015) (Chan et al., 2017). Eliciting the patient perspective was an important element of this research in order to understand whether interventions to reduce dental antibiotic prescribing should include patient-focused components. In addition, dental nurses are always present during urgent dental appointments as the GDC requires dentists to 'work with another appropriately trained member of the dental team at all times when treating patients in a dental

setting'. As a third party observer of the dentist-patient interaction, dental nurses have a unique perspective and insight into influences on treatment and habits of dentists. For this reason, their views were also elicited as part of this research.

In the light of informed consent and the 2015 Montgomery vs Lanarkshire legal ruling together with its link to shared decision making, both dentists and patients play essential parts in the decision to prescribe dental antibiotics (Main and Adair, 2015). For this reason, the **influence of both dentists and patients on the decision whether to prescribe antibiotics for adults with acute dental conditions** was included in the research (GDC, 2015b).

1.4 Interventions to reduce antibiotic prescribing

1.4.1 How clinicians use guidelines

Guidelines alone have limited effect on changing clinician behaviour (Cabana et al., 1999). Gabbay & Le May's ethnographic study to understand this is in more detail found that clinicians rarely accessed and used explicit evidence from research or other sources directly. Instead, they rely on *'mindlines'* – described as *"collectively reinforced, internalised, tacit guidelines"* informed by brief reading but mainly by experience (their own and their colleagues'), their interactions with each other and with opinion leaders, patients, and pharmaceutical representatives (Gabbay and le May, 2004). The resulting socially constructed 'knowledge in practice' is often gained through a range of informal interactions in fluid 'communities of practice'(Gabbay and le May, 2010). So whilst guidelines are important, they are insufficient on their own to change clinician behaviour.

In relation to antibiotic prescribing, clinical trials have demonstrated that multifaceted/complex interventions can be effective at achieving reduction of antibiotic prescribing in general practices and other ambulatory settings (Arnold and Straus, 2005). An example of a multifaceted intervention in this setting is the *Stemming the Tide of Antibiotic Resistance programme which* resulted in a 4.2% reduction in total oral antibiotic dispensing across general practices in the intervention group relative to the control group (Butler et al., 2012). It included a practice-based seminar reflecting on the practices' own dispensing and resistance data, online educational elements, and practising consulting skills in routine care.

Treat Antibiotics Responsibly, Guidance, Education, Tools (TARGET) is a toolkit designed to help influence prescribers' and patients' personal attitudes, social norms and perceived barriers to optimal antibiotic prescribing (RCGP, 2015). It was designed to be used by the whole primary care team within the General Practice (GP) or out of hours setting, including to enable primary care organisations to demonstrate

compliance with the Health and Social Care Act 2008: Code of Practice on the prevention and control of infections and related guidance.

1.4.2 Supporting reduced dental antibiotic prescribing

To promote the appropriate use of antibiotics in dental care, a website of existing tools similar to TARGET was collated by the ESPAUR dental subgroup, led by Public Health England (PHE) (PHE, 2016a). This dental AMS toolkit built on initial work undertaken by NHSE Cheshire & Merseyside's Local Dental Network through a series of peer review workshops with members of the dental team. Patient-facing resources included leaflets and posters (Figure 1-6) and there were links to national guidance from FGDP, BNF and SDCEP accompanied by a self-audit tool for clinicians which was hosted on the FGDP and British Dental Association (BDA) websites (FGDP, 2019). On-line scenario-based training about optimal use of dental antibiotic prescribing, hosted on the British Association of Oral Surgeons (BAOS), and guidance on analgesic prescribing for dental pain were added later to the evolving dental AMS toolkit website (BAOS, 2019). The addition of new evidence-based, theory-informed tools to complement the existing toolkit has the potential to improve public health and patient safety by enabling further reductions in antibiotic use by dentists. Whilst the existing education, guidelines and self-audit resources have been made available in the UK, their impact on antibiotic prescribing in dentistry is largely unknown and antibiotic prescribing by dentists remains high, at 5% of all NHS antibiotics (PHE, 2018b). With an established dental AMS toolkit in place, the complex intervention being developed through this doctoral research will be designed to complement and dovetail with the existing tool.

Figure 1-6 Poster from the dental antimicrobial stewardship toolkit. Source: UK Dental Antimicrobial Stewardship Toolkit (PHE, 2016a).

A systematic review of international dental AMS interventions identified just two randomised controlled trials (RCTs) relating to primary dental care for inclusion, both from the UK (Löffler and Böhmer, 2017). The first RCT comprised clinical outreach education to rationalise antibiotic prescribing for acute dental pain in the primary dental care setting in Wales and showed significant reductions in antibiotic prescribing (Seager et al., 2006). The study compared a short educational intervention delivered by a pharmacist at GDPs with just sending the practices copies of guidance relating to antibiotic prescribing. It concluded that providing guidance alone was insufficient to achieve behaviour change. The second RCT involved an audit and feedback

undertaken in Scotland which concluded that providing feedback to practices using routinely-collected data resulted in significant reductions in the rate of antibiotic prescribing and that targeting higher prescribing practices results in greater reductions (Elouafkaoui et al., 2016). Systems in Scotland (unlike England) allocate all prescriptions to individual practices via Prescribing Information System for Scotland (PRISMS).

Chapter 2 – Approach to developing a new evidence-based, theory-informed dental antimicrobial stewardship intervention

To address the public health and patient safety issues associated with high rates of dental antibiotic use, the research sought to inform the development of an evidence-based, theory-informed behaviour change intervention to reduce antibiotic prescribing by dentists for adults with acute conditions during urgent NHS dental appointments in England.

2.1 Research Aim

To develop a complex intervention to support reduced antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England.

2.2 Research Questions & Objectives

This study will develop a complex intervention aimed at changing dentists' prescribing behaviour so as to enable reduced antibiotic prescribing for adults with acute conditions during urgent NHS primary dental care appointments in England.
As advocated by the Medical Research Council (MRC) guidance on complex interventions, an important precursor to behaviour change development is the development of a detailed understanding of the behaviour to be changed as well as the factors influencing it. Thus the objectives of this research were to obtain an in-depth understanding of dental antibiotic prescribing for adults with acute conditions through a systematic review of the published literature; exploration of routinely-collected NHS data; and an ethnographic approach to understanding dentist and patient-related influences on the dentist's decision whether to prescribe antibiotics.
A further objective was to employ behavioural science theories and techniques to develop a theory-informed, evidence based complex intervention.

2.2.1.1 Systematic review – Chapter 3

In order to build on the plethora of published research about antibiotic stewardship which exists across healthcare, the first step of the research was to conduct a systematic review of factors associated with the decision to prescribe antibiotics to adults with acute dental conditions, accompanied by an umbrella review (systematic review of systematic reviews) to identify factors associated with the decision to prescribe antibiotics to adults with acute conditions across primary healthcare. Comparing and contrasting the factors identified in these two reviews would facilitate knowledge transfer between the two contexts. The next step, linking the identified factors to the Theoretical Domains Framework (TDF) would then underpin the

development of an initial evidence-based, theory of behaviour relating to antibiotic prescribing by dentists for adults with acute dental problems.

RESEARCH QUESTION 1:- What does the published literature tell us about the factors that are associated with the decision whether to prescribe antibiotics (rather than the specifics of which drug to prescribe) for adults with acute conditions during urgent/unscheduled appointments across primary care, including dentistry.

OBJECTIVE 1A:- To compile the evidence of the factors that are associated with the decision whether to prescribe systemic antibiotics for adults with acute conditions across primary healthcare.

OBJECTIVE 1B:- To evaluate which factors are associated with the decision whether to prescribe systemic antibiotics for adults with acute conditions in urgent primary dental care.

2.2.1.2 Exploring routinely-collected data – Chapter 4

Given that an initial scoping review indicated that much of the published research would likely be based upon dentists' self-report, the next step was to explore available data on antibiotic use during NHS dental appointments from routinely-collected sources of data, collected for purposes other than research. The use of such data, might allow for the identification of high and low prescribing practices. Such practices at the extremes would be interesting research sites to observe interactions between dentists and patients during urgent dental appointments in order to identify a wide range of factors influencing treatment decisions, including whether or not to prescribe antibiotics.

RESEARCH QUESTION 2:- To what extent could routinely-collected NHSE data contribute to the development and evaluation of an evidence-based, theory-informed intervention to reduce antibiotic prescribing during urgent NHS dental appointments?

OBJECTIVE 2A:- To describe practice-level variation in the rate of antibiotic prescribing to inform the ethnographic study in Chapter 5.

OBJECTIVE 2B:- To explore the utility of routinely-collected NHS datasets, including the accuracy and completeness of practice-level data about antibiotic prescription, for use as a potential measure of the effectiveness of the intervention (within Chapter 6).

2.2.1.3 Ethnographic study – Chapter 5

Given that an initial scoping review suggested that dental antibiotic prescribing decisions were intimately linked with decisions about other treatment options, the next step was to study decisions about antibiotic prescribing within the wider context of treatment decisions during urgent dental appointments. To ensure richness of

understanding about the decision whether to prescribe antibiotics and to supplement the paucity of high quality routinely-collected data available from NHS dental practices in England (which was established during planning of the study), a qualitative study was planned. The reasons for selecting an ethnographic approach will be discussed in Chapter 5. The ethnographic study would explore treatment decisions during urgent dental appointments for adults with acute conditions in GDP and OOH dental clinics so as to broaden and deepen understanding of the factors associated with treatment decisions including but not limited to antibiotic prescribing for adults with acute dental conditions. This element of the research would also allow exploration of patient influences on the dentist's decision to prescribe antibiotics. Overt observation/audio-recording of dental appointments and follow-up interviews (using the systematic review finding to inform the topic guides) were planned to provide insight into aspects of the dentist-patient interaction and characteristics of the prescribing decision beyond understanding from published papers.

By utilising the list of factors identified in the systematic review as the basis for analysis of dentist-related influences, the ethnographic study would evolve the evidence-based theory of behaviour relating to dental antibiotic prescribing which would underpin a logic model for development of an intervention to reduce dental antibiotic prescribing. Additional exploration of the patient perspective and how they influence treatment decisions was planned as little had been published in the literature.

> **RESEARCH QUESTION 3:-** What factors influence treatment of adults with acute conditions during urgent NHS dental appointments in England?
>
> **OBJECTIVE 3A**:- To explore the dentist-related factors that affect treatment provided by dentists.
>
> **OBJECTIVE 3B** - To explore patient-related factors that affect treatment received by patients.

2.2.1.4 Intervention development – Chapter 6

Finally, evidence from the three earlier studies will be combined using behavioural science to build a programme theory and logic model for the development of an intervention aimed at reducing antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England.

To assist interpretation of the results and assist prioritisation of areas of intervention development, a stakeholder group with broad membership will be assembled. This will include individuals with lived experience of urgent NHS dental care, members of dental teams with experience of delivering urgent NHS dental care, NHSE dental service commissioners, Health Education England (HEE) providers of training to clinicians and PHE consultants in dental public health.

RESEARCH QUESTION 4:- Can the theoretical knowledge base inform the development of a plausible complex intervention to reduce antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England?

OBJECTIVE 4A:- To develop a theory of change aimed at reducing antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments.

OBJECTIVE 4B:-To develop an overarching logic model of the complex intervention, informed by behavioural science and with knowledge transfer from the GP context, as appropriate.

OBJECTIVE 4C:-To outline how components of the complex intervention could be co-developed with key stakeholders, to produce new tools for addition to the national dental AMS toolkit.

2.3 Theoretical perspective

To address the research aim and objectives would require a mixture of study methods. Where quantitative research uses numerical data to formulate fact and uncover patterns about the natural world, qualitative research explores understanding about the social world (Creswell and Creswell, 2017). Mixed methods research combines elements of qualitative and quantitative research approaches in order to achieve breadth and depth of understanding and corroboration (Johnson et al., 2007). Researchers tend to undertake one of these types of research and often regard the others with suspicion for a range of reasons, including from a philosophical perspective (Hammarberg et al., 2016).

2.3.1 Philosophical assumptions

The term ‘research paradigm’ was coined by Kuhn whilst unravelling the reason behind ‘the number and extent of overt disagreements between social science researchers about the nature of scientific problems and methods’ (Kuhn, 1962). He described them as ‘scientific achievements which, for a time, provide model problems and solutions to a community of practitioners.’ Over time, the term has evolved to become the philosophical approach underpinning research which takes the research process in a particular direction. As shown Table 2-1, three components of the research paradigm are: ontology, epistemology and methods (Ritchie et al., 2013) (Mackenzie and Knipe, 2006).

Table 2-1 Description of research paradigm components adapted from (Ritchie et al., 2013) (Mackenzie and Knipe, 2006).

Components of the research paradigm	Description
Ontology	Assumptions about the nature of reality and what exists in the world.
Epistemology	Assumptions about how we can come to know about what exists in the world and learn from reality.
Methods	Combination of approaches to data collection and analysis.

Quantitative and qualitative research paradigms differ markedly in their ontological and epistemological assumptions. Quantitative research is generally positivist or post-positivist in nature and is explored using objective 'scientific method.' For qualitative research, there are a plethora of paradigms from which researchers may choose, depending on the researcher's view of the world. As shown in Table 2-2, these include interpretivist, constructivist, and pragmatist.

Table 2-2 Examples of research paradigms. Adapted from (Ritchie et al., 2013). and (Hallberg and Richards, 2015).

Paradigms	Ontology	Epistemology	Methods
Positivism	Reality exists independent of our beliefs. Reality is objective and perceived	Acquisition of knowledge is independent of morals or values	Quantitative
Interpretivism/ constructivism	No external reality exists independent of our beliefs and understanding. Reality is affected by the research process.	Knowledge is actively constructed by humans	Qualitative
Pragmatism	Reality is ambiguous. Multiple ways of perceiving the world.	Knowledge is formed by both objective and subjective values	Quantitative and/or qualitative

2.3.2 Mixed methods – the third way

Mixed methods research is the type of research in which a researcher or team of researchers combines qualitative and quantitative elements to gain breadth and depth of understanding and corroboration (Johnson et al., 2007). Mixed methods research has emerged as the 'third methodological movement'(Denzin, 2010). These names recognise the strict polarisation between quantitative research (the first) and qualitative (the second) to which has already been alluded (Hallberg and Richards, 2015). Whilst some researchers place no importance on the differences at either the level of practice or that of epistemology, for others the mixing of incompatible approaches within mixed methods research has been controversial (Denzin, 2010) (Howe, 2012).
More recently, it has become a more accepted norm to use quantitative and qualitative methods together for empirical inquiries (Tashakkori and Teddlie, 2010) (Johnson et al., 2007). Proponent researchers favoured a 'what works' pragmatic argument which has become known as *'evidence-based research'* (Denzin, 2010).

2.3.3 Evidence-based research

Evidence-based research originating in pragmatism was characterised by the importance given to the research objective, which governed the direction of the research (Hallberg and Richards, 2015). A pluralistic approach to addressing the objective from more than one perspective was equally important. For this reason, the need to choose between world views was replaced by embracing a range of approaches and perspective, thus allowing the best evidence to be sought with which to address the question/objective. Both inductive and deductive approaches are used within mixed methods research, allowing theory generation and verification. Use of pragmatism also means the research can take place in context, allowing consideration of the complexity of healthcare's social, historical and political factors.
The MRC's 2013 complex interventions guidance advocated an iterative and pragmatic approach to intervention development (Craig et al., 2013). In contrast to mono-method studies, mixed methods can allow for modification of the research question(s) and research design during the course of the study (Hallberg and Richards, 2015). A range of mixed methods designs exist in which the various strands of research are undertaken concurrently, sequentially or as a multi-phase design in which each subsequent phase uses a study design to build on the research finds of the previous study in order to build towards achieving the project's overall objective. This study used a multi-phase design (qualitative – quantitative – qualitative) and the follow-on study would refine components of the complex intervention through iterations leading to a feasibility and then full trial to evaluate the complex intervention.

2.3.4 Theory-informed behaviour change interventions

Interventions to support behaviour change tend to be more successful when underpinned by behavioural theory (Abraham et al., 2009). Whilst a plethora of behaviour change theories and models exist, Asimakopoulou & Newton (2015) contend that even two of the most commonly used and researched (Theory of Planned Behaviour and Trans-Theoretical Model) have been poor at explaining actual behaviour and proved rather unconvincing in supporting behaviour change in the dental setting (Asimakopoulou and Newton, 2015). By combining existing theories and models, however, a new paradigm for behavioural theory to underpin understanding about behaviours and approaches to tackling them was developed: a coherent suite of theories, techniques and tools developed by the University College London (UCL) Centre for Behaviour Change (CBC) and its partners (Michie et al., 2014). Further descriptions are presented in the relevant Chapters of the thesis: TDF (Chapter 3), Capability-Opportunity-Motivation-Behaviour (COM-B) model (Chapter 5), Behaviour Change Techniques (BCTs) (Chapter 6) and Theory & Techniques Tool (TTT) (Chapter 6).

2.3.5 Implementation science

Implementation science has been defined as: '*the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services and care*' (Eccles and Mittman, 2006). It is a relatively new discipline dating back to around 2006 and has tended to be based on a *'clockwork universe paradigm with a step-by-step approach to interventions'* (Braithwaite et al., 2018). By contrast, complexity is described as '*a dynamic and constantly emerging set of processes and objects that not only interact with each other, but come to be defined by those interactions*' (Cohn et al., 2013). Scholars of complexity increasingly draw distinctions between *complicated* and *complex* interventions. Complicated interventions work roughly the same way in different settings whereas complex interventions adapt in response to changes in social systems (Mills et al., 2019). Conventional healthcare interventions have tended to be predicated on linearity and predictability, which works well for complicated interventions (Greenhalgh and Papoutsi, 2018). Non-linear approaches to test and evaluate complex interventions are increasingly advocated and it is anticipated that the new MRC guidance will provide an impetus for natural experiments as part of evaluation (Skivington et al., 2018).

2.3.6 Complex interventions

Complex interventions are described in current MRC guidance as '*interventions with several interacting components*' (Craig et al., 2008). An on-going review of this guidance, however, has found its current definition is somewhat outdated and relates to multifaceted rather than complex interventions. A revised definition of complex interventions is anticipated which will draw upon '*a wider understanding of the complex contexts (systems) in which interventions are delivered and evaluated'* (Craig et al., 2019) (Skivington et al., 2018). The consultation draft of the updated MRC/NIHR guidance on complex interventions also included a revised model for developing and evaluating complex infections which reflects its new emphasis on context and overarching considerations as well as the importance of combining interventions which act at both local and wider levels (Craig et al., 2019).

The way in which an intervention is expected to lead to its effects and under what conditions is described as 'programme theory' (Rogers, 2008). The APTiTUDE intervention programme theory will be presented in Chapter 6, based on evidence and behavioural theory identified in Chapter 5. Logic models are visual representations of the programme theory (Moore et al., 2015). A logic model to describe the dental antimicrobial stewardship intervention being developed will be presented in Chapter 6. With increasing emphasis on the dynamic context within which complex interventions are implemented, the APTiTUDE logic model will include evidence from Chapter 5 about the context of urgent NHS dental appointments within which dentists and adult patients share decisions about whether to prescribe antibiotics for acute dental conditions in England.

2.3.7 Story-based interventions

Stories and anecdotes are a powerful way to communicate ideas, increase knowledge and trigger action, including modifying existing mind lines (short cuts in thinking) (Gabbay and le May, 2010). The 'stickiness of stories' make them a very good way to spread information, although conversely they may also spread misinformation. During their ethnographic research Gabbay & Le May noted clinicians were routinely sharing stories which allowed continual checking and upgrading of their practice (Gabbay and le May, 2004). They also found that theoretical knowledge is better retained when linked to a narrative, especially if the story is oral rather than written as the listener can actively engage (Connell et al., 2004). Furthermore, because stories often contain metaphor, analogy and other expressive imagery, they are highly effective in conveying tacit information that is otherwise difficult to articulate (Nonaka, 1994).

2.3.8 Participatory research

Participatory research is an umbrella term for a school of approaches that share a core philosophy of inclusivity and of recognising the value of engaging in the research process (rather than including only as subjects of the research) those who are intended to be the beneficiaries, users, and stakeholders of the research (Cargo and Mercer, 2008). INVOLVE defines Patient and Public Involvement & Engagement (PPIE) in research as '*research that is carried out with and by patients and the public, not to, for or about them*'(NIHR, 2019c).

Together and individually, a stakeholder group was convened to help shape the research questions. Through the course of the research, it will guide the sampling strategies, research site recruitment, analysis and prioritisation of the research results, design of the interventions and dissemination of the findings – very much aimed at a co-production approach.

2.3.9 Quality in research

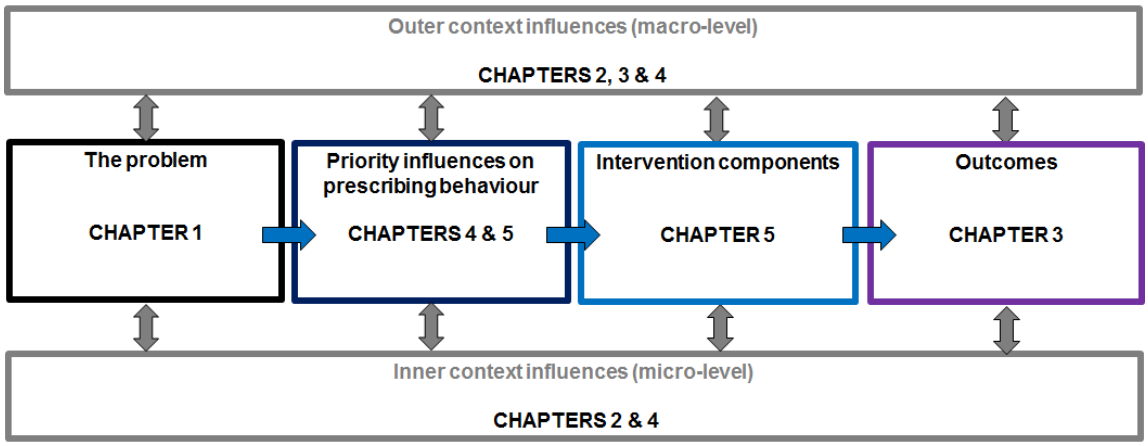
High quality research is more likely to produce reliable high quality results. Concern about assessing quality has manifested itself in the proliferation of guidelines for doing so (Mays and Pope, 2000). The EQUATOR (Enhancing the QUAlity and Transparency Of health Research) Network was established to improve the reliability and value of published health research literature by promoting transparent and accurate reporting and wider use of robust reporting guidelines (EQUATOR, 2019). Each Chapter of this thesis is underpinned by an appropriate reporting framework: PRIMSA for the systematic review(Moher et al., 2009); RECORD for the analysis of routinely-collected data(Benchimol et al., 2015). and SRQR for the qualitative research(O'Brien et al., 2014). Two frameworks are considered for reporting the intervention development: CReDECI2 and TIDieR (Hoffmann et al., 2014) (Möhler et al., 2015).

2.4 Research Design and Methods

In the spirit of Pawson's realist manifesto *'clarion call to scavenge for evidence of all forms, qualitative and quantitative, outcome and process, measurement and gossip!'*, the research methods will include: systematic review (Chapter 3); analysis of routinely-collected NHS data (Chapter 4) and ethnographic research (including overt observations/audio-recording of appointments and semi-structured interviews – Chapter 5) in NHS GDPs and OOH dental clinics involving dentists, patients and dental nurses (Pawson, 2013). The MRC guidance on developing complex interventions and the UCL CBC suite of behaviour change theories, techniques and tools will provide the underpinning behavioural science for production of a complex intervention's programme theory and logic model (Chapter 6). A graphic summary presented in

Figure 2-1 shows how the findings of the Chapters will be combined in order to facilitate development of an evidence-base, theory-informed intervention to reduce antibiotic prescribing for adults with acute dental conditions during urgent NHS dental appointments in England.

Figure 2-1 Thesis chapters mapped to the logic model structure



Chapter 3 - Factors associated with antibiotic prescribing for adults with acute conditions: an umbrella review across primary care and a systematic review focusing on primary dental care.

3.1 Introduction

3.1.1 Health Need

Antibiotics are important for treating and preventing infections caused by bacteria. Professor Dame Sally Davies, the UK Chief Medical Adviser has issued serious warnings about the global health problem faced if the threat of DRIs is not tackled (Davies, S. and Gibbens, 2013). One way to slow the spread of resistant bacteria is by improved stewardship of antibiotics: using them more carefully and reducing the number of unnecessary prescriptions, which requires clinicians to change current prescribing behaviours.

The behavioural and social sciences are increasingly appreciated as fundamental to the development of interventions aimed at modifying clinician/patient behaviours (PHE, 2018c). Although interventions attempting to change antibiotic prescribing behaviour are regularly reported in the scientific literature, largely in hospital and primary medical care settings, few have been explicitly designed using behaviour change theory(Charani et al., 2011) (PHE, 2015a). or tested in primary dental care (Löffler and Böhmer, 2017). The MRC guidance on developing complex interventions advocates understanding how the intervention causes change as an important precursor to intervention development (Craig et al., 2013). Yet despite the extensive base of published research which exists in relation to the impact of behavioural determinants on antibiotic prescribing, these influences have not generally been given due consideration in the design and evaluation of targeted antibiotic stewardship interventions (Charani et al., 2011).

A more comprehensive understanding of the determinants of antibiotic prescribing behaviour should improve the effectiveness and sustainability of future interventions (Lorencatto et al., 2018). The TDF was developed to provide a comprehensive, theory-informed approach to identify determinants of behaviour and support behaviour change intervention design (Atkins et al., 2017). Since this study commenced, TDF has increasingly been reported in behaviour change studies, including in relation to antibiotic prescribing (Newlands et al., 2016).

With antibiotic resistance being a global problem that requires a global solution, the health research community and World Health Organisation (WHO) has turned its focus towards understanding the specific issues effecting its emergence and spread in hotspots such as low- and middle-income countries (LMICs) (Zellweger et al., 2017)

(World_Bank, 2018) (Pearson et al., 2018). Including international studies in the review enabled comparisons between factors in different parts of the world.

3.1.2 Identifying factors influencing antibiotic prescribing

Before developing an antibiotic stewardship complex intervention for use by dental teams working in primary care settings to treat patients with acute conditions, we needed to understand first what was known about the factors associated with the decision to prescribe systemic antibiotics. The goal was to identify factors that could be pertinent to a primary dental care setting and to harness them to support behaviour change intervention design. For this reason, each factor identified during the study was linked to the TDF.

In order to maximise the opportunity to translate existing knowledge between settings, first the factors influencing antibiotic prescribing decisions for urgent consultations across all primary care settings were identified. Owing to the plethora of studies relating to antibiotic prescribing across primary medical care, an umbrella review (also known as a systematic review of systematic reviews or overview of reviews)(Bougioukas et al., 2019) (Aromataris, Edoardo et al., 2015). was chosen as an efficient way to identify factors and summarise the extensive evidence base. Then a systematic review was undertaken to collate the sparse dental-specific evidence base. Finally, the identified factors were compared and contrasted between clinical settings in order to inform the development of future antibiotic stewardship interventions.

3.1.3 Focus on dental antibiotic prescribing

Across primary medical care, antibiotics are prescribed by general practitioners, nurse practitioners and pharmacists to adults with conditions such as cough, respiratory tract infections (RTIs), sore throat and urinary tract infections (Pouwels et al., 2018). Prescribing of antibiotics for paediatric patients is particularly high in the medical context (Ivanovska et al., 2016).

By contrast, dental prescribing data from the NHS in England suggest that the most prescribed medications by dentists in primary dental care are antibiotics for adult patients with acute infections (such as pericoronitis) and/or pain (such as irreversible pulpitis) during urgent dental appointments (NHSDigital, 2018; Digital, 2018). For the reason, the review focused on adults with acute conditions during urgent dental appointments. Urgent dental care is usually provided in GDP or unscheduled/ OOH dental clinics (NHSE, 2015).

3.1.4 Focus on whether to prescribe antibiotics

Antibiotic resistance has been shown to be more associated with prior antibiotic exposure than the quality of the antibiotic prescription in relation to guidelines (Chatterjee et al., 2018). This review has focused, therefore, on identifying what factors influence the decision whether to prescribe any antibiotic agent to adult patients with acute/urgent conditions in primary care settings rather than the specifics of the agent prescribed. Thematic analysis of the umbrella review across primary care and the systematic review of primary dental care was undertaken to identify the factors as it provided a flexible approach to identifying issues without being tied to a particular epistemology or theory (Braun and Clarke, 2006). This was felt to be particularly appropriate at this early stage in the development of understanding about factors influencing dentists' decisions to prescribe antibiotics. Other methods considered for synthesising the data included framework analysis using TDF and Realist Synthesis. Framework analysis using TDF was rejected,(Cane et al., 2012). as the extent to which TDF would be applicable to the issue of antibiotic prescribing was unclear at the start of the review. Realist synthesis was rejected as it relies on the availability of sufficient literature addressing how and why context influences outcomes in relation to specific interventions (Papoutsi et al., 2017). There was insufficient literature reporting the outcome of interventions relating to the prescription of systemic antibiotics for adults in primary dental care for realist synthesis to be appropriate for this review.
Journal of Antimicrobial Chemotherapy published this study on-line in April 2019 (Thompson, W et al., 2019b). A team of researchers was required in order for independent assessment of studies for inclusion/exclusion, quality assessment of the included studies and analysis/synthesis of the themes. Only one author (WT) took part in all aspects of the study, the other researchers (ST-C, SHP, RRCM, GVAD, VRA and JATS) and their contributions are identified at appropriate points in the Chapter.

3.2 Aim

The aim of this study was to identify evidence from the published literature about the factors that are associated with decisions whether to prescribe antibiotics (rather than the specifics of which drug to prescribe) for adults with acute conditions during urgent/unscheduled appointments across primary healthcare, including dentistry.

3.3 Objectives

Objective A - Umbrella Review across Primary Care

To compile the evidence of the factors that are associated with the decision whether to prescribe systemic antibiotics for adults with acute conditions across primary care. A scoping study indicated the published literature across primary care was extensive, so

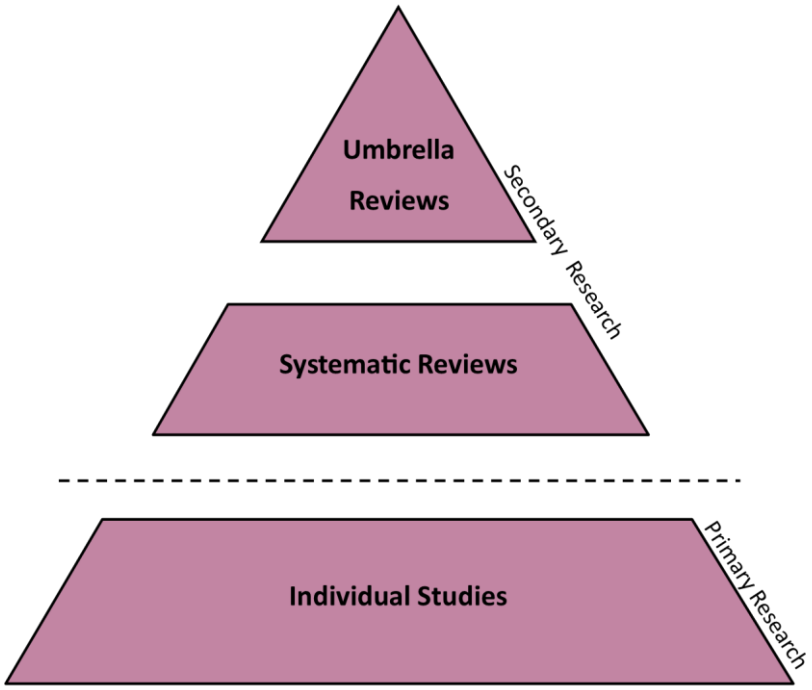
a qualitative umbrella review (a systematic review of systematic reviews (see Figure 3-1) was planned as an efficient way of collating the evidence.

[Primary care was defined as '*the first point of contact in the healthcare system….including general practice, community pharmacy, dental and optometry service.*'(NHSE, 2018c). Urgent primary dental care included out-of-hour (OOH)/emergency dental services provided in community settings.]

Objective B - Systematic Review of Primary Dental Care

To evaluate which factors are associated with the decision whether to prescribe systemic antibiotics for adults with acute conditions in urgent primary dental care. A scoping literature search indicated that the published literature for the urgent dental care setting was small, so a qualitative systematic review of primary research studies was planned.

Figure 3-1 Hierarchy of evidence synthesis methods. Adapted from: (Fusar-Poli and Radua, 2018).



3.4 Methods

An umbrella review (systematic review of systematic reviews) was undertaken to address Objective A and a systematic review for Objective B.

The protocol for the umbrella review across primary care and systematic review of primary dental care was published in PROSPERO (http://www.crd.york.ac.uk/PROSPERO/) with the accession number

CRD42016037174. Both reviews conformed to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (Moher et al., 2009). In addition, the umbrella review was guided by the Joanna Briggs Institute (JBI) methodology for umbrella reviews (Aromataris, E et al., 2014).

3.4.1 Search Strategies

In July 2018, five databases were searched from their earliest dates: Ovid MEDLINE, Ovid EMBASE, Ovid PsychINFO, Web of Science and the British Library e-thesis online service (EThOS). Separate search strategies and inclusion/exclusion criteria were developed for each review in collaboration with information specialists.

Electronic searches were conducted initially in May 2016 and as the researchers became aware that the literature base was rapidly evolving, the searches were re-run in August 2017 and then again in July 2018.

Each search strategy used a 'human' search limit as animal studies were not eligible for the reviews and an 'English language' limit due to lack of resources for translation. The reference lists of included studies were manually searched for additional potentially relevant studies; other papers were also identified through discussion among the researchers. After performing the full search for each review, titles and abstracts retrieved from each database were combined in EndNote X7 and duplicates were removed. Separate EndNote libraries were used for the umbrella review across primary care and the systematic review of primary dental care.

3.4.1.1 Umbrella review across primary care - Search strategy

The umbrella review search strategy focused more broadly across primary care settings (see Appendix A1). Search terms were determined by specifying the broader concepts being assessed ("antibiotic," "primary care," "acute" and "prescribing") and by identifying relevant terms within these concepts. Keywords and MeSH (medical subject headings) terms were compared from known, relevant studies as well as similar reviews. The list was then further refined through discussion with information specialists and consensus within the research team (WT, GVAD, JATS, SHP, VRA and RRCM) and an additional search limit for 'systematic reviews' study type was applied.

3.4.1.2 Systematic review of primary dental care - Search strategy

The systematic review strategy focused more narrowly on the primary dental care setting (see Appendix A2).

A summary of the number of papers found from each database for each element of the search strategy is presented in Appendix A3).

3.4.2 Study selection

Studies published as original research articles in peer-reviewed journals were included if they contained factors associated with decisions about whether to prescribe systemic antibiotics for the treatment of adults with acute conditions in non-specialist primary care settings. Studies related to specialist care delivered in primary care settings and/or primary care services delivered in hospital settings were excluded. Studies relating solely to the antibiotic regimen (type, dose and/or duration), unusual conditions or diagnostics/treatment efficacy were excluded. Where the full reference could not be accessed, these studies were also excluded.

3.4.2.1 Umbrella review across primary care – Study selection

For the umbrella review, a sensitive approach to the study selection was employed. Systematic reviews were included if they reported, as a minimum, factors relating to the provision of care for adults with acute conditions in primary care settings.
Two researchers (WT and JATS) screened all study titles and abstracts for potential relevance. The full texts of all studies identified as potentially relevant were then assessed for inclusion eligibility independently by the same two researchers. Discrepancy or disagreements about inclusion or exclusion were resolved through discussion of the full text article.

3.4.2.2 Systematic review of primary dental care – Study selection

A more specific application of the eligibility criteria was employed for the systematic review of primary dental care. Primary research studies (qualitative, quantitative and mixed methods) were included only if they reported on the provision of care for adults with acute dental conditions (pain and/or infection) by general (non-specialist) dentists in primary dental care settings. Studies that included additional types of care, such as dental emergencies (e.g. trauma), prophylactic use of antibiotics for routine procedures or the provision of care in specialist as well as primary care settings were excluded. Studies which included only paediatric patients or specialist/hospital settings were excluded. Case studies were also excluded.
Two researchers (WT and GVAD) screened all study titles and abstracts for potential relevance. The full texts of all studies identified as potentially relevant were then assessed for inclusion eligibility independently by the same two researchers. Discrepancy or disagreements about inclusion or exclusion were resolved through discussion of the full text article.

3.4.3 Data extraction

A draft data extraction form was developed in Microsoft Excel, piloted and modified by an iterative process. The following study characteristics were extracted: reference (First

author, journal); year of publication; objectives; country; country's income (high, upper middle, lower middle or low) (World_Bank, 2017); care setting (primary/ambulatory care, GDP, out of hours/urgent dental care, other health care setting); clinician characteristics; patient characteristics (if applicable); study type/design (e.g. qualitative research/ quantitative research/ mixed methods/ systematic review); data source; intervention (if applicable); size of study population and conclusions/whether factors associated with the decision to prescribe antibiotics were identified from the study. For the umbrella review, additional information was extracted in accordance with the JBI guidance on umbrella reviews: the number of databases searched and information about the studies included in the systematic reviews (date range, number, study type and countries of origin) (Aromataris, Edoardo et al., 2015).

One reviewer (WT) extracted all of the data using the standardised data extraction form and a second reviewer (JATS for the umbrella review of primary care studies and GVAD for the systematic review of dental studies) verified the data. Disagreements were resolved through discussion.

3.4.4 Methodological quality assessment

Quality assessment of the systematic reviews included in the umbrella review across primary care used the Critical Appraisal Skills Programme (CASP) Checklist for Systematic Reviews (Critical Appraisal Skills Programme, 2018). The CASP checklist contains two screening and eight detailed questions that address the issues characterising systematic reviews. Two researchers (WT and JATS) independently quality assessed the studies included in the umbrella review, with discrepancies or disagreements resolved through discussion.

Quality assessment of the primary research studies included in the systematic review of primary dental care used the 16 criteria of the Quality Assessment Tool for Studies with Diverse Design (QATSDD) (Sirriyeh et al., 2012). One researcher (WT) quality assessed all of the studies included in the systematic review and another author (VRA) independently assessed >50% (4/7), with discrepancies or disagreements resolved through discussion. Three reviewers individually assessed the publications: WT&JATS for the umbrella review of primary care studies and WT&VRA for the systematic review of primary dental care studies. Disagreements were resolved through discussion between reviewers of all the papers.

Given the heterogeneous nature of the primary research studies included in the systematic review, the researchers recognised a tension between reporting quality and potential contribution of a paper to the synthesis (Germeni et al., 2018). It was agreed that papers would only be excluded if it was agreed that the paper would not help answer the research questions. For systematic reviews to be excluded from the

umbrella review, it was agreed that this would be indicated if their CASP assessment for ‘applicability of results’ was ‘NO’. For the primary research studies to be excluded from the systematic review, it was agreed that this would be indicated if a study scored less than 25% of their total possible score in the QATSSD assessment. None of the papers were excluded on this basis. Details of their quality assessment are presented in Table 3-1 and Table 3-2).

Table 3-1 Methodological Quality Assessment of Systematic Reviews included in the Umbrella Review of Healthcare Studies using the Critical Skills Appraisal Programme (CASP) checklist for systematic reviews.

	A) Are the results of the review valid?					B) What are the results?		C) Will the results help?	
	Clear question?	Right type of papers?	All relevant studies included?	QA of included studies?	Reasonable to combine results?	Overall results?	Precision?	Applicability of results	All important outcomes?
Germeni et al, 2018	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	N/A
Keller et al, 2018	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	N/A
Lopez-Vazquez et al, 2012	Yes	Yes	Yes	No	Yes	Yes	N/A	Yes	N/A
McKay et al, 2016	Yes	Yes	Yes	Yes	No	Yes	N/A	Yes	N/A
Ness et al, 2016	Yes	Yes	Yes	Yes	Can't tell	Yes	N/A	Yes	N/A
Rezal et al, 2015	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	N/A
Rodrigues et al, 2013	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	N/A
Tonkin-Crine et al, 2011	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	N/A
Touboul-Lundgren et al, 2015	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	N/A

Table 3-2 Methodological Quality Assessment of Systematic Reviews included in the Systematic Review across Primary Dental Care using the Quality Assessment Tool for Studies with Diverse Design (QATSSD).

	Explicit theoretical framework	Statement of aims/ objectives in main body of report	Clear description of research setting	Evidence of sample size considered in terms of analysis	Representative sample of target group of a reasonable size	Description of procedure for data collection	Rationale for choice of data collection tool(s)	Detailed recruitment data	Statistical assessment of reliability and validity of measurement tool(s)
(Cope, A.L. et al., 2016b)	0	3	3	0	2	3	3	3	3
(Dailey, 2001)	0	3	3	0	2	3	3	3	0
(Kaptan et al., 2013)	0 and 0	3 and 1	2 and 2	0 and 0	3 and 1	2 and 1	0 and 1	2 and 1	0 and 0
(Newlands et al., 2016)	3 and 3	3 and 2	3 and 3	3 and 3	3 and 3	3 and 3	3 and 3	3 and 3	N/A
(Palmer, N.A.O. et al., 2000)	3 and 0	3 and 1	3 and 3	0 and 0	3 and 3	2 and 1	2 and 1	3 and 1	0 and 0
(Tulip and Palmer, 2008)	0 and 0	3 and 2	3 and 3	0 and 0	3 and 1	3 and 3	3 and 1	3 and 2	0 and 0
(Vessal et al., 2011)	0	3	2	3	3	3	3	3	3

Table 3-2 (continued) – Quality assessment of studies included in the systematic review using the QATSSD assessment tool.

	Fit between stated research question and method of data collection	Fit between stated research question and format and content of data collection tool e.g. interview schedule	Fit between research question and method of analysis	Good justification for analytical method selected	Assessment of reliability of analytical process	Evidence of user involvement in design	Strengths and limitations critically discussed	Total	% Total
(Cope, A.L. et al., 2016b)	3	N/A	3	3	N/A	0	3	32	76%
(Dailey, 2001)	2	N/A	2	1	N/A	0	0	22	52%
(Kaptan et al., 2013)	2 and 1	N/A	2 and 1	0 and 1	N/A	0 and 0	0 and 1	16 and 11	38% and 26%
(Newlands et al., 2016)	N/A	3 and 3	3 and 3	3 and 3	3 and 2	0 and 0	3 and 2	39 and 36	93% and 86%
(Palmer, N.A.O. et al., 2000)	0 and 2	N/A	0 and 1	0 and 1	N/A	0 and 0	0 and 0	19 and 14	45% and 33%
(Tulip and Palmer, 2008)	2 and 2	N/A	2 and 1	0 and 1	N/A	0 and 0	0 and 0	22 and 16	52% and 38%
(Vessal et al., 2011)	3	N/A	3	1	N/A	3	0	33	79%

3.4.5 Analysis and synthesis

All included papers were imported into NVivo 11 as electronic .pdf versions for thematic coding and synthesis. This ensured preservation of the original meaning and context as far as possible. Thematic synthesis using an inductive, iterative process that consisted of three stages which overlapped to some degree: i) free line-by-line coding of the 'results' and 'discussion' sections of the included papers; ii) organisation of these 'free codes' into related areas; and iii) the identification, development and refinement of detailed descriptions of the factors associated with antibiotic prescribing (Thomas and Harden, 2008). To assist the organisation of the free codes into related areas, they were first grouped according to whether they were related to clinician , patient, clinical context or wider social/political context, as this structure was presented in several of the systematic reviews included in the umbrella review across primary care (Lopez-Vazquez et al., 2012) (McKay et al., 2016) (Rodrigues et al., 2013).

To assist the identification, development and refinement of detailed descriptions of the factors associated with antibiotic prescribing, TDF was used to ensure clarity of meaning for each influence on behaviour being characterised and to facilitate identification of factors which might be amendable to modification (potential targets for a behaviour change intervention) to reduce antibiotic prescribing. The process of identifying descriptive themes/potentially modifiable factors and mapping them to domains of the TDF was an iterative process repeated until consensus was reached between the researchers (WT, JATS and GVAD). Factors identified which did not map to the TDF were also identified and characterised as these may be important for targeting during intervention development, for example tailoring the intervention towards a particular group of patients or clinicians.

Given the heterogeneous nature of the studies included in the reviews, many of the findings were irrelevant to the research question; only findings of direct relevance to the aims of the umbrella and systematic review were coded.

3.4.5.1 Synthesis of the studies in the umbrella review

Codes were produced initially for the umbrella review across primary care by two researchers (WT and JATS) working independently. Discrepancies or disagreements were resolved through discussion. To ensure that the factors identified related to the population of interest, identified factors were cross-checked back to the primary research studies within the umbrella review's constituent systematic reviews. Codes that were found not to relate to the specific criteria of this review (e.g. studies only

about paediatric patients, hospital settings or prophylactic prescribing) were excluded from the synthesis.

3.4.5.2 Synthesis of the studies in the systematic review

The dental care studies were analysed using the bank of codes produced from the umbrella review across primary care by two researchers (WT and GVAD) working independently. Discrepancies or disagreements were resolved through discussion. Three reviewers (GVAD, JATS and WT) then reviewed the bank of codes against the full set of papers from both the umbrella review of primary care and systematic review of dental care studies. Codes were added or adjusted by consensus to achieve a final bank of codes applicable to the whole set of papers included within the review.

3.4.5.3 Independent checks

Following completion of synthesis of the umbrella and systematic reviews, a group of researchers (WT, SHP, RRCM, GVAD and JATS) and the study's PPIE contributors undertook a sense check of the full list of identified factors to ensure that they had relevance and meaning. An independent check of the full list of identified factors/definitions and how they mapped to the TDF was then undertaken by ST-C. Disagreements and discrepancies were resolved through discussion.

3.4.5.4 Comparing the factors

The final stage of data synthesis and analysis was to compare and contrast the theme codes identified between the settings across primary care versus primary dental care, and between countries (including UK versus 'other countries' and high-income versus LMICs).

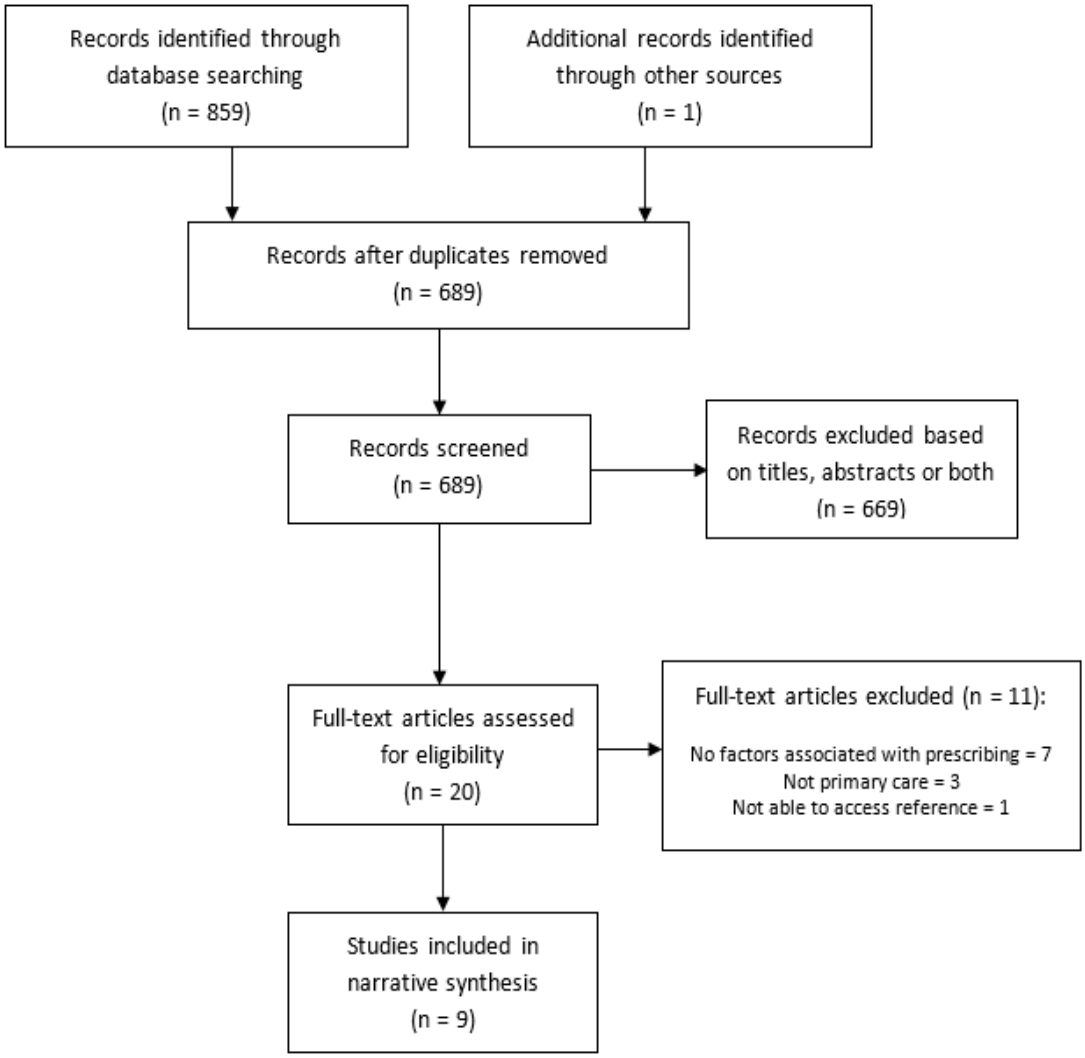
3.5 Results

3.5.1 Study selection

3.5.1.1 Umbrella review across primary care – Study selection

For the umbrella review across primary care search, 688 studies were identified for possible inclusion in the review. One additional, recently published paper, was identified by the researchers after the re-run of the search July 2018 (Germeni et al., 2018). During screening of the titles and abstracts, 669 studies were excluded. Of the remaining 20, full-text articles were assessed and 9 systematic reviews met the inclusion/exclusion criteria and so were included in the final synthesis for the umbrella review across primary care. Details of the study selection process are shown in Figure 3-2

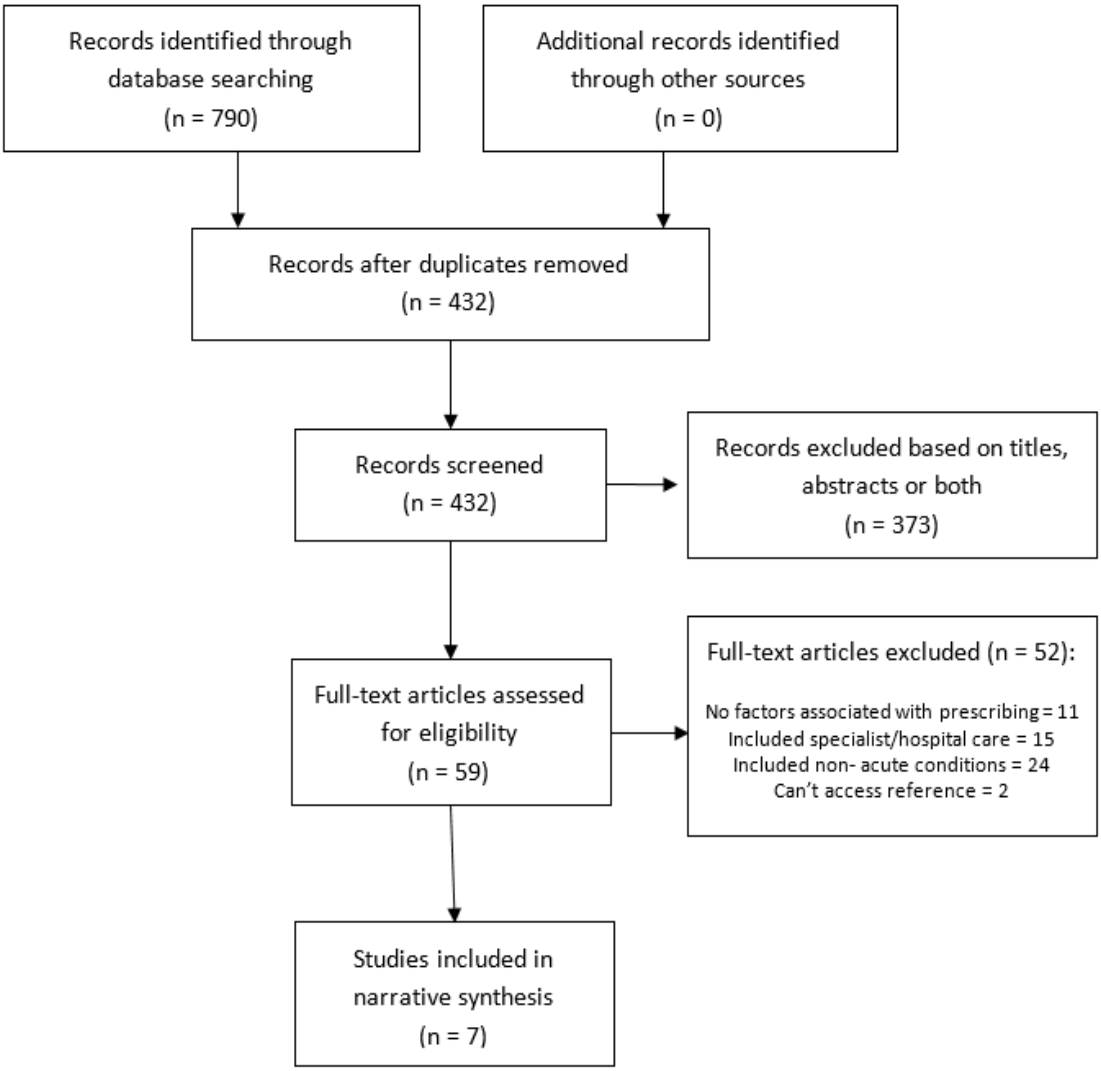
Figure 3-2 PRISMA flow chart detailing selection of the systematic reviews included in the umbrella review of factors associated with the decision whether to prescribe systemic antibiotics for adult patients with acute conditions across primary care.



3.5.1.2 Systematic review of primary dental care – Study selection

For the systematic review of primary dental care, 432 studies were identified for possible inclusion in the review. During screening of the titles and abstracts, 373 were excluded. Of the remaining 59 full-text articles, 7 studies met the inclusion/exclusion criteria and so were included in the final synthesis for the systematic review of primary dental care. Details of the study selection process are shown in Figure 3-3.

Figure 3-3 PRISMA flow chart detailing selection of the primary research studies included in the systematic review of factors associated with the decision whether to prescribe systemic antibiotics for adult patients during urgent primary dental care appointments.



3.5.2 Study characteristics

3.5.2.1 Umbrella review - Characteristics of the included studies

The characteristics of the nine systematic reviews included in the umbrella review across primary care are described in Table 3-3 within these systematic reviews, a total of 98 qualitative and quantitative primary research studies contributed factors relating to adult patients with acute conditions in primary care settings. Across these 98 studies, the participants were primary care professionals (including doctors, nurse practitioners and pharmacists) working in 45 countries. Eleven of the countries were LMICs and 26 studies were undertaken in the UK. The studies had a date range of 1990-2017.

3.5.2.2 Systematic review – Characteristics of the included studies

The characteristics of the seven primary research studies included in the systematic review of primary dental care are described in Table 3-4. The study participants were all dentists working in primary dental care (including OOH dental clinics). Two of the studies took place in LMICs (Turkey and Iran) and the other five were UK studies. The studies had a date range of 2000-2016.

3.5.3 Overlap of included studies

3.5.3.1 Overlap between the reviews

None of the seven dental studies included in the systematic review of primary dental care was included in any of the umbrella review's nine systematic reviews.

3.5.3.2 Overlap within the systematic reviews of the umbrella review

Analysis of the overlap between primary research studies within the umbrella review's nine systematic reviews found that: 12/98 appeared in two of the systematic reviews; 5/98 appeared in three of them; and none appeared in more than three.

Table 3-3 Characteristics of studies included in the umbrella review of factors associated with prescribing of systemic antibiotics to adult patients with acute conditions across primary care

Author, year	Objectives	Participants characteristics	Setting/context	Number of databases searched	Included studies* (date range)	Included studies* (number, type)
(Germeni et al., 2018).	Primary care practitioner experiences of antibiotic prescribing for acute respiratory tract infections	Primary care professionals (including GPs, nurses and pharmacists)	Primary care	6	1998-2014	22 qualitative studies
(Keller et al., 2018).	What is known about effective ambulatory AS interventions and identify barriers and facilitators to successful implementation of ambulatory AS interventions?	Unclear	Ambulatory care	6	1999-2017	24 qualitative & quantitative studies
(Lopez-Vazquez et al., 2012).	To identify the factors, attitudes and knowledge linked to mis-prescription of antibiotics.	Doctors	Primary care	2	1990-2007	24 quantitative studies
(McKay et al., 2016).	Assessment of the factors associated with antibiotic prescribing for respiratory tract infections (RTI).	Prescribers for patients with respiratory tract infection	All health care	3	1997-2013	18 quantitative studies
(Ness et al., 2016).	To explore the influences on the antimicrobial prescribing behaviour of independent nurse prescribers	Nurse prescribers	All health care	7	2005-2012	2 qualitative & quantitative studies
(Rezal et al., 2015).	To review the knowledge, perceptions and behaviour of physicians regarding antibiotic prescribing.	Physicians of patients with respiratory tract infection	All health care	6	2010-2014	4 qualitative & quantitative studies
(Rodrigues et al., 2013).	To explore physicians' perceptions of factors influencing antibiotic prescribing	Physicians	All health care	1	2001 - 2011	13 qualitative studies
(Tonkin-Crine et al., 2011).	To understand how GPs perceive antibiotic prescribing	GPs of patients with acute conditions	Primary care	5	2002-2010	7 qualitative studies
(Touboul-Lundgren et al., 2015).	To describe the influence of culture on antibiotic use, using a framework of cultural dimensions	Unclear	Primary care	10	1997-2013	6 qualitative & quantitative studies

* Relevant studies are the 98 primary research papers included within the systematic reviews which relate to adult patients in non-specialist primary care settings. .

Table 3-3 (continued) Characteristics of studies included in the umbrella review of factors associated with prescribing of systemic antibiotics to adult patients with acute conditions across primary care

Author(lead), year	Countries included in relevant constituent studies*	Appraisal instrument	Type of review/method of analysis	Conclusions
(Germeni et al., 2018).	Australia, Belgium, Finland, Germany Hungary, Iceland, India, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Russia, Spain, UK, USA	Dixon-Woods et al approach	Systematic review/ metaethnography	Primary care prescribers tend to assume multiple roles in the context of acute respiratory tract infection consultations (the expert self, the benevolent self, the practical self), depending on the range of intrapersonal, interpersonal and contextual situations in which they find themselves.
(Keller et al., 2018).	Belgium, China, Denmark, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Spain, Sweden, Switzerland, UK, USA	None reported	Systematic review/work system modelling	Investigating the role of the clinic's processes or physical layout or external pressures on antibiotic prescribing may be a promising way to improve ambulatory antimicrobial stewardship.
(Lopez-Vazquez et al., 2012).	Australia, Belgium, Canada, Denmark, Germany, Hong Kong, Korea, Malaysia, Ireland, Netherlands, Spain, Taiwan, UK, USA	None reported	Systematic review/ quantitative synthesis	Before designing interventions aimed at improving the prescription and use of antibiotics, studies are needed to identify precisely which factors influence prescribing.
(McKay et al., 2016).	Belgium, Canada, Finland, Germany, Hungary, Italy, Netherlands, Norway, Poland, Slovakia, Spain, Sweden, UK, USA	Customised instrument used	Systematic review/ quantitative synthesis	Antimicrobial stewardship programs should continue to expand in the outpatient setting and should emphasize clear and direct communication between patients and physicians, as well as signs and symptoms that do and do not predict bacterial aetiology of upper respiratory tract infections.
(Ness et al., 2016).	UK, USA	Instrument used unclear	Systematic review/ narrative synthesis	Further research should focus on the use of sound theoretical frameworks in the planning of studies if we are to be able to understand and, if required, change nurses' behaviours.
(Rezal et al., 2015).	Bangladesh, Belgium, Hungary, India, Spain, UK, Poland, Italy, Norway, Netherlands	Instrument used unclear	Systematic review/ qualitative synthesis	Multifaceted interventions targeting all key stakeholders, including patients, are needed to improve future antibiotic prescribing.
(Rodrigues et al., 2013).	Germany, Iceland, India, Netherlands, Spain, Sweden, UK, USA	CASP for qualitative studies	Systematic review/ qualitative synthesis	Antibiotic prescribing is a complex process influenced by factors affecting all the actors involved, including physicians, other healthcare providers, healthcare system, patients and the general public.
(Tonkin-Crine et al., 2011).	Belgium, France, Iceland, Netherlands, Norway, Poland, Spain, UK, USA	CASP for qualitative studies	Systematic review/ interpretive metasynthesis	Interventions should allow GPs to reflect on their own prescribing: help decrease uncertainty about appropriate acute respiratory tract infection management, educate GPs about appropriate prescribing, facilitate more patient-centred care, and be beneficial to implement in practice.
(Touboul-Lundgren et al., 2015).	Austria, Belgium, Bulgaria, Czech Republic, Denmark, East Germany, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Morocco, Nepal, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Thailand, Turkey, UK, Yugoslavia (Former)	Various published checklists	Systematic review/ mixed research synthesis	Interactions between determinant categories, cultural dimensions and antibiotic use in primary care are multiple and require further investigation within overlapping disciplines.

* Relevant studies are the 98 primary research papers included within the systematic reviews which relate to adult patients in non-specialist primary care settings

Table 3-4 Characteristics of studies included in the systematic review of factors associated with the prescription of antibiotics for adult patients in urgent primary dental care

Author(lead), year	Objectives	Country income	Dental Care Setting	Clinician characteristics	Patient characteristics (if applicable)	Study type/ design	Size of population	Conclusions
(Cope, A.L. et al., 2016b).	To describe factors associated with antibiotic prescription in the absence of spreading infection or systemic involvement	UK	General dental practice	NHS or private general dental practitioners (GDPs)	Adults with pulpal, apical or periodontal pathology	Quantitative/ cross-sectional prospective	42 GDPs / 568 cases	Features of the healthcare environment, such as clinical time pressures, and patient-related characteristics, such as expectations for antibiotics and refusal of operative treatment, are associated with antibiotic prescribing in the absence of infection
(Dailey, 2001).	To investigate the therapeutic prescribing of antibiotics to patients presenting for emergency dental treatment	UK	Out of hours dental	NHS dentists	Walk-in emergency dental patients	Quantitative/ cross-sectional prospective	55 dentists / 1011 cases	The majority of patients attending the emergency dental clinics had pain, with a large proportion having localised infections either as pulpitis or localised dental abscess.
(Kaptan et al., 2013).	To gather information about Turkish general dental practitioners' treatment approaches towards endodontic emergencies, antibiotic-prescribing habits, and their participation in lifelong learning programs	Turkey	General dental practice	General dental practitioners	N/A	Quantitative/ survey	589 analysed / 1400 distributed	There have been discrepancies between taught and observed practice. Educational initiatives are needed to prevent inappropriate prescription of antibiotics.
(Newlands et al., 2016).	To understand the barriers and facilitators of using local measures instead of prescribing antibiotics to manage bacterial infections	UK	Not clear	General dental practitioners	N/A	Qualitative/ semi-structured interviews	30 interviews	Results suggest a number of intervention functions through which future interventions could change GDPs' antibiotic prescribing for bacterial infections: including through training, modelling or incentivisation.
(Palmer, N.A.O. et al., 2000).	To study the therapeutic prescribing of antibiotics by general dental practitioners	UK	General dental practice	General dental practitioners	Patients with an acute dental infection	Quantitative/ survey	891 analysed / 1546 distributed	Therapeutic prescribing of antibiotics in GDP varies widely and is suboptimal. Practitioners were generally not influenced by patient's expectations of receiving antibiotics, but would prescribe when under pressure of time, if they were unable to make a definitive diagnosis, or if treatment had to be delayed.
(Tulip and Palmer, 2008).	To investigate the clinical management of patients attending for emergency dental treatment.	UK	Out of hours dental	General dental practitioners	Patients with an acute dental condition	Quantitative/ retrospective data analysis	1167 patient records	GDPs working within the OOH services are not adhering to current clinical and best practice guidelines with respect to patient examination, diagnosis, management, in particular the correct prescribing of antibiotics for dental infections,
(Vessal et al., 2011).	To evaluate the knowledge and practices of dentists in Shiraz, Iran regarding their use of antibiotics for patients with dentoalveolar infections.	Iran	Not clear	Dental practitioners	N/A	Quantitative/ survey	219 analysed / 450 distributed	Guidelines on rational antibiotic use are needed for dental practitioners in the Islamic Republic of Iran.

3.5.4 Quality assessment

3.5.4.1 Umbrella review across primary care – Quality assessment

For the umbrella review, the included systematic reviews were generally good quality. All of the CASP criteria were fulfilled (or not applicable) for seven of the nine. The other two systematic reviews failed to show quality assessment of their included studies. Details of the assessments are presented in Table 3-1. No papers were excluded on the basis of these assessments as all included results that were relevant to meeting the aims of the umbrella review.

3.5.4.2 Systematic review of primary dental care – Quality assessment

For the systematic review of primary dental care, quality of the included systematic reviews was more variable, with QATSSD scores ranging from 11 to 39 out of a possible total of 40. General weaknesses across the studies concerned identification of a theoretical framework, sample size, validity of measurement tools and evidence of user involvement in study design. Details of the assessments are presented in Table 3-2. No papers were excluded on the basis of these assessments as all included results that were relevant to meeting the aims of the systematic review.

3.5.5 Thematic analysis

A total of 30 themes associated with the decision to prescribe antibiotics were identified across both the umbrella review of primary care and systematic review of primary dental studies. Descriptors of each of these factors and how they map to the TDF are presented in Table 3-5.

Table 3-5: Factors associated with prescribing of antibiotics for acute conditions in primary care setting: short name, descriptor and mapping to Theoretical Domains Framework (TDF) presented in alphabetical order

Factor short name	Descriptor	TDF Domain
Access	Access to right care for the right patient at the right time. This includes when the practice is shut (e.g. weekends), whilst the patient is on holiday, for patients who live a distance from the practice, continuity of care by a single clinician, and if necessary access to specialist care through referral services and laboratory equipment and/or testing.	Environmental context & resources
Accountability	Clinicians held accountable (or feel like they are held accountable) for their antibiotic prescribing patterns.	Beliefs about consequences
Antibiotic awareness	Level of clinician knowledge about the relationship between antibiotic use and resistant infections.	Knowledge
Antibiotic beliefs	Level of personal responsibility towards antibiotics. This includes blaming others for misuse of antibiotics and/or resistant infections. Belief that antibiotics are low risk: describing use as '*better safe than sorry'*.	Beliefs about consequences
Clinician characteristics	Clinician age, sex, years in practice, location of primary dental qualification, previous clinical experience.	Does not map to TDF
Competing demands	Availability of sufficient time to treat patient in accordance with guidelines. This includes using a 'sit and wait' approach to booking urgent patients and other patients waiting.	Environmental context & resources
Conflict	Fear of conflict with patient due to dissatisfaction and subsequent loss of the patient to the practice.	Emotion
Efficacy of options	Beliefs about the efficacy of different treatment options. This includes: ability of antibiotics versus other approach/procedure to resolve conditions; and belief that a procedure may worsen symptoms.	Beliefs about consequences
Fear about outcome	Fear about adverse outcomes. This includes anxiety about making a mistake and the prospect of serious complications if patients with symptoms go without antibiotics. Described as *'just-in-case'* or *'belt-n-braces.'*	Emotion
Feelings about decisions	Feeling about the appointment and decisions. This includes frustration at lack of consent for gold standard treatment or clinician's emotional state at the appointment start	Emotion
Financial burden	Beliefs about financial burden on patients. This includes the patient's ability to pay for clinical consultation or fees for laboratory tests.	Beliefs about consequences
Fix the problem	Goal for the appointment is to fix the patient's problem: symptomatic relief or preventing the problem returning.	Goals

Theme short name	Descriptor	TDF Domain
Guidance-practice gap	Gap between guidance and clinical practice. This includes clinician concerns about the application of the guidelines to specific clinical encounters and belief about whether their clinical practice (such as delayed prescribing in dentistry) adheres to relevant guidance.	Beliefs about consequences
Guidelines & Information	Knowledge about relevant guidelines and other sources of information (e.g. internet and medical representatives). This includes guidelines/information about appropriate treatment of acute conditions/prescribing.	Knowledge
Habits	Prescribing habits of clinician. This includes patterns of prescribing and practitioner-level variation.	Memory, attention & decision processes
Healthcare context	Healthcare system context in relation to prescription of antibiotics. This includes perceived pressure to reduce antibiotic prescribing, ability to reuse a prescription and availability of antibiotics without a prescription.	Environmental context & resources
Incentives	Incentives for and against antibiotic use. This includes the impact of a 'time is money' business approach on unscheduled/urgent appointments and the financial risk of losing dissatisfied patients.	Reinforcement
Patient/condition characteristics	Characteristics of the patient (age, sex, ethnicity), their presenting condition (signs, symptoms & diagnosis), their medical history/comorbidities and their socioeconomic background (level of education, affluence/deprivation etc.).	Does not map to TDF
Patient influence	Influence of (perceptions about) patients. This includes: antibiotic-seeking behaviour(expectations/demand), negotiating skills; patient knowledge/attitudes towards antibiotics; fear of adverse outcomes without antibiotics; willingness/ability to accept operative dental procedure. Also the influence of poor/irregular attenders and the impact of late running unscheduled appointments making other patients who are waiting for their scheduled appointment angry.	Social influences
Patient management	Skills in patient management, diagnosis, treatment planning and consent. This includes eliciting concerns, interpreting the patient's description of their symptoms, managing anxious patients, managing expectations, avoiding confrontation. Negotiation, persuasion, education and hedging. Communication skills.	Skills

Theme short name	Descriptor	TDF Domain
Patient satisfaction	Belief about patient satisfaction. This includes: impact of failing to meet patient expectations; impact of repeat visits; and failure to relieve symptoms.	Beliefs about consequences
Peers & colleagues	Influence of peers and other colleagues in practice. This includes: prescribing patterns locally; professional courtesy by avoiding encroaching when treating another clinician's patient; confusion caused by different treatment patterns by different clinicians (patients uncertain what is correct); and utility of peer support when dealing with demanding situations.	Social influences
Planning & consent	Belief about ability to plan treatment and gain consent during urgent appointments. This includes *'do nothing'* options and managing anxious/phobic patients.	Beliefs about capabilities
Practice characteristics	Characteristics of the practice. This includes: public/private/insurance provision, geographic location (rural vs urban) and country.	Does not map to TDF
Procedure possible	Belief about whether it is possible to provide treatment due to issues beyond the dentist's skills during urgent appointments. This includes the ability to achieve adequate local anaesthesia and/or to provide operative treatment (in accordance with guidelines) to dentally phobic patients without sedation.	Beliefs about capabilities
Professional role	Influence of professional role on managing urgent appointments. This includes what it means to care for patients; and feeling 'morally obliged' to offer something tangible (to 'do nothing' is difficult). The ability to prescribe antibiotics and use own 'rules of thumb' are both signs of expertise and power.	Professional/social role & identity
Relationship	Desire to build/maintain a good clinician-patient relationship.	Goals
Risk perception	Beliefs about risks when managing the patient's condition. This includes: worsening of the condition; failure of (or inability to complete) an operative procedure, pain during or after provision of a procedure or medicolegal complaint.	Beliefs about consequences
Treatment skills	Skills in providing urgent procedures. This includes placing local anaesthetic by injection in difficult clinical situations or lancing an abscess in the presence of swelling.	Skills
Workload	Belief about impact on workload. This includes time taken to: explain treatment options, gain informed consent, deliver treatment options and/or treat the patient another day on recall.	Beliefs about consequences

Details of which factors were identified from each study of the umbrella review across primary care studies and the systematic review of primary dental care studies are shown in Table 3-6 and Table 3-7, respectively.

Of the 30 factors, three did not map to the TDF:

- Clinician characteristics (such as age, sex and place of qualification);
- Patient/condition characteristics (such as periapical abscess or anxious/phobic patient); and
- Practice characteristics (such as rural versus urban location).

Upon inspection, it was found that these were non-modifiable factors. The most frequently identified non-modifiable factor was ‘patient/condition characteristics.’ It was found in all systematic reviews included within the umbrella review and six of the seven dental studies within the systematic review.

No conclusions about the directionality of the influence of these non-modifiable factors were drawn. Studies within the umbrella review found differences between their included studies. For example, McKay et al found a direct relationship between being a male prescriber and antibiotic prescribing in one study compared to nine studies in which no association was found (McKay et al., 2016). Similarly, Lopez-Vazquez et al found a direct relationship between the age of the prescriber in eight studies, an inverse relationship in one study and no relationship in three studies (Lopez-Vazquez et al., 2012).

Table 3-6: Summary of factors associated with the decision whether to prescribe antibiotics identified from studies included in the umbrella review across primary care.

Short title	(Germeni et al., 2018).	(Keller et al., 2018).	(Lopez-Vazquez et al., 2012).	(McKay et al., 2016).	(Ness et al., 2016).	(Rezal et al., 2015).	(Rodrigues et al., 2013).	(Tonkin-Crine et al., 2011).	(Touboul-Lundgren et al., 2015).
Clinician related									
Accountability		✓							
Antibiotic awareness		✓	✓			✓	✓	✓	✓
Antibiotic beliefs		✓	✓	✓		✓	✓		✓
Clinician characteristics	✓		✓	✓		✓	✓	✓	✓
Competing demands	✓	✓	✓	✓	✓	✓	✓	✓	
Efficacy of options		✓					✓	✓	
Fear about outcome	✓		✓				✓	✓	✓
Feeling about decisions	✓	✓				✓	✓	✓	✓
Fix the problem	✓			✓		✓	✓		✓
Guidance-practice gap	✓	✓		✓		✓		✓	
Guidelines & information	✓	✓	✓	✓	✓	✓	✓	✓	
Habits	✓	✓		✓					
Patient management	✓	✓		✓	✓	✓	✓	✓	✓
Planning & consent	✓	✓			✓	✓	✓	✓	
Professional role	✓	✓						✓	✓
Workload		✓		✓		✓		✓	
Patient related									
Conflict	✓	✓		✓		✓	✓	✓	
Financial burden	✓				✓	✓	✓		
Patient/condition characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓
Patient influence	✓	✓	✓	✓	✓	✓	✓	✓	✓
Patient satisfaction	✓	✓		✓		✓		✓	
Relationship	✓	✓		✓		✓		✓	
Risk perception	✓	✓			✓			✓	✓
Clinical context related									
Peers & colleagues		✓	✓		✓			✓	✓
Practice characteristics	✓	✓	✓	✓	✓	✓	✓		✓
Wider social-political context									
Access	✓			✓		✓	✓	✓	
Healthcare context	✓	✓	✓				✓	✓	✓
Incentives	✓	✓				✓		✓	

Table 3-7: Summary of factors associated with the decision to prescribe antibiotics identified from studies included in the systematic review of primary dental care.

Short title	(Cope, A.L. et al., 2016b).	(Dailey, 2001).	(Kaptan et al., 2013).	(Newlands et al., 2016).	(Palmer, N.A.O. et al., 2000).	(Tulip and Palmer, 2008).	(Vessal et al., 2011).
Clinician related							
Clinician characteristics	✓		✓				
Competing demands	✓	✓		✓	✓	✓	
Efficacy of options				✓		✓	✓
Fear about outcome				✓			
Feeling about decisions				✓			
Guidance-practice gap				✓			
Guidelines & information	✓	✓	✓	✓	✓	✓	✓
Habits	✓			✓		✓	✓
Patient management				✓		✓	
Planning & consent	✓			✓	✓		
Professional role				✓			
Fix the problem				✓			
Procedure possible	✓			✓			
Treatment skills	✓		✓	✓			
Workload				✓			
Patient related							
Patient/condition characteristics	✓	✓	✓		✓	✓	✓
Patient influence	✓		✓	✓	✓	✓	✓
Patient satisfaction				✓			
Relationship				✓			
Risk perception	✓			✓			
Clinical context related							
Peers & colleagues				✓			
Practice characteristics	✓		✓				
Wider social-political context							
Access		✓		✓			
Healthcare context			✓				

3.5.5.1 Identifying potential determinants of behaviour

The 27 factors that mapped to the TDF were classed as potentially modifiable determinants of antibiotic prescribing in primary care. Of these, 20 were identified in both the umbrella review across primary care and the systematic review of primary dental care studies. As shown in Table 3-8 five of the factors were identified only from the umbrella review of primary care studies and two factors only from the systematic review of primary dental care. As with previously published systematic reviews about antibiotic prescribing, the factors were found to group into clinician-related, patient-related, clinical context-related and wider social-political context-related (Lopez-Vazquez et al., 2012) (McKay et al., 2016) (Rodrigues et al., 2013) (Keller et al., 2018).

Table 3-8: Summary of potentially modifiable determinants of antibiotic prescribing, showing a comparison between factors identified in the umbrella review across primary care and/or systematic review of primary dental care.

Both umbrella and systematic review	Umbrella review across primary care studies only	Systematic review of dental care studies only
Access	Accountability	Procedure possible
Competing demands	Antibiotic awareness	Treatment skills
Efficacy of options	Antibiotic beliefs	
Fear about outcome	Conflict	
Feelings about decisions	Financial burden	
Fix the problem		
Guidance-practice gap		
Guidelines & information		
Habits		
Healthcare context		
Incentives		
Patient influence		
Patient management		
Patient satisfaction		
Peers & colleagues		
Planning & consent		
Professional role		
Relationship		
Risk perception		

3.5.5.2 Potentially modifiable factors – Across primary care

The ‘patient influence’ factor was found in all of the systematic reviews of the umbrella review (Table 3-6). As described in Table 3-5, this included but was not limited to demand for antibiotics and/or the clinician’s perception of the patient’s desire for them. Five factors were found only in the umbrella review: ‘accountability’, ‘antibiotic awareness’, ‘antibiotic beliefs’, ‘conflict’ and ‘financial burden’ (Table 3-8).

3.5.5.3 Potentially modifiable factors – Primary dental care

Only ‘guidelines & information’ was found in all of the dental studies (Table 3-7). Two factors were found only in dental studies: ‘procedure possible’ and ‘treatment skills’ (Cope, A.L. et al., 2016b) (Kaptan et al., 2013) (Newlands et al., 2016). ‘Procedure possible’ related to dentists’ beliefs about whether it was possible to deliver operative dental procedures in accordance with guidelines (due to issues beyond the dentist’s skill). ‘Treatment skills’ related to dentists’ abilities to undertake difficult elements of urgent dental procedures, such as ‘achieving adequate anaesthesia’ and ‘how to lance an abscess when swelling is present.’

Antibiotics were identified as a way of balancing the ‘competing demands’ of a busy list of patients booked for routine dental care with the addition of unscheduled patients, sometimes as ‘sit and wait’ due to lack of available appointment slots (Cope, A.L. et al., 2016b) (Tulip and Palmer, 2008) (Dailey, 2001) (Newlands et al., 2016) (Palmer, N.A.O. et al., 2000).

3.5.5.4 Comparing factors between primary healthcare settings

Twenty factors were found in both the umbrella review across primary care and the systematic review of primary dental care (Table 3-8). Of these, ‘patient influence’ was the most frequently identified factor, being found in all of the systematic reviews of the umbrella review and six of the seven dental studies of the systematic review (Table 3-7).

Communication with patients during urgent appointments, including managing anxious patients and negotiation towards a shared decision, were found to be important to the prescribing decision in both dental and wider healthcare settings (‘patient management’). Maintaining a good patient-clinician relationship, including by avoiding conflict, was an important goal shared across primary care and primary dental care, where enduring relationships are central to the model of care provision (‘relationship’). Clinicians’ fear about the potential for adverse outcomes, including when patients had reduced access to medical/dental services (such as when going away on holiday or at weekends/bank holidays) were frequently identified (‘fear about outcome’ and ‘access’).

3.5.5.5 Comparing factors between countries

‘Accountability’ was the only factor absent from all of the UK-based studies included within the umbrella review’s systematic reviews. It has, however, been reported in at least one recent UK primary research study which found that nurse practitioners working in OOH primary medical care felt greater accountability for their antibiotic prescribing than general medical practitioners (GPs) (Williams et al., 2017).

Further differences between UK-based and other studies were found within the 'healthcare context' factor, including the availability of antibiotics without a prescription (Germeni et al., 2018) (Kaptan et al., 2013). and the ability to use a prescription more than once (Rodrigues et al., 2013) (Rezal et al., 2015). For example in India, where prescriptions are retained by patients after purchasing their medicines from a pharmacist rather than being kept by the pharmacist, it is common practice that patients reuse their old prescriptions for similar complaints or symptoms (Kotwani et al., 2010).

Eleven factors were identified from studies involving LMICs and no factors were identified unique to studies undertaken in LMICs (Table 3-9). Exploring the detail within the factors, however, found that access to internet-based 'guidelines & information' was lower in LMICs compared with high-income countries (Rezal et al., 2015). Furthermore, pharmaceutical industry medical representatives were identified by several non-UK studies as being an important source of 'guidelines and information', especially in LMICs where local guidelines were not always available (Lopez-Vazquez et al., 2012) (Rodrigues et al., 2013) (Germeni et al., 2018) (Rezal et al., 2015).

Table 3-9 Summary of potentially modifiable factors showing a comparison between those identified in studies of high income countries and Low- and Middle-Income Countries (LMICs).

High income countries only	High income countries & LMICs	LMICs only
Accountability	Access	
Antibiotic awareness	Antibiotic beliefs	
Efficacy of options	Competing demands	
Feeling about decisions	Conflict	
Guidance-practice gap	Fear about outcome	
Guidelines & information	Financial burden	
Incentives	Fix the problem	
Patient management	Habits	
Patient satisfaction	Healthcare context	
Peers & colleagues	Patient influence	
Planning & consent	Treatment skills	
Professional role		
Relationship		
Risk perception		
Procedure possible		
Workload		

3.6 Discussion

Whilst it is not uncommon for reviews to appear which combine different types of analysis, there do not appear to be others in the published literature which combine an umbrella review with a systematic review. This approach was chosen to draw together the plethora of previous studies undertaken across primary healthcare and the much smaller set of studies which have been undertaken in the primary dental care setting.

3.6.1 Main findings

A comprehensive list of potentially modifiable and non-modifiable factors associated with the decision whether to prescribe systemic antibiotics for adults with acute conditions in primary care has been collated. Mapping of the potentially modifiable factors to the TDF has provided a resource for development of new antibiotic stewardship interventions informed by behaviour theory. Identification of variation within many of the factors adds support to the recommendations of Ackerman et al. (2013) that designers of antibiotic stewardship interventions need to recognise 'one size does not fit all'. Comparing and contrasting the factors between settings has enabled the identification of components of existing antibiotic stewardship interventions which could be amenable for translation into new settings and where new approaches may be required. For example, interventions which address patient influences may be amendable for translation between primary healthcare settings, whereas addressing skills and clinician beliefs about providing procedures rather than prescribing antibiotics seems to be unique to dentistry.

Most of the potentially modifiable factors were found to be the same or similar across primary care settings. Factors which seem to be unique to dentistry relate to the provision of procedures rather than prescription of antibiotics. Dentists' beliefs about their ability to manage an anxious patient and provide a dental procedure (as per guidance, such as extracting a tooth or removing the tooth pulp rather than prescribing antibiotics) were identified as important. The emotion surrounding dentally-anxious patients who were unwilling or unable to consent to a dental procedure was key to the prescribing decision in some dentist-patient interactions. For other dentists, beliefs about consequences when providing certain procedures, for example placing local anaesthetic in the presence of infection, was relevant.

Owing to the heterogeneous nature of the included studies, attribution of causality between the factors found to be associated with antibiotic prescribing and actual prescribing rates was not possible. Similarly it was not possible to say whether factors identified from the umbrella review across primary care but not identified in the systematic review of dental studies were relevant in dental settings. It could only be concluded that these factors were not found in the published dental studies within this review. Researchers planning to implement existing antibiotic stewardship interventions in other contexts (or to develop new ones) should, therefore, first seek to understand which factors are relevant to the prescribers' decisions in their specific context.

3.6.2 Strengths & Weaknesses

3.6.2.1 Justification of methods

Systematic reviews provide a rigorous and transparent synthesis of evidence from published primary research studies (Gough et al., 2012). Umbrella reviews are reviews of previously published systematic reviews (Aromataris, Edoardo et al., 2015) (Fusar-Poli and Radua, 2018). Due to the dearth of available primary research studies about the factors associated with dental antibiotic prescribing found in a scoping study, the population of interest was broadened to include all primary healthcare and a plethora of studies was found. After discussion with information specialists, it was agreed that a two part review would be undertaken: an umbrella review of systematic reviews across primary healthcare and a systematic review of primary research studies from primary dental care.

From the scoping study, it was established that nearly all of the studies which included factors associated with the decision to prescribe antibiotics for acute conditions were qualitative or mixed methods rather than quantitative in nature. Whilst thematic analysis is a method often used to analyse data in primary qualitative research, Thomas & Harden advocate thematic synthesis of qualitative research for systematic reviews. This provides rigour when analysing the text by preserving an explicit and transparent link to the context of the original studies, including through use of a dedicated software package (NVivo 11) (Thomas and Harden, 2008).

Other approaches considered for synthesis of qualitative data included realist synthesis and metaethnography. Realist synthesis focuses on understanding the mechanisms by which an intervention works. It was not selected for this study as the dental literature identified during the initial scoping study was too sparse to define the research question in those terms. Metaethnography involves interpreting and synthesising qualitative data then going beyond them to produce a 'line or argument' (Campbell, R. et al., 2006). This approach was rejected as an option for synthesis as extrapolation of meaning beyond the studies was not required for the purposes of this research. As the results would be tested during the ethnographic phase of the study, the aim of the review was to produce a list of candidate factors which might be associated with dentists' decisions to prescribe antibiotics for adults with acute conditions.

3.6.2.2 Review structure - Umbrella and systematic reviews

An important strength of this study was the ability to compare and contrast findings across primary care contexts, including dentistry. By doing so, the study should assist the theory-informed design of new interventions aimed at helping clinicians to optimise their prescribing of antibiotic during urgent appointments. This may include drawing on the experience of existing multifactorial interventions developed for GPs that have been

shown to be effective at reducing antibiotic prescribing. One such intervention for managing adults with acute cough (GRACE/INTRO) used enhanced communication skills and a point-of-care test for the C-reactive protein biomarker of bacterial infection. The intervention positively influenced three factors identified in this review, as tested in the process evaluation of the trial: (i) increased clinician confidence to reduce antibiotic prescribing ('guidance-practice gap'); (ii) increased perceived importance of decreasing prescribing ('antibiotic awareness'); and (iii) reduced perceived risk of decreasing prescriptions ('risk perception') (Yardley et al., 2013).

3.6.2.3 Research questions – Decision whether to prescribe antibiotics

As antibiotic resistance has been shown to be more associated with prior exposure to any antibiotic rather than with inappropriate prescribing (Chatterjee et al., 2018). and as UK government targets were to reduce the total amount of antibiotic prescribing(Davies, S. and Gibbens, 2013), this review focused on what influences the decision whether to prescribe systemic antibiotics to adult patients with acute/urgent conditions in primary care settings rather than details of the regimen (such as drug type, dose or duration). No distinction was made between appropriate and inappropriate prescribing.

Neither was consideration given to other uses of antibiotics, such as self-medication by patients. A further review about antibiotic 'use' in relation to healthcare would be a helpful addition to the literature and could inform development of a different type of behavioural intervention to reduce antibiotic use among the general population.

3.6.2.4 Search strategies - Sensitive and specific approaches

In line with the aim of using the umbrella review to identify a wide range of factors from across primary care, a sensitive approach to selecting studies for the umbrella review was employed to ensure identification of as broad a range of studies as possible from across primary care. Employing the same logic, a specific approach to selecting studies for the systematic review of primary dental care was chosen to identify factors specifically associated with the prescription of systemic antibiotics to adult patients presenting with acute dental conditions in primary dental care.

3.6.2.5 Study selection – Study types

Publication bias is a major threat to the validity of any type of review (Higgins and Green, 2011). The risk to this review was balanced, however, by the breadth of study types and methodological quality included, which has enabled identification of a broad range of factors associated with the decision whether to prescribe antibiotics. The heterogeneous methodologies of the included studies (systematic reviews, meta-ethnographies and primary research (both quantitative and qualitative)), complicated

the quality assessment as well as extraction, interpretation and presentation of the results.

The research team recognised that many of the included dental studies relied on self-reporting by clinicians about real or simulated clinical cases through interviews and/or questionnaires. Studies that rely on self-reported perceptions are inherently at risk of bias in the way people account for their and others' behaviour and people are not usually aware of what influences their unconscious/instinctive behaviour (Conner and Norman, 2005). This was a recognised limitation of the included studies and could account in part for the two most frequently found factors across the two reviews: 'patient influence' and 'patient/condition characteristics.' A study of clinical autonomy in relation to prescribing in general practice found that to balance the requirements of the patients and the healthcare system, doctors may state 'clinical need' when it suits them to do so, otherwise they blame 'patient demand.'(Britten, 2001). Studies of GP consultations and with patients have found a mismatch between GP reports of patient expectations/demand for antibiotics and patient reports (Stivers et al., 2003) (Gaarslev et al., 2016) (Cole, 2014). Further studies of real clinical encounters and prescribing data are required, therefore, to explore which factors influence actual prescribing decisions in primary dental care.

3.6.2.6 Study selection - Inclusion criteria

The patient/clinician populations included in these reviews are diverse, including different disciplines of primary care providers and geographic locations. While the benefit is that the factors identified stem from varied populations and as such are more representative, the consequence is that we are not able to identify factors associated with particular age groups, illnesses or countries.

The definition of 'primary care' chosen aimed to reflect the setting of particular interest for this overall thesis – the prescribing of antibiotics by general dentists in GDPs and urgent dental care clinics. Specialist and hospital settings were specifically excluded as this would have included more specialty trained clinicians with a different skill set and patients with more complex medical histories and non-routine oral/dental problems.

The inclusion criteria for the review were defined as a balance between these competing challenges in order to obtain a set of the most relevant papers to answer the research question. By focusing only on those findings specifically about prescribing systemic antibiotics for adult patients with acute conditions in primary care, it is recognised that some additional factors of interest may have been missed in this study. For example, some factors acting at the environmental level may have been omitted due to the focused application of the search terms.

3.6.2.7 Study selection - Exclusion criteria

Given the context specific nature of antibiotic prescribing decisions, it was agreed that studies not written in English (assumed to be from non-English speaking nations) would be of limited relevance to the researchers. Again this may mean that the review has missed some factors associated with antibiotic prescribing in primary care but this was felt to be an appropriate trade-off. Other restrictions (such as a date range) were considered but found to have no impact on the final selection of papers for inclusion in the study, so no restriction on date was applied.

3.6.2.8 Study characteristics - Countries of origin

With antibiotic resistance recognised as an important element of global sustainable development, a strength of this study was its inclusion of international studies, including studies from LMICs (World_Bank, 2018) (Nations, 2015). It is recognised, however, that fewer research studies are undertaken in LMICs and that different research questions may be required to understand the way in which antibiotics are used in those parts of the world.

A key limitation was a lack of generalisability of study results as the studies were restricted to certain geographic areas. Whilst many different countries were represented in the study, most were from developed countries. As explored in the Discussion section, there are appreciable differences in healthcare provision between high income countries and LMICs. Of particular concern is that most of the dental studies included in the systematic review originated in the UK (see Table 3-4). This is a pattern identified also in a review of dental antibiotic stewardship interventions (Löffler and Böhmer, 2017), where all five of the interventions tested in GDP settings were undertaken in the UK.

3.6.2.9 Analysis & synthesis - Thematic analysis

The JBI guidance on umbrella reviews noted that where heterogeneous studies were included in the systematic review, narrative synthesis would be an appropriate method for presenting the results of multiple studies (Aromataris, E et al., 2014). Thomas & Harden advocated thematic synthesis for combining the qualitative elements of systematic reviews which combined both quantitative and qualitative data (Thomas and Harden, 2008). As the purpose of this study was to identify factors associated with antibiotic prescribing, it was agreed by the research team that a thematic approach to identifying them would be most appropriate in meeting the aim of the study.

Few of the primary research studies included in the systematic review of primary dental care were explicitly aiming to identify factors associated with prescribing antibiotics during urgent appointments. As a consequence, the researchers found it more difficult

to identify factors from these studies than from the umbrella review's systematic reviews which were already more focused on the issue.

3.6.2.10 Analysis & synthesis - Inductive versus deductive analysis

The research team considered whether to undertake analysis using an inductive approach (by themes emerging organically from the data) or deductive approach (through use of a framework such as the TDF to guide identification of the themes). It was decided that an iterative approach – starting with an inductive approach in line with that published by Thomas (Thomas and Harden, 2008) -would be followed by a refinement of the themes by mapping to the TDF would facilitate their use to target intervention development. As many behaviour change research groups are using the Michie Behaviour Change Wheel (Michie et al., 2011) for intervention development, this approach was felt to be helpful in facilitating easy integration of our results with those of other research groups.

The research team did consider using the TDF as a framework for initial identification of the emerging themes but this was felt to risk losing meaning and producing results which were too generic to access the root of the issues influencing prescribing.

3.6.2.11 Analysis & synthesis – Comprehensive list of factors

Although the 30 factors identified have been presented as distinct, many are interlinked, such as the relationships between 'patient satisfaction', 'conflict' and 'incentives'. There was a risk of the factors being either too generic to be useful or too specific (and hence too numerous) to be manageable. To address this, synthesis was guided iteratively through reference to the TDF. Whilst the research team noted that some of the factors could be mapped to more than one TDF domain, they saw the value of mapping as being to inform and assist identification of behaviour change interventions which could be targeted to reduce antibiotic prescribing rather than to finding the 'correct' answer.

3.6.3 Self-reflexivity

Social scientists are part of the contexts they study and it is not possible to step outside in order to study the topic entirely objectively (Ritchie et al., 2013). The researchers were acutely aware, therefore, of their unique knowledge, attitudes and expectations, including in relation to antibiotic use. Recognising this, the researchers have attempted to remain exact, sincere and impartial when handling the data (Ambedkar, 1946). Results were checked for sense and understandability with both clinical and non-clinical colleagues, including the study's PPIE contributors. Nevertheless, the research team acknowledges that the conclusions were related to its specific interpretations and that other, equally valid conclusions could be drawn from the same data.

3.7 Conclusions

This study provides a robust identification of the breadth of factors associated with the decision whether to prescribe systemic antibiotics for adults presenting with acute conditions in a range of primary care contexts around the world. Further studies of real clinical encounters and prescribing data are required to explore which factors influence actual prescribing decisions in order to inform the evidence-based, theory-informed design of context-specific antibiotic stewardship interventions.

Further studies of routinely-collected data relating to dental antibiotic prescribing are recommended; these will be covered in Chapter 4. Further studies of real clinical encounters will be covered in Chapter 5's ethnographic study. Both will then be drawn upon in Chapter 6 to provide an evidence base for development of an intervention to reduce antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England.

Chapter 4 - Antibiotic use across NHS primary dental care: exploring routinely-collected data

4.1 Introduction

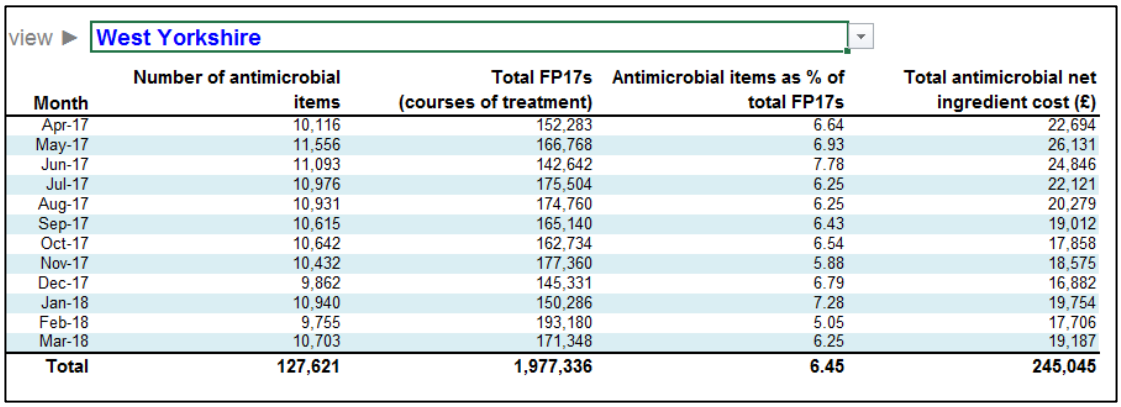
Developing effective interventions to reduce antibiotic prescribing by dentists requires improved understanding of what factors influence antibiotic prescribing in the real world setting. This Chapter will explore the extent to which routinely-collected data available from NHSE sources may contribute to the development of effective interventions . Its results will inform recruitment of dental practices to the ethnographic study reported in Chapter 5 and identification of outcomes for the complex intervention being developed in Chapter 6.

Reporting of this element of the research, including nomenclature of section titles, follows the REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement (Benchimol et al., 2015).

4.1.1 Problem of variation in antibiotic prescribing rates

Tackling unwarranted variation in antibiotic prescribing rates has been highlighted internationally as a priority (FDI, 2017; WHO, 2018b; Parliament, 2018). In order to understand this variation, PHE has been exploring routinely-collected data and has made a 'dental prescribing dashboard' available on-line (see (Figure 4-1). (PHE, 2018a). The dashboard presents regional data which was readily available from its existing systems of data-collection

Figure 4-1 Extract from the 2017/18 Dental Prescribing Dashboard showing data for the NHS England West Yorkshire region relating to 'antimicrobial items' [antibiotics]. Source: (PHE, 2018a).


view ▶ West Yorkshire

Month	Number of antimicrobial items	Total FP17s (courses of treatment)	Antimicrobial items as % of total FP17s	Total antimicrobial net ingredient cost (£)
Apr-17	10,116	152,283	6.64	22,694
May-17	11,556	166,768	6.93	26,131
Jun-17	11,093	142,642	7.78	24,846
Jul-17	10,976	175,504	6.25	22,121
Aug-17	10,931	174,760	6.25	20,279
Sep-17	10,615	165,140	6.43	19,012
Oct-17	10,642	162,734	6.54	17,858
Nov-17	10,432	177,360	5.88	18,575
Dec-17	9,862	145,331	6.79	16,882
Jan-18	10,940	150,286	7.28	19,754
Feb-18	9,755	193,180	5.05	17,706
Mar-18	10,703	171,348	6.25	19,187
Total	**127,621**	**1,977,336**	**6.45**	**245,045**

The *rate* of antibiotic use is presented as a ratio of:

> *"the number of antimicrobial items dispensed by pharmacies to patients presenting an NHS dental prescription (FP10D form) to the number of NHS patients treated in dental practices (FP17s)… Analysis of antimicrobial products was based on BNF 72 section 5.1 (Bacterial Infection)."*(PHE, 2018a).

Wide variation between the regions was found: during 2017/18 is ranged from 4.74 antibiotics per 100 FP17s in 'Bristol, North Somerset, Somerset & South Gloucestershire' to 12.14 in 'North East London' (PHE, 2018a).

In 2015, ESPAUR undertook to improve granularity of NHS dental data to practice-level in England (PHE, 2015b). As neither computer generated (over printed) prescriptions nor electronic prescribing (to send prescriptions direct from prescriber to dispenser) are available to NHS dentists in England, producing data at practice-level required a manually-intensive process. Antibiotic relating to antibiotic use per NHS dental practice is not routinely available in England.

4.1.2 Outcomes metrics for dental antibiotic stewardship interventions

Two previous RCTs of dental antimicrobial stewardship interventions have been reported in the literature. A Welsh study of a clinical outreach intervention by Seager et al (2006) used two metrics, based on self-reported data, to measure their outcomes: (1) the number of antibiotic prescriptions issued to patients presenting with acute dental pain across the study; and (2) the number of inappropriate prescriptions (if the patient did not have symptoms indicative of spreading infection). A Scottish study of an audit and feedback intervention by Elouafkaoui et al (2016) used routinely-collected data to measure the number of antibiotic items dispensed per 100 NHS treatment claims for each dentist. Routinely-collected data on antibiotic prescribing per dentist was obtained from the Prescribing Information System for Scotland (PRISMS) database and on NHS treatment claims was obtained from the Management Information and Dental Accounting System (MIDAS) database (Elouafkaoui et al., 2016). Similar routinely-collected datasets are not currently available from NHSE.

4.2 Aim

To what extent could routinely-collected NHSE data contribute to the development and evaluation of an evidence-based, theory-informed intervention to reduce antibiotic prescribing during urgent NHS dental appointments?

4.3 Objectives

Objective A - Practice-level variation in the rate of antibiotic prescribing
To describe practice-level variation in the rate of antibiotic prescribing between NHS dental practices across Lancashire and West Yorkshire, including to inform the recruitment of GDPs to an ethnographic study (reported in Chapter 5).

Objective B - Utility of available datasets for measuring NHS dental antibiotic use
To explore the utility of routinely-collected NHSE datasets, including the accuracy and completeness of practice-level data about antibiotic prescription, for use as a potential measure of the effectiveness of the intervention (within Chapter 6).

4.4 Methods

Ethical approval for this study was obtained from the University of Leeds (UoL) Dental Research Ethics Committee (DREC re 120416/WT/202 dated 08 April 2016 updated 28 October 2018). The NHS Business Services Authority (NHSBSA) datasets are Crown Copyright and their use is licensed under the terms of the (The National Archives).

4.4.1 Study design

Anonymised routinely-collected data was analysed in order to rank practices in relation to their rates of antibiotic use within and between GDPs providing care to NHS patients in Lancashire and West Yorkshire. Data from sources were assessed to identify their utility for measuring rates of dental antibiotic use.

4.4.2 Setting

Lancashire and West Yorkshire were identified as the setting for this study due to the availability in early 2017 of NHSE dental practice-level relating to antibiotic use. This timescale was required to inform recruitment of practices to the ethnographic study (see Chapter 5). At that time, only a subset of the national dataset (relating to Lancashire and West Yorkshire NHS Area Teams during July 2015) had been refined by NHS Prescription Services due to the manually-intensive efforts required.
The suitability of this geographic area for the purposes of recruiting to the ethnographic study, was confirmed with reference to its sampling strategy (detailed in Chapter 5). A mix of dental practices in urban and rural settings was required and, as shown in Table

4-1, both regions were required in order to fulfil this sampling criterion: Lancashire had a more rural characteristic whereas West Yorkshire was predominantly urban (Service, 2017).

Table 4-1 Lancashire and West Yorkshire local authority districts ranked by rural and hub-town (rural-related) populations 2011, with the 2011 Rural Urban Classification. Source: (DEFRA, 2014).

	Rural-Urban Classification 2011
West Yorkshire Districts	
Leeds	Urban with Major Conurbation
Bradford	Urban with Major Conurbation
Calderdale	Urban with Major Conurbation
Wakefield	Urban with City and Town
Lancashire Districts	
Blackburn with Darwen	Urban with City and Town
Blackpool	Urban with City and Town
Burnley	Urban with City and Town
Fylde	Urban with City and Town
Hyndburn	Urban with City and Town
Pendle	Urban with City and Town
Preston	Urban with City and Town
Rossendale	Urban with City and Town
South Ribble	Urban with City and Town
Chorley	Urban with Significant Rural
Lancaster	Urban with Significant Rural
West Lancashire	Urban with Significant Rural
Wyre	Largely Rural
Ribble Valley	Mainly Rural

4.4.3 Participants

Dental practices delivering dental care services to the NHS through a GDS contract were eligible for inclusion in this study. Dental practices delivering care to NHS patients through a Personal Dental Services (PDS) Agreement were excluded as this indicated a more specialised type of dental service provision, such as sedation or domiciliary care (NHSBSA, 2016c).

4.4.4 Variables and data sources

The following datasets and key variables contained within them of interest for calculating the rate of antibiotic use were accessed:

Antibiotic use:

- *antibiotics dispensed* - descriptions of each antibiotic dispensed by pharmacists during July 2015 in Lancashire and West Yorkshire, produced manually by NHS Prescription Services from FP10D forms;

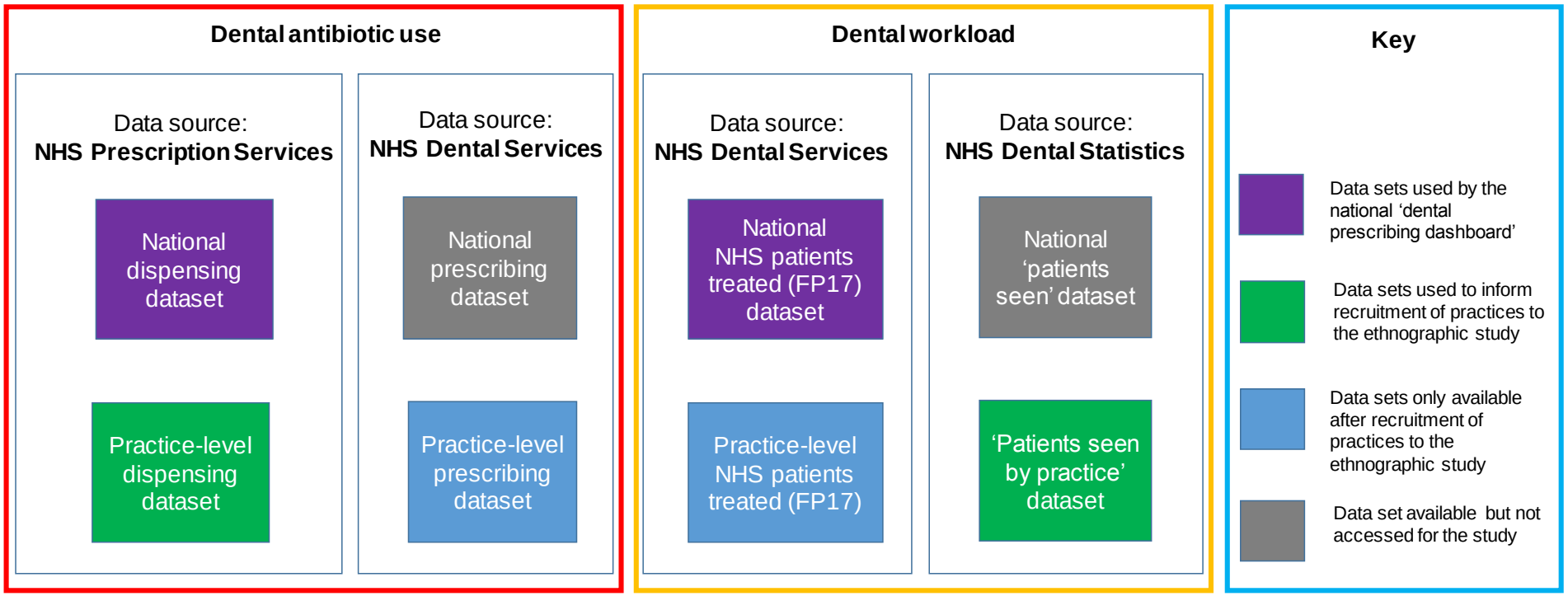
- *antibiotic prescribed* - number of antibiotic items reported by dentists to have been prescribed during July 2015, derived from the NHS Dental Services FP17 clinical dataset.

Dental workload:

- *patients seen by practice* - numbers of adult patients from the NHS Dental Statistics website, as a proxy for the size of the practice's patient-base in 2015;
- *NHS patients treated* - numbers of NHS treatment plans completed per dental contract derived from the NHS Dental Services FP17 clinical dataset, as a measure of the dental activity for each practice during July 2015.

Datasets and sources at both national and practice-level are shown in Figure 4-2. Those were used to inform recruitment of practices to the ethnographic study (Chapter 5) are shown in green and those which became available later in the study (during 2018/19) and were assessed for utility as outcomes for the complex intervention (Chapter 6) are shown in blue. Data available national via the dental prescribing dashboard are shown in purple. Further details of the data sources are provided below:

Figure 4-2 Summary of data sources and datasets. Source: (PHE, 2018a) (Dockey, 2016) (Dockey, 2018) (Kitchingside, 2019) (NHSDigital, 2016a).



4.4.4.1 NHS Prescription Services - dispensing dataset

NHS Prescription Services is the body which calculates the remuneration and reimbursement due to dispensing contractors (pharmacists) across England. It publishes data relating to the dispensing of antibiotics (specifically antibacterial drugs) to NHS dental patients on the NHS Digital Prescribing Costs Analysis website (NHSDigital, 2016b). This does not usually contain practice-level data.

The onerous task of producing practice-level data had been undertaken by NHS Prescription Services as part of their efforts to improve the granularity of dental prescribing data beyond regional level. This involved members of the NHS Prescription Services team looking at each FP10D form and extracting data into an Excel spreadsheet. The dataset detailed systemic antibiotics dispensed by pharmacists during July 2015 to NHS dental patients accessing services commissioned by the Lancashire and West Yorkshire NHSE Area Teams (see Table 4-2). It was made available for this research project (Dockey, 2016).

Table 4-2 Extract from the practice-level dispensing dataset relating to July 2015 provided by the NHS Prescription Services showing the 'Valid Contracts' dataset: with practice identifiable details concealed. Source: (Dockey, 2016).

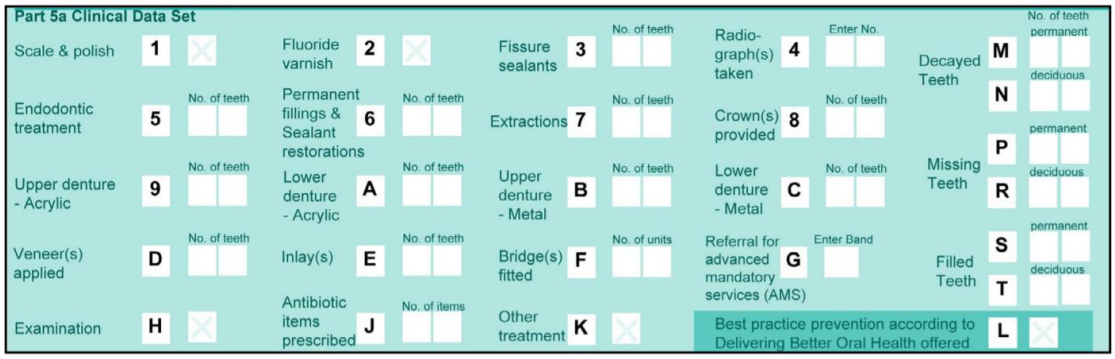
PERIOD	DESCRIPTION	QUANTITY	6 Digit contract number	4 Digit tag number	6 digit location ID	Principal Practice and Correspondence Address
Details of prescription forms with a valid contract id (including contract details)						
201507	Amoxicillin 250mg capsules (15)	15				
201507	Amoxicillin 250mg capsules (15)	15				
201507	Amoxicillin 500mg capsules (21)	21				
201507	Amoxicillin 500mg capsules (15)	15				
201507	Amoxicillin 250mg capsules (15)	15				
201507	Amoxicillin 250mg capsules (15)	15				
201507	Amoxicillin 250mg capsules (15)	15				
201507	Amoxicillin 500mg capsules (21)	21				
201507	Metronidazole 200mg tablets (21)	9				
201507	Amoxicillin 500mg capsules (21)	15				
201507	Metronidazole 200mg tablets (21)	15				
201507	Amoxicillin 250mg capsules (21)	21				
201507	Metronidazole 200mg tablets (21)	9				
201507	Amoxicillin 250mg/5ml oral suspension (100)	1				
201507	Metronidazole 200mg/5ml oral suspension (100)	150				
201507	Metronidazole 200mg tablets (21)	15				

4.4.4.2 NHS Dental Services - prescribing dataset

NHS Dental Services is the body which provides activity processing and payment services for NHS dentists in England and Wales. As such their data is a source of a number of variables including information about dental practice population sizes, numbers of dental patients treated and antibiotic prescribing. 'Antibiotic item prescribed' is one item of the FP17 clinical data set (as seen (Figure 4-3) although there is no automatic link to populate it with data from the dental management software

and the item is not associated with remuneration for dentists. Information from the clinical dataset is published online annually within the NHS Dental Statistics for England (NHSBSA, 2016b) .

Figure 4-3 Extracts from the FP17 form Part 5 (Treatment category) and Part 5a (Clinical Data Set). Source: (NHSBSA, 2018b).



Upon request, during 2019, a breakdown of this data to practice-level for Lancashire and West Yorkshire was provided to the researchers by NHS Dental Services; an extract from the provided spreadsheet is presented in Table 4-3. (Kitchingside, 2019).

Table 4-3 Extract from the dental activity dataset provided by NHS Dental Services showing the total number of FP17 forms submitted in July 2015 per practice (contract number) and the number of antibiotic items which were reported to have been prescribed. Source: (Kitchingside, 2019).

Total FP17s	Total FP17s with Antibiotic Items Prescribed
1,190	18
154	0
177	1
1,239	5
596	92
821	0
1,302	0
371	2
19	1
610	0

4.4.4.3 NHS Dental Services – patients treated (FP17) dataset

An FP17 form is submitted for every course of NHS dental treatment completed by dentists. The number of FP17 forms completed during a period is an estimation of the number of patients treated during that period. Information about the number of FP17 forms submitted for each region is published online annually within the NHS Dental

Statistics for England. Upon request, during 2018, a breakdown of this data to practice-level for practices in Lancashire and West Yorkshire was provided to the researchers by NHS Prescription Services; an extract from the provided spreadsheet is presented in Table 4-4 (Dockey, 2018).

Table 4-4 Extract from the dataset provided by NHS Dental Services showing for each practice the contract type (General Dental Services (GDS) or Personal Dental Services (PDS)), banding of the treatment plans banding and the number of patients treated during July 2015. Source: (Dockey, 2018).

Contract Number and Tag	Full name or company name	Contract Type Name	Full Treatment Address	Treatment Postcode	Total Number of Patients Treated (General)
		GDS Contract			1,185
		GDS Contract			866
		GDS Contract			282
		GDS Contract			137
		GDS Contract			71
		PDS Contract			99
		GDS Contract			85
		GDS Contract			741
		GDS Contract			2,129
		PDS Contract			313

4.4.4.4 NHS Dental Statistics – Patients seen by practice

The ‘patients seen’ measure is an estimate of the size of the practice’s patient base. It shows the number of adult patients who received NHS dental care under each NHS dental contract during the previous 24 months (NHSDigital, 2016a). Datasets relating to adult ‘patients seen by practice’ for the 24 month period to March 2016 were accessed on-line from the NHS Dental Statistics for England 2015/16 website. As a proxy estimate of the size of each practice’s adult patient base during July 2015, and in the absence of better data to meet the timescale required for recruitment to the ethnographic study (early 2017), this data was deemed fit for the purpose of identifying practices with higher and lower rates of antibiotic prescribing. It was not, however, appropriate for calculation of prescribing rates due to the difference in timescales associated with the datasets; additional data sources were sought for this purpose.

4.4.4.5 Other variables

In order for the antibiotic use and dental workload data to be matched to individual dental practices with NHSE GDS contracts and to assist identification of a set of high and low prescribing practices for recruitment to the ethnographic study (as addressed

in more detail in Chapter 5), the variables also included: NHS contract number/tag; type of NHS dental contract (GDS or PDS); and the postcode alphabetical prefix for each practice. No information about individual dentists, patients or dental condition was included in the datasets. At the time of the study, NHS primary care dental practices and clinics were identified by a 6-digit contract number, a 4-digit tag and a 6-digit practice location ID number (NHSBSA, 2018d).

4.4.5 Accessing the source data

The datasets provided by NHS Prescription Services and Dental Services described in 4.4.4 were provided by NHSBSA via email as Microsoft Excel spreadsheets (Dockey, 2016) (Dockey, 2018) (Kitchingside, 2019). No access to data from the NHSBSA systems beyond those provided in the spreadsheets provided were available to the researchers. Datasets from the NHS Dental Statistics for England Report which is available on-line (NHSDigital, 2016a).

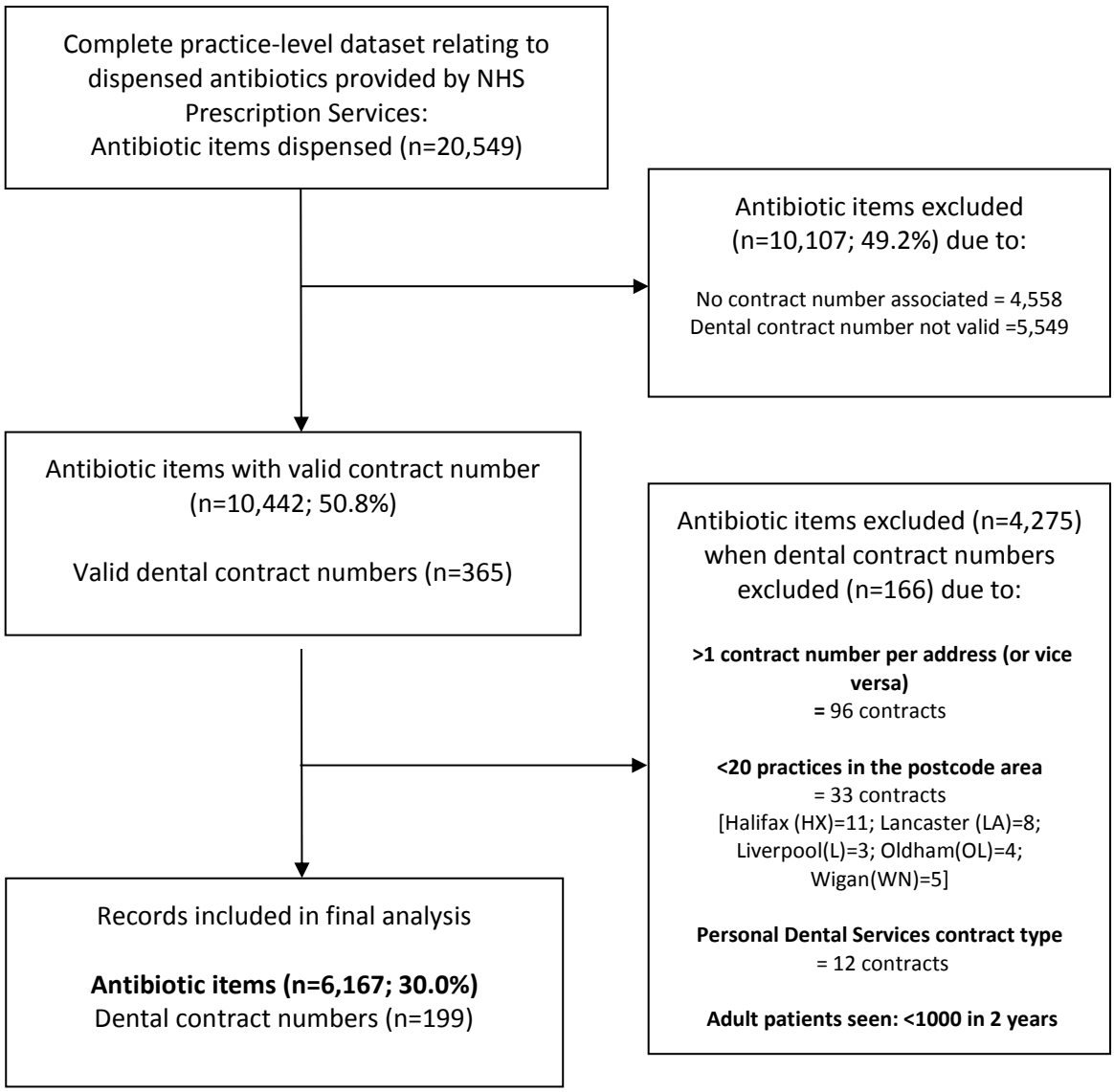
4.4.6 Inclusion/exclusion criteria

Data were required to be associated with a valid contract number to allow linkage to individual GDPs (see Figure 4-4). PDS agreements were excluded for reasons given in section 4.4.3. GDS contracts associated with more than one practice address and practice addresses associated with more than one contract were also excluded, to ensure clarity that data per contract was synonymous with data per practice. To prevent inadvertent identification of specific individuals and to ensure a sufficiently large number of adult patients would be available in each practice for recruitment to the ethnographic study, contract numbers associated with fewer than 1000 adult patients seen in the 24 month period to March 2016 were excluded, as were those practices in areas with fewer than 20 practices in the dataset.

4.4.7 Data access, cleaning and linkage

Data not required for the purposes of the study were removed. To enable collation of the results and analysis across dental practices, the dispensing and dental contract activity datasets were first linked using the GDS/PDS contract agreement number/tag and practice address. The dataset for analysis was generated by application of the inclusion/exclusion criteria (see Figure 4-4).

Figure 4-4 Flowchart showing inclusions/exclusions from the dataset of antibiotic items dispensed from pharmacies across Lancashire and West Yorkshire during July 2015.



4.4.8 Addressing potential bias

To avoid the potential for bias arising from identifying dental practices with patterns of inappropriate prescribing activity relating to antibiotic type or amount, the dataset was partitioned into:

1) an anonymised dataset of prescribing and workload data; and
2) a key linking the unique identifiers with the full list of practice addresses (partition held by an independent researcher, in accordance with ethics, for use in the recruitment of practices to the ethnographic study (see Chapter 5).

The two partitioned halves of the dataset were held and manipulated separately. Only the anonymised partition was used for the purposes of this study, to explore variation between GDPs and across geographic areas.

Partitioning of the dataset was undertaken by an independent researcher after linkage of the antibiotic prescribing and dental workload/activity (prescribing, patients seen and total FP17s) datasets and following application of the inclusion/exclusion criteria (as described in Figure 4-4. The key was retained by the independent researcher for use during the recruitment phase of the ethnographic study (to provide the full practice addresses for practices to be invited to participate in the study). The independent researcher played no role in the analysis of data in either this or the ethnographic study.

4.4.9 Analysing the dataset

4.4.9.1 Informing recruitment to the ethnographic study

The number of dispensed antibiotics per dental practice/NHS contract number was produced from the practice-level dataset provided by NHS Prescription Services (Dockey, 2016). Undertaken in January 2017, the records of antibiotic items dispensed were collated and counted for each anonymised dental practice/contract (see Figure 4-5).

Table 4-5 Number of antibiotic items dispensed counted per anonymised practice (NHS dental contract number) - excerpt from the collated dataset. Source: (Dockey, 2016).

Practice ID	Antibiotic item dispensed	No. of antibiotics counted per practice
1161	Amoxicillin 500mg capsules (21)	
1161	Amoxicillin 500mg capsules (21)	
1161	Erythromycin 250mg gastro-resistant tablets (28)	
1161	Amoxicillin 500mg capsules (21)	
1161	Clindamycin 150mg capsules (24)	
1161	Amoxicillin 500mg capsules (21)	
1161	Amoxicillin 250mg capsules (21)	
1161	Erythromycin ethyl succinate 500mg tablets (28)	
1161	Amoxicillin 250mg/5ml oral suspension (100)	
1161	Amoxicillin 500mg capsules (21)	
1161	Erythromycin 250mg gastro-resistant tablets (28)	
1161	Amoxicillin 250mg/5ml oral suspension (100)	
1161	Amoxicillin 500mg capsules (21)	
1161	Erythromycin 250mg gastro-resistant tablets (28)	
1161	Cefalexin 500mg capsules (21)	
1161	Amoxicillin 500mg capsules (21)	
		16
1162	Amoxicillin 250mg capsules (21)	
		1

To inform recruitment of practices to the ethnographic study, higher and lower prescribing practices were identified from a ratio of: dispensed antibiotics (the 'number of antibiotic items dispensed by pharmacies for patients presenting an NHS dental prescription (FP10D form)') to the size of the patient base ('number of NHS adult patients seen' in dental practices over the previous 24 month period.' An extract from the spreadsheet used to calculate this ratio is shown in Table 4-6.

Table 4-6 Excerpt from the spreadsheet used to identify practices with higher and lower rates of antibiotic so as to inform recruitment to the ethnographic study. Source: (Dockey, 2016) and (NHSDigital, 2016a).

Practice ID	Dispensed antibiotics	Size of patient base	Ratio: Antibiotics to patient base
1109	9		0.0093
2081	65		0.0093
2038	25		0.0094
1063	62		0.0094
1038	22		0.0094
1011	12		0.0094
2148	36		0.0095
1009	41		0.0095

The 25th percentile and 75th percentile were calculated for the dataset. For the purposes of informing recruitment to the ethnographic study, practices in the upper quartile by rate were defined as higher prescribing practices and in the lower quartile were defined as lower prescribing practices. As an estimate of the size of the practice, the patient base was used as a proxy denominator, these figures have not been presented graphically as better datasets continued to be sought and were eventually found, as described in the next section.

4.4.9.2 Describing practice-level variation

4.4.9.2.1 Identifying high/low rates of antibiotic use

The dataset of FP17 claims submitted per practice during July 2015 was provided to the researchers in 2018. This allowed rates of antibiotics use to be calculated as the ratio of: the number of antibiotic items dispensed by pharmacies to patients presenting an NHS dental prescription (FP10D form) to the number of NHS patients treated during July 2015 (see Table 4-7). The number of patients treated was considered to be equivalent to the number of FP17 claims submitted by dentists for completed courses of NHS treatment (N.B. the same formulation as used at the national and regional levels within the Dental Prescribing Dashboard) (PHE, 2018a).

Table 4-7 Excerpt from the spreadsheet used to calculate rates of antibiotic use per practice. Source: (Dockey, 2016). and (Dockey, 2018).

Practice ID	Dispensed antibiotics	No. of FP17s	Antibiotics per 100 FP17s
1148	19		16.0
1077	28		12.9
2036	20		12.5
1037	12		11.8
1204	64		11.3
2017	167		10.4
1097	105		9.6
1207	38		9.4
2043	27		8.8

4.4.9.2.2 Describing patterns of geographic variation in prescribing

To describe patterns of dental antibiotic prescribing across Lancashire and West Yorkshire the data were presented as number of antibiotic items dispensed per practice and rate of antibiotic dispensing per practice (calculated as the number of antibiotic items dispensed per 100 FP17 forms submitted).

4.4.9.3 Exploring utility of available datasets

Data on the dispensing of dental antibiotics across NHSE from the Prescription Cost Analysis are reported in the annual PHE ESPAUR report. NHS Prescription Service reporting systems are underpinned by a robust quality assurance system for collecting and reporting data. NHS Prescription Services internal audit validates the published data to ensure its accuracy. In 2015/16, it found an accuracy of at least 98.5% (HSCIC, 2016). This data source has been identified, therefore, as the *standard* against which the other data sources have been assessed for utility in terms of accuracy. Completeness was assessed by considering the proportion of the data which was excluded from each dataset

4.5 Results

4.5.1 Informing recruitment of practices to the ethnographic study

After applying inclusion/exclusion criteria, the practice-level dispensing dataset included 6,167 dispensed antibiotic items associated with 199 NHS GDS contract numbers for GDPs across Lancashire (36%, n=71) and West Yorkshire (64%, n=128). A list of practice identifiers (with their postcode alphabetical prefixes) ranked from highest ratio of dispensed antibiotics to adult patients seen to lowest was produced. To inform recruitment to the ethnographic study (as described in Chapter 5 in more detail), a list of practices in the upper quartile and another list of practices in the lower quartile were produced. The postcode alphabetical prefix for each listed practice was included to assist researchers when applying the ethnographic study's sampling strategy in relation to urban/rural mix.

These lists were sent to the independent researcher holding the key of dental practice addressed for use during recruitment of practices to the ethnographic study. This ranked list of practice identifiers and postcode alphabetical prefixes played no further role in this analysis of routinely-collected data.

4.5.2 Describing practice-level variation in antibiotic use

4.5.2.1 Patterns across Lancashire and West Yorkshire

The median number of antibiotic items dispensed per dental practice/contract number during July 2015 was 23 (range one to 167 items) (Figure 4-5).

A summary of the rate of antibiotic items dispensed per 100 patients treated during July 2015 for each practice in the dataset is presented in Figure 4-6. The median was 3.2 antibiotic items per 100 patients seen per practice with the 75th percentile at 4.8 and the 25th percentile at 2.0.

Using the data for patients seen over the 24 month period to March 2016 rather than the patients seen during July 2015 as the denominator produced the same pattern of practices in the upper and lower quartiles.

Figure 4-5 Number of antibiotics dispensed (FP10Ds) per NHS dental practice by pharmacies during July 2015 across the Lancashire and West Yorkshire NHS England Area Teams. Each bar represents one of the 199 dental practices where the prescriptions (FP10D forms) originated; the bars are arranged from highest to lowest number of antibiotics. Source: (Dockey, 2016). and (Dockey, 2018).

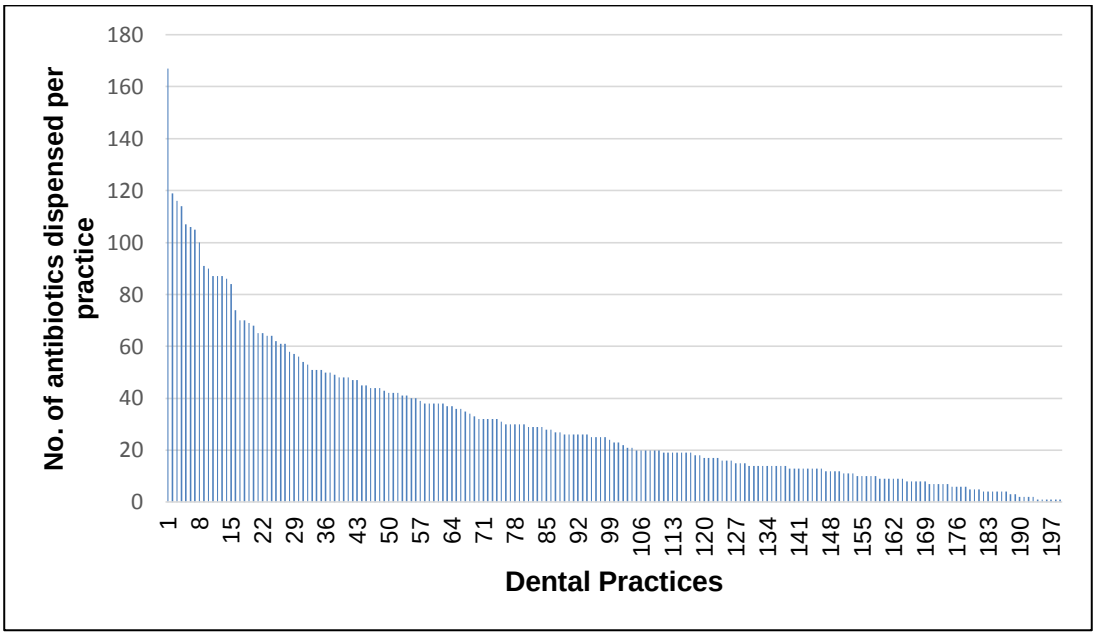
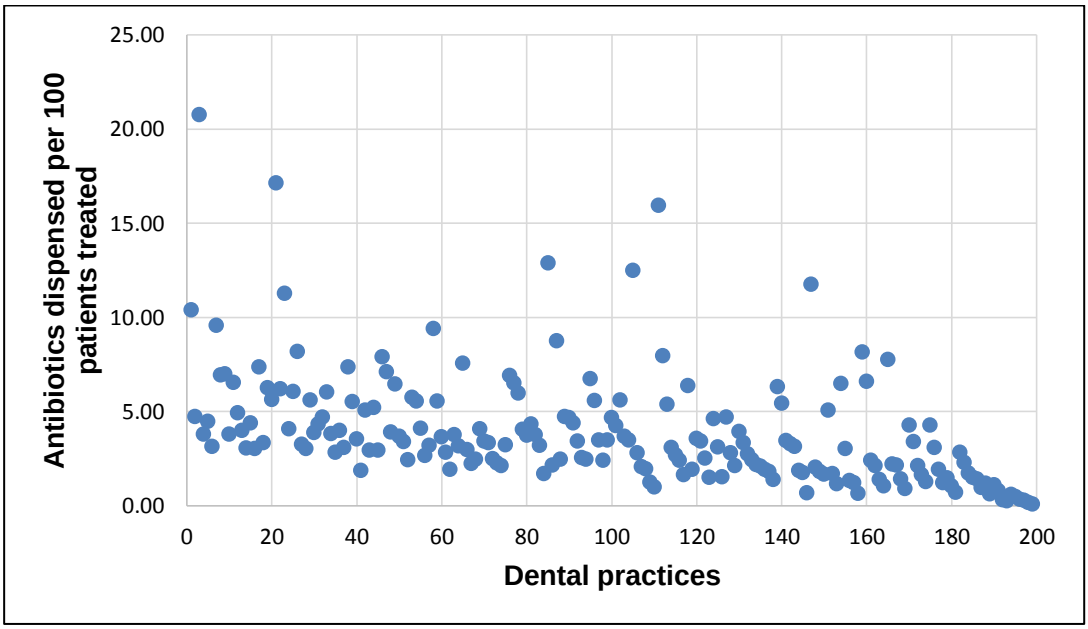


Figure 4-6 Rate of antibiotic use (antibiotic items dispensed (FP10Ds) per 100 patients treated (FP17s) during July 2015 for each of the 199 dental practices across the Lancashire and West Yorkshire NHS England Area Teams. Each point represents one practice; the points are arranged in the same order as the bars in Figure 4-5.



4.5.3 Utility of available NHS datasets

4.5.3.1 Accuracy

Nationally, NHS Prescription Services records identified 3.4 million antibiotic items dispensed to NHS dental patients by community pharmacists across England during 2015 (NHSDigital, 2016b). NHS Dental Services identified 1.3 million antibiotic items prescribed by NHS primary care dentists in England during the reporting year 2015/16 (NHSDigital, 2016a). This equates to 2.6 times fewer antibiotics recorded as being prescribed by dentists than were known to be dispensed by pharmacists.
The practice-level dispensing dataset provided by NHS Prescription Services for Lancashire and West Yorkshire during July 2015 included a total of 20,549 antibiotic items dispensed. The practice-level prescribing dataset provided by NHS Dental Services the same regions and timeframe included 5398 antibiotic items dispensed. This equates to 3.8 times fewer antibiotics recorded as being prescribed by dentists than were known to be dispensed by pharmacists.

Of the 199 practices analysed from the 'practice-level dispensing dataset, more than half (n=101) were associated with practice-level prescribing data which suggested no antibiotic had been prescribed from the practice that month (see Table 4-8).

Table 4-8 Excerpt from spreadsheet comparing practice-level data from antibiotic dispensing and prescribing datasets. Source: (Dockey, 2016) (Kitchingside, 2019).

Practice ID	Dispensed antibiotics	Prescribed antibiotics
2031	4	1
2033	17	0
2098	25	0
1009	41	1
2032	60	0
1014	79	66

4.5.3.2 Completeness

Of 20,549 prescriptions included in the full practice-level dispensing dataset provided by NHS Prescription Services, 10,442 were allocated to a valid NHS contract and were thus included in the dataset for analysis (see Figure 4-4). This dataset is 51% complete.

Comparison of the accuracy and completeness of the practice-level dispensing and prescribing data sets found that neither would be an appropriate outcome measure for the complex intervention to reduce NHS dental antibiotic prescribing in England.

4.6 Discussion

4.6.1 Key results

By exploring routinely-collected NHS dental prescribing/dispensing data from various sources, it is clear that there are significant challenges with currently available datasets for purposes beyond their current uses. Given its extensive limitations, the only conclusion that it is possible to make with confidence is that a step change is required in the completeness and accuracy of currently available datasets if they are to be used for quality improvement and/or evaluation of a complex intervention to reduce dental antibiotic prescribing.

4.6.1.1 Informing recruitment to the ethnographic study

For the purposes of informing practice recruitment to the ethnographic study within the required timeframe, the data analysis was adequate. Using the 'adult patients seen' (size of the patient base) as a denominator to account for the different volumes of workload between practices, it was possible to rank the practices from highest to lowest users of antibiotics. However, it was a suboptimal and inefficient approach. Ideally the practice-level FP17 data relating to July 2015 would have been available for use immediately. Whilst not presented in the results section for brevity, comparison of the lists of high and low rate practices produced using the 'adult patients seen' and 'FP17' data were very similar and all of the practices ultimately recruited to the ethnographic study were identified as either high or low rate users of antibiotics in both analyses.

4.6.1.2 Patterns of antibiotic use

Wide variation exists between the NHS dental practices included in this analysis in relation to the amount and rate of antibiotic use. With around two thirds of the dental contracts excluded from the analysis which related only to July 2015 in Lancashire and West Yorkshire, it is possible that an even greater range of use exists in reality across England. There was also no mechanism in this study for identifying practices which had undertaken no dental antibiotic prescribing during July 2015.

4.6.1.3 Utility of datasets for measuring dental antibiotic use

The main conclusion from this study is that none of the practice-level datasets identified were sufficiently accurate or complete to be used for measuring practice-level

dental antibiotic prescribing. No quality assurance system currently exists relating to the quality of data from the dental electronic health record system (Byrne, 2019). Without a step change to improve its quality, dispensing data from NHS Prescription Services and/or prescribing data from NHS Dental Service's clinical data set (FP17 forms) would be inadequate for monitoring antibiotic prescribing at either practice-level or individual prescriber level.

Review of the data which were excluded due to lack of valid contract number indicated that it was hard to draw any conclusion about whether there was a systematic bias introduced by excluding them. In many cases the practice information provided was difficult to interpret or attribute. For example, postcodes were often missing or practices with the same postcode had different names. Practices excluded due to the small size of the adult NHS patient bases (and hence insufficiently large to support recruitment to the ethnographic study) were noted often to have a larger proportion of child patients. It is assumed by the authors that many of these practices were based on a larger proportion of private dental care within the mixed NHS/private economy which exists within primary dental care. It would be interesting to undertake further research focused on factors influencing antibiotic prescribing for private adult dental patients and also child NHS patients.

4.6.2 Interpretation

The study demonstrated that routinely-collected data was sufficient to identify practices with both high and low rates of antibiotic use where practice level identifiers were included. The extent to which variation in prescribing rates represents overprescribing cannot be determined from this analysis; clinical audit of antibiotic prescriptions against clinical guidance would have been required to reveal the appropriateness of each prescribing decision and hence the extent to which the variation identified was warranted (Palmer, N. et al., 2001) (Chate et al., 2006) (Spivak et al., 2016). To optimise the use of antibiotics in dentistry, there is some evidence that targeting antibiotic stewardship interventions (such as self-audit), (PHE, 2016a) towards high prescribing practices using monitoring & feedback could be a more efficient approach than a more general encouragement of all dental prescribers to engage in such initiatives (Elouafkaoui et al., 2016). As described in (section 4.6.3 above), the study results have suggested that different definitions of 'high rate' use may be appropriate for different settings (such as GDS vs PDS contracts). Further research is recommended to explore the potential for development of useful definitions of 'high rates' of antibiotic prescribing/dispensing and to improve understanding of factors influencing these differences between practices and settings.

The dental prescribing dashboard shows considerably higher rates of antibiotic use across primary dental care settings than the figures found in this study. It should be recognised that this study focused specifically on GDPs and excluded more specialist services such as OOH dental care, where antibiotic prescribing rates would be expected to be significantly higher due to the nature of urgent and emergency dental problems which present to those services (PHE, 2018a). The dashboard figures for Lancashire and West Yorkshire in 2017/18 were 6.1 and 6.5 antibiotics per 100 patients seen (measured as FP17 treatment plans completed), respectively. By contrast, this study found a median figure for GDPs across the combined Lancashire and West Yorkshire dataset to be 3.2 with an upper quartile at 4.8. A number of reasons could exist for this difference and further research to explore this is indicated. One reason may be the removal of such a large number of practices/clinics, including those excluded because they provide more specialist services through PDS agreements. Other reasons for bias might relate to the type of dental teams which ensure they use a practice stamp with the correct details (or vice versa) and the exclusion of practices in areas with few dental practices (which may indicate lack of access to dental services, a factor found in Chapter 3 to be an influence on antibiotic prescribing). Further investigation with a more extensive dataset is indicated to improve understanding about antibiotic prescribing and dispensing by dentists working in different settings.

4.6.3 Generalisability

The PHE dental prescribing dashboard currently presents antibiotic use rates at the level of NHSE Local Area Team (PHE, 2018a). As part of their efforts to produce the equivalent data set at a practice-level, the NHS Prescription Services team used a restricted dataset (for July 2015 covering the Lancashire and West Yorkshire regions). Due to the manual nature of this process to produce it, it was not possible to gain additional information within the timescales required by this study in order to inform recruitment to the ethnographic study. As described in section 4.6.2, the geographic area covered by Lancashire and West Yorkshire met the requirements of the ethnographic study's sampling strategy in terms of urban/rural mix; this study found a sufficient number of high and low prescribing practices could be identified from across the area for the purposes of the ethnographic study. The final element of the sampling strategy relating to type of service provider (independent business versus corporate) was applied during the recruitment phase detailed in Chapter 5. For the purposes of the ethnographic study, therefore, the results of the study were sufficient.

By its nature, ethnographic research is not easily generalisable beyond the population which was studied (Savage, 2000) (Goodson and Vassar, 2011). In spite of its

combined population of 3.5 million (6% of England's population) and mix of urban/rural geographies, it is unlikely that the results of this study accurately reflect antibiotic prescribing in NHS GDP across England due to the extremely short timescale and high number of practices and clinics which were excluded from the dataset (ONS, 2017). The results may, however, provide a starting point for further research about primary dental care services provided by the NHSE. However, as the NHS dental contracting and prescribing arrangements continue to evolve and diverge from those of the other nations, the applicability of the findings to NHS dentistry will become increasingly restricted (BDA, 2019). Further research is indicated to explore how NHS dental contract reform will impact on dental prescribing generally and antibiotic use specifically – and how improvements in measuring prescribing can contribute to quality improvement as part of the new contract.

Building on the findings of this study, NHSBSA has started collating monthly antibiotic dispensing and dental activity datasets at practice level across England for inclusion within its on-line database for authorised users to access prescribing/dispensing data (ePACT2) (NHSBSA, 2018a). Once accurate and complete datasets relating to antibiotic prescribing in NHS general dental services become available, NHS commissioners/contract managers could use them as a quality indicator of patient safety (protecting patients from the unnecessary risk from adverse events due to antibiotics such as anaphylaxis, antibiotic-related colitis and antibiotic-resistant infections) (Thompson, W et al., 2018).

4.6.4 Strengths & limitations of the study

A previous study in Scotland used routinely-collected data to demonstrate reductions in prescribing at the dental practitioner and dental practice levels as part of an audit and feedback intervention (Elouafkaoui et al., 2016). The PRISMS collected data at practitioner level using the individual list number allocated to each primary care dentist in Scotland. This study used similar data from NHS Prescription Services, except in England only practice identifiers (contract numbers) rather than individual dental practitioner identifiers were available. For this reason, my study took the approach of exploring variation between dental practices in order to recruit practices (rather than individual dentists) to the ethnographic study.

4.6.4.1 Justification of research methods

Routinely-collected healthcare data, obtained for administrative and clinical purposes without specific a priori research goals, have become increasingly used for research. Although they potentially provide a rich source of clinical, health service systems and epidemiological data, the quality of such routinely-collected healthcare data is known to be variable (Benchimol et al., 2015). Incomplete or inadequate reporting of research

based on routinely-collected data can exacerbate the challenges (Nicholls et al., 2017). For this reason, an important element of this study was to assess the utility of the available datasets relating to dental antibiotic use.

To meet the timescales required for the ethnographic study and due to the non-availability (to the researchers at that time) of FP17 activity per dental practice in the study area for July 2015, a decision had to be made about the basis for the definition of high/low antibiotic prescribing dental practices. The options were: 1) total antibiotic use per practice during July 2015; or 2) proxy rate of antibiotic prescribing (calculated as a ratio of total antibiotic use during July 2015 to estimated size of adult patient base per practice). As workload was a factor identified in Chapter 3 as a possible factor associated with dental antibiotic prescribing decisions, the researchers decided that it would be appropriate to account for this whilst selecting practices. Furthermore, as the ethnographic study was interested only in adult patients and as the patient base sizes selected related to adult patients, it was recognised that a proxy rate for each practice would provide a suitable way of ranking practices in relation to their rate of antibiotic prescribing. In this way, recruitment of practices in the upper quartile (high prescribing) and lower quartile (low prescribing) to the ethnographic study was informed.

4.6.4.2 Restricted dataset for the purposes of the study

Restricting the dataset to those prescriptions associated with valid contract numbers (necessary to ensure clarity when linking practice-level antibiotic with dental workload/activity data) was responsible for excluding nearly half of the dataset (see Figure 4-4). Further exclusions for the purposes of the study produced a dataset with less than a third of the original NHS Prescription Service dataset provided. Together with the risks of misclassification and omission inherent in the manually intensive process used by NHS Prescription Services to deliver the dataset and the short timeframe perspective of just one month, a descriptive presentation of the results rather than statistical analysis was produced. Given the restrictions described, care should be taken not to extrapolate the results. Rather the value of these results is the basis they provide for demonstrating challenges associated with the currently available routinely-collected NHS datasets relating to dental prescribing**.**

4.6.4.3 Limited ability to explore the reasons for variation observed

Whilst this dataset was sufficient for the purposes of identifying practices for recruitment to the ethnographic study, the restricted size of its dataset may account for some of the variation in calculated rates of antibiotic use. Another reason may have been the assumption that all NHS prescriptions were associated with an NHS treatment FP17 claim form. The NHS GDS contract states that FP10D prescription forms may only be given to patients as part of a course of NHS treatment (NHSE,

2018d). The researcher recognises, however, that this may not always be the case in practice. For example, GDC professional conduct committee proceedings occasionally report that dentists have provided prescriptions to patients without opening treatment plans, or indeed without seeing the patient (GDC, 2016). Anecdotally, some dentists may also provide NHS prescriptions to patients who receive private care without realising that this is not allowed within the NHS dental contract (NHSE, 2018d). .
A more in-depth analysis of the reasons underpinning the variation observed was not possible. The practice-level data were anonymised for this study and, in any case, only limited patient-level data (such as postcode or ethnicity) are currently collected through FP17 forms. More detailed patient information such as diagnoses are not collected routinely by the NHS.

4.6.5 Limitations for routinely collecting dental antibiotic use data

A major challenge for improving the quality of data concerning dental antibiotic use in England is the nature of NHS systems for recording dental antibiotic dispensing and prescribing activity.

4.6.5.1 Limitations of antibiotic dispensing data

Dentists complete dental prescription FP10D forms by hand, with practice details provided by means of a practice stamp (to validate the prescription by inclusion of the practice address). Whilst stamps for this purpose used to be provided by the NHS, more recently practices provide their own. NHS-provided stamps used to include contract numbers, however, no requirement for inclusion of the contract number appears to exist. This may be the reason that so many of the prescriptions failed to include a valid contract number: no contract number or invalid (possibly previously valid) contract number. Furthermore some practices were found to have more than one contract number yet seemed to use only one of them on prescriptions. As a result, the identifiable information available on prescriptions is complex for the NHS Prescription Service staff manually analysing and reconciling records of around three million dental antibiotic prescriptions each year in England. Improvements to the data quality would require an overhaul to prescribing processes, for example through digitisation of NHS dental prescribing.

4.6.5.2 Limitations to ‘antibiotic item prescribed’ data

It is known that financial incentives within remuneration systems may affect clinical activity undertaken by primary care dentists (Goodwin et al., 2018) (Brocklehurst, P. et al., 2013) (Tickle et al., 2011). However, the NHS remuneration system (FP17 clinical data set) relating to ‘antibiotic items prescribed’ is not linked to any units of dental activity (the basis of payment) (NHSBSA, 2018c) (Cockcroft, 2012). The lack of an

incentive (financial or non-financial) to record antibiotics on FP17 forms may be one reason for the disparity between the 'antibiotics items prescribed' dataset and NHS Prescription Services dataset of antibiotic items dispensed.

Furthermore, the 'antibiotic item prescribed' was not linked to any of the NHSBSA standard treatment codes used by the dental software systems to automatically generate the FP17 clinical data set (NHSBSA, 2016b). Lack of an automated way to report prescribing of antibiotic drugs alongside other elements of the clinical data set may be another reason for the incomplete nature of the prescribing dataset. Revising the list of standard treatment codes to include, as a minimum, 'antibiotic item prescribed' would facilitate automatic completion of the FP17 form's 'antibiotic items prescribed' field and may lead to improvements in the routine collection of data relating to antibiotic prescribing by NHS dentists.

4.6.5.3 Deciding which antibiotic data to study

A discrepancy was found between the datasets in relation to antibiotic use: the number of antibiotics dispensed (derived from the NHS Prescription Services dataset) was much higher than the number of antibiotic items prescribed (derived from the NHS Dental Services dataset). Logically, the number of antibiotic prescriptions issued to patients by dentists ought to be higher than the number of antibiotic prescriptions actually dispensed, due to the number of patients who fail to present the prescription to the pharmacy for dispensing (Hagström et al., 2004). Reasons for the discrepancy seem to relate to the nature of the system within the dental software management system which produces FP17: lack of treatment code for 'antibiotic item prescribed' and hence lack of an automatic completion of the clinical data set in this respect may account for this in part. Similarly, lack of a link between remuneration and drug prescribing may be seen as a disincentive for providing more than the bare essential details in clinical notes. The need to understand and improve the quality of data recording in order to ensure accurate and complete datasets is an area for further research (Byrne et al., 2018). Data from NHS Prescription Services was employed in the study as it represented the actual number of drugs dispensed from a quality assured system, rather than data from the dental contract system which is currently rather less robust. Further work with and between the NHS Prescription Services and Dental Services teams will enable development of datasets which are sufficiently accurate and complete for use as quality indicators.

4.6.5.4 Electronic prescribing for dentistry

Recognising the lack of routinely collected data relating to patients and their diagnoses, NICE Quality Standard 121 on Antimicrobial Stewardship recommended the introduction of electronic prescribing (NICE, 2016a). Whilst linking the indication with

the prescription would support antibiotic stewardship by monitoring individual prescribers, NICE noted that primary dental care settings and secondary care services had no access to this technology. To address this, the UK 5-year Action Plan for Antimicrobial Resistance 2019-2024 included introduction of electronic prescribing for secondary care; no commitment was made in relation to dentistry (HMG, 2019b).

4.6.6 Implications for policy and clinical practice

Using routinely-collected data from normal business processes would help to embed accountability and quality improvement derived from measuring them within NHS dental service management (NQF, 2017). Significant improvements to the way in which antibiotic prescribing data are collected (to ensure accuracy and completeness) would be required, however, if these data were to be used in this way, for example as an element of future NHS dental contract management. Electronic prescribing in dentistry would streamline the process of prescribing/dispensing as well as enabling access to more accurate and complete datasets across NHS primary dental care (and potentially beyond to encompass the growing number of patients receiving private dental care in the UK). Significant investment would be required, however, to effect this change. NICE recommended the introduction of electronic prescribing for dentistry in its Quality Standard 121 in 2016 (NICE, 2016a). Whilst access for all secondary care services by 2024 was included in the UK 5-year national AMR action plan, no commitment has yet been made for dentistry (HMG, 2019b). This should be pursued as a matter of paramount importance.

A simpler interim solution may be to improve the quality of data available from NHS Dental Services. For example, the introduction of systems which allow dentists to overprint (computer generate) prescriptions to avoid the requirement to hand write them, together with amendment of the NHS dental contract treatment codes so that they are linked to the ‘antibiotic item given’ item within the FP17 clinical data set (as shown in Figure 4-3) could be a quick win to improving the NHS Dental Services dataset (NHSBSA, 2016b).

Targeting antibiotic stewardship interventions, such as clinical audit, towards high prescribing dental practices may be an efficient way to reduce overall antibiotic prescribing rates nationally (Elouafkaoui et al., 2016). When sufficiently accurate and complete datasets become more widely available, their utility will be wider than just measuring the outcome of this dental antimicrobial stewardship complex intervention. NHSE commissioners would be expected to monitor prescribing rates and to challenge high prescribing practices to optimise their prescribing whilst rewarding those delivering high quality urgent dental care.

4.6.7 Implications for future research

Working with NHS Prescription Services and Dental Services teams to improve the quality of routinely collected data for quality improvement will provide opportunities for future research, including medicines optimisation across healthcare. When complete datasets are available, it will be possible to explore in greater detail the non-modifiable characteristics associated with dental antibiotic prescribing (as identified in Chapter 3). By understanding the characteristics of dentists who are higher prescribers of antibiotics, the practices/clinics in which they work and the patients who receive dental antibiotics more often, it should be possible to improve the targeting of dental antimicrobial stewardship interventions. This future research should include analysis of the link between deprivation/affluence and antibiotic prescribing, by using postcodes mapped to IMD.

Further research is indicated to explore whether it would be appropriate to define a 'high' rate of antibiotic prescribing/dispensing (such as the threshold figure introduced in Bradford urgent dental care service above which high prescribers were challenged by management to reduce their rate of prescribing) (Shahid S, 2013) (PHE, 2019). This would explore where differences may be appropriate, for example between practices/clinics providing general and more specialised dental care.

Whilst minimising antibiotic use is important, it is also necessary to guard against under-prescribing. Failure to treat bacterial infections appropriately increases the risk of serious complications, including sepsis or obstruction of the airway(HMG, 2019a). Further research is also indicated, therefore, to test how far dental antibiotic prescribing can be safely reduced without increasing the rate of adverse events. In preparation for such a trial, ways of monitoring adverse outcomes following dental care would need to be developed. The ability to track patients across healthcare settings including connectivity between electronic medical and dental records would be an important aspect.

4.7 Conclusions

Significant improvements in the accuracy and completeness of datasets relating to dental antibiotic prescribing across NHSE would be required before they could be used to measure the outcome of the APTiTUDE complex intervention (in Chapter 6), improve accountability and inform service quality improvement, for example as part of NHS dental contract reform. To enable this, digitisation of dental prescribing processes should be a priority for NHSE, including pursuing the commitment from Government to deliver electronic prescribing for dentistry (as recommended in 2016 by NICE). In the meantime, NHSE should endeavour to produce the most accurate and complete datasets relating to dental antibiotic prescribing and dispensing.

Further research is indicated to explore the extent to which antibiotic prescribing by dentists in different primary dental care settings (including GDP and OOH) could be reduced without increasing the incidence of adverse events such as sepsis. Such research would likely need to be supported by new systems such as linking electronic records between medical and dental healthcare systems, which in turn would facilitate further medicines optimisation research across primary healthcare.

Chapter 5 - Treatment in urgent dental care: an ethnographic study

5.1 Introduction

Factors which influence clinicians' decision making about whether to prescribe antibiotics for adults with acute conditions across primary healthcare were identified from the published literature in Chapter 3. Two factors were unique to dentistry: both related to the prescription of antibiotics to patients with dental pain or infection rather than undertaking the dental procedures indicated as appropriate in clinical guidance. This Chapter explores decision making by dentists and patients about treatment options (including but not limited to antibiotics) during urgent NHS dental appointments in England.

5.1.1 Why do some dentists prescribe antibiotics rather than provide procedures?

With 5% of all antibiotics prescribed within NHSE coming from primary care dentists (PHE, 2016b) and an estimated 50-80% of dental antibiotics used inappropriately in the UK (Cope, A.L. et al., 2016b; Cope, A.L. et al., 2016a), addressing antibiotic prescribing in dentistry presents a significant opportunity for reducing overall use. Most systemic antibiotic medication prescribed by NHSE dentists is associated with the provision of urgent dental care to adult patients in primary dental care settings (Digital, 2018). A logical target for antibiotic stewardship interventions is, therefore, adults with acute conditions presenting in GDP and OOH dental clinics. The systematic review presented in Chapter 3, found the published literature relating to antibiotic prescribing in dentistry was sparse in comparison to its primary medical care counterpart. Urgent healthcare for adults with acute conditions involves a complex set of interactions and influences, as illustrated by the 30 factors found to influence antibiotic prescribing (see Table 3-5). Comparison of the factors found for medical and dental settings identified two factors unique to antibiotic prescribing by dentists: whether a *procedure* rather than a prescription is possible ('procedure possible') and whether a dentist has the skills to deliver the procedure ('treatment skills') (see 3.5.5.4). Both related to the provision of dental procedures (such as tooth extraction) during urgent dental appointments. Acute dental infections usually require a dental procedure, rather than antibiotics, in order to prevent the problem recurring and to reduce the risk of the condition progressing to a medical emergency such as sepsis or severe cellulitis endangering the airway (Joint Formulary Committee, 2018) (FGDP, 2012) (SDCEP, 2007). Notably, decisions about whether antibiotics were prescribed appropriately (in accordance with guidance) can be complex and were outside of the scope of this study. In order to inform development of a complex intervention aimed at reducing antibiotic prescribing by NHS dentists, further

research was indicated to explore in more depth the factors associated with treatment decisions during urgent dental appointments generally, not limited to antibiotic prescribing.

5.1.2 Urgent dental care

Urgent dental care is focused on addressing pain and/or infection and stabilising the oral/dental condition, usually within a single appointment. The 2009 national survey of adult dental health in the UK found that nearly 30% of people in England chose to see a dentist only for urgent care (Steele et al., 2012). Various definitions of urgent dental care exist (PHE, 2019) (NHSE, 2018d). For the purposes of this study, the Department of Health definitions for urgent, emergency and OOH dental care have been employed (DH, 2005).:

a) Urgent dental care is provided to people presenting with:
    i) Severe dental and facial pain not controlled by over-the-counter preparations; or
    ii) Dental and soft tissue acute infection.

b) Emergency dental care is provided to people presenting with:
    i) Uncontrollable dental haemorrhage following extractions;
    ii) Rapidly increasing swelling around the throat or eye; or
    iii) Trauma confined to the dental arches.

c) Out-of-hours dental care
    i) Services provided outside the scheduled opening hours of a particular dental practice or clinic.

Urgent dental care services are usually provided in primary care settings, within NHS general dental practice (GDP) or OOH/unscheduled dental care clinics and is the focus of this Chapter. Emergency dental care presents most frequently in hospital emergency departments rather than primary dental care settings and is outside the scope of this study (PHE, 2019).

5.1.3 Decision making in urgent dental care

In the umbrella review across primary care and the systematic review in primary dental care ‘patient influence’ was found to be one of the most frequently cited factors associated with treatment planning decisions involving antibiotics. This was unsurprising given the emphasis on working in partnership with patients to make good clinical decisions and obtaining consent for treatment provided (GMC, 2013) (GDC, 2015b). The importance of understanding the patient perspective as well as that of dentists was clear. The systematic review of factors associated with dental antibiotic prescribing was based largely on self-reporting by dentists through interview and

questionnaire based studies (Chapter 3), so the literature was almost entirely from the perspective of dentists. However, people often do not know what influences their behaviour and there are biases in the way people account for their and others' behaviour (Conner and Norman, 2005). Dental nurses have an interesting perspective as they must always be present during dental appointments and often work with different dentists so are used to seeing differences in their treatment approaches (GDC, 2015b) (Kelly, 2015).

An ethnographic study design was selected, therefore, to enable a rich understanding of the complex contexts that influence treatment during urgent dental care to be explored. In particular, the views of patients and dental nurses have been included alongside those of dentists in our study about why some dentists prescribe antibiotics rather than undertake dental procedures.

5.2 Aim

To understand the factors that influence treatment of adults with acute conditions during urgent NHS dental appointments in England.

5.3 Objectives

Through observation and follow-up interviews, explore the factors that influence treatment (including antibiotic prescribing) provided to adults with pain and/or infection during urgent NHS dental appointments in GDP and OOH dental clinics in England. Specifically:

Objective A – Dentist-related factors

To explore the *dentist-related factors* that affect treatment provided by dentists

Objective B – Patient related factors

To explore patient-related factors that affect treatment they received by patients

5.4 Methods

The following section starts by outlining the methodological approach to qualitative research and data collection methods employed. It then provides more detailed descriptions of the context (including research site recruitment) and sampling strategies for recruiting patients, dentists and dental nurses. Next, data collection instruments used and the data processing and analysis techniques used during the study are presented. Finally, statements are included about characteristics of the researchers which may have influenced the study as well as ethical issues impacting on the study design.

The rational for and reporting within this Chapter has been guided by the Standards for Reporting Qualitative Research (SRQR) (O'Brien et al., 2014). Creating a single reporting framework for qualitative research is inherently difficult due to the different

epistemological approaches and methods of enquiry (Peditto, 2018). EQUATOR identifies two reporting frameworks for qualitative research which had potential for reporting this ethnographic study: the COnsolidated Criteria for REporting Qualitative Research (COREQ) and SRQR. COREQ is a 32-item checklist based around three domains: research reflexivity, study design and analysis and findings (Tong et al., 2007). SRQR was produced as a resource to assist authors during manuscript preparation and has 21 reporting items structured around Introduction, Methods, Results and Discussion. It has been adopted as the British Medical Journal Open's reporting checklist for qualitative studies (BMJOpen, 2018). SRQR's structure seemed to provide overall a better fit to the structure of this Chapter..

5.4.1 Qualitative approach and research paradigm

An ethnographic approach based on a pragmatic paradigm was selected for this study to enable a rich understanding of the complex context within which urgent NHS dental care is provided to adults with acute conditions. In particular, it is well suited to identifying what happens 'in practice' and capturing the views of dentists, patients and dental nurses to understand why some dentists prescribe antibiotics rather than undertake dental procedures.

Qualitative research is an approach that focuses on people and their experiences, behaviours and opinions in order to answer questions of 'how' and 'why'. As described in Chapter 1, the guiding philosophical assumptions behind qualitative research are known as paradigms. A range of paradigms exist, including positivism, interpretivism /social constructivism, and pragmatism. Positivism /postpositivism is associated with a scientific approach to research and is based on cause and effect (Creswell, 2013). Interpretivism (also known as social constructivism) is based on the construction of meaning and interpretations based on exploration of the social world of people being studied (Ritchie et al., 2013). A pragmatist paradigm believes that there are multiple ways of viewing reality and what is useful is what works 'in practice.' (Creswell, 2013). For the purposes of this research to develop sufficient understanding from different perspectives of the barriers and drivers to antibiotic use during urgent NHS dental appointments, a pragmatist paradigm was selected.

To meet the aims of this qualitative study, non-probability sampling was selected to allow the researcher to deliberately select samples which reflected features of interest within the population (Ritchie et al., 2013). A combination of purposeful and convenience sampling was chosen for reasons detailed below. Theoretical sampling was rejected as the requirement to select individuals thought by researchers to be best able to contribute to the development of theory as the theory evolves through the course of the research did not fit well with the design of this study due to recruitment of

participants by local staff rather than the researcher (Creswell, 2013). Convenience sampling selects individuals who are available, an approach which is limited by the selection bias and questions about the validity of findings. This approach was used for recruiting patient participants to the study as it was not possible to predict in advance of their appointment whether their urgent dental appointment would of interest.

Subsequent purposeful (or purposive) sampling of cases for follow-up interviews was based on sampling criteria to select a diverse range of features or characteristics of interest, in order to enable detailed exploration and understanding of the research problem (Ritchie et al., 2013; Gentles et al., 2015).

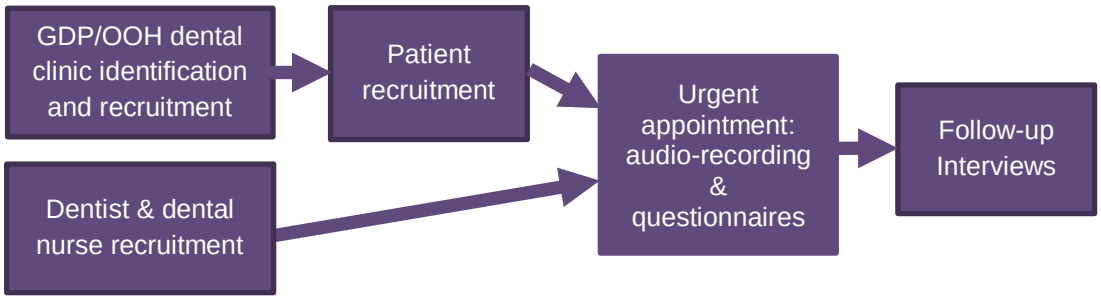
Maximum variation sampling was selected from the forty types of purposeful sampling which have been described, including homogenous samples, critical case samples and maximum variation samples (Patton, 2015) Homogenous sampling would not have been appropriate as it focuses research on more tightly defined groups or situations than would be appropriate to answer the study's research question (Ritchie et al., 2013). Critical case sampling was not appropriate as it focuses on processes (Haralambos and Holborn, 2008). Maximum variation sampling was selected as it increases the likelihood of the research results reflecting differences or different perspectives by maximising differences at the beginning of the study. Data collection methods

In order to investigate factors that influence treatment provided to adults with acute conditions, urgent NHS dental appointments were studied through observations in GDP and OOH dental clinics using audio-recordings (with additional direct observation of some cases). Short questionnaires were completed by the dentists and dental nurses at the end of each urgent dental appointment, which were used to purposefully select cases for subsequent followed up through semi-structured telephone interviews with dentists, dental nurses and patients. A schematic summary of the study's workflow is presented in Figure 5-1.

A number of categories of qualitative methods exist, including: narrative, phenomenological, grounded theory, case study and ethnographic research. Narrative research focuses on collecting and studying the stories of one or two individuals (Creswell, 2013). Phenomenology studies lived human phenomena from the perspective of those who experience them (Haralambos and Holborn, 2008). Grounded theory moves beyond describing behaviours or situations and aims to develop theories of social interactions through data analysis (Ritchie et al., 2013). Case study research seeks to develop in-depth understanding of a single case or issue (Creswell, 2013). Ethnographic studies go further than case studies and seek in-depth exploration of cultural norms, beliefs and behaviours within the setting that the researcher is seeking to understand. This is increasingly used in healthcare to provide a thick description of

the interaction between patients and healthcare delivery teams (Goodson and Vassar, 2011).

Figure 5-1 Study workflow schematic



5.4.2 Researcher characteristics and reflexivity

The researchers acknowledged the importance of being self-aware and reflexive about their own roles in the process of collecting, analysing and interpreting the data, and in the pre-conceived assumptions they brought to the research. This research was about treatment decisions during urgent NHS dental appointments for adults with acute conditions. The research team consisted of a mixed group of clinical (WT, GVAD and JATS) and non-clinical (RRCM, SHP, JB, MB) healthcare researchers. WT and GVAD are academic clinical dentists with experience of providing urgent NHS dental care and in-depth knowledge of dental antibiotic stewardship. WT was also a microbiology graduate with a 14-year non-clinical career before training to be as a dentist. JATS is a clinical microbiologist with specialist experience of antibiotic stewardship and caring for patients with severe dental infections in the medical setting. SHP is a translational and applied health researcher with clinical trial expertise of complex interventions and relating to antibiotic stewardship. RRCM is a health psychologist with extensive experience of exploring and changing the behaviour of individuals including clinicians and patients. At the time of the study, JB was the manager of the LDI Dental Translational and Clinical Research Unit and MB was an international tutor and student advisor at LDI. All researchers had lived experience as adult NHS dental patients and some have previously attended urgent dental appointments.

5.4.2.1 Reflexivity of lead researcher

Researchers aim to achieve ‘empathic neutrality’ in the conduct of research, by avoiding obvious, conscious or systematic bias during data collection, interpretation and presentation. (Ritchie et al., 2013). However, all social researchers are part of the

world they study and there is no ‘objective’ knowledge (O'Reilly, 2018). Whilst the goal was for the research to be as unbiased as possible, unconscious bias from the insider perspective (as clinicians and as patients) was acknowledged. (Dwyer and Buckle, 2009). Reflexivity was regularly addressed through reflection during each stage of the research and regular discussion with both dental and non-dental colleagues through the course of the study. This was designed to reduce the impact of this potential bias when identifying influences on treatment decisions during urgent dental appointments. Being a general dental practitioner, brought the potential for unconsciously influencing the way in which the study participants engaged with the study and the potential for bias whilst interpreting the results. During research site and dentist recruitment, an advantage of being an insider was the ability to access research sites and dental teams (relatively) more easily. By working together with the independent observers, the researcher (WT) was able to maintain an objective perspective on the observational data. With local research support staff at each of the research sites responsible for collecting fieldwork data, WT was also able to retain a distance without ‘going native’. All of the follow-up interviews, however, were undertaken by the researcher (WT). To address the issue of reflexivity during the period in which follow-up interviews were taking place, a short reflexive note was recorded on the paper copy of the interview schedule following each interview. In addition, when analysing the interviews, independent coding checks were undertaken by RRCM..

5.4.3 Context - practice/clinic identification and recruitment

Maximum variation sampling was employed to sample the research sites as it was most appropriate for addressing the aim of the study to identify as wide a range as possible of factors associated with treatment decisions during urgent dental appointments. Sampling criteria for the research sites were based on the non-modifiable characteristics identified in the systematic review of factors associated with the decision whether to prescribe antibiotics for adults with acute conditions (Chapter 3). To explore the influences on treatment decisions for adults with acute conditions during urgent NHS dental appointments in England, this research took place in GDP and OOH dental clinics. To ensure a wide range of influences could be identified, a maximum variation sampling approach was employed to recruit a diverse group of research sites. Criteria for this purposeful sampling approach were identified from the systematic review of the published literature (Chapter 3). In particular, the ‘practice characteristics’ of geographic location (urban vs rural) and type of service provider (e.g. public vs private provision) were selected. Chapter 4 found wide variation between the rates of antibiotic prescribing in GDP. As the PhD thesis was aiming to identify ways of reducing the rate of antibiotic prescribing, an additional criterion was added to allow

differences between GDPs with high rates and low rates of antibiotic prescribing to be identified for future targeting of interventions. Finally, the GDPs recruited to the study needed to have a sufficiently large number of patients who might present with an acute dental condition for recruitment to the study. Another criterion for GDPs was the size of patient base; a cut off of 1000 adult patients (numbers of individual people not treatment plans) seen during a 24 month period (April 2014-March 2016) was judged to be appropriate. A summary of the sampling matrix for the GDP and OOH research sites is shown in Table 5-1; at least one GDP/OOH with each of the criteria was required to fulfil the sampling matrix.

Table 5-1 Sampling matrix for GDP and OOH research sites

Sample matrix	Criteria	Source
GDP & OOH research sites		
Geographic location	Rural vs Urban	Rural Urban Classification: (ONS, 2016). 'Predominantly urban' through 'Predominantly rural'
Provider type	Independent Corporate Social enterprise NHS Trust	From CQC healthcare provider website: 'Who runs this service?' (CQC, 2016).
GDP research sites only		
Rate of antibiotic prescribing	High vs Low rate	Upper vs lower quartile by rate of antibiotics dispensed across Lancashire and West Yorkshire (as calculated in 4.5.1)
Size of patient base of each practice	At least 1000 adult patients	Patients seen over a 24 month period 1 April 2014 to 31 March 2016 (NHSDigital, 2016a).

As described in Chapter 4, this research was located in Lancashire and West Yorkshire for two reasons: 1) the availability of a practice-level dataset which allowed identification of dental practices with high and low rates of antibiotic prescribing; and 2) the need to ensure a sufficiently large pool of dental practices in rural as well as urban areas from which to recruit research sites.

5.4.3.1 Inviting expressions of interest to participate

All OOH dental clinics in Lancashire and West Yorkshire were considered as potential research sites. Services which were in the process of organisational restructuring were excluded, leaving OOH dental clinics in Bradford, Fylde Coast and Leeds. Emails were sent to the manager of each clinic inviting an expression of interest to participate in the study. The NHS Local Dental Network in Lancashire and the NHS Local Dental Committees in West Yorkshire acted as facilitators to dialogue with these three potential research sites.

As described in Chapter 4, the GDPs were allocated anonymised identifiers and the database partitioned so as to blind the researchers to potentially identifying practices with inappropriate patterns of antibiotic used. For example, at the time of the study, cephalexin and clindamycin were not indicated in UK guidance for drug prescribing in dentistry (SDCEP, 2016) yet practices prescribing them would be identifiable from the data. Partitioning of the database meant that: 1) the independent researcher holding the key for identifying practices from the lists of practice identifiers had no access to seeing the actual prescribing data; and 2) the researchers with access to prescribing data (who could potentially see patterns of inappropriate behaviour in the anonymised data) had no means of identifying specific practices responsible for it. For purposeful sampling of GPDs in accordance with the sampling criteria relating to urban/rural mix, the lists of practice identifiers produced in Chapter 4 for GDPs with high and low rates of antibiotic prescribing across Lancashire and West Yorkshire, were sorted by postcode alphabetic prefix (e.g. BD for Bradford). GDPs with the same postcode prefix as the three OOH clinics (BD – Bradford, FY – Fylde Coast and LS – Leeds) plus two additional postcode areas (PR – Preston and WF – Wakefield, in accordance with the sampling criterion for urban/rural (see Table 5-2) were invited to express an interest in participating in the study. A copy of the invitation sent to the potential research sites is included as Appendix BB1. In accordance with the ethical approval, invitations to were sent to potential research sites in batches of 20 until sufficient expressions of an interest had been received/practices recruited. The lists of practice identifiers for these high rate and low rate practices were given to the independent researcher holding the key (as described in Chapter 4) and addresses for 10 GDPs on the high rate list and 10 GDPs on the low rate list were provided to the researchers, for the purpose of inviting expressions of interest for participation in the ethnographic study.

Table 5-2 Postcode areas selected as the focus for recruitment. Source: (Service, 2017) and Chapter 4

Postcode area (Local Authorities)	Characteristic: Geographic location	Characteristic: Antibiotic prescribing rate	Local OOH clinic expressed an interest
Initially selected			
FY (Fylde & Wyre)	Largely Rural / Urban with City and Town	6 high - 3 low	Yes
LS (Leeds)	Urban with Major Conurbation	15 high - 19 low	Yes
BD (Bradford)	Urban with Major Conurbation	7 high - 3 low	Yes
PR (Preston & Chorley)	Urban with City and Town/Urban with Significant Rural	6 high – 6 low	No
WF (Wakefield)	Urban with City and Town	5 high – 5 low	No

In order to raise awareness about the study and encourage expressions of interest, the researcher attended meetings of the NHS Local Dental Network and British Dental Association (Fylde and Ribble Section) meetings in Lancashire and the NHS Dental Committee in Bradford which covered the geographic areas of interest in the month prior to inviting expressions of interest in participation. Local clinical leads for the local NHS Trust and the corporate providers of NHS primary dental care services ({my} dentist and Oasis/BUPA) were also approached to facilitate recruitment of OOH and GDP research sites.

Invitations were sent to the practices by post using the contact details provided by the independent researcher, or by email if the email address was available to the researchers from a practice website.

5.4.3.2 Recruitment of practices

Practices and clinics that expressed an interest were visited by the researcher (WT) and provided with a Local Information Pack (see Appendix CC1). Each research site nominated a local Principal Investigator (PI) as the individual responsible for the conduct of the research at that research site who confirmed their site's 'Capacity and Capability' to participate by returning forms from the Health Research Authority (HRA) by email to the researcher (NIHR, 2019a). Recruitment of practices into the study continued until all of the sampling criteria had been included and saturation of results of the follow-up interviews had been achieved (defined as when no new factors were identified).

5.4.4 Sampling strategy – patients, dentists and dental nurses

In order to identify influences on treatment decisions, sampling strategies were required for dentists, dental nurses and patients. Dentists and dental nurses working at each of the dental practice/clinic research sites and patients attending those dental practices/clinics for treatment of severe dental pain or infection were recruited to the study. As the objective of this qualitative study was to explore as wide a range of perspectives and experiences as possible (rather than to obtain a representative sample), maximum variation sampling was employed. Sampling strategies for each of these participant types are detailed in each of the sections below.

Predicting the exact number of urgent dental appointments required to achieve saturation of the results (factors influencing the range of treatment types during urgent dental appointments in GDP and OOH) was impractical. Creswell (2013) suggests that ethnographic research should be based on numerous interviews and observations of a tightly-defined culture sharing group (in this case dentists providing urgent NHS dental care to adults) until saturation of the results is achieved. (Creswell, 2013) The research continued until no new factors emerged from the thematic analysis of follow-up interviews. Estimates in advance of the study, based on a National Centre for Research Methods review paper (Baker et al., 2012), were that this would be achieved by interviewing dentists, dental nurses and patients up to 24 cases: 12 from GDPs and 12 from OOH clinics.

Similarly, it was not possible to predict in advance how many urgent dental appointments would need to be observed in order to recruit a sufficient mix of treatment types to meet the sampling criteria for follow-up interviews. Based on clinical audit data which showed one in eight urgent dental appointments may result in a dental antibiotic, it was estimated that up to 16 cases per dentist would need to be recruited in order to follow-up one case per dentist which received an antibiotic and one case which received another treatment option (Shahid S, 2013). As shown in Figure 5-2, the total sample size for the study was, therefore, up to 12 dentists and up to 192 patients recruited for audio-recording/observation of their urgent dental appointment in order to identify up to 24 case for study through follow-up interview.

There is, therefore, a high risk of selection bias associated with the demographic findings relating to the data of audio-recorded and directly observed urgent dental appointments. For this reason, the demographic results which are based on these data are described rather than statistically analysed. Convenience sampling was also the approach taken to sampling dental nurses as no characteristics had been identified relating to them from the systematic review in Chapter 3 and pragmatically so as not to complicate still further the process of purposefully sampling research sites and dentists during set up of the study.

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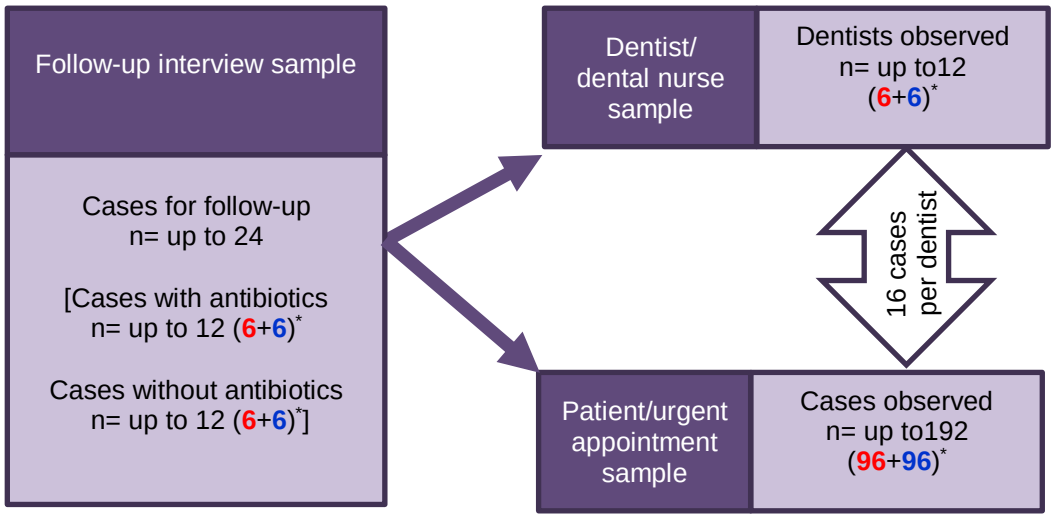
Figure 5-2 Sampling framework for recruiting patients, dentists and dental nurses across GDP and OOH



* Figures in red relate to GDP and in blue to OOH .

The sampling matrix for purposeful sampling of cases for follow-up interview, in order to achieve maximum variation, is detailed in the 'Recruitment of cases for follow-up interview' section (see 5.4.4.3). Sampling of the dentists and dental nurses is described first, followed by sampling of patients attending for urgent appointments and finally cases for follow-up interview.

5.4.4.1 Recruitment of dentists and dental nurses

Purposeful sampling of dentists at the recruited research sites was undertaken to ensure a cohort of dentists participating across the study which included full coverage of the features of interest identified in the sampling matrix by at least one dentist (see Table 5-3). The sampling matrix for dentists based on the non-modifiable characteristics identified in the systematic review of factors associated with the decision whether to prescribe antibiotics for adults with acute conditions/during urgent appointments in primary dental care (Chapter 3). Dentists working at the research sites were identified by the researcher (WT) and the local PI through reference to the sampling matrix for dentists. Across the sample of dentists recruited to the study each of the criteria required to be identified at least once in order to fulfil the sampling matrix.

Table 5-3 Sampling matrix for dentists

Sample matrix	Criteria	Source
Gender	Male vs Female	Self-reported
Where gained primary dental qualification	UK vs Overseas	GDC Register
When gained primary dental qualification	Before vs After UK antibiotic prescribing guidance first published in 2001	GDC Register

Convenience sampling of dental nurses was based on those who were scheduled to work with the dentists during the period of the study and who were willing to volunteer their consent to participate. Details of the inclusion and exclusion criteria for the dentist and dental nurse participants are presented in Table 5-4.

Table 5-4 Inclusion/exclusion criteria for dentists and dental nurses

Inclusion criteria	Exclusion criteria
Registered with the GDC or enrolled on a recognised programme that will lead to GDC registration.	Currently subject to any condition on their registration (including from the NHSE Area Team and the GDC).
Professional indemnity in place which covered any activity undertaken during the course of the research, including any harm to participants in the conduct of the research.	When treating adults, provides only private dental treatment.
Willing to provide valid consent to participate in the research.	

As part of research site recruitment, the researcher (WT) provided the potential participating dental team (dentist/dental nurse dyad) with clinician information sheets (see Appendix C.1.2) and briefed them face-to-face about the research. After confirmation of research site capacity & capability to participate and after answering any questions from each dentist and dental nurse, written consent was sought by WT individually from those volunteering to participate. Consent was gained at least 24 hours in advance of the first clinical observation for each dyad. Dentist and dental nurses were advised that they could withdraw from the study at any point until the data was no longer individually identifiable (which would be not sooner than a week after the consultation/interview to which it related). The clinician information sheet and consent form are at Appendices C.1.2 and C.1.3.

Recruitment of dentists and dental nurses took place concurrently with the recruitment of practices/clinics because it was necessary for participating GDP/OOH clinics to have both dentists and dental nurses who were willing, eligible and had the capacity to participate. Recruitment of dentists/dental nurses into the study continued until all of the sampling criteria had been addressed and saturation of results of the follow-up interviews had been achieved (no new factors were identified).

All of the dentists and dental nurses who participated in the study were invited to a telephone interview about the selected cases. Before any follow-up interview took place, each participant was invited to consider whether they still wished to volunteer their consent to participate in the study.

5.4.4.2 Recruitment of patients

For the initial patient sampling (recruitment immediately before their urgent dental appointment), convenience sampling was selected as a pragmatic approach to recruiting adult patients with acute conditions in the inherently unpredictable environment of urgent NHS dental appointments in GDP and OOH dental clinics. Details of the inclusion and exclusion criteria for the patient participants are presented in Table 5-5. Patients were approached when attending for urgent NHS dental appointments at the research sites during the study period (September 2017 to March 2018).

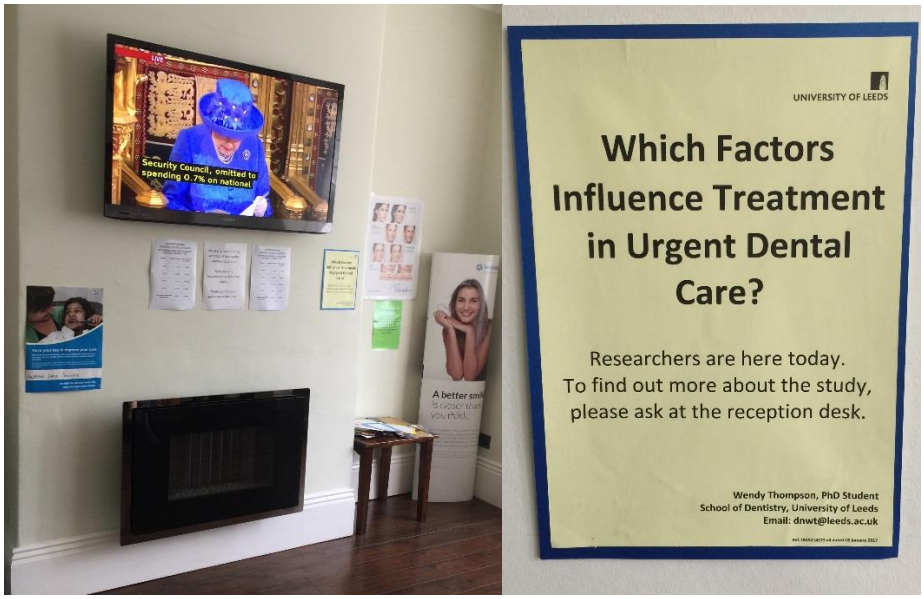
Table 5-5 Inclusion/exclusion criteria for patients

Inclusion criteria	Exclusion criteria
Aged 18 years and over.	Severe/debilitating pain or distress which prevents ability to consent to participate.
Attending for NHS urgent dental care to address: 'dental or facial pain not controlled by over-the-counter drugs' or 'acute dental or soft tissue infection'.	Attending for routine NHS or any private dental care.
Willing to have his/her appointment observed and/or audio-recorded.	Accompanied during appointment by someone under the age of 18 years.
Able and willing to give their informed consent to participate.	Accompanied during appointment by someone who is not able and willing to consent to participate.
	If needed by the patient, no translation service available.

At first contact (usually when they called by telephone for an appointment) they were advised by locally employed staff that research was taking place within the practice/clinic. There were posters in prominent places within the waiting room at the research site advising patients that research was taking place (see Figure 5-3).

Figure 5-3 Posters on display in the waiting rooms at two research sites:

a) Independent practice in an area which is 'urban with city and town'.



b) Out-of-hours clinic in an area which is 'urban with major conurbation'

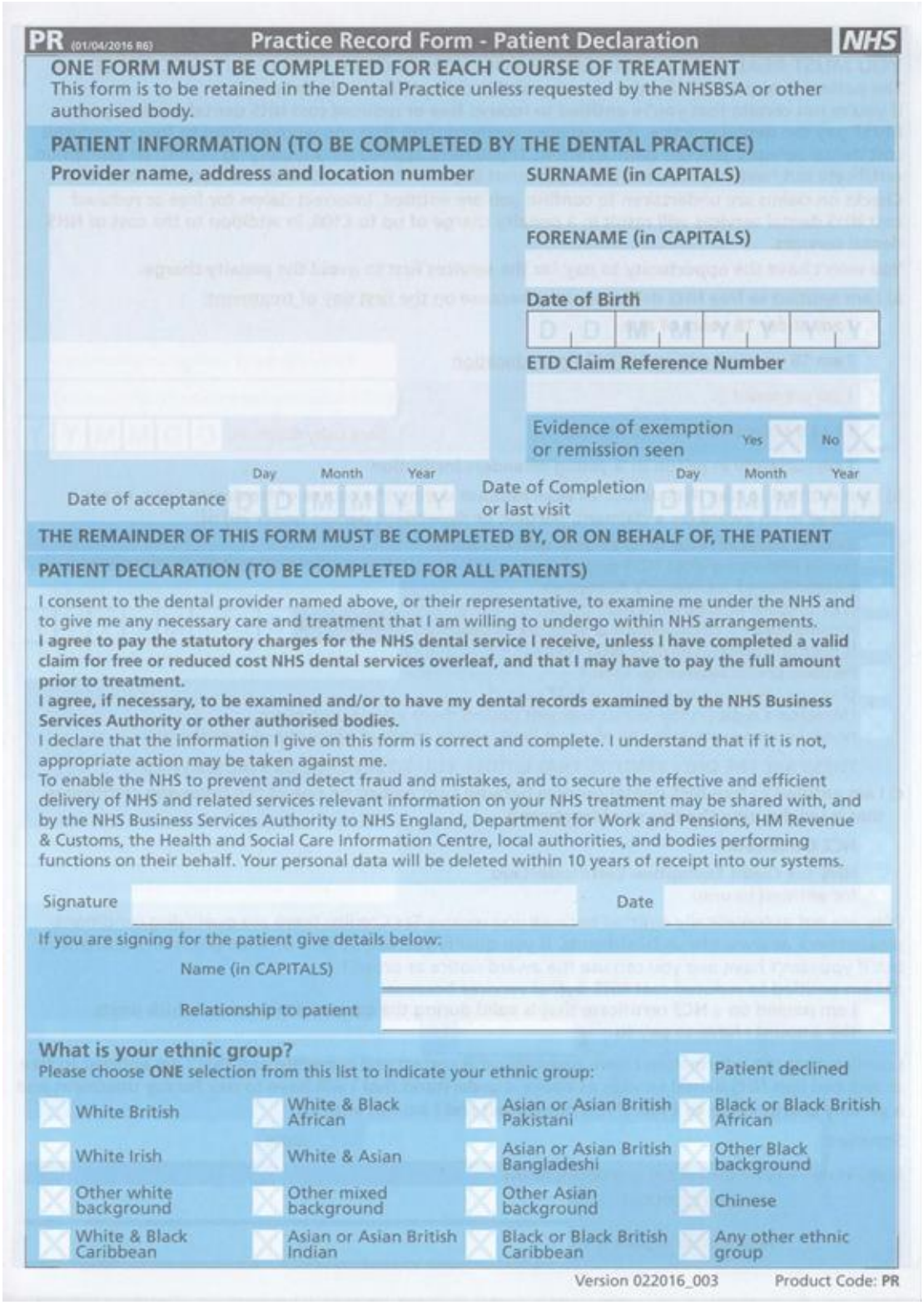
Upon presentation at the participating GDP/OOH clinic, the potential participant was given a copy of the short participant information sheet (PIS) (Appendix C.1.4). After a few minutes to read the information in the waiting room, a member of the local research support staff who had been trained to check eligibility and take consent for the study invited them to discuss the study and consider giving consent to participate. Patients willing to discuss the possibility of volunteering their consent to participate were invited to discuss it further in a private room away from the waiting room, where they were given the full information sheet to read (see Appendix C.1.5) and encouraged to ask any questions. Patients with communication difficulties were included in the study if they could give valid consent to participate using the resources normally available for

the provision of urgent dental care at the practice/clinic. It was made clear that their decision whether to participate would not impact on their current or future treatment in any way and that they could withdraw from the study at any point until the data was no longer individually identifiable (which would be not sooner than a week after the consultation/interview to which it related).

For patients who were agreeable, eligibility for the study was confirmed by the member of research support staff who had been trained to recruit and consent patients. Details of the training undertaken by local research support staff to enable them to recruit and consent patients are included in the Key Ethics Risks section of the Discussion. By completing section 1 of the Case Report Form (CRF) (Appendix CC2) eligibility against the inclusion/exclusion criteria (see Table 5-5) was checked and recorded. If content to provide written consent after reading the PIS and asking any questions about it, the study asked the participants to read and complete the consent form (Appendix Table 5-5), by initialling each section and providing contact details.

Informed, written consent was gained from the patients and anyone they brought with them to their appointment (henceforth known as their ‘chaperone’) in advance of any part of the study taking place. After recording consent, section 2 of the CRF (Appendix CC3) was completed to record additional patient information, which would inform purposeful selection of cases (based on the purposeful sampling criteria) for follow-up interview during a later stage of the research. The CRF was developed with the local NIHR Clinical Research Network (CRN) and, wherever possible, used information already recorded on standard NHS paperwork completed by patients in advance of a dental appointment, including gender, ethnicity, postcode and whether the patient paid NHS fees. These data were already declared by each patient ahead of their appointment on an NHS Practice Record (PR) Form (see Figure 5-4).

Figure 5-4 NHS Practice Record Form – Patient Declaration each appointment



PR (01/04/2016 R6) Practice Record Form - Patient Declaration NHS

ONE FORM MUST BE COMPLETED FOR EACH COURSE OF TREATMENT
This form is to be retained in the Dental Practice unless requested by the NHSBSA or other authorised body.

PATIENT INFORMATION (TO BE COMPLETED BY THE DENTAL PRACTICE)

Provider name, address and location number

SURNAME (in CAPITALS)

FORENAME (in CAPITALS)

Date of Birth D D M M Y Y Y Y

ETD Claim Reference Number

Evidence of exemption or remission seen Yes No

Date of acceptance Day D D Month M M Year Y Y

Date of Completion or last visit Day D D Month M M Year Y Y

THE REMAINDER OF THIS FORM MUST BE COMPLETED BY, OR ON BEHALF OF, THE PATIENT

PATIENT DECLARATION (TO BE COMPLETED FOR ALL PATIENTS)

I consent to the dental provider named above, or their representative, to examine me under the NHS and to give me any necessary care and treatment that I am willing to undergo within NHS arrangements.
I agree to pay the statutory charges for the NHS dental service I receive, unless I have completed a valid claim for free or reduced cost NHS dental services overleaf, and that I may have to pay the full amount prior to treatment.
I agree, if necessary, to be examined and/or to have my dental records examined by the NHS Business Services Authority or other authorised bodies.
I declare that the information I give on this form is correct and complete. I understand that if it is not, appropriate action may be taken against me.
To enable the NHS to prevent and detect fraud and mistakes, and to secure the effective and efficient delivery of NHS and related services relevant information on your NHS treatment may be shared with, and by the NHS Business Services Authority to NHS England, Department for Work and Pensions, HM Revenue & Customs, the Health and Social Care Information Centre, local authorities, and bodies performing functions on their behalf. Your personal data will be deleted within 10 years of receipt into our systems.

Signature Date

If you are signing for the patient give details below:

Name (in CAPITALS)

Relationship to patient

What is your ethnic group?
Please choose **ONE** selection from this list to indicate your ethnic group:

Patient declined

White British | White & Black African | Asian or Asian British Pakistani | Black or Black British African

White Irish | White & Asian | Asian or Asian British Bangladeshi | Other Black background

Other white background | Other mixed background | Other Asian background | Chinese

White & Black Caribbean | Asian or Asian British Indian | Black or Black British Caribbean | Any other ethnic group

Version 022016_003 Product Code: PR

An additional question about the patient's educational background was included in accordance with the sampling criteria. To ensure clarity of meaning, wording from the Government's 'What qualifications mean' website were used and a supporting resource

for those taking consent was provided to assist identification of 'equivalence' of qualification (HMG, 2017). As the questions relating to demographics were well established within the NHS, the CRF was not tested during the feasibility testing of methods as part of the service evaluation in the Leeds Dental Institute (LDI) Acute Dental Care (ADC) department.

Recruitment of patients into the study at each research site continued until at least two cases had been recruited where antibiotics had been prescribed and at least two cases had been recruited which involved other treatment types (or until saturation of the study's results had been achieved – whichever came sooner).

5.4.4.3 Recruitment of cases/patients for follow-up interview

Using a purposeful approach to achieve maximum variation, cases for follow-up interview were identified by the researcher (WT) based on the sampling matrix (Table 5-6). The sampling matrix for cases/patients for follow-up interview was based on the non-modifiable characteristics identified in the systematic review of factors associated with the decision whether to prescribe antibiotics for adults with acute conditions/during urgent appointments in primary dental care (Chapter 3). In addition, a further issue identified during feasibility testing of data collection techniques at LDI was included in the sampling matrix: cases where patients were accompanied during their urgent dental appointment by another adult (referred to in this study as their chaperone). Each criteria needed to be included in at least one of the cases to fulfil the sampling matrix. Two cases per dentist were sampled in order to explore the range of reasons why dentists made particular treatment decisions. Specifically for each dentist: one case where antibiotics were prescribed and one case with a different treatment type (extraction, open & dress pulp, other treatments and no treatment).

Sample selection required an iterative planning process to ensure all of the criteria were included within the total sample of cases selected. Using contact details provided on their consent forms, patients associated with the selected cases were invited (by email wherever possible, otherwise by telephone) to take part in a follow-up telephone interview. For each patient agreeing to participate in a follow-up interview, the audio-recording of the appointment was transcribed. Where a patient declined to participate in a follow-up interview or did not respond to the invitation, a further case (still in accordance with the sampling criteria) was identified, such that wherever possible two cases per dentist (one with antibiotics and one with another treatment) were followed-up by interview.

Table 5-6 Sampling matrix for follow-up interview cases.

Sample matrix	Criteria	Source
Treatment/care provided	Antibiotics vs Other (Extraction, Open & Dress Pulp, Other treatment, No treatment)	Dentist questionnaire
Patient gender	Male vs Female	CRF data
Patient ethnicity	White British vs Other	CRF data
Level of patient's educational attainment	No formal qualifications GCSE or equivalent A' Level or equivalent College/university degree or equivalent Postgraduate degree or equivalent	CRF data
Level of deprivation of the patient	High-level deprivation Medium-level Low-level deprivation	CRF data - Postcode used to identify Indices of Multiple Deprivation (IMD): (DCLG, 2015). IMD Decile 1-3: High IMD Decile 7-10: Low
Regularly attends dental check-ups at this practice/clinic	Yes vs No	CRF data
Presence of chaperone (accompanying adult)	Yes vs No	CRF data
Anxiety of patient assessed by nurse	Seems to be anxious vs Seems not to be anxious	Nurse questionnaire: Seems anxious (score 3-5) Seems not anxious (1-2)
Pressure felt by dentist to provide a particular treatment	Yes vs No	Dentist questionnaire
Level of confidence in this diagnosis	Certain vs Not certain	Dentist questionnaire: Not certain (score 1-3) Certain (score 4-5)
Appointment was long enough	Yes vs No	Dentist and nurse questionnaires
Level of clinician stress	Either dentist or nurse felt stressful vs not stressful	Dentist and nurse questionnaires: Not stressful (score 1-2) Stressful (score 3-5)

Patients associated with the selected cases were invited to participate in a follow-up telephone interview. For each patient agreeing, their urgent dental appointment's audio-recording was transcribed. Where a patient declined to participate in a follow-up interview or did not respond to the invitation, a further case (still in accordance with the sampling matrix) was identified, such that wherever possible, two case per dentist were studied. This complex algorithm of approach, response, agreement for transcribing of the urgent dental appointment audio-recording and then finding a suitable time for telephone interview, or finding that the interviewee has dropped out of the study, whilst also ensuring that case met all aspects of the sampling matrix was tracked using the case recruitment tracker. An extract from this spreadsheet is shown in Table 5-7.

Table 5-7 Excerpt from the case recruitment tracker showing how elements of the sampling criteria were covered by data from the Case Report Form (CRF) Section 2 relating to patient characteristics and Questionnaires for Dentists and Dental Nurses.

	Practice A Case 1	Practice A Case 2	Practice B Case 1	Practice C Case 1
CRF Patient characteristics				
Gender of patient	Male	Male	Female	Female
Ethnicity of patient	Other	White British	White British	Other
Chaperone present	No	No	No	Yes
Education	GCSE	Postgrad	Nil	College/University
IMD from postcode	4 to 6	10	7 to 9	4 to 6
Pays NHS fees	Yes	Yes	No	Yes
Attends for regular check-ups	Yes	Yes	No	No
Dentist Questionnaire				
Confidence of diagnosis	High (4 or 5)	Medium (3)	High (4 or 5)	High (4 or 5)
Pressure felt from someone	No	No	No	Yes
Treatment provided	Extraction	Other	Antibiotics	Open & dress
Appointment length	Yes	Yes	Yes	No
Stress	Low (1 or 2)	Low (1 or 2)	Low (1 or 2)	Low (1 or 2)
Nurse Questionnaire				
Appointment length	No	Yes	Yes	No
Patient anxiety	Low (1 or 2)	Low (1 or 2)	Low (1 or 2)	High (4 or 5)
Stress	Low (1 or 2)	Low (1 or 2)	Low (1 or 2)	Medium (3)

Ethical approval was to recruit no more than two cases per dentist, even if one or both of the patients subsequently dropped out of the study. Recruitment of cases for follow-up interview continued until all of the sampling criteria had been included and saturation of results had been achieved (defined as when no new factors were identified from analysis of the follow-up interviews). Before each follow-up interview took place, WT invited the participant to verbally confirm their continued voluntary consent to participate in the study.

5.4.5 Ethical issues pertaining to human subjects

Ethical approvals for this ethnographic study of urgent dental appointments during which patients were being treated by dentists for severe pain/infection was gained in a number of stages. The identification of potential GDP research sites and the initial approach for recruitment to this study was done in accordance with ethical approval from the UoL Dental Research Ethics Committee (DREC ref: 120416/WT/202 dated 27/10/2016 and updated 29/10/2018). Testing of the data collection methods was undertaken in accordance with ethical approval from DREC (ref: 080716/WT/207 dated 10/08/2016 and amended 12/11/2016). Recruitment of the practices/clinics,

dentists/dental nurses and patients was in accordance with HRA approval (dated 28 February 2017) which incorporated Integrated Research Application System (IRAS) Project ID 214573 and ethical approval from the Bradford/Leeds Research Ethics Committee (REC:16/YH/0487 dated 9 February 2017). Amendment of the approval to enable trainee dental nurses to participate in the study was received on 12 May 2019.

5.4.5.1 Key ethical risks

The risks which were considered key to the study design are presented below:

Patients in pain - People attending for urgent dental appointments may have been suffering from toothache and there was some concern about the validity of consent given by people in such circumstances. The importance of ensuring the validity of consent was addressed during training for staff who took consent from participants. They were instructed that, in cases of doubt, the participant should be excluded from the study. The service evaluation of urgent dental care in LDI ADC included the same eligibility criteria and few were excluded on this criterion.

Short time scale for consent - Due to the short timescale for consent in advance of treatment in this acute setting, it was made clear to all participating dentists, dental nurses, patients and chaperones that their consent could be withdrawn at any point before, during and after the consultation (until the data were no longer individually identifiable) without affecting their clinical treatment. The ability of patients to consent to participation in the study immediately before their urgent appointment was confirmed during the testing of research techniques in the LDI ADC.

Recording of personal data - As some people might have found the recording of personal information (through observations and/or audio-recording) to be intrusive, potential participants were advised clearly during the consent process about the nature of the recording that would take place during the appointment (including discussion of their medical history). All personal data collected during this study was treated in accordance with the Data Protection Act 1998 (see section 5.4.5.2).

Mitigating risk to the research - Maintaining participant confidentiality and anonymity was a key element of the research. Putting patients' interests first and acting to protect them is one of the professional standards for dental professionals in the UK (GDC, 2015b). The risk of identifying issues during the course of the observational research that might have warranted overriding the principle of confidentiality and anonymity was mitigated to a large extent by employing an independent observer, ensuring no researcher had access to the patient participants' clinical records and partitioning the database used for GDP research site identification so as to blind the researchers to potentially identifying practices with inappropriate types or doses of antibiotic use which would otherwise have needed to be addressed, in accordance with professional

standards. From the practice-level rate of antibiotic use alone, it was not possible to judge the appropriateness of prescribing at each practice, thus this potential ethical risk was mitigated. Furthermore, the ethnographic data analysis took place some weeks after the dental appointments to which they related and only two cases per dentist were followed-up through interview (noting that identifying a pattern of behaviour requires it to be seen three times). In the unlikely event that an issue or pattern of dentist/dental nurse behaviour was identified during the data analysis, in spite of the mitigation activities, a process was established for addressing it with the PhD Advisory Group dental professional members.

Complaints, allegations and disclosures - It was recognised that complaints, allegations or disclosures during the course of the interviews might be received by the researchers. Processes were established for addressing them as follows:

- for issues which constituted a potential complaint about the research site or clinical treatment a patient participant had received, the patient participant would be advised of the dental practice/clinic's complaints procedure;
- other types of issues would be raised with the dental professional members of the PhD Advisory Group (GVAD and YD) to agree an appropriate way ahead by consensus.

Consent - Patients were consented into the study by members of the dental teams at the research sites (not the participating dentists/dental nurses) who were responsible for taking consent. Training for these individuals was provided by the researcher in association with the local NIHRCRN (NIHR, 2019b). This included the NIHR Research Awareness training for each PI and all research support staff employed locally at the research sites as well as all participating dentists and dental nurses.

In addition, the PIs undertook the NIHR on-line certificated training: Introduction to Good Clinical Practice in General Dental Practice. The local research support staff responsible for recruiting and obtaining valid consent from research participants ('without freedom to act') additionally undertook face-to-face NIHR Fundamentals of Clinical Research Delivery training with a research nurse/manager from the local NIHR Clinical Research Network and/or the researcher for which their received a certificate confirming completion of verifiable Continuing Professional Development (CPD) (NIHR, 2017). Following training, they were supported by NIHR and/or the researcher for recruitment of the first patient participant per site to check that they fully understood how to ensure consent was ethical and valid in law. Additionally, the importance of checking that patients who could be in pain or emotionally distressed were able to give valid consent was emphasised during training. In cases of doubt, those taking consent were instructed to exclude the participant from the study.

Patients (and anyone accompanying them in the surgery during the appointment) were asked to consent to participate in the study. Written consent was gained in advance of any part of the study taking place and recorded also in the patient's clinical record. Whilst best practice is to give people at least 24 hours to consider whether or not to consent to being part of a study, due to the nature of urgent dental appointments it was not possible to identify (and hence gain consent from) these patients until a few minutes before the appointment. As described in 5.4.4, it was made clear to participants that they could withdraw their consent at any point until the data were no longer individually identifiable (which would be not sooner than a week after the consultation/interview to which it related) and that doing so would not affect their treatment. A summary version of the patient information sheet was given to the patient to read in the waiting room and a full version of the information sheet was used to explain the study by the person seeking valid consent from the patient before the urgent dental appointment. Potential participants were encouraged to ask questions whilst considering whether they wished to participate in the study. A full version of the information sheet was also provided for the patient to consider in more detail including after the appointment as part of their consideration about whether to withdraw their consent. Before any follow-up interview took place, patient participants were provided with another copy of the PIS and invited to consider whether they were still content to participate in the study.

5.4.5.2 Data protection and patient confidentiality

All investigators and study site staff were required to comply with the requirements of the Data Protection Act 1998, NHS Code of Confidentiality 2003 and the UoL Data Protection Policy, which was compliant with relevant legislation and professional guidance at the time of the study. Anonymous unique numerical identifiers were used to label and manage data, including the audio-recordings. The study's data management plan covers collection, access, use, secure storage and destruction of electronic and paper-based data.

5.4.6 Data collection methods

Common methods of data collection qualitative research include: focus groups, observations, participant diaries and interviews. Focus groups are group discussions aimed at encouraging participants to interact with each other (Gill and Baillie, 2018). As this ethnographic study was seeking to identify influences on individuals during real world urgent dental appointments rather the views of a group about potential influences, focus groups were not employed for this study...

Observation is the systematic watching of people and interactions between them in order to understand what actually happens in context rather than analysis of self-

reported accounts (Ritchie et al., 2013). It may expose influences of which people are not aware and illuminate subconscious factors. It can also help overcome discrepancies between what people say or think they do (for example in self-reported data interviews or surveys), and what they appear to do to others (Nippert-Eng, 2015). Observation may be undertaken directly with the researcher's active presence an inherent part of the environment in which the behaviour is being undertaken, or indirectly through the use of audio- and/or video-recording (Ritchie et al., 2013). Observation was chosen as a data collection method for this study due to its good fit with the aims of the research to identify influences on behaviour during actual urgent dental appointments. Direct observation in a dental consultation, where there are fewer people and each has a defined, interacting role may be more conspicuous than within a more public setting; this sort of role has been called a participant observer (Gill and Baillie, 2018). For practical reasons relating to the ability to predict when recruitment might occur and hence have an observer at the research site able to observe the appointment(s), direct observation was only undertaken in OOH, where urgent appointments are grouped together during time limited sessions. Direct observation was undertaken by independent, non-clinical researchers, as per the ethical approval relating to risk mitigation to the research. Indirect observation through audio-recording or video-recording may be less intrusive in clinical settings and consideration was given to these approaches during the acceptability testing of techniques with members of the LDI ADC team. It was agreed that video-recording of patients attending with severe pain or infection would be unnecessarily obtrusive. Audio-recording yielded valuable insights during testing and was deployed as a method of data collection in the main study. It also allowed production of an accurate transcription for subsequent analysis and retention as a permanent record. (Gill and Baillie, 2018).

Observational research presents the possibility that researchers might identify issues during the study that would warrant overriding the principle of confidentiality and anonymity of participants (such as raising concerns about the quality of care being provided to patients. With a dental registrant as the main researcher (WT), careful consideration was given to her professional duty to 'put patients' interests first and act to protect them' (GDC, 2015b).. Whilst ethnographic observations are usually undertaken by the researcher spending time becoming part of the environment being researched, it was agreed that employing independent observers had a range of advantages: less influence on the care provided as the participating dentists and dental nurses would not feel judged by a peer or an expert; assistance with the researcher's reflexivity by enabling discussion about what was seen (by the observer) and heard (by the researcher on the audio-recording); and less risk to the project if concerns were identified which a dental registrant would have a duty to raise.

To ensure the basic dataset collected by the independent observers provided additional richness of data which complemented the audio-recordings and demographic data from the case report forms and questionnaires for dentists and dental nurses, an ORF was used. A prototype semi-structured ORF was developed by an undergraduate student (Jordan Au) who was funded through the British Society for Antimicrobial Chemotherapy Summer Studentship Scheme to assist the feasibility testing of methods for observing dentists during urgent dental appointments within the LDI ADC. Learning from this testing of the prototype was incorporated into a completely redesigned ORF which included observation of dentists, dental nurses and patients. Asking research participants to keep diaries or other documentary evidence allows them to report on their own behaviour in the setting in their own way without requiring the presence of the researcher (Stewart et al., 2008). As no observer would be present in most of the appointments, very short questionnaires for the dentists and dental nurses were used to record a simple dataset straight after each appointment in order to support the selection of cases for follow-up interviews; these data were described rather than statistically analysed as per the aim and non-validated nature of the questionnaires. Due to data collection methods, comparison of the data statistically would be inappropriate due to high risk of bias.

Self-reporting of behaviours and feelings by requiring participants to provide documentary self-reports enables collection of data without requiring the presence of a researcher (Stewart et al., 2008). As no observer would be present in most of the appointments, this approach was selected to help inform case selection for follow-up interview. Very short questionnaires, structured using the sampling strategy, were designed so that dentists and dental nurses could record a simple dataset straight after each appointment. These were tested during the LDI ADC acceptability service evaluation and no changes were made to them in advance of the main study.

Interviewing in qualitative research is about researchers talking to those who have knowledge or experience in order to illuminate the problem of interest (Ritchie et al., 2013). The central aim of ethnography has been described as to provide rich insight into people's views, actions and environment, through the collection of detailed observations and interviews (Reeves et al., 2008). This ethnographic study of influences on dentist's decision making about treatment during urgent NHS dental appointments in England was based primarily on observations and interviews. Structured interviews, similar to verbal questionnaires, produce less in-depth data but are useful to provide clarity on a topic. Unstructured interviews are appropriate when little is known about a topic and once the researcher has asked an opening question, the participant takes the lead. Semi-structured interviews allow for predetermined questioning (based on a topic guide) whilst ensuring the participant covers issues

important to them. For this reason, semi-structured interviews with dentists, dental nurses and selected patients were chosen for this study.

Audio-recorded telephone interviews allow participants to participate from geographically remote areas and may be less onerous than meeting in person (Gill and Baillie, 2018). During testing of the data collection techniques with LDI's Acute Dental Care team, it became clear that this approach was preferred by dentists as it could more easily be slotted into their busy personal schedule (including at evenings or weekends) than face-to-face interviews. A limitation of this approach was that it reduced the opportunity to pick up on body language and other non-verbal cues during the interview. Audio-recording also allowed production of an accurate transcription for subsequent analysis and retention as a permanent record.

The ability ***to test the data collection techniques*** and instruments in advance provided some degree of insight into how they might be received by those working at the GDP and OOH clinics during the ethnographic study. Based on the experience gained during this test study within the LDI's ADC department, and following discussion with colleagues from the GDC and Dental Protection (one of the main indemnity organisations in the UK), the study protocol, participant facing information and data collection instruments were fine tuned for the purposes of this study. One of the key elements added to the protocol as a result of this approach were the provisions for dealing with patient complaints about the care provided by the dentist during the course of the study. This facilitated straightforward and confident management of one case during follow-up interview where a patient expressed concern about the care that had been provided by a dentist at one of the research sites over a period of years.

Advice during protocol development was also received in relation to minimising the extent to which the study might feel invasive for these vulnerable patients (on account of their dental infection and/or severe pain). For this reason, and on advice of the UoL SMILE AIDER (Stakeholder Meaningful InvoLvement & Engagement Aiding DEntal Research Patient & Public Involvement & Engagement (PPIE) Forum) and the study's PPIE contributors, the patients were not asked to complete questionnaires after each appointment in the same way as the dentists and dental nurses. Whilst this would have further enhanced the richness of the data, it was felt to be too much for the patients immediately following their appointment during which they could have had an operative procedure or at a time when they might be feeling emotionally exhausted (Cohen et al., 2000).

Experience during the techniques testing phase in LDI and PPIE review also confirmed the study's use of audio-recording rather than video recording. The dental nurses in the LDI ADC explained that they would feel too self-conscious being video-recorded and that they would decline to participate. This reluctance to be recorded and in doing so

expose their practice to scrutiny has been previously identified as an issue which can affect recruitment rates to studies (Parry et al., 2016). A study about dental nurse response to video recorded consultations found some evidence of awareness of the camera during placement of fluoride varnish so these concerns may not have been insurmountable (Zhou et al., 2010). However, on the basis of further concerns from the dental teams working in the ADC about the degree of intrusiveness of video recording vulnerable patients (i.e. those experiencing dental infection and/or severe pain), this data collection method was rejected.

Use of the ***interview topic guide*** alone to structure telephone interviews with dentists during the feasibility testing proved difficult. By the addition of prompts, drawing on guidance for structuring interview questions using the TDF (Michie et al., 2014) interview schedules (see Appendix CC5) were developed to support semi-structured interviews with dentists, dental nurses and patients. By the addition of spaces for details relating to the interviewee's specific urgent dental appointment (from the appointments transcript, dentist and dental nurse questionnaires and, where applicable, the ORF), each interview scheduled was designed to be tailored in order to identify features of interest from the sampling strategy and/or potential new features of interest.

Reducing the risk of identifying patterns of inappropriate care by dental teams was also advised. Failure to raise concerns would have been inappropriate for a dental registrant (and would risk their own registration with the GDC if challenged), yet raising concerns would have stymied further data collection due to lack of trust from the remaining dentists and dental nurses within this (and future) studies. Advice was that formal whistleblowing was only required if a pattern of behaviour was identified; a pattern of behaviour was defined as being identified three or more times. For this reason, the decision was made to transcribe no more than two case per dentist. In the same vein, and as the study aimed to explore influences on treatment decisions not the appropriateness of those decisions, the dentists were not asked to share their diagnosis for each patient with the researchers. Case packs of collected data were retained at each research site until all of the cases at that site had been recruited. Only once the demographic data from the CRF and dentist/dental nurse questionnaires had been retrieved and analysed could cases be selected in accordance with the sampling strategy and the relevant audio-recordings transcribed and analysed was it possible to arrange follow-up interviews with the dentists, dental nurses and patients. In some cases this resulted in a significant time delay of months between appointment and follow-up interview. Generally, the patients had no problems recalling the details of their urgent dental appointment, which seem to be a significant event in their lives. Most of the dentists and dental nurses, however, relied on the clinical records about the

appointment as in most cases the events of the appointment were not sufficiently memorable to recall unaided. The advantage of this time delay between appointment and follow-up interview was to reduce still further the risk of the researchers potentially identifying inappropriate care. Unfortunately the time delay reduced the amount of insight into reasons for specific decisions which could be gleaned from the interviews with the dentists and dental nurses. Whilst this was a necessary compromise and was not the intention of the study, it did provide insight into the dentist's habitual behaviour which is arguably equally as useful when it comes to understanding how dental professionals view and use antibiotics. The appointment transcripts allowed pinpointing of specific issues for discussion and the dentist then explained how they would typically act in those situations and the dental nurse explained how the dentist(s) they work with would typically act. Without the appointment transcripts, the interviews would have been little different to previously published research. By using data relating to actual observed behaviour, the additional four factors affecting decision making by dentists during urgent dental appointments were identified.

5.4.7 Data collection instruments & technologies

To test the feasibility and acceptability of some of the methods of data collection developed for this ethnographic study, a short service evaluation study was undertaken in the LDIADC department during August 2016. As a service evaluation, this focused only on clinician behaviours and patient data was collected only as a consequence of audio-recording the clinicians The evaluation took a similar format to the main study: clinician consent at least 24 hours in advance, patient consent immediately before audio-recording/direct observation of the urgent dental appointment, questionnaires for the dentist and dental nurse after each urgent dental appointment and follow-up interviews for the dentists only. Dentist, dental nurse and patient consents were gained by WT. Audio-recording and direct observations were undertaken by an undergraduate student using a semi-structured ORF based on the generic structure to identify features from a draft sampling matrix based on the emerging findings of the systematic review (Chapter 3). Semi-structured follow-up telephone interviews were undertaken with those dentists willing to verbally confirm their consent based on an interview schedule. Audio-recordings of the appointments and follow-up interviews were transcribed by WT. Following the service evaluation, the ORF and interview schedules were substantially revised whereas the dentist and dental nurse questionnaires remained unchanged. Details of the data collection instruments and technologies used during the ethnographic study are provided in the following sections:

5.4.7.1 Urgent appointments – audio-recording, observation & questionnaires

In advance of each appointment and at the same time as recording consent, key patient data were recorded on paper-based Case Report Forms (CRFs).After each appointment, the dentists and dental nurses each completed short questionnaires relating to the case. Each appointment was audio-recorded and a selection of cases in OOH were also observed by an independent researcher who kept notes by completing an ORF.

Transcripts of the appointments selected for follow-up interview together with an ORF where available were analysed during the period November 2017 to May 2018.

5.4.7.1.1 Audio-recording

The urgent dental appointment for each case recruited into the study was audio-recorded using an Olympus DS-7000 voice recorder with Personal Identification Number (PIN) code, passwords and encryption activated. A boundary microphone (Olympus ME-33 conference microphone) was employed with the voice recorder to maximise clarity of recordings from the clinical setting. This approach was shown to be effective during the feasibility testing of data collection methods in LDI's ADC.

A case waiting/recording instructions sheet (Appendix CC4) was produced and tested in collaboration with the research support staff and at the first general dental practice recruited to the study. As the reception team at each research site were responsible for initial approach and recruitment of cases, this was an important part of the process for them as it allowed them to communicate with the participating dentists and dental nurses who would be treating the recruited patient. The provision of a script for one of the participating clinicians to read onto the audio-recording at the beginning and end of each appointment facilitated identification later in the study of those audio-recordings relating to the selected cases which required transcription.

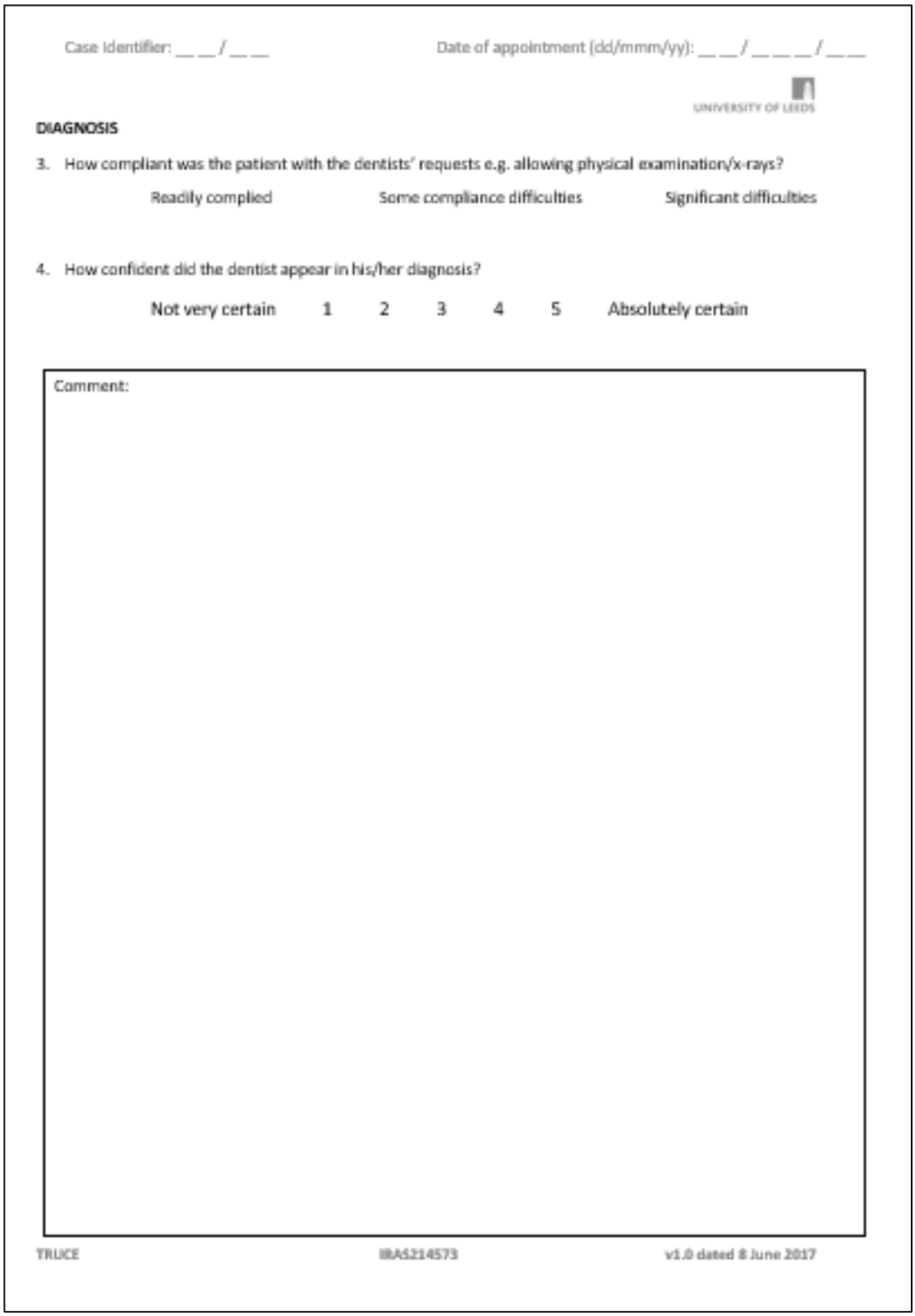
5.4.7.1.2 Observation

In addition to audio-recordings, a selection of cases in OOH were also observed so that for each OOH dentist, some cases were independently observed as well as audio-recorded whilst others were just audio-recorded. Due to the unpredictable nature of urgent dental care in GDP (i.e. knowing when such cases would present for care), it was impractical to observe urgent dental appointments in that setting.

Two researchers were employed to undertake the observations in OOH; both were familiar with working in a dental context but neither was (or had ever been) a registered dental professional. A semi-structured ORF was developed, drawing on experience of the feasibility testing of data collection methods in LDI's ADC and based on the interview topic guides and dentist/dental nurse questionnaires to facilitate triangulation of the data relating to dentist, patient, dental nurse and wider environmental influences (see Figure 5-5). The observers were involved with production of the ORF and both

were trained in its use in LDI's ADC before undertaking observations at OOH dental clinics as part of the study. Hard copies of the form were provided for the observers to complete during their observations.

Figure 5-5 Extract from the Observation Record Form (ORF)



Case Identifier: __ __ / __ __ Date of appointment (dd/mmm/yy): __ __ / __ __ __ / __ __

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DIAGNOSIS

3. How compliant was the patient with the dentists' requests e.g. allowing physical examination/x-rays?

Readily complied Some compliance difficulties Significant difficulties

4. How confident did the dentist appear in his/her diagnosis?

Not very certain 1 2 3 4 5 Absolutely certain

Comment:

TRUCE IRAS214573 v1.0 dated 8 June 2017

5.4.7.1.3 Questionnaires

Dentist and dental nurse participants each completed very short questionnaires (see Figure 5-6 and Figure 5-7) following each audio-recorded appointment to record their immediate thoughts, feelings and treatment provided during the urgent appointment. The aim of the questionnaires was to inform selection of cases for follow-up interview rather than to collect data for quantitative analysis. The questions were designed to complement data from the CRF, based on the sampling matrix relating to cases for follow-up interview (see section Table 5-6). As the questions were not validated and given that a convenience approach to sampling patients was employed (with cases self-selected rather than randomly selected or consecutive cases), there was no intention to analyse the data collected from the questionnaires quantitatively as it would be at a high risk of bias.

The dentist/dental nurse questionnaires were developed to capture issues which had identified from the literature (see Chapter 3) as possible influences on treatment decisions, and tested during the acceptability/feasibility testing of data collection techniques undertaken in the LDI ADC. It was found that they were straightforward to complete and took less than 30 seconds. No changes were made to the questionnaire between feasibility testing and the main study. Hard copies of the questionnaires were provided for completion following each appointment by dentists and dental nurses.

Figure 5-6 Questionnaires for dentists to complete after each appointment

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QUESTIONNAIRE FOR DENTISTS

Which factors in dentist-patient interactions influence treatment in urgent dental care?

Case Identifier: __ __ / __ __

1. **How confident were you of the diagnosis for this patient?** (Please circle one option)

   Not very certain 1 2 3 4 5 Absolutely certain

2. **Did you feel pressure from anyone about the type of treatment provided today?** (Please circle one option)

   Yes No Not sure

   If 'Yes', please give details...

   ....

3. **What treatment did you provide today?** (Please circle ALL that apply)

   Antibiotics Extraction Open & dress pulp Other treatment No treatment

   If 'Other' or 'No' treatment, please give details..

   ....

4. **Was the scheduled appointment slot long enough?** (Please circle one option)

   Yes No Not sure

   If 'No', what happened as a result?..

   ....

5. **How stressful did you find the appointment?** (Please circle one option)

   Not at stressful 1 2 3 4 5 Extremely stressful

   Please give details...

   ....

6. **Was there anything else about this appointment which you feel would be useful for us to consider in our study about what influences decision making?** (Please circle one option)

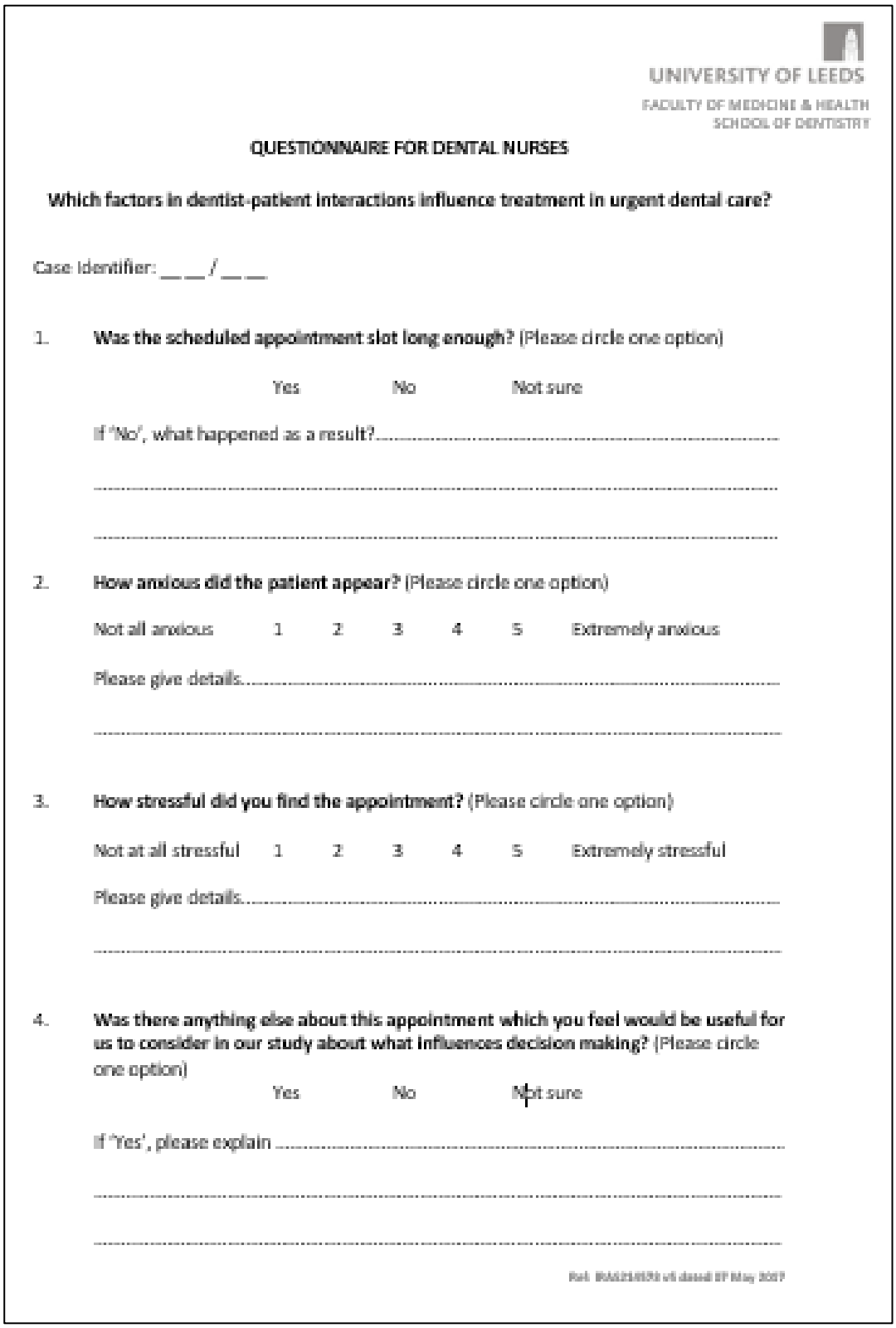
   Yes No Not sure

   If 'Yes', please explain ....

   ....

Ref: [illegible]

Figure 5-7 Questionnaires for dental nurses to complete after each appointment



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SCHOOL OF DENTISTRY

QUESTIONNAIRE FOR DENTAL NURSES

Which factors in dentist-patient interactions influence treatment in urgent dental care?

Case Identifier: __ __ / __ __

1. **Was the scheduled appointment slot long enough?** (Please circle one option)

   Yes No Not sure

   If 'No', what happened as a result?.....

   .....

   .....

2. **How anxious did the patient appear?** (Please circle one option)

   Not all anxious 1 2 3 4 5 Extremely anxious

   Please give details.....

   .....

3. **How stressful did you find the appointment?** (Please circle one option)

   Not at all stressful 1 2 3 4 5 Extremely stressful

   Please give details.....

   .....

4. **Was there anything else about this appointment which you feel would be useful for us to consider in our study about what influences decision making?** (Please circle one option)

   Yes No Not sure

   If 'Yes', please explain .....

   .....

   .....

Ref: [illegible]

5.4.7.2 Follow-up interviews

Semi-structured follow-up telephone interviews with the patients and dentists and dental nurses were undertaken by the researcher. Based on topic guides and using semi-structured interview schedules which had been tailored for each case, the interviews explored issues of interest identified from the appointment transcripts, dentist/dental nurse questionnaires and any available ORFs. For the purposes of triangulation, issues identified from any interviews already completed with the other participants present during the urgent appointment were also included in the tailored interview schedule (see Figure 5-8). The interviews were audio-recorded and transcripts analysed between November 2017 and July 2018. The researcher (WT) contacted the participants associated with the selected cases using contact details provided on the consent form. Participants were reminded about the study in which they had participated and then invited to take part in a telephone interview. If after two attempts to contact the patient no contact had been established it was assumed that the individual no longer wished to actively participate in the study and other cases were identified. Once patients for two cases per dentist had been recruited to the follow-on interviews, the audio-recording of their appointments were transcribed and analysed to inform the interviews and the interview schedule was tailored accordingly.

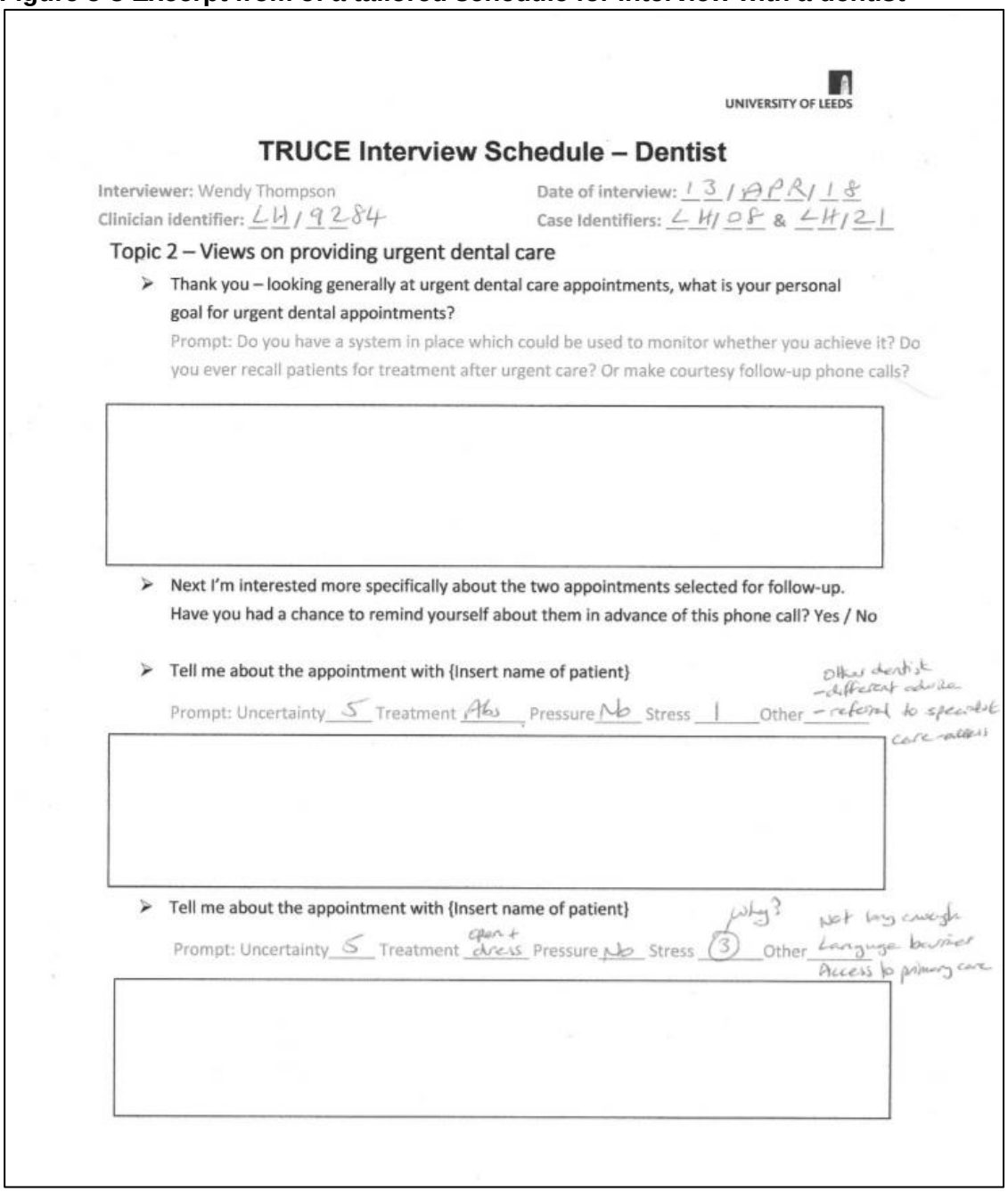
Fulfilment of the range of sampling criteria when recruiting cases for follow-up interview was tracked using an MS Excel spreadsheet which included relevant patient/case demographics and characteristics from data collected during recruitment of (see an extract in Table 5-7).

5.4.7.2.1 Interview topic guides/schedules

To identify factors influencing urgent dental appointments, two separate topic guides were developed for the follow-up semi-structured interviews. These were based on similar topic guides used by a colleague (Dr Sarah Tonkin-Crine of University of Oxford) when interviewing general medical practitioners about their use of antibiotics for RTIs. The clinician topic guide enabled exploration of individual, interpersonal and contextual influences on treatment in urgent dental care during interviews with the dentists and dental nurses (Appendix C.5.1). A patient-centred topic guide enabled exploration of the patient perspective about treatment during urgent NHS dental appointments (Appendix C.5.2).

In advance of each interview, the recording form was tailored by the researcher (WT) to address specific issues identified from the transcript of the urgent dental appointment plus any available interview transcripts of others present during that urgent dental appointment (i.e. the patient, dentist and/or dental nurse). An example of a tailored dentist interview scheduled is in Figure 5-8.

Figure 5-8 Excerpt from of a tailored schedule for interview with a dentist



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TRUCE Interview Schedule – Dentist

Interviewer: Wendy Thompson
Date of interview: 13 / APR / 18
Clinician identifier: LH / 9284
Case Identifiers: LH/08 & LH/21

Topic 2 – Views on providing urgent dental care

- Thank you – looking generally at urgent dental care appointments, what is your personal goal for urgent dental appointments?
  Prompt: Do you have a system in place which could be used to monitor whether you achieve it? Do you ever recall patients for treatment after urgent care? Or make courtesy follow-up phone calls?

- Next I'm interested more specifically about the two appointments selected for follow-up. Have you had a chance to remind yourself about them in advance of this phone call? Yes / No

- Tell me about the appointment with {Insert name of patient}
  Prompt: Uncertainty 5 Treatment Abs Pressure Nb Stress 1 Other – referral to specialist
  Other dentist – different advice
  care

- Tell me about the appointment with {Insert name of patient}
  Prompt: Uncertainty 5 Treatment open + dress Pressure Nb Stress (3) Other Language barrier
  why?
  Not long enough
  Access to primary care

5.4.7.2.2 Interview audio-recordings

Each telephone interview was audio-recorded using an Olympus TP-7 telephone pickup hands-free cable attached to an Olympus DS-7000 voice recorder with PIN code, passwords and encryption activated. This system was tested during the feasibility testing with LDI's ADC and found to produce high quality recordings which were easily transcribed.

5.4.7.2.3 Transcribing of audio-recorded observations and interviews

Audio-recordings of selected observations and all of the interviews were professionally transcribed by members of staff from UoL. In accordance with the data management plan, each signed an additional confidentiality agreement. Olympus Transcribing Kit AS-2400 and Olympus Dictation Management System Software (Transcription Module) were used. All transcriptions were produced and stored directly on the UoL IT system.

5.4.8 Data processing

Data from the dentist/dental nurse questionnaires and Case Report Forms were transferred by the researcher to a Microsoft Office Excel 2013 spreadsheet for case selection and to facilitate description of the dataset (see Table 5-8 and Table 5-9). Included on the spreadsheet also were details from the audio-recorder of the length of each appointment audio-recording.

Table 5-8 Extract from Urgent Appointment Case Demographics spreadsheet – Data from the Questionnaire for Dentists and Dental Nurses

Dentist Q1	Dentist Q2	Dentist Q3	Dentist Q4	Dentist Q5	Dentist Q6	Nurse Q1	Nurse Q2	Nurse Q3	Nurse Q4
4	No	Antibiotics	Yes	2	No	Yes	1	1	No
5	No	Extraction	Yes	2	No	Yes	1	2	No
5	No	Extraction	Yes	1	Yes	Yes	1	1	Yes
5	No	Extraction	No	2	Yes	Not sur	4	2	No
5	No	Extraction	Yes	1	No	Yes	1	1	
5	No	Antibiotics	Yes	1	Yes	Yes	1	1	No
5	No	Antibiotics	Yes	1	No	Yes	1	1	No
5	No	Antibiotics	Yes	1	Yes	Yes	1	1	No
5	No	Other treatment	Yes	1	No	Yes	1	2	No
5	No	Open & dress pulp	No	3	Yes	Yes	4	1	Not sur
5	No	Extraction	No	3	No	Yes	3	2	Not sur
5	No	Open & dress pulp	Yes	1	No	Yes	1	2	Not sur

Key:		
Questions for Dentists		
Q1	How confident were you of the diagnosis for this patient?	Not very certain 1 2 3 4 5 Absolutely certain
Q2	Did you feel pressure from anyone about the type of treatment provided today?	Yes / No / Not sure
Q3	What treatment did you provide today?	Antibiotic / Extraction / Open & dress pulp / None / Other
Q4	Was the scheduled appointment slot long enough?	Yes / No / Not sure
Q5	How stressful did you find the appointment?	Not at stressful 1 2 3 4 5 Extremely stressful
Q6	Was there anything else about this appointment which you feel would be useful for us to consider?	Yes / No / Not sure
Questions for Dental Nurses		
Q1	Was the scheduled appointment slot long enough?	Yes / No / Not sure
Q2	How anxious did the patient appear?	Not all anxious 1 2 3 4 5 Extremely anxious
Q3	How stressful did you find the appointment?	Not at stressful 1 2 3 4 5 Extremely stressful
Q4	Was there anything else about this appointment which you feel would be useful for us to consider?	Yes / No / Not sure
Indicates additional information relating to that entry is available		

Table 5-9 Extract from Urgent Appointment Case Demographics spreadsheet – Data from the Case Report Forms (CRFs).

Patient gender	Patient ethnicity	Educational qualification	Regular check-ups	Other adult present?	IMD
Male	Black or Black British	Postgraduate degree or	No	No	5
Male	White British	College/university degree	No	No	6
Female	White British	College/university degree	No	No	6
Male	White British	Unclear/patient declined	No	No	2
Male	White British	GCSE or equivalent	No	No	1
Male	White British	GCSE or equivalent	No	No	2
Male	White British	GCSE or equivalent	No	No	1
Female	White British	No formal qualifications	No	No	7
Female	White British	A Level or equivalent	No	No	5
Female	Black or Black British	A Level or equivalent	No	No	1
Male	White British	A Level or equivalent	No	No	5
Female	Asian or Asian British	Postgraduate degree or	No	No	6

Key:	
Other adult?	Was another adult/chaperone present during the appointment?
IMD	Indices of Multiple Deprivation – Decile of the patient's home postcode

Data from the Observation Record Forms (ORFs) were transferred by the researcher to a standard table in Microsoft Office Word (2013). Audio-recordings of dental appointments and interviews were transcribed verbatim. Each transcript was double checked for accuracy, grammar/spelling corrected and anonymisation/de-identification undertaken by the researcher. Data from the appointment/interview transcripts and ORFs (see Table 5-10) were analysed using NVivo 11 Plus software.

Table 5-10 Extract from NVivo of an Observation Record Form (ORF)

Treatment planning			
	5	What body-language did you notice?	
		Dentist-patient	Dentist confident - patient listening
		Dentist-nurse	Working well together/confident that got what needed
		Nurse-patient	
	6	How was consent gained?	Verbal only
	7	Were any clinical records written during the course of the appointment?	Dentist only
		Comment	Dentist explained all the time - including what xray showed with patient out of chair to see xray on pc screen. Dental nurse explained whilst putting in xray pad which was painful. Pt wants to keep the tooth. Nurse now starts to get equipment out for the procedure.
Treatment provided			
	8	If operative treatment was provided, when did the nurse start preparing the equipment?	After consent gained
	9	If a prescription only, who completed most of the prescription form?	No prescription given
	10	If any advice leaflets were given, what were they about?	No leaflets given
		Comment	Post opt to complete root canal treatment by own dentist. Dentist and nurse caring and offering support whilst pt having anaesthetic. Telling patient to breath through nose. Patient very compliant with whole procedure. Whilst going numb, dentist writing up notes and nurse getting further supplies - so a lot of undoing wrappers. Pt just lying back in dental chair and moving mouth as if making chewing movements and moving jaw side to side. Before treatment started, patient breathing slowly and told dentist had no pain. Rapport with nurse who checked if patient OK before procedure started. Todl pt may have to keep taking pain killers after treatment today. Dentist and nurse appeared confident in what they were doing at all times. Post-op instructions given to patient by dentist. Nurse gave address of possible dentist and to ring Monday morning. Pt listening. Patient looked in mirror when got up from the chair to see mouth. Appeared content with treatment carried out

5.4.9 Data synthesis and interpretation

To identify and characterise influences on the dentist's treatment decisions (including whether to prescribe antibiotics), deductive thematic analysis of the observation and interview transcripts was undertaken. Synthesis of the results was based on the list of factors identified in Chapter 3 (Braun and Clarke, 2006). To inform the development of a complex intervention to change dentists' antibiotic prescribing behaviour, each of the potentially modifiable factors influencing treatment in urgent dental care was linked (as in Chapter 3) to the TDF. Additionally, with 'patient influence' having been identified in Chapter 3 as such an important effect on dentists' behaviours, interviews with patients were analysed and synthesised to identify the patient perspective about their influence on dentists.

Data relating to the cases follow-up through interview were analysed to identify the factors influencing treatment (including antibiotic prescribing) during urgent dental appointments and interpreted to identify potential targets for optimising care. Building on the framework of factors identified from the umbrella and systematic reviews of the literature in Chapter 3, synthesis of the ethnographic data employed an iterative and recursive approach to analysing the themes emerging from data collected during the appointments and follow-up interviews. A theory-informed model of behaviour relating to decision making during urgent dental appointment was then developed as the basis

for subsequent development of a complex intervention to optimise treatment for NHS patients receiving urgent dental care in England.

5.4.9.1 Demographic data about the urgent dental appointments

Data from the dentist and dental nurses questionnaires and case report forms (CRFs) were collated to identify areas for exploration during the follow-up interviews with dentists, dental nurses and patients. The length of each appointment audio-recorded during the study was noted and for each case selected for follow-up interview, the audio-recording transcript was analysed to identify additional issues which appeared to influence the dentist's treatment decision. Together with data from the dentist and dental nurse questionnaires, these data were used to tailor the semi-structured interview schedules; an example is shown in Figure 5-8.

During analysis of the appointment transcripts, it became clear that antibiotics had been discussed in most of the appointments, even though they had only actually been prescribed in half of cases selected for follow-up interview. A further analysis to explore the nature of the discussion about antibiotics during the appointment and consideration of whether the patient wanted antibiotics (including from the follow-up interview transcripts where available) was undertaken.

5.4.9.2 Analysis of follow-up interviews with dentists

Deductive thematic analysis was undertaken based on the list of factors developed in Chapter 3 from the published literature. Additional codes were added to the framework as necessary. NVivo 11 Plus software was employed for analysis of the transcripts and ORFs. Coding of all transcripts was undertaken by WT in NVivo 11 Plus, with another researcher (RRCM) coding 10% of the transcripts independently using comments in Microsoft Word 2013.

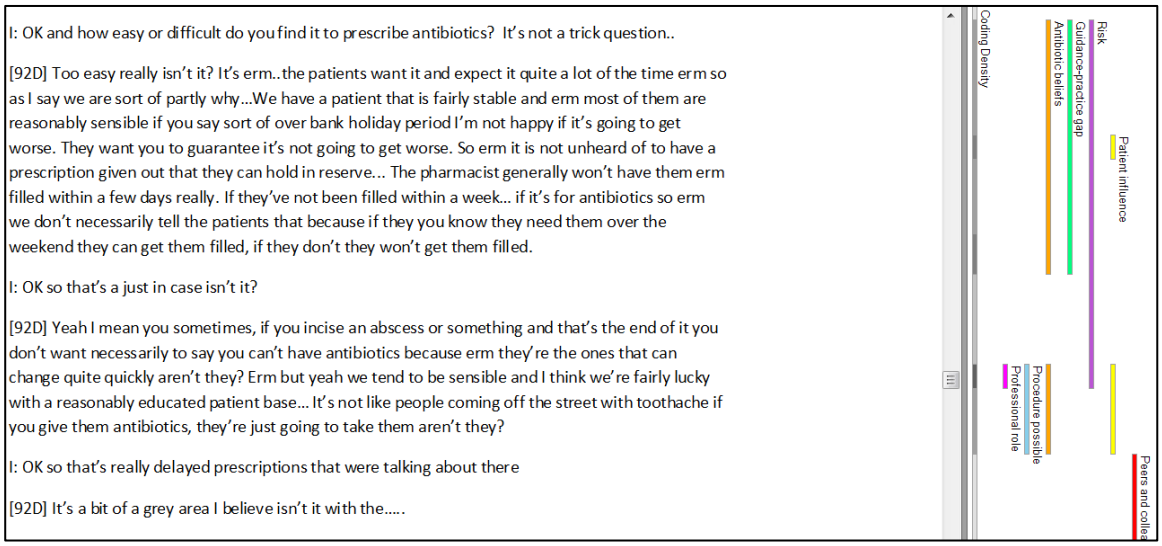
Additional sense checks of the identified factors were provided by other members of the research team and the study's PPIE contributors during a stakeholder group described in more detail in Chapter 6.

By comparing reproducibility of codes between the independent coders, inter-coder reliability relating to factors influencing dentists was found initially to be 78% (immediate agreement for 55 out of the 70 coded section within the one transcript which was double-coded) and inter-coder agreement was 100% after discussion of the remaining 15 codes (Campbell, J.L. et al., 2013). If there had been unresolved disagreements, it was planned that these would have been resolved by discussion with the other members of the research team. Analysis of interview transcripts continued until no new factors influencing treatment provided by dentists during urgent dental appointments emerged (saturation was achieved). The screenshot from NVivo 11 Plus

in Figure 5-9 shows how coding of the transcripts maintained context and an audit trail for the coded excerpts.

The description of each factor from the original list (produced in Chapter 3) was revised to reflect the findings of the study. Each of the new factors added to the framework was described based on the findings of the ethnographic study and mapped to the TDF. By combining these two lists, a comprehensive set of factors contextualised to treatment decisions during urgent NHS dental care was produced. Where differences between the factors were found which related to either clinical setting (i.e. GDP vs OOH) or prescribing pattern of the practice (i.e. high rate antibiotic prescribing practices vs low rate practices), these differences were also highlighted.

Figure 5-9 Extract from NVivo showing analysis of a dentist interview transcript

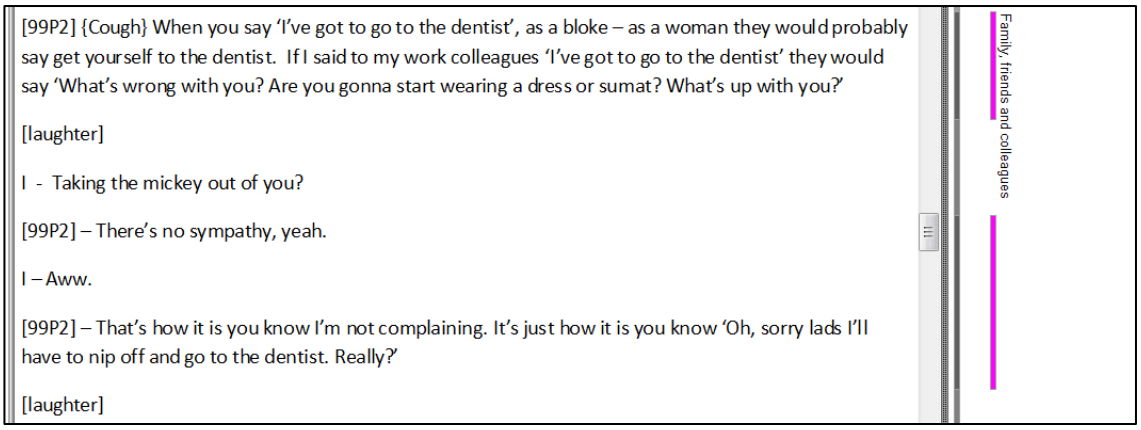


5.4.9.3 Analysis of follow-up interviews with patients

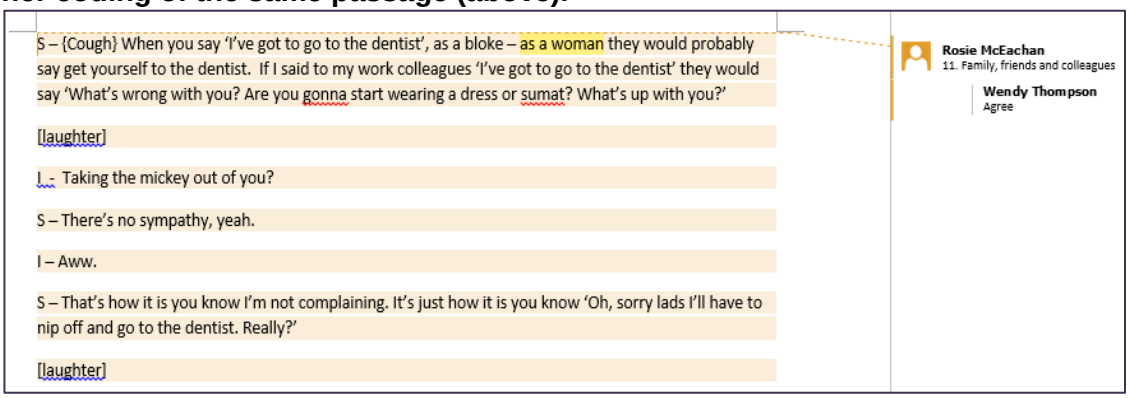
Inductive thematic analysis of the interviews with patients was undertaken to develop a new set of codes relating to factors associated with urgent treatment from the patient perspectives. Coding was undertaken by two researchers: WT coded all of the patient interview transcripts whilst RRCM undertook independent coding of 10% of the patient interview transcripts (Campbell, J.L. et al., 2013). By comparing codes (see Figure 5-10), inter-coder reliability for the patient-factors coding framework was found to be 68% (immediate agreement for 34 out of the 50 coded sections across the two transcripts) (Campbell, J.L. et al., 2013). Further discussion to refine 6 of the codes resolved 9 of the disputed sections. Remaining disagreements were discussed and resolved.

Figure 5-10 Excerpt from a patient interview transcript showing independent coding by researchers WT and RRCM

Excerpt of Researcher WT's coding of a patient interview transcript using NVivo



Excerpt of Researcher RRCM's independent coding of the same transcript using Microsoft Word comments. Also shown are researcher WT's responses based on her coding of the same passage (above).



A final sense check of the identified factors was undertaken by the study's stakeholder group during a workshop event described in more detail in Chapter 6. This included members of dental teams (dentists, dental nurses and managers) who had participated in the research, members of dental teams from other parts of the country (Devon, Hampshire and Norfolk) who had not participated in the research other members of the research team, policy makers from PHE and HEE, the study's PPIE contributors (FH and BH) and the PhD supervisors (RRCM, GVAD, SHP and JATS).

5.4.9.4 Developing a theory-informed model of behaviour

Dentist-related factors were mapped to the TDF and then linked directly to the COM-B model (using approaches detailed in Michie's Behaviour Change Wheel guidance) (Michie et al., 2011). This enabled production of a theory-informed model.

5.4.10 Techniques to enhance trustworthiness

Techniques to enhance trustworthiness of the data collection and analysis have been identified by Korstojen and colleagues as credibility, transferability, dependability/confirmability and reflexivity (Korstjens and Moser, 2018). They suggest that credibility can be shown through three types of triangulation: between data, investigators and methods. Triangulation between the study's data sources is illustrated through the process of tailoring the interview schedule with issues identified from the dental appointment transcripts, questionnaires for dentists and dental nurses and follow-up interviews with the dentists, dental nurses and patients. Triangulation between investigators is demonstrated through the high levels of inter-coder reliability found in relation to the independent coding of follow-up interview transcripts. This reliability was found in spite of recognised difficulties coding semi-structured interviews where 'rambling responses often require several codes simultaneously.' (Campbell, J.L. et al., 2013). Method triangulation can be seen in the way the interview schedules were tailored with information from the urgent appointment transcripts and questionnaires for dentists and dental nurses. Indeed, triangulation of methods beyond this study to the wider programme of research presented in this thesis is also demonstrated, as a real world cross check of the factors identified in Chapter 3 with actual urgent dental appointments.

Transferability relates to the provision of a thick description of the context and way in which the research was undertaken, so as to enable other researchers to assess the potential for transferability of the approaches and/or findings to their own context. In the Case Demographics section of the Methods, detailed descriptions of the setting, sample size, sample strategy, demographics, inclusion/exclusion criteria, interview procedures and topics (including excerpts from a tailored interview schedule) are provided.

Audit trails to demonstrate the dependability and confirmability of the research are demonstrated by presentation of excerpts from field notes and data summary spreadsheets. These audit trails between the electronic data kept within the UoL system and paper based field notes have proved invaluable to organisation of the data and its analysis during the course of the research. The use of NVivo for coding the transcripts provides a further example of the confirmability of the data as the software maintains the context of coded sections of the transcripts and an audit trail of where each factor originated,

In addition to credibility, transferability, dependability/confirmability, Korstjens and colleagues identified reflexivity as key to ensuring the trustworthiness of the study.(Korstjens and Moser, 2018) This is addressed in 5.4.2, in accordance with the structure of the SRQR reporting standard.

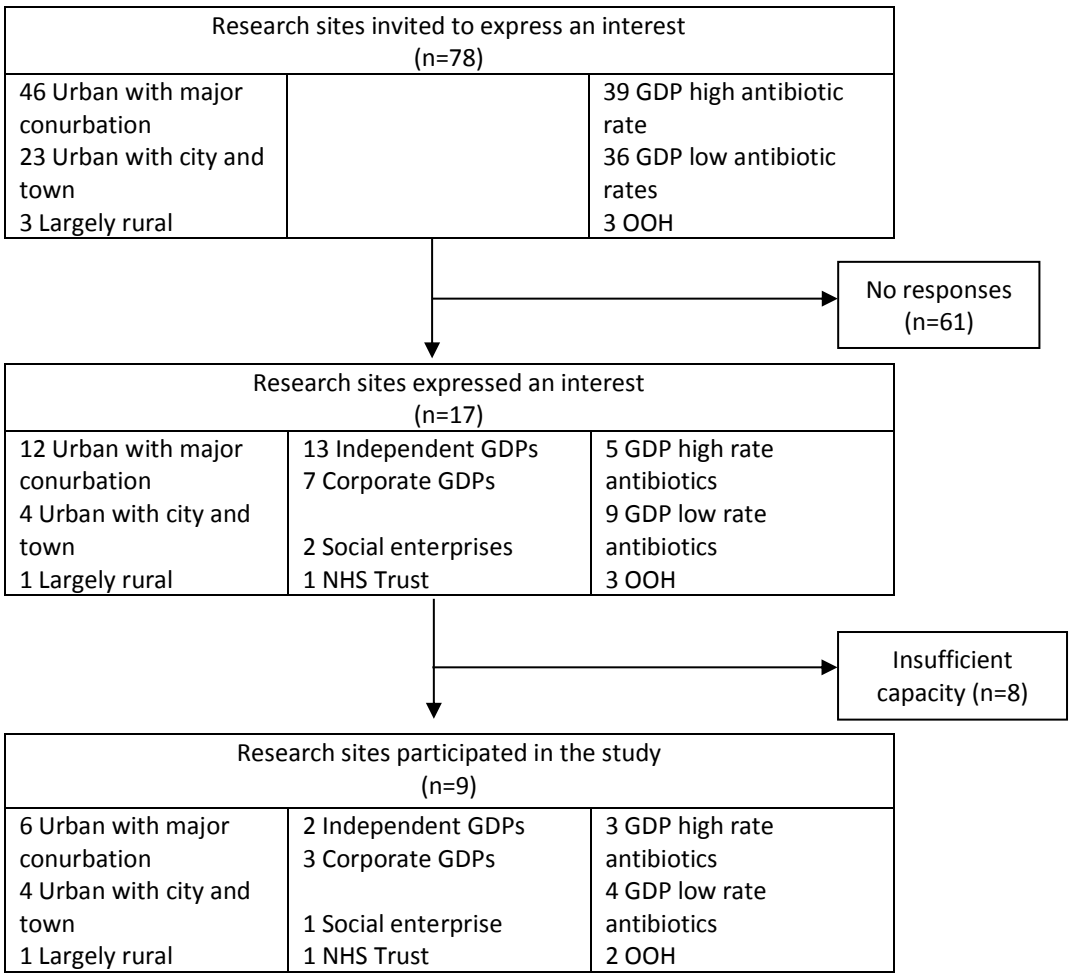
5.5 Results

5.5.1 Case demographics

5.5.2 Research site demographics

During the period October 2016 to November 2017, nine research sites (seven GDP and two OOH) were recruited (see Table 5-11). Of the recruited GDPs, four were small independent businesses and three were corporate providers of dentistry to the NHS; one of the OOH clinics was a social enterprise and the other was an NHS Trust.

Figure 5-11 Research site recruitment flowchart



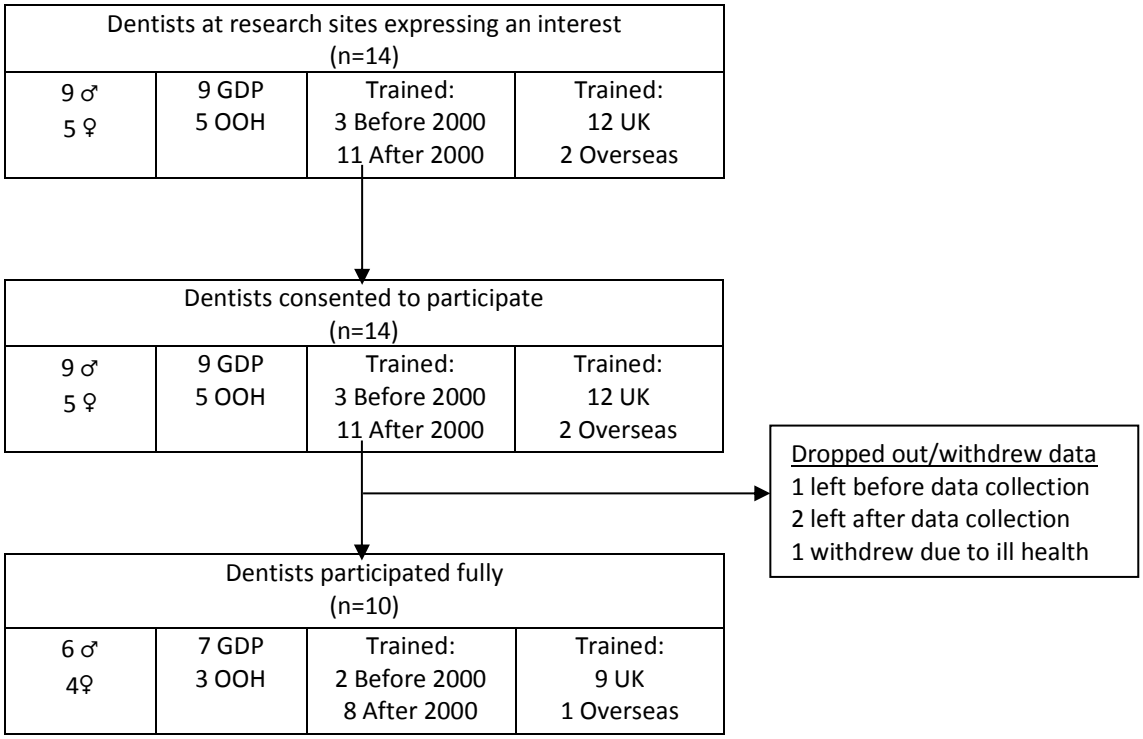
5.5.2.1 Dentist participant demographics

A total of 10 dentists (7 in GDP and 3 in OOH) contracted by NHSE to deliver primary dental care to adult patients participated in all aspects of the fieldwork (audio-recording of urgent appointments). A summary of dentist recruitment and the fit between the dentists recruited and the sampling strategy is presented in Figure 5-12. Six of the dentists working in GDP were self-employed associates paid based on UDAs; the other dentist in GDP was a salaried foundation dentist. All of the dentists working in OOH

dental clinics were general dentists contracted and paid per session of care provided (usually around four hours of time).

The overseas dentist who participated fully in all parts of the study was trained in a European country. The nine UK dentists who participated fully trained across a range of dental schools: Leeds, Liverpool, London, Manchester, Newcastle, Sheffield and University of Central Lancashire (UCLAN).

Figure 5-12 Dentist recruitment flowchart

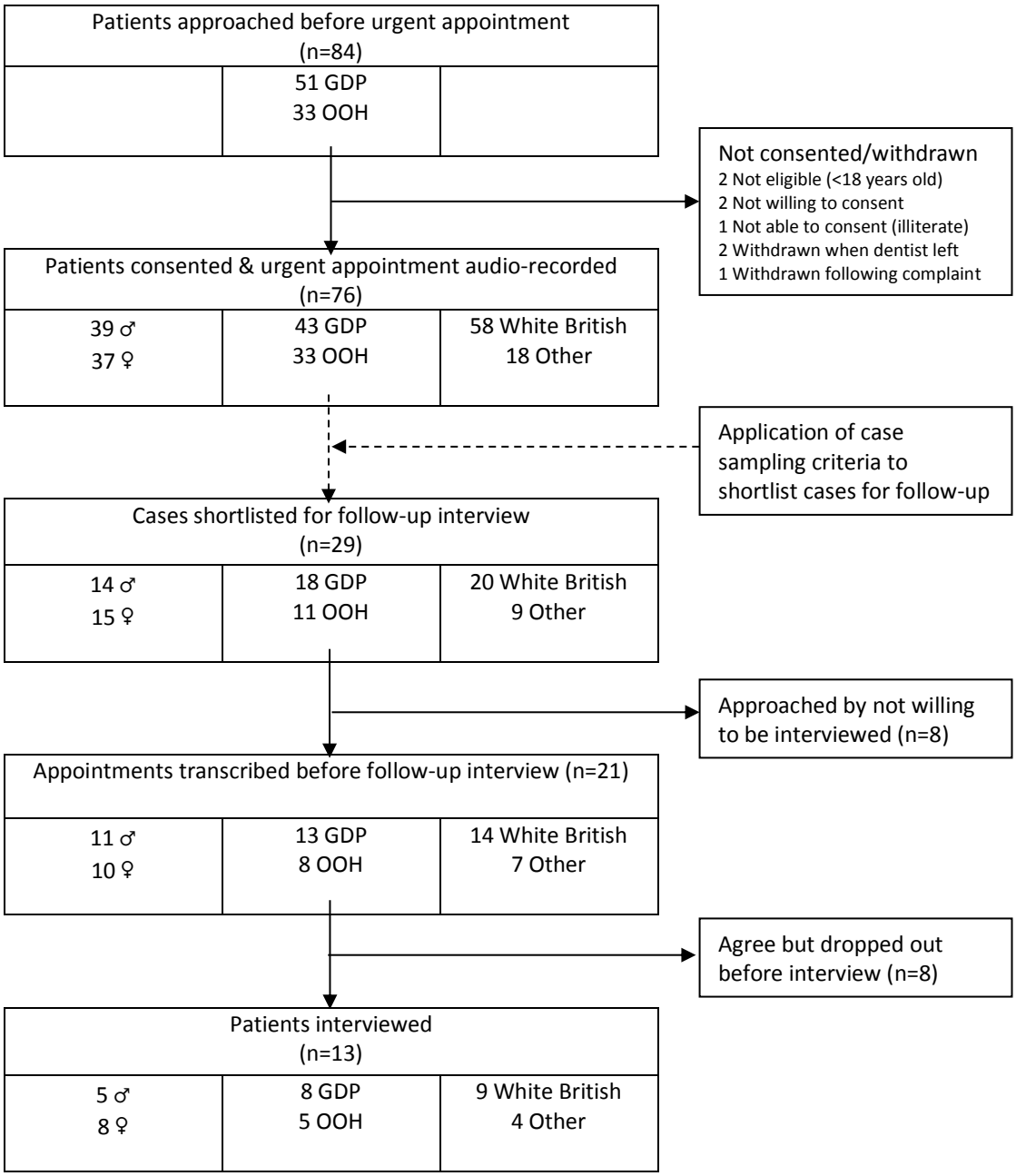


5.5.2.2 Patient participant demographics

A total of 84 patients (51 in GDP and 33 OOH) attending with dental pain and/or infection were approached by research support staff at the research sites between September 2017 and March 2018. Of these, 76 (43 in GDP and 33 OOH) were recruited to the study.

A summary of the characteristics of the patients recruited to the study as they relate to the sampling strategy are shown in Figure 5-13.

Figure 5-13 Patient recruitment and case selection flowchart



5.5.2.3 Cases recruited for urgent appointment audio-recording

A summary of the full data set collected during the observation of consultations (Table 5-11) direct observation and/or audio-recording) is presented in showing how it fitted with the sampling criteria.

The most common outcome for patients in the study was tooth extraction (n=25/76; 33%) or antibiotic prescription (n=19/76; 25%). Six of the patients who received an antibiotic prescription (6/19; 32%) also received irrigation of a post-extraction socket or an operculum (flap of gum associated with an erupting wisdom tooth). Eleven of the patients were treated by opening and dressing of the tooth's pulp (11/76; 14%).

Table 5-11 Summary of data relating to observed cases by sampling criteria

Characteristic	Measure	General dental practice (n=43)	Out-of-hours dental clinic (n=33)
Patient gender	Male	18	21
	Female	25	12
Patient ethnicity	White British	36	22
	Other	7	11
Level of patient's educational attainment	No formal qualifications	7	7
	GCSE or equivalent	9	9
	A' Level or equivalent	4	6
	College/university degree	9	5
	Postgraduate degree	4	3
	Unclear	10	3
Level of deprivation of the patient's area of residence	IMD Decile 1-3: High	20	21
	IMD Decile 4-6: Medium	13	9
	IMD Decile 7-10: Low	10	3
Regularly attends dental check-ups	Yes	31	0
	No	12	33
Presence of accompanying adult	Yes	7	5
	No	36	28
Dental anxiety of patient (nurse view)	Seems anxious (score 3-5)	10	9
	Seems not anxious (1-2)	33	24
Treatment/care provided	Antibiotics	12	7
	Any other/no treatment	31	26
Pressure felt by dentist to provide a particular treatment	Yes	6	4
	No	37	29
Dentist's reported confidence in this diagnosis	Not certain (score 1-3)	11	4
	Certain (score 4-5)	32	29
Dentist's view: Appointment long enough?	Yes	35	24
	No/Not sure	8	9
Level of clinician stress	Dentist: Stressful (score 3-5)	12	8
	Nurse: Stressful (score 3-5)	9	2

5.5.2.3.1 Appointment length descriptions

Across all of the audio-recorded appointments, the median length of time between the patient entering the surgery at the beginning of the appointment and leaving the surgery after completion of treatment (including time spent in the waiting room for at least one patient) was 16 minutes 34 seconds (range: 5 minutes 42 seconds to 1 hour, 23 minutes and 55 seconds). The summary of appointment lengths between GDP and OOH settings is shown in Figure 5-14 and a more detailed description by treatment type is shown in Table 5-12.

Figure 5-14 Box plot showing a summary of the appointment lengths in GDP and OOH

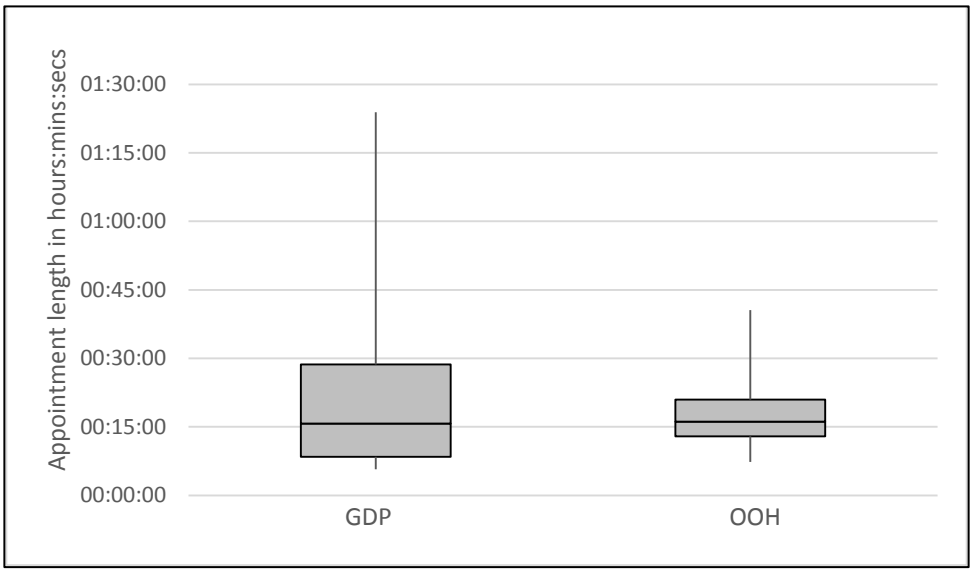


Table 5-12 Describing appointment lengths with reference to treatment type and clinical setting

Treatment type	Appointment length in minutes : seconds			
	General Dental Practice		Out of Hours	
	Median	Interquartile range	**Median**	Interquartile range
Antibiotics*	**07:18**	06:01 to 16:47	**11:00**	08:23 to 15:32
Extraction	**17:43**	10:38 to 29:15	**17:47**	15:01 to 21:59
Open & dress pulp	**42:16**	35:12 to 01:04:06	**25:52**	18:56 to 33:28
Other treatment	**28:41**	18:02 to 48:58	**15:45**	12:52 to 17:52
No treatment	**14:30**	08:51 to 17:01	**10:21**	07:20 to 13:23

* Antibiotics were provided in addition to irrigation of a dry socket or pericoronitis for some

5.5.2.4 Cases for follow-up interview - demographics

As shown in Figure 5-13, 29 of the patients who had been recruited into the study were approached with a view to undertaking a follow-up telephone interview; 18 patients were recruited from GDP research sites and 11 from OOH. Of these, 13 patients participated in telephone interviews: 8 from GDP and 5 OOH.

Of the 16 patients who did not go ahead with an interview, eight declined when approach to be interviewed and the other eight dropped out of the study after initially agreeing to follow-up interview and hence after their audio-recorded appointments had been transcribed. One patient withdrew from the study after the appointment was transcribed because, as he was reflecting on what he would like to say (in advance of the research interview), he decided that he would prefer to express his concerns

directly to the dental practice about the care he had received over a period of time. This was dealt with using the process in the protocol relating to complaints, allegations or disclosures, as described in section 5.4.5.1.

A summary of the match between the cases followed up through interview and the sampling strategy is presented in Table 5-13.

Table 5-13 Summary of data relating to cases followed up matched to the sampling strategy

Characteristic	Measure	General dental practice (n=13)	Out-of-hours clinic (n=8)
Patient gender	Male	8	3
	Female	5	5
Patient ethnicity	White British	9	5
	Other	4	3
Level of patient's educational attainment	No formal qualifications	2	2
	GCSE or equivalent	2	2
	A' Level or equivalent	2	3
	College/university degree	4	1
	Postgraduate degree	2	0
	Unclear	1	0
Level of deprivation of the patient	IMD Decile 1-3: High	4	5
	IMD Decile 4-6: Medium	6	2
	IMD Decile 7-10: Low	3	1
Regularly attends dental check-ups	Yes	12	0
	No	1	8
Presence of accompanying adult	Yes	2	3
	No	11	5
Dental anxiety of patient (nurse view)	Seems anxious (score 3-5)	2	4
	Seems not anxious (1-2)	11	4
Treatment/car provided	Antibiotics	6	4
	Extraction	3	0
	Open & dress pulp	1	3
	Other treatment	1	1
	No treatment	2	0
Pressure felt by dentist to provide a particular treatment	Yes	3	3
	No	10	5
Level of confidence in this diagnosis	Not certain (score 1-3)	6	2
	Certain (score 4-5)	7	6
Appointment was long enough	Dentist:		
	Yes	12	4
	No/Not sure	1	4
Level of clinician stress	Dentist:		
	Stressful (score 3-5)	4	3
	Nurse:		
	Stressful (score 3-5)	2	1

5.5.3 Data collection, synthesis and interpretation

Data collection at the research sites (observations and/or audio-recordings of appointments) took place between September 2017 and March 2018. Follow-up interviews took place between November 2017 and May 2018. Analysis of the data took place between October 2017 and June 2019.

5.5.3.1 Influences on treatment of adults during urgent NHS appointments

A total of 20 clinical cases (12 from GDP and 8 from OOH) were studied in depth. Although saturation of the results was judged to have been achieved when no new factors were found after analysis of 10 clinical cases; a further 10 cases were analysed to ensure richness of the results.

All of the 27 potentially modifiable factors found previously in the umbrella review across primary care and in the systematic review of primary dental care were identified during analysis of the study's observation and follow-up interview transcripts. A further four potentially modifiable factors were identified during this ethnographic study: 'feedback loop', 'lifetime impact, 'running late' and 'patient safety.' Details of the factors are presented in Table 5-14 to Table 5-16 below.

A theoretical model of influences on treatment in urgent dental care, produced as the theory of change for subsequent development of a complex intervention (as detailed in Chapter 6), is presented in Figure 5-15. Showing how the 31 potentially modifiable factors may influence behaviour during urgent dental appointments through reference to the COM-B model and TDF. It is presented early in this section to assist navigation through the more detailed results tables which follow:

:

- Capability elements in Table 5-14
- Opportunity elements in Table 5-15
- Motivation elements in Table 5-16

Each factor includes an interpretation of the extent to which it was found to be a driver of excellent care or a barrier to the provision of guideline congruent urgent dental care. Illustrative quotes from the transcripts of interviews, observations and in some cases the actual dental appointment are included.

Figure 5-15 Model of influences on treatment for adult patients in urgent dental care underpinned by the COM-B and Theoretical Domains Framework (TDF). The four new factors identified during this ethnographic study highlighted)

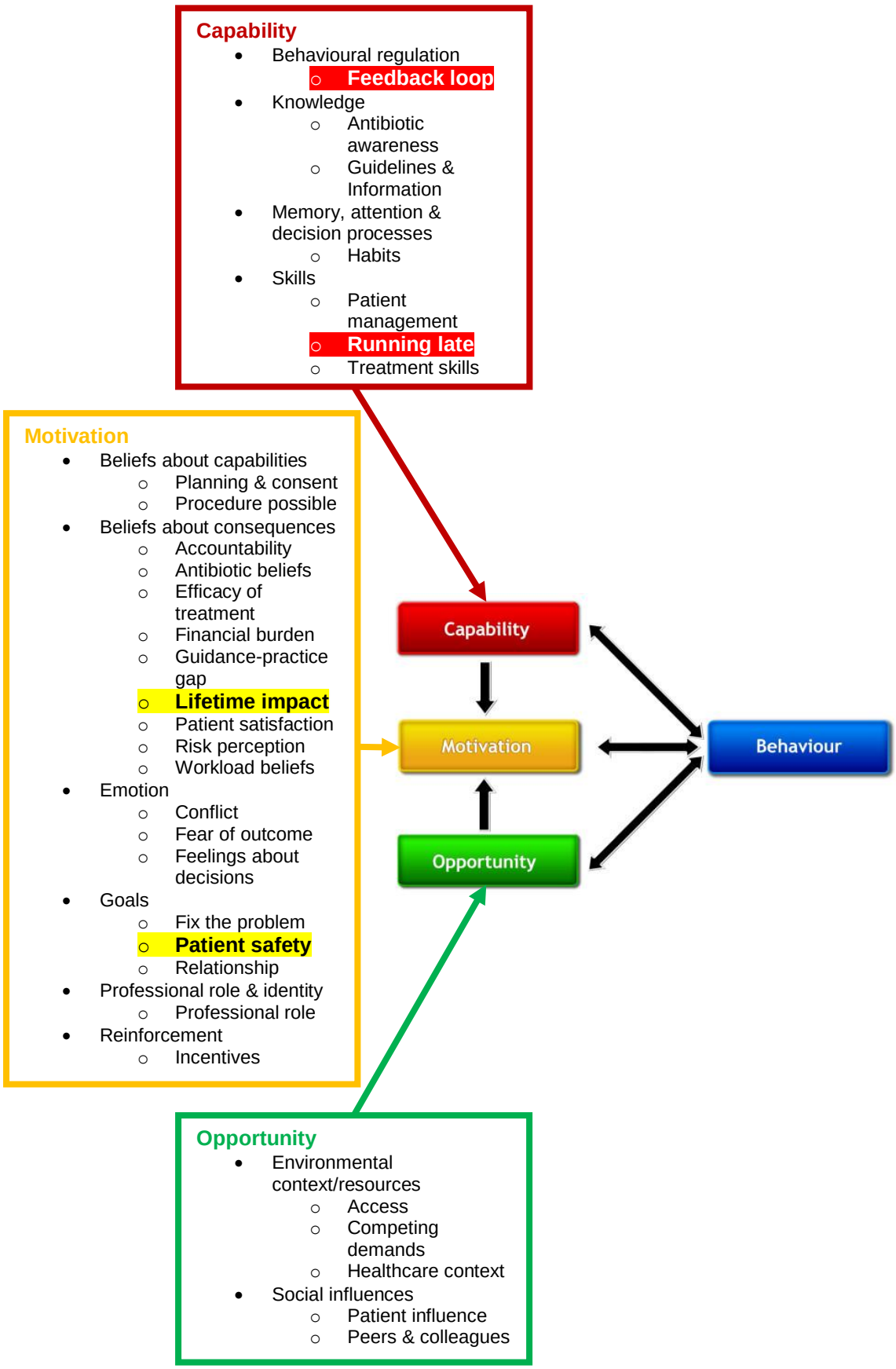


Table 5-14 Capability-based factors influencing dentists treatment decisions during urgent dental appointments identified from thematic analysis of observations and follow-up interviews, arranged by Theoretical Domains Framework (TDF) domain.

Factor name	Descriptor	Barriers to / drivers of good practice identified
Behavioural regulation TDF domain		
Feedback loop	Follow-up of patients after an urgent appointment or as part of continuing care for a patient provides a feedback loop which facilitates dental team learning.	The ability to follow-up patients enabled learning through experience. Where patient conditions improved following guideline congruent care, dentist confidence with guidelines may increase. *"I gave her the option to book in herself rather than book [a review] in proactively and since then I've not seen her, so I'm assuming it must've been fine."* (Dentist interview) Learning may also occur, however, with care provided not in accordance with guidelines yet still delivering a positive result for the dentist. *"My first and second year, I would try everything on the first appointment. But … after a few times I was still disappointed and making the patient unhappy. So I decided to change the way I do it* [using antibiotics] *and it's a lot better."* (Dentist interview)
	Potential target for optimising care: Nil due to risk of unintended consequences if behaviour driven in the wrong direction.	
Knowledge TDF domain		
Antibiotic awareness	Level of dentist's knowledge about the relationship between antibiotic use and adverse outcomes such as resistant infections.	All of the dentists had some level of knowledge about the relationship between antibiotic use and antibiotic resistance although most believed it was an issue for society generally rather than their patient specifically. A few of the dentists were also aware of other adverse outcomes such as *C.difficile* and anaphylaxis. *"My biggest concern would be the development of C. diff erm but obviously there are other smaller concerns like people can develop allergy....But obviously with the general good, we don't want to develop resistance."* (Dentist interview)
	Potential target for optimising care: Increasing knowledge and understanding of the patient safety risks of antibiotic use (rather than current public health messages which emphasis the risks for wider society), including the risk of resistance to individuals as well as other adverse outcomes.	

Factor name	Descriptor	Barriers to / drivers of good practice identified
Knowledge TDF domain (continued)		
Guidelines & Information	Dentist's knowledge about relevant guidelines and where they source other relevant information (including the internet and social media) about appropriate treatment for acute dental conditions and dental prescribing.	All of the dentists knew about relevant official sources guidelines relating to urgent dental care and some reported being given summaries at their dental practice/clinic. *"Before we kind of start we're kind of given like a pack and it just gives you a few things in there like what to prescribe, what dose for antibiotics, pain relief etc. so that's kind of a starter point for newbies."* (Dentist interview) Some dentists also reported using more informal sources of information. In their ethnography exploring how clinicians use (or rather don't use) guidelines, Gabbay & Le May report common use of this sort of informal learning through sharing of stories (Gabbay and le May, 2010). This may account for the guidance-practice gap identified within the factors relating to Motivation. "[My main source of information on treatment*] is gonna sound awful but always from my peers."* (Dentist interview)
	Potential target for optimising care: Tapping into this preference of clinicians to learn through sharing stories rather than official guidelines could prove a fruitful way to change dentists' knowledge and beliefs.	
Memory, attention & decision processes TDF domain		
Habits	Habits of dentists in relation to patterns of treatment and/or prescribing.	The habits of dentists relating to antibiotics were identified more often by the dental nurses who work with the dentists rather than the dentists themselves. *"….the dry socket appointment... it's just what [name of dentist] usually does is erm give alvogyl and antibiotics...."* (Nurse interview) Dentists were either more aware or more comfortable sharing their habits relating to the provision of urgent dental procedures. *"I do tend to take teeth out a lot compared to some other clinicians because I do know that you know they'll struggle to find a dentist and by the time they do find one the tooth ... won't be restorable."* (Dentist interview) This factor highlighted the value of triangulating data (as per this study's approach) and the risk of relying on self-reported data (such as interviews with prescribers) when identifying factors influencing their behaviour.
	Potential target for optimising care: Increasing self-awareness through self-audit against guidelines is already included within the national dental AMS toolkit (PHE, 2016a). There may, however, be value in a whole team approach to identifying treatment habits which are not guideline congruent. For this reason, increasing accountability may be more effective with practice/team feedback rather than individual prescriber targets.	

Factor name	Descriptor	Barriers to / drivers of good practice identified
Skills TDF domain		
Patient management	Skills in patient management, diagnosis, treatment planning and consent, including eliciting concerns, interpreting the patient's description of their symptoms, managing anxious patients, managing expectations, managing uncertainty and avoiding confrontation. Negotiation, persuasion and education. Communication skills, including using images (radiographs & photographs) and test results as communication tools.	The analysis highlighted the wide range of skills required for managing patients attending urgent dental appointments. "...*managing the patient and managing the patient's expectations as well as managing the tooth*.." (Dentist interview) "…*anxious patient who doesn't have a UK dentist (international student)*."(Observation record) Flexibility of communication style to respond to different patient needs was apparent: "…*the language used was simple, down to earth and blokey - short and to the point so the language was easily accessible*." (Observation record) "*Dentist used soothing tone of voice. Nurse whispered reassurance whilst staying unobtrusive*." (Observation record) Radiographs were taken and showed to the patient in many of the appointments ".. [explained] *what xray showed with patient out of chair to see xray on pc screen*." (Observation record) "*Dentist pointed to screen - showed hole in tooth. Explained which part to treat now and which for next dentist*." (Observation record) In OOH dental clinics, it was clear that these skills were required at a higher level of proficiency, in order to gain rapport and reassure nervous patients who avoid regular dental care so as to gain consent for guideline congruent care. "*Dentist tried very hard to gain rapport - lots of eye contact - used gestures... clear explanation of findings on radiograph*...." (Observation record) "*Anxiety of patient seemed to be successfully managed - pt much calmer at the end*." (Observation record) The language barrier provided an additional layer of complexity, including the difficulty of explaining technical concepts using a telephone translation service. "...*I can't use all of the tricks of the trade that I can do with English speakers…I can't always be confident [with* a telephone interpreting service*] that the message is being passed on..."* (Dentist interview)
	Potential target for optimising care: Assisting engagement between patients and dental teams during urgent dental appointments, through use of tools to share information and decisions, including through the use of images rather than just words.	

Factor name	Descriptor	Barriers to / drivers of good practice identified
Skills TDF domain (continued)		
Running late	Skills to cope with the impact of over running appointments, including time management, team working and resilience.	Running late for appointments and having patients waiting in reception was reported by most dentists to be a source of stress. Squeezing unscheduled patients in between other scheduled appointments inevitably results in late running. Practices with a low rate of antibiotic prescribing seemed to manage this by ensuring dedicated slots each day for unscheduled patients "...*because of the way the patients are usually squeezed in it's (you know again as I said) it's a time management thing…I mean I get stressed when I'm running late generally anyway but you accommodate*." (Dentist interview) Various techniques were reported for reducing the impact of late running, including inviting the patient to return to the waiting room for thinking time whilst seeing scheduled patients. "…*sometimes [*giving patients 10 minutes back in the waiting room] *is needed erm you know because you do have to think about the people that are waiting cos they do have appointments and they are often distressed too*." (Nurse interview).
	Potential target for optimising care: Inclusion of scheduled slots of an appropriate length during each clinical session for unscheduled patients would help reduce stress experienced by members of dental teams by minimising the extent of late running due to unscheduled patients.	
Treatment skills	Skills in providing urgent procedures, including placing local anaesthetic by injection in difficult clinical situations or lancing an abscess in the presence of swelling.	None of the dentists participating in the study reported any concerns about their treatment skills to deliver urgent dental procedures. *"I'm usually fairly confident about what's going on I've got enough experience dealing with stuff that I've… it's unusual that it's something that surprises me."* (Dentist interview) As with the 'patient management' skills factor, those who had worked in OOH clinics felt that their skills for providing urgent dental treatment were at a higher level of proficiency as a result. *"I think working here [in the OOH dental clinic] has definitely improved my* [extraction] *technique."* (Dentist interview)
	Potential target for optimising care: Opportunities for early career GDPs to develop their urgent dental care skills could be a helpful way to increase the proficiency of general dentists in relation to managing conditions requiring both oral surgery and endodontic solutions as well as developing highly tuned patient management skills.	

Table 5-15 Opportunity-based factors influencing dentists treatment decisions during urgent dental appointments identified from thematic analysis of observations and follow-up interviews, arranged by Theoretical Domains Framework (TDF) domain.

Factor name	Descriptor	Barriers to / drivers of good practice identified
Environmental context & resources		
Access	Access to the right care for the right patient at the right time, including routine and specialist care (e.g. sedation) on referral. Availability of an accurate medical history. Provision of treatment over more than one appointment. Continuity of care during working hours and OOH (e.g. weekends) and/or by a single dentist. Access whilst the patient is on holiday and for patients who live remotely.	Many people in England see a dentist only if they have a dental problem. Emergency NHS dental care services are designed to stabilise conditions sufficient to keep the patient safe or relieve their pain. Not everyone has access to the routine care required to stop them returning. *".. it's difficult for us to guarantee anything. It could flare up in days or weeks or months... that's why we recommend finding a dentist straight away... there's not anything else we can do."* (Dentist interview) Difficulties accessing routine care was a frustration for both patients and dentists delivering OOH care. *"…might not have matched the patient's expectations - she wanted to be referred to a regular dentist in {specific area of the city} and seemed to want a more thorough and permanent treatment today."* (Observation record) *"After the appointment, the dentist explained his frustration at the lack of options for patients like this one - not able to access NHS dental care - no one 'taking on' patients in {name of city} - possibly a 6 month waiting list leaving this patient with few options."* (Observation record) Access to accurate patient information during urgent dental appointments influenced treatment provided. Relying on patient reporting of their medical history was a safety risk identified by the dentists when planning operative dental procedures such as extractions. *"It's just they don't tell you stuff [in their medical history] and then later they say 'Oh, I thought you didn't need to know that!'* (Dentist interview)
	Potential target for optimising care: Urgent care commissioning and access to electronic health records needs addressing by NHS.	

Factor name	Descriptor	Barriers to / drivers of good practice identified
Environmental context & resources (continued)		
Competing demands	Priority given to ensuring sufficient time to treat unscheduled patients in accordance with guidelines and other clinical requirements e.g. record keeping. Practice/clinic approach to dealing with urgent appointments (e.g. daily slots of defined length kept free, ability of team to flex time to meet need, squeezing patients in between routine patients etc). Impact of running late (e.g. due to unscheduled patients or the dentist arriving late for the clinic). Workload impact on competing demands due to shortage of dentists and dental nurses associated with staff turnover, illness, maternity or annual leave.	Most of the dentists and dental nurses reported 15-20 minute slots as standard. Some said that slots of 10 minutes or less made it difficult to do anything other than prescribe antibiotics. *"If someone's been booked in literally for a 5 minute appointment because they need to be seen…the appointment isn't long enough, [the dentist] will give antibiotics instead."* (Nurse interview) When short staffed, additional demands were felt by dentists and dental nurses continuing to provide care. *"…for the last year there has been intermittent locum cover …rather than just my own list … I've got 2 lists worth of emergencies…"* (Dentist interview) One of the observers in an OOH clinic noted that one dentist was multitasking in order to manage the impact of short timeslots. *"Dentist mostly at computer screen typing* ... [Antibiotics] *needed to reduce swelling in order to perform multiple extractions...Not enough time for* [thorough] *reassurance and explanations regarding the cause of the difficulties and when to go to casualty/A&E if infection got worse..."* (Observation record)
	Potential target for optimising care: Further research to identify the appropriate length of slots for urgent dental care and enforceable contract terms which ensure sufficient dedicated urgent appointment slots are available in each area – through a combination of routine and out of hours dental care services.	

Factor name	Descriptor	Barriers to / drivers of good practice identified
Environmental context & resources (continued)		
Healthcare context	Healthcare system context in relation to the delivery of urgent dental care, including drug prescribing/dispensing processes and availability of antibiotics from outside of the healthcare system.	Providing urgent dental care to patients who are in pain, often anxious about treatment, during unscheduled appointments and in an unfamiliar setting late at night (in the case of OOH care) can be an uncomfortable situation. "[In the OOH waiting room] *there's often a lot of people around. Sometimes there are crying children, people that are upset or distressed ... Sometimes I think that can influence how a patient comes in the surgery... And they're all desperate to be seen."* (Nurse interview) Dental prescribing of drugs to NHS patients must be undertaken using hard copy FP10D forms. Failure of the reception team to validate them using the dental practice stamp was highlighted as a source of tension with patients and pharmacists. "…*they all walk out without getting it stamped... find out it needed to be stamped and get really upset about it...."* (Dentist interview) Access to drugs without seeing a clinician (e.g. on-line, from left-overs in their medicine cabinet/from friends or through illicit sources) was highlighted as influencing urgent care. "*I'd notice a lot of my patients were actually taking antibiotics that they'd just bought in corner shops."* (Dentist interview)
	Potential target for optimising care: Overhaul of dental prescribing processes, including introduction of e-prescribing and/or a way of printing out prescriptions which would avoid the need for reception teams to stamp prescriptions.	

Factor name	Descriptor	Barriers to / drivers of good practice identified
Social influences TDF domain		
Patient influence	Influence of patients including: dentist's perceptions about patient expectations/demands for particular treatment types e.g. antibiotics; sharing decision making and obtaining valid consent for operative dental procedures; and dealing with patients who frequently fail to attend routine appointments. More detail about the 'patient influence' is in 5.5.3.2.	All dentists reported patients requesting antibiotics and this was observed during the study. *"*Patient*: Can I have some antibiotics?"* (Appointment transcript) Whilst some dentists reported some patients being content when reassured antibiotics were not needed, all reported it being a difficult discussion at times. "Patient: ... [I've] *been given amoxicillin before and that's been twice now*... Dentist: ...*there's absolutely no indication to give you that*. Patient: *I was actually given it last time I was here...* Dentist: ...*Antibiotics will make no difference in this case... So I can* [list of all options] Patient: *Erm, I don't really want that tooth out to be honest*.... " (Appointment transcript) Patients shared a range of reasons for their desire for antibiotics, including delaying extraction until psychologically ready or as a quick fix so as to minimise the disruption to their life. *"'I'm 55 - give me 'em! Give me the painkillers and give me the antibiotics. Let's get going 'ere. I can get back to work then!"* (Patient interview). Details of 19 factors identified from the patient perspective are detailed in Table 5-19.
	Potential target for optimising care: Managing patient expectations for antibiotics by providing resources for use by dental teams before and during urgent dental appointments. Breaking the association in people's minds that antibiotics are a quick fix for toothache.	
Peers & colleagues	Influence of peers and other colleagues, relating to: dental nurse & reception influence (including time management); relationship with dentists or doctors treating the same patient (including professional courtesy to avoid encroaching / territorialism); different treatment options offered by different dentist; and utility of peer support/second opinions when dealing with difficult situations.	Some dentists reported the impact of advice other clinicians have given (or appear to have given) e.g. routine use of antibiotics by some dentists in urgent care or by GPs for toothache. *"…tooth has been opened and dressed by a different dentist erm but it's not really a restorable tooth. And that's when it becomes a bit tricky … it needs to come out without making the other dentist look bad as well."* (Dentist interview) Some dentists also reported that colleagues may attempt to influence them to use antibiotics as a way of managing time (see 'professional role) e.g. dental nurses. *"You want it incised and drained and it's getting close to home time and the nurse is getting a bit restless… I think the nurse can have a bigger effect than we imagine…It's silent body language isn't it sometimes."* (Dentist interview)
	Potential target for optimising care: Further research to understand the influence of peers and colleagues would be helpful, including extending it to encompass the whole dental team (including workforce development for those who are non-clinical yet are responsible for managing patient relationships and supporting dentists) as well as exploring opportunities for interdisciplinary primary healthcare wide research aimed at delivering safe, joined up care for patients.	

Table 5-16 Motivation-based factors influencing dentists treatment decisions during urgent dental appointments identified from thematic analysis of observations and follow-up interviews, arranged by Theoretical Domains Framework (TDF) domain.

Factor name	Descriptor	Barriers to / drivers of good practice identified
Beliefs about capabilities TDF domain		
Planning & consent	Belief about ability to plan treatment and gain consent during urgent appointments, including 'do nothing' options and managing anxious/phobic patients.	All dentists were comfortable providing patients with treatment plan options and discussing their relative merits as part of the consent process. However, if patients declined to consent to one of those options, only some of the dentists felt comfortable if the patient declined any of the options. *"...if the tooth is so badly decayed and necrotic [that] it just needs taking out* [and] *if they decline it, you just refuse treatment."* (Dentist interview) Some dentists felt that allowing a patient to leave without any treatment was contrary to their professional role. These dentists often reported prescribing antibiotics to avoid doing nothing. *"I can't refuse to give antibiotics if he's in pain."* (Dentist interview)
	Potential target for optimising care: Developing strategies for dealing with patients who decline dental procedures may help, such as advice on safety netting for patients and analgesia options.	
Procedure possible	Dentist's belief about whether it is possible to provide treatment (due to issues other than relating to their skillset) during urgent appointments, including the ability to achieve adequate local anaesthesia, manage a non-vital tooth without local anaesthesia and/or to provide operative treatment (in accordance with guidelines) to dentally phobic patients without sedation.	Some dentists shared practical ways in which they manage urgent dental care patients which may not always be included in official guidance or text books. For example, opening & dressing a non-vital tooth without local anaesthesia can be a pain-free and quick approach, including for patients who are phobic of needles and preferred to be treated without their use. *"I mean if you've got an abscess and you can't inject into it and you open it up and the pus comes out you can see the relief in the patients face immediately... "* (Dentist interview) Some of the dentists (generally the most recently qualified dentists) were not aware of this treatment option. *"If they're phobic there's, they're saying 'There's no way erm you're numbing me up' erm which, therefore, I can't really erm say incise & drain or take the tooth out which might be needed to solve the problem.."* (Dentist interview)
	Potential target for optimising care: Facilitating dentists to share experience and stories about ways to manage urgent dental conditions in accordance with guidance, using practical techniques which go beyond textbooks.	

Beliefs about consequences TDF domain		
Accountability	Dentist feels like they are held accountable for their individual treatment patterns.	Some dentists reported receiving individualised feedback about their prescribing rates. Knowing that those with high prescribing rates would be challenged clearly influenced behaviour. *"I must say since* [the OOH service] *started publishing those results* [about individual prescriber use of antibiotics] *I have had them in the back of my mind when I'm dealing with patients. It is interesting because I'm now a little bit more thorough when I'm trying to persuade patients that antibiotics are not the best option."* (Dentist interview) The policy of the corporate provider which participated in the study was for dental nurses and practice managers to be involved with data collection about prescribing and subsequent audit. *"Obviously every prescription we write is written down by the nurse to say which dentist prescribed it and what was prescribed. So they do monitor it."* (Dentist interview)
	Potential target for optimising care: Monitoring and feedback seems to work well already within some provider organisations. The awareness of sanctions for high prescribing seem to be particularly effective at changing behaviour. As per the 'habit' factor, monitoring and feedback to dental teams rather than individual dentists may be more effective at reducing unnecessary use of antibiotics. Feedback to prescribers is already strongly advised by the Health & Social Care Act 2008 Code of Practice on the Prevention and Control of Infections (DH, 2015). and ensuring compliance with the Code fits within the remit of the CQC. Incentivisation of all primary care dental provider organisations in England to meet these requirements could be effected through CQC inspections checking that processes are in place and being used locally. Further incentives for NHS dental providers could be effected through their dental contract, although this would be reliant upon the availability of high-quality data (see Chapter 4).	

Beliefs about consequences TDF domain (continued)		
Antibiotic beliefs	Dentist's level of personal responsibility towards antibiotics, including blaming others for misuse of antibiotics and belief about the level of risk associated with antibiotic use.	Some dentists believe that antibiotics have few risks for the individual patient and that antibiotics help patients suffering toothache. Their motivation for giving antibiotics in these circumstances is their perception that their patient's needs are more important than the problem for society of antibiotic resistance which many saw as inevitable, irrespective of their personal actions. *"'I'll write out a prescription for you, just in case" which is completely what you're not supposed to do but actually I'm thinking of the patient...If it's significant that it's keeping them up at night then I will probably give them."* (Dentist interview) By contrast, some dentists expressed significant concerns about the risk to their patients (and indirectly to themselves) from adverse outcomes to antibiotics, which motivated them to avoid prescribing antibiotics unless necessary for treatment of a severe infection. "[Antibiotics] *wouldn't have been any benefit to him. So imagine if he'd have developed an allergic reaction and I dunno died or something bad had happened…You'd feel guilty forever inside."* (Dentist interview)
	Potential target for optimising care: Personalisation of the risks of antibiotic use (linked to 'antibiotic knowledge' and 'risk perception') as they relate to patient safety rather than public health.	
Efficacy of treatment	Beliefs about the efficacy of different treatment options, including: ability of antibiotics versus other approach/procedure to resolve conditions.	All of the dentists recognised that dental procedures rather than antibiotics were indicated by guidance for treating most acute dental problems. Some dentists saw antibiotics as a shortcut for resolving symptoms quickly rather than addressing the cause of the problem. *"...metronidazole for pericoronitis can work wonders very quickly can't it."* (Dentist interview) Some dentists seemed to hope that antibiotics might be an effective treatment for managing urgent patients whilst they waited until another appointment to address the cause. *"For situations which need extraction or a root canal treatment but the patient is phobic then I am a bit more worried that antibiotics might not do anything."* (Dentist interview) By contrast other dentists were dismissive of dentists who rely heavily on antibiotics rather than taking the time to perform dental procedures during urgent dental appointments. *"I've heard dentists saying that you know, 'Oh I didn't have time to open and dress it. I gave them antibiotics.' But we all know that it doesn't work."* (Dentist interview)
	Potential target for optimising care: There is a risk that targeting this factor could provide dentists with the opportunity to learn about the efficacy of antibiotics as a short cut. For this reason (as with the 'feedback loops' factor) this factor has not been identified as a target for optimising care.	

<table>
<tr><th colspan="3">Beliefs about consequences TDF domain (continued)</th></tr>
<tr><td rowspan="2">Financial burden</td><td>Beliefs about financial burden on patients, including ability to pay for the definitive treatment plan to restore oral function and appearance.</td><td>The cost of NHS urgent dental care appointments was not seen as a financial burden on patients. However, the cost of definitive treatment, for example to fill spaces left by emergency extractions, was mentioned by a number of dentists as influencing discussion with the patient about treatment options during urgent dental appointments.

"[Between patients, the dentist] talked about the cost of dental treatments not covered by the NHS. [The dentist] seemed angry about this on behalf of the patients." (Observation record)

Some dentists also discussed the impact of the cost of definitive private treatment options on urgent NHS dental care. For example, patients may delay extractions until absolutely necessary in order to delay paying for dental implant placement.

"He knew then there would be another implant coming and he's got to pay for it. So he tried to keep them as long as - erm - so I said take the antibiotics but then it's time for it to come out." (Dentist interview)</td></tr>
<tr><td colspan="2">Potential target for optimising care: Discussing the financial burden of follow-up definitive treatment with patients is a part of the shared decision making process and essential element of the process for gaining informed consent. The best way to support a patient to make such an informed decision during a short urgent dental appointment and whilst in severe pain and/or with high levels of anxiety is an area for future research.</td></tr>
</table>

Beliefs about consequences TDF domain (continued)		
Guidance-practice gap	Gap between guidance and clinical practice, including dentists' concerns about the application of national guidelines to specific clinical encounters and belief about whether their clinical practice (such as delayed prescribing) adheres to relevant dental guidance.	As identified in 'feedback loop' and 'treatment efficacy', some dentists preferred not to follow guidance and reported that antibiotics work well to manage patients/address symptoms so that definitive care could be provided at a subsequent, scheduled appointment. *"He had an infection at the time so she prescribed antibiotics so that could settle before we go ahead with the extraction.* " (Nurse interview) *"The key factor behind today's decision to prescribe antibiotics seemed to be the need to reduce swelling in order to perform multiple extractions. However as this patient cannot tolerate penicillin a 'second rate' antibiotic had to be prescribed - possibly leading to further infection and a trip to A&E for the patient*". (Observation record) Mixed views were expressed about NHSE's slogan 'Antibiotics Don't Cure Toothache.' *"Hits the nail on the head!"* (Dentist interview) *"Bollocks! It's not true. They sometimes do."* (Dentist interview) Back-up (delayed) prescribing was identified as a gap between guidance and practice. Whilst it is advocated when clinicians are unsure about the nature of the infection, this is rarely the case for dentists, who have everything necessary to diagnose and treat infections without the need for back-up prescribing. Some dentists reported using this approach often relating to 'just-in-case' a condition flares up over a holiday period *"That [extraction] was really rough…a prime candidate. Easter weekend and I'm on holiday next week. Then I might go – 'I'll write a prescription for you in case' which is completely what you're not supposed to do."* (Dentist interview)
	Potential target for optimising care: Guidance relating to the use of back-up/delayed prescribing in dentistry is recommended.	

Beliefs about consequences TDF domain (continued)		
Lifetime impact	Belief about the consequences that providing a dental procedure (such as extraction of the problematic tooth) will have on the patient's overall lifetime health and wellbeing.	Most dentists reported being concerned about the long-term impact of an irreversible dental procedure provided during an urgent dental appointment on a patient's quality of life. This incorporated concerns about anticipatory regret which might be experienced by a patient once they are no longer in pain and issues around the value that dentists place on retaining a patient's teeth (which is sometimes different to the value that the patient themselves places on retaining their own teeth). *"When you are in a lot of pain you want the pain to go and don't think about future consequences. So I think I sometimes worry that patients when they are out of pain and once they have calmed down will then worry about this gap that possibly will not be able to be replaced because they don't have a dentist."* (Dentist interview)
	Potential target for optimising care: Linked closely to the 'financial burden' and 'access' factors, 'lifetime impact' associated with urgent dental treatment is an issue which warrants further research to understand the issues of shared decision making and informed consent during urgent appointments.	
Patient satisfaction	Belief about patient satisfaction, including: impact of failing to meet patient expectations; impact of repeat visits; and failure to relieve symptoms.	Patient satisfaction was mentioned frequently, especially by dentists working in GDP where the enduring nature of the transactional relationship is advantageous to supporting a successful dental business. *"...any other sort of erm queries that the patient really wasn't happy, then we'd try and fit them in generally on the day..."* (Dentist interview) Prescribing antibiotics when requested by a patient rather than risking conflict from a failure to meet the patient's request was described by some as a strategy to maintain patient satisfaction. *"I would feel uncomfortable and probably just give them antibiotics just to keep them happy."* (Dentist interview)
	Potential target for optimising care: Strategies to manage patient expectations with respect to availability of urgent dental appointments and also appropriateness/necessity of antibiotics for treating acute dental problems.	

Beliefs about consequences TDF domain (continued)		
Risk perception	Beliefs about risks when managing the patient's condition, including: pain during or after provision of a procedure; failure of (or inability to complete) an operative procedure; worsening of the condition; or medicolegal complaint.	Dentists displayed different perceptions of risk, including medicolegal risks to themselves. "[Studying for a Masters in Law] *totally changes your perspective as a practitioner. Like, completely and totally and utterly... And I'm always thinking, 'Do you know what? The best thing is to imagine that someone is recording you.'"* (Dentist interview) They also had different perceptions about the risks of urgent dental procedures and how they share them with patients as part of the process of gaining informed consent. *"I'll normally say 'There's always a risk that this might cause some extra pain or it might not settle.'"* (Dentist interview) None of the dentists reported explaining the potential risks of antibiotics to patients when deciding whether to prescribe them. However, one dentist reported including safety netting advice relating to antibiotics in the practice's standard post-operative instructions for patients...
	Potential target for optimising care: Resources to support dentists explaining the potential benefits and risks of antibiotics as part of the shared decision process. Also resources for providing safety netting advice for all patients given a prescription for antibiotics.	

Beliefs about consequences TDF domain (continued)		
Workload	Belief about impact on workload, including time taken to: diagnose/explain/gain informed consent/deliver treatment options or refer to a specialist service.	Many of the dentists reported that it was quicker to prescribe antibiotics than to undertake dental procedures. Some went on to share that prescribing antibiotics was a strategy which they sometimes used to manage their workload, include when 'running late'. *"I guess that [prescribing antibiotics] is quicker…short appointments… So they are useful to use when needed."* (Dentist interview) A mismatch between the amount of time provided for urgent dental appointments and the time felt necessary to provide appropriate, safe care for patients with acute dental conditions was highlighted by some of the dentists. *"It's very difficult with a new patient* [who is attending for an urgent appointment] *to diagnose them and treat them in a quarter of an hour slot. Erm it is totally unrealistic isn't it?"* (Dentist interview) Some dentists referred to the use of antibiotics as a shortcut. *"[*If] *you've just given antibiotics because you know that can keep the patient quiet then you've cut a corner, in my opinion."* (Dentist interview)
	Potential target for optimising care: Ensuring sufficient time for dentists to provide urgent dental care. Further research may be required to identify what constitutes sufficient time for urgent dental appointments in different dental settings and also how best to implement this so that those dentists using antibiotics as a short cut change their behaviour rather than using the additional time for some other purpose.	
Emotion TDF domain		
Conflict	Fear of conflict with patient due to dissatisfaction and subsequent loss of the patient to the practice.	Encompassing the emotional component of the 'patient satisfaction' factors, it was clear from the dentists that failure to meet patient expectations was associated with a general fear of medicolegal complaint or loss of the patient to the practice. *"...you just kind of worry that ... they may even make a complaint. Because sometimes they don't understand. You're saying they need to find a dentist and have it completed. And they might make a complaint saying that they had a filling done and it's hurting again, because they haven't fully understood."* (Dentist interview)
	Potential target for optimising care: No examples of good practice in relation to managing the emotional burden of fear on dentists were identified during the study. Future research on the emotional well-being of the dental workforce is indicated.	

Emotion TDF domain (continued)		
Fear of outcome	Fear about adverse outcomes, including anxiety about making a mistake and the prospect of serious complications if patients with symptoms go without antibiotics.	Encompassing the emotional component of the 'efficacy of options' and 'risk perception' factors, it was clear that dentists find management of risks an emotionally task. *"You always worry in the back of your mind whether they are going to be ok....The swelling could spread to the eye or may encroach under the jaw and to the neck and affect the breathing and swallow. Effectively it could cause death."* (Dentist interview) Outcomes which caused dentists emotional distress also related to the unknown ability of patients who had not been seen before by the dentist to tolerate treatment. *"You just don't know how [patients in the OOH setting] are going to react [to dental procedures]. I'm very, very wary."* (Dentist interview)
	Potential target for optimising care: No examples of good practice in relation to managing the emotional burden of fear on dentists were identified during the study. Future research of this important issue for the emotional well-being of the dental workforce is indicated.	
Feelings about decisions	Feeling about the appointment and decisions, including frustration at lack of consent for appropriate treatment and positive or negative emotions related to delivering treatment.	Encompassing the emotional component of the 'planning & consent' factor, many of the dentists expressed feelings of frustration and helplessness when patients declined guideline congruent treatment. *"It's frustrating more than anything. I mean it's the patient's loss* [that they decline the indicated dental procedure] *but it is just frustrating that's all."* (Dentist interview) One dentist provided an example of a positive emotion related to the provision of an urgent dental procedure rather than antibiotics for a dental infection. *"When you get something* [like pus coming out of a root canal] *that's fairly dramatic, it's quite entertaining."* (Dentist interview)
	Potential target for optimising care: No examples of good practice in relation to managing the emotional burden of frustration on dentists were identified during the study. Future research of this important issue for the emotional well-being of the dental workforce is indicated. Building on the positive emotions relating to draining an infected root canal without antibiotics may be a useful component of interventions aimed at motivating dentists to provide dental procedures rather than antibiotic prescriptions for dental infections.	

Goals TDF domain		
Fix the problem	Goal for urgent dental appointments is to fix the patient's problem: symptomatic relief and/or preventing the problem returning.	Initially, all of the dentists reported resolution of pain as their aim for urgent dental appointments. The similarity of wording used by all of the dentists interviewed suggests that this was a mantra learned early during their dental education. *"To get them out of pain."* (Dentist interview) Some dentists, especially those working in OOH clinics, went on to clarify their aim was not just symptom resolution but also to prevent the patient experiencing dental pain in the future *"My personal goal is if the patient has arrived in pain...to get them out of pain and to provide them with enough information such as they don't get back into the same situation."* (Dentist interview) Two also dentists identified a more fundamental goals of treatment (see 'patient safety').
	Potential target for optimising care: Developing tools to refocus the provision of urgent dental care towards patient safety and an understanding of the patient's perspective of the problem which needs fixing. Aligning the undergraduate and dental foundation training curriculum with this new emphasis for urgent dental care.	
Patient safety	Patient safety identified as a goal of treatment.	Upon reflection, after initially stating that pain resolution was the goal of urgent dental care, some dentists reported patient safety as their primary goal. *"My first goal is to make sure they're not in danger."* (Dentist interview) The importance of patient safety was highlighted by one dentist who highlighted the risk associated with failure of urgent dental treatment to arrest the spread of dental infections. *"You're providing a service which you know is effectively saving lives….patients come in with a massive facial swelling, it could become quite severe and quite serious - and you feel like you're making a difference."* (Dentist interview)
	Potential target for optimising care: Refocusing the curricula for undergraduate teaching and early career development of general dentists for urgent dental care towards patient safety and an understanding of the patient's perspective of the problem which needs fixing. Developing new tools for use during urgent appointments would facilitate embedding this new emphasis across the profession.	

Goals TDF domain (continued)		
Relationship	Desire to build/maintain a good dentist-patient relationship.	'Relationship' as a goal is linked to the 'patient satisfaction' factor, especially for dentists working in general dental practice where maintaining an enduring and good relationship with patient is desirable from a business as well as medicolegal perspective. *"...don't feel like it is a practice-builder…we will deal with the definitive treatment later on so I'm keeping my patients happy...I don't wanna break down that relationship."* (Dentist interview)
	Potential target for optimising care: As per the 'patient satisfaction' factor, development of tools to managing patient expectations with respect to the appropriateness/necessity of antibiotics for treating acute dental problems.	
Professional role & identity TDF domain		
Professional role	Influence of professional role on managing urgent appointments, including: what is means to care for patients; and feeling 'morally obliged' to offer something tangible (to 'do nothing' is difficult).	Dentists reported a range of different philosophies relating to urgent dental care and in particular to the use of antibiotics to manage patients and acute dental condition. "[The practice owner] *is very much against antibiotics. He will not prescribe them unless they really, really need to be prescribed. Whereas I think I'm not as kind of you know as stuck to that as he is."* (Dentist interview) Clinicians develop their personal philosophy to providing care early in their careers (as identified by Gabbay & Le May's exposition on mindlines) (Ihimekpen and Thompson, 2018). Evidence that foundation dentists in their year after graduation felt inexperienced at providing urgent dental care and that they were introduced to using antibiotics as a shortcut was highlighted by both current and recent foundation dentists. "E*verybody pushes antibiotics. They know it's wrong but they push it…. The* [foundation dental] *trainers*..[say] *"Don't have time! Don't have time!" I've heard it from so many* [foundation dentists]…..*On a study day* [about prescribing] *we were actually encouraged to challenge our trainers if we didn't agree* [but colleagues felt*]... it wasn't going to happen."* (Dentist interview)
	Potential target for optimising care: Ensuring an appropriate environment during foundation training for learning about providing urgent dental care – either in practice or associated in some ways to an OOH service, Linked to 'patient management', 'treatment skills', 'competing demands' and 'workload', one potential target could be ring-fenced timeslots required each day/week for foundation dentists to ensure they develop their skills to provide urgent dental procedures rather than prescriptions wherever possible.	

Reinforcement TDF domain		
Incentives	Incentives for and against certain treatment options, including the impact of a '*time is money'* business approach on unscheduled/urgent appointments and the financial risk of losing dissatisfied patients.	*"...time is money....there is a big emphasis on how much money things have attached to them. So if you follow the money then you'll often see that behaviours conform to the money rather than conform to er what the textbook says."* (Dentist interview) *"I think in this emergency setting [the online referral system] can be a bit off putting. Erm I know some dentists try to avoid using it….because they know it'll take time."* (Dentist interview)
	Potential target for optimising care: In order to incentivise high-quality dental care it is necessary to be able to measure it in order to know when it has been achieved. This is an area of on-going current research both in relation to dental prescribing data (see Chapter 4) and assessing quality in primary dental care (Byrne et al., 2018).	

5.5.3.1.1 GDP vs OOH – comparing settings

Comparison of the dentist-related factors between GDP and OOH settings found 17 factors where their influences on treatment of patients with acute dental conditions differed. These were generally related to the enduring nature of the dentist-patient relationship in GDP compared to the transient nature in OOH. More details of how the dentist-related factors differed between NHS GDP and OOH dental clinics in England are presented in Table 5-17.

More generally, dentists and dental nurses working routinely in the OOH setting seemed to have become desensitised to the context within which they were delivering care. None of the dentists noted anything particularly stressful about the OOH working environment. Rather they related stress to competing demands and concerns about litigation. By contrast, a dental nurse who had recently started working in the OOH clinic provided an interesting perspective, likening it to an accident and emergency department:

> *"It's like being in A&E - the dentistry's A&E. There's always a mixed bag of people* [in the waiting room] *having different problems. Erm. They're all feeling different things. They've got different pressures. They've all got their own problems going on in their lives and they're all desperate to be seen. And it's a massive influence on what the appointment holds."* (Nurse interview)

Similarly one of the OOH observers reflected afterwards that it felt like a war zone. Reflection on emotionally relevant situations may be an important element of a strategy to improve the provision of treatment during urgent dental appointments as well as on the health & wellbeing on members of the dental workforce. (Chapman, Helen R et al., 2015).

Table 5-17 Comparing factors associated with urgent dental treatment between NHS GDP and OOH dental clinics in England

Factor	Issues relating to General Dental Practices	Issues relating to Out-of-Hours Dental Clinics
Access	Good access to care for regular patients so able to undertake 'watchful waiting' before committing patient to irreversible procedure. *"...you think it'll settle, they come back six months later and it's settled. They've forgotten they had a problem and you've not ploughed in to get drainage. You've not done this that and the other."* (Dentist interview)	Poor access to routine care for those without a dentist leading to a cycle of re-attendance in OOH for temporary rather than definitive treatment. *"* Third time [the patient] *had emergency treatment* [for this]...*Dentist knew he* [could] *only offer first part of treatment to get out of pain today and do a temp filling."* (Observation record)
Accountability	Audit undertaken in some practices but no sanctions reported for high or inappropriate use. *"We write all our scripts down and then we audit I think twice a year*…[I log] *the date, the prescription number, the patient and what was prescribed."* (Nurse interview)	Regular audit, monitoring and feedback by service managers to the whole dental team. *"We are given reports...if more than 10%.. it comes up as a red flag… which goes to management group…I feel a little bit intimidated by them!'"* (Dentist interview)
Competing demands	Balancing routine and unscheduled care. Not all practices provide dedicated slots. *"There's no allocated slots each day or anything….We will tell people to come and sit and wait [and] we will squeeze them in between other patients so that we're providing care for them as soon as possible."* (Dentist interview)	All patients get a dedicated slot – even when patients are double booked, slots are still 10 minutes. *"...they're generally 20 minutes for adults I believe, sometimes they're 10 minutes if they've been squeezed in a bit."* (Nurse interview)
Fear of outcome	Concern about hurting patients during treatment. *"My worst nightmare is the anaesthetic is not working and anything you touch or try to go in that pulp the patient feels it."* (Dentist interview)	No emotion about delivering treatment reported or identified.
Feedback loop	Follow-up available but patients often fail to attend when symptoms resolve. Reception sometimes calls them to check. *"...if they don't have to have treatment done sometimes they fail the appointment because once ... their problem is sorted then they tend to cancel or fail."* (Dentist interview)	Follow-up to review patients or complete their treatment is not generally available. *"You always worry in the back of your mind whether they are going to be OK."* (Dentist interview)

Factor	Issues relating to General Dental Practices	Issues relating to Out-of-Hours Dental Clinics
Fix the problem	Goal was to keep the tooth whenever possible. *"I'm trying to save as many teeth as I can. I am big believer in that."* (Dentist interview)	Goal included to stop the patient needing to return again with the same problem. *"…my personal goal. It's actually to make sure that the patient doesn't return again."* (Dentist interview)
Healthcare context	None recalled 'Antibiotics Don't Cure Toothache' in their GDP. *"I'm pretty sure I've seen* [the Antibiotics Don't Cure Toothache] *posters so like at GP surgeries and things like that."* (Dentist interview) Dental teams used to working closely together, including beyond direct patient care. *"We're in quite a good routine as we work together all the time*." (Nurse interview)	Antibiotics Don't Cure Toothache posters and leaflets were in use in the OOH dental clinic. "*I think I've seen the posters around in* [name of urgent dental clinic]." (Dentist interview) OOH teams come together only to deliver patient care. *"We're like ships passing in the night, We don't really speak to them even the staff who we work …[OOH] is very intense when you finish you go home."* Dentist interview).
Incentives	Dentists are paid a flat NHS rate per urgent patient irrespective of treatment provided or time. Good potential for further fees relating to follow-up definitive care. *"...he's a patient I have treated loads. I've done implants for him* [privately] *and I kind of, he knows he can trust me and I can trust him…"* (Dentist interview)	Dentists are paid a sessional (hourly) rate for delivering urgent care. No follow-up treatment means no potential additional earning. *"...some dentists [in the OOH clinic] work a lot faster than others but they're still getting paid the same but they're seeing more patients..."* (Dentist interview)
Lifetime impact	Ability to provide a permanent solution over a period of time. "*If you were to extract the tooth* ... [there are] *four ways to think about doing up the gap afterwards...[1] leave the gap ... [2] a denture* [£244 NHS & ideally wait for healing 6 months after extraction*]... [3] A bridge ...[4] implants* [which are] *about £2-3,000 ... in the private sector."* (Dentist interview)	Only limited treatment options available which are often temporary measures. *"So what we will do today is not the full treatment. Ok. We can take out part of the nerve to get you out of pain. But you have to find a Dentist to finish your root canal treatment ok? If you don't find a Dentist you will get pain again or swelling."* (Dentist interview)

Patient management	Rapport quickly gained as well established dentist-patient relationships. "Dentist: *Hi. So you've been booked in with toothache today, Tell me all about it."* (Appointment transcript)	More rapport building and oral health education as dentist-patient relationship not already established and patient often not a regular dental attender. Communication difficulties included the language barrier or cultural differences, *"It was difficult to understand what the patient meant - unintelligible patches in speech…. Pt was clear about her preference for treatment but may not have fully understood what root canal treatment was due to language barrier."* (Observation record)
Peers & colleagues	Receptionists working at the same site as the dentist and having a range of patient facing roles, including triage and booking emergency appointments (including deciding on appointment length and how quickly they need to be seen). Other roles including greeting patients, advising them if the dentist is running late, booking follow-ups, and stamping any prescriptions upon departure. *"...the practice receptionist will erm sort of grade it in terms of sort of severity or urgency and then they would book it in erm sort of on the day if necessary or, depending on what it is. It could be staggered later say the day after or later in the week."* (Dentist interview)	Call centre operators for the OOH service often working at different sites to the dentist and having a limited role to book appointments into dedicated slots of predefined length. Separate receptionists employed at the same site as the dentist to greet patients, let them know if the dentist is running late, book follow-up appointments and stamp prescriptions upon departure. "[The telephone operators] *are admin staff because the purpose of the centre is not to triage the patient it's literally to call them back to book back in for an appointment...where we think an urgent appointment is required ...we have capacity for dental nurses to call back ...up to 10% of the phone calls."* (Dentist interview)
Planning & consent	Enduring relationship with patients and previous records make consent and trust over time easier. The treatment planning and consent processes may take place over a number of appointments leading up to the urgent appointment. "[It] *was a tooth that had some pain previously...We'd already discussed that this tooth's prognosis was quite poor erm previous to this appointment."* (Dentist interview)	No previous relationship or records on which to build so undertake the whole process of recording a full medical and dental history, examination, diagnosis, treatment planning and gaining consent process for each patient prior to treatment. "…*we try* [to explain the common and/or complex complications] *but whether the patient understands or not within small timeframes. I don't think they do...."* (Dentist interview)

Procedure possible	Easier for anxious patients to tolerate procedures if have built up a trusting relationship with the GDP. *"...the majority of my patients have seen me for many years and there is a relationship there that they already believe and trust me to acting in their best interest…"* (Dentist interview)	Phobic/more anxious patients less likely to be regular dental attenders and less able to tolerate treatment. *"I don't have a regular dentist. I am a phobic patient...I just wanted antibiotics...[*when I went back for the extraction] *it was so awful. I made him stop. I couldn't breathe. I was in such a state I had to get up and leave..."* (Patient interview).
Relationship	Goal to maintain enduring relationships. *"…I don't wanna lose that trust."* (Dentist interview)	Goal for patient satisfaction during individual appointment only. *"... to know that patients are satisfied and that they understand what treatment is being carried out – and just making sure that they do try and find a dentist as well because a lot of people are unsure about how to go about doing that…"* (Dentist interview)
Risk perception	Patients are at lower risk of recurring problems as they have access to a full course of definitive treatment, including prevention. *"…when people are having an emergency they come in, and I will do a full course of treatment for them….rather than just deal with the emergency."* (Dentist interview)	Concern was expressed about the risk of leaving patients with temporary treatment if they are unable to find a dentist to provide definitive treatment. *"Dentist did stress this was only temporary - patient needs follow up with own dentist."* (Observation record)
Treatment skills	Some dentists with regular patients with stable oral health and no experience working for the local dental care service are less experienced at delivering urgent dental treatment. *"Well if it's a hot pulp, you might not be able to get it numb."* (Dentist interview)	Dentists working OOH had more experience of providing urgent dental care tend to be more confident at providing urgent care especially numbing difficult teeth and for anxious patients. *"A lot of the dentists* [in the OOH clinic] *have more experience in those fields ... tend to happen a lot easier* [than in GDP]." (Nurse interview)
Workload	Time taken for the consent process was not raised by GDPs although there was a suggestion that it might be a stage which is rushed on occasions. *"If proper consent isn't taken before the extraction the patient will be very upset…. 'Oh, I'm toothless now and I could've managed it differently'..."* (Nurse interview)	Time taken for the consent process was highlighted only by OOH dentists. *"So sometimes when patients can't decide – they're sat there thinking 'Oh I don't know what to do. I might ring this person. I might ring that person…' It does become quite frustrating ...in the back of your mind, 'Oh god, we've not got much time left.'* (Dentist interview)

5.5.3.1.2 High vs low rates of antibiotic prescribing – comparing settings

Comparison of the study's results between GDPs with high and low rates of antibiotic prescribing found five factors where their influences on treatment of patients with acute dental conditions differed. These were generally related to dentists' beliefs about efficient time and patient management. Notably many of the practices with higher prescribing rates seemed to prefer a process of squeezing unscheduled patients in between routine patients, whereas the lower prescribing practices reported leaving dedicated slots in the diary for managing unscheduled patients. Whilst dentists across the study related stress levels to running late, dentists in high prescribing practices identified using antibiotics as a way of reducing that stress. Details of the differences between factors associated with treatment planning between dental practices with higher and lower rates of antibiotic prescribing are presented in Table 5-18.

Table 5-18 Comparing factors associated with urgent dental treatment between NHS GDPs with high and low antibiotic rates

Factor	Issues relating to high rate antibiotic prescribing practices	Issues relating to low rate antibiotic prescribing practices
Efficacy of treatment	Antibiotics were seen as a less stressful way of fixing the patient's presenting condition. "The patient h*as the antibiotics to calm everything down which means that when they come in next time they're less stressed because they're not in pain."* (Dentist interview)	Dental procedures were seen as a quicker way of fixing the patient's presenting condition. "Interviewer: *Which would work more quickly an extraction or antibiotics?* Dentist: *Extraction*" (Dentist interview)
Feelings about decisions	Research did not identify emotion attached to antibiotic use by dentists working in practices with high rates of antibiotic use.	Antibiotic use characterised as a source of frustration and/or pride *"I feel proud because I've not caved in and given antibiotics when I shouldn't."* (Dentist interview)
Guidance-practice gap	Practice based on the believe that antibiotics cure toothache. "[Antibiotics don't cure toothache*?]...it's not true though! That's why I'm pausing because it's not true."* (Dentist interview) Back-up (delayed) prescribing observed in practice or raised by dentists during interview.	Practice based on the believe that antibiotics do not cure toothache. *"I think the title* [Antibiotics don't cure toothache] *hits the nail on the head."* (Dentist interview) No reference to back-up prescribing in either observations or interviews.
Guidelines & Information	British National Formulary (BNF) was the main source of information mentioned. N.B. It provides guidance on the management of common conditions with drugs not treatment. (Joint Formulary Committee, 2018). *"I follow the BNF normally…you know you're not wrong with that."* (Dentist interview)	A range of treatment guidelines were mentioned. *"I normally refer straight to SDCEP guidelines… and erm a lecture from [*a UK dental school and*]...NICE guidelines on infective endocarditis..."* (Dentist interview)
Habits	Routinely prescribe antibiotics to clear up the infection before treatment at a follow-up visit. *"...while the infection is there it can take...extra numbing… a lot of the time, we will prescribe antibiotics because the infection's there and bring them back for extraction."* (Nurse interview)	Routinely provide treatment at the urgent appointment rather than antibiotics. *"..we don't give antibiotics out that often…you open a tooth and you show them treatment can be done…"* (Nurse interview)

Exploring how to reduce the stress of general dental practice, Newton et al also identified that sources of stress for dentists may be varied, including both feelings of time urgency/pressure and difficulties with patients (Newton, J. et al., 2006). The link between these issues and stress was found to be linked, in part, to be related to the dentists' career expectations. Rather than developing a complex intervention to address stress on GDP, it was proposed that a flexible approach based on the

individual needs of the practitioner, within a structured intervention framework, would be most appropriate. This framework classified potential sources of stress as:

- Demands which are unreasonable in nature or too numerous for current resource
- Reasonable demands which prove challenging as we lack one or more resource (e.g. capability, skills, equipment, staff, energy, money)
- Demands which are reasonable and sufficiently well-resourced but the allocated time determines that the proposition is challenging
- Time and resources are available but we have too few or insufficiently taxing demands (Newton, T. and Hendron, 2015).

With antibiotics being used by some as a short cut to manage lack of time and resources (Table 5-16 'workload') and the finding in Chapter 4 of high rates of inter-practice variation and inter-prescriber variation (Cope, A.L. et al., 2016b), this individually tailored approach to reducing antibiotic prescribing has been included in consideration of intervention development (see Chapter 6).

5.5.3.2 Patient-related influences

Factors from the patient perspective were identified by thematic analysis of the patient interview transcripts. As shown in Table 5-19, 19 factors were identified.
Negotiation for antibiotics was particularly interesting as this could be interpreted as demand by dentists. A number of the patients made attempts during their appointment to solicit antibiotics from dentists who were not otherwise going to offer them. In follow-up interview, one of the patients was particularly clear in explaining his strategy and thought process:

> "Patient*: I tried to push it so I did say it quite a few times just to see what they would say or if they'd actually give me any so I did keep trying to push for them because and the reasoning for that I kept giving the same reason that it did help me before."* (Patient interview).

Whilst there has been a trend in the medical literature recently to criticise clinicians for blaming patients for unnecessary prescribing of antibiotics, (Glover et al., 2019). These results show that far from being unsubstantiated, there is plenty of evidence that even when they know they are being studied, patients will still press for antibiotics. During interview another patient also shared his strategy to ensure he was prescribed antibiotics:

> "Interviewer: ...*Did you have a plan in place to make sure you got [antibiotics]?*
>
> Patient: *Oh I'd have rolled around crying on the floor. They'd have had to give me them before I left. Yeah….I'd have been 'I can't bear this!' I perhaps maybe have gone away and suffered the painkillers. But I'd have been back!"* (Patient interview).

Table 5-19 Patient-related factors associated with treatment during urgent dental appointments

Patient-related factor	Definition
Access	Ability to access routine or specialist dental care. This included length of wait for appointments/referrals e.g. sedation. Ease of access to see a GP about a dental problem compared to a dentist.
Acute condition	Patient's understanding of the causes of acute condition/symptoms
Antibiotic beliefs	Beliefs about the need for antibiotics to treat acute dental conditions before definitive procedures can be provided and/or the speed with which it will fix the problem. Alternatively some are motivated not to use them, for example due to associated risks. Some showed insight into the risks yet still desired antibiotics.
Communication/ negotiation	Patient communication/negotiation skills in relation to dental appointments, including patient recognition of constraints within which the dentist was working
Costs	Affordability & longevity of treatment - patient perception of cost effectiveness and ability to pay (including for private care such as implants as definitive treatment options to fill spaces left by urgent procedures).
Delaying tactic	Patient's aim to delay losing a tooth or extensive dental work until they believe there are no other options
Dental procedures	Patient expectation or beliefs about dental procedures, such as whether extraction or endodontics are seen as desirable or undesirable courses of action.
Engagement in consent	Ability of the patient to engage in the process of consent and sharing decisions, including capacity to take in, weigh up and use information.
Family, friends & colleagues	Patient views influenced by family, friends and colleagues about appropriate treatment (and they sometimes accompany the patient to the appointment) or legitimacy of time off work for dental problems.
Fear of worsening condition	Concern that the condition might get worse or cause a more severe problem.
Feelings about urgent dental appointments	Feelings of patients (including anxiety or phobia) with respect to urgent dental appointments (such as desire to fix the problem in a single appointment or avoidance of an operative procedure) or urgent dental treatment (such as desire for antibiotics or extraction, or avoidance of injections or endodontic treatment)
Information & advice	Sources of information and advice about dental conditions and treatment options used by patients, including the internet versus reliance on dentist.
Medicines knowledge	Knowledge about antibiotics, including the risks and benefits of antibiotics for individuals and society. Knowledge about analgesics, including use for dental conditions.
Minimise disruption	Minimise disruption to life such as arranging time off work for dental appointments or fixing the problem quickly
Plan to get antibiotics	Goal of appointment was to get antibiotics and patient stated that they had a plan as they were not going to leave without antibiotics
Previous experience	Previous experience for similar condition influenced the patient's perceived need for a particular treatment type e.g. antibiotics for pain caused by an abscess.
Stop the pain	Goal of appointment was to stop the pain
Trust in dental team	Degree of trust in the dental team, including if they have previously accepted extensive courses of treatment or if they are seeing a dentist with whom they are unfamiliar
Value placed on teeth	Degree of emotional attachment patient has to their teeth – willingness to agree to extraction.

5.5.3.2.1 Analysis of discussions about antibiotics during appointments

Antibiotics were discussed in 13 of the 16 appointment transcripts analysed and of those patients seven received an antibiotic prescription. In order to explore who initiated those discussions and the extent to which patients across the study desired antibiotics, the appointment transcripts were analysed further. The patient's desire for antibiotics was assessed by reference to the patient interview transcripts, where available. No assessment was made by the researchers about the appropriateness or necessity for antibiotics for reasons set out in section 1.3.1.

As shown in Table 5-20, four patients wanted antibiotics of which only half received them. Where antibiotics were discussed but no desire for them was directly expressed by the patient, most (7 out of 9) received antibiotics.

Table 5-20 Exploring link between patient desire and antibiotic prescribing

Discussion about antibiotics initiated by:	Number of cases	Number of antibiotics given
Patient wanted antibiotics	4	2
Patient asked about but expressed no desire for antibiotics	5	4
Dentist initiated discussion about antibiotics	4	3
No discussion about antibiotics	3	0

Analysis of the urgent dental appointment transcripts found that the some discussions were initiated by patients with direct requests:

> *"Can I have some antibiotics?"* (Appointment transcript)

Or by a patient making a statement about previous experiences of antibiotics, which may be interpreted as the opening statement in a negotiation:

> *"Basically what I've had before is like been given Amoxicillin."* (Appointment transcript)

> *"So I took my antibiotics the* [other dentist] *give me but it's returned."* (Appointment transcript)

When one of the dentists declined to prescribe antibiotics, a protracted negotiation for antibiotics ensued which resulted in the patient leaving without antibiotics and then returning the following day for an extraction. In his follow-up interview, he explained that he had been using antibiotics to delay extraction of the tooth and that he needed to

feel convinced that there were no other options before he could prepare to accept loss of his tooth:

> *"…I sort of felt disappointed because of the fact that them saying no it means that it was in a bad state and it wouldn't help at all. Erm so I did feel disappointed because of the fact that she assured me that it was all leaning across towards the tooth being taken out rather than trying to get the tooth sorted."* (Dentist interview)

In one of the cases where the patient wanted antibiotics and the dentist agreed to prescribe them, this was because the patient declined other treatment.

> *"Is there no way I can just have antibiotics and come back after Christmas and have this done and have it removed? And can I be knocked out? Because honestly I'm terrified."* (Appointment transcript)

The dentist had found capitulating to the patient request particularly frustrating as he had felt helpless to offer anything more for her so close to the festive period.

> "*It's very rare that I don't manage to convince the patients to have it out …..[but if a patient declines care] just give them antibiotics just to keep them happy: (1) to prevent a complaint and (2) to prevent any sort of subsequent swelling or infection that may take them to A&E." (Dentist interview)*

The other case where the patient requested antibiotics and the dentist prescribed them was as a back-up (delayed) prescription.

> *"At the moment it's not like a big infection so I wouldn't take antibiotics….before your appointment if you feel like the infection's coming back then start taking them."* (Appointment transcript)

Back-up prescribing is advocated when there is '*clinical uncertainty about whether a condition is self-limiting or is likely to deteriorate*' (NICE, 2016a), it is not incorporated within dental guidance as dentists have the tools readily available in clinic to diagnose whether a condition is caused by a spreading bacterial infection which would indicate their use. It is not, however, prohibited by the GDC whose standards allow deviation from guidance provided a clear rationale for doing so is included in the patient's clinical records (GDC, 2015b). Targeting the number of back-up prescriptions given could by providing clear guidance on its use may be a way of reducing antibiotic prescribing by dentists.

Alternatively, providing guidance about appropriate ways to use back-up prescribing could be a new way of informing patients that antibiotics are often not actually needed and empowering them to decide whether to take them after they have been prescribed. In doing so, this approach could reduce the amount of dental antibiotics dispensed by pharmacists or actually consumed by patients after they receive an antibiotic prescription from a dentist. As the focus of this thesis is to reduce antibiotic prescribing by dentists rather than consumption by patients, this concept will not be pursued.

5.5.3.3 Comparing influences on dentists and patients

Factors found to influence both dentists and patients were ‘access’, ‘antibiotic beliefs’ and ‘fear of outcome’/’fear of worsening condition’. In addition, skills relating to the ‘patient management’ for dentists and ‘communication/negotiation’ for patients overlapped in relation to sharing decisions and the process of consent.

A target for interventions to reduce antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments could address the beliefs about antibiotics, fears about outcomes and skills in relation to sharing decisions/consent of both dentists and patients. As identified in Table 5-15 ‘Access’, addressing ‘access’ is an issue for NHS service commissioning rather than behavioural research.

Of particular interest to the researchers was a comment by one of the patients during follow-up interview. Whilst he was well versed in the risks of antibiotics and national drive to reduce unnecessary use, he nevertheless desired antibiotics:

> *“People are trying to cut them down and I understand it like…yeah, I do.”* [Patient interview]

Further research to understand the tipping point at which different people will start wanting to avoid rather than wanting to have antibiotics would provide useful insight across healthcare.

5.6 Discussion

By identifying and contextualising factors associated with treatment for adults with acute conditions during urgent NHS dental appointments within GDP and OOH in England, this ethnographic study has provided a sound evidence base on which to develop interventions in this context. By building on the framework of factors identified from the systematic review in Chapter 3, this study showed that ethnographic research may provide valuable additional insight into behaviours than may be otherwise unavailable from studies based solely on clinician self-reporting (e.g. interviews). Using an ethnographic methods has both pros and cons; a reflection on these in relation to the doctoral research is provided below. Similarly the challenges of undertaking research in the unpredictable context of urgent dental appointments is discussed. Extending the study to cover influences on decision making during urgent dental appointments generally rather than focusing specifically on antibiotic prescribing provided wider insight into the factors influencing antibiotic prescribing. Furthermore, whilst not the focus of this study, the demographic data collected about the urgent dental appointments recruited to the study has provided insight into urgent dental care, which is discussed further.

Exploring patient influences in addition to dentist-related factors and triangulating the results between the observations and the follow-up interviews facilitated deeper insight, including the complex system of interactions at macro-, meso- and micro-levels. These results will thereby strengthen confidence for the design of evidence-based interventions aimed at optimising care (including antibiotic prescribing) for adults with acute dental conditions during urgent NHS dental appointments in England. Finally, additional limitations of the study not already covered within the earlier discussion are identified.

5.6.1 Findings and integration with other work

5.6.1.1 Insight from demographic data

Whilst this ethnographic study did not set out to focus entirely on decisions about antibiotic prescribing, it became clear during analysis that antibiotics were frequently discussed during urgent appointments. In spite of a carefully selected a mix of cases for follow-up interview in which no more than half of the patients had received antibiotics, upon analysis of the appointment transcripts it was found that over three-quarters of them included dialogue about antibiotics.

Appointments were generally shorter when an antibiotic was prescribed than where a dental procedure was undertaken. Furthermore, in GDP, it was generally quicker to prescribe an antibiotic than to ‘do nothing’ (i.e. no procedure provided). During the follow-up interviews, some of the dentists referred to prescribing an antibiotic rather than providing a dental procedure as a strategy to manage their workload when ‘running late’. This approach to managing patients and/or their conditions has been reported in a number of studies (Dempsey et al., 2014; Linder and Singer, 2003; Rodrigues et al., 2013; Newlands et al., 2016) although this study seems to be the first to characterise those differences during actual urgent dental appointments in GDP and OOH.

The median appointment length (16 minutes 34 seconds) fits with the 15-20 minute long urgent care slots reported as standard by the dentists and dental nurses during follow-up interview. Some went on to note than slots of less than 10 minutes made it difficult to do anything other than prescribe antibiotics, which also fits with the appointment length data which found the only treatment associated with a median of less than 10 minutes was antibiotic prescribing during urgent dental appointments in GDP. By contrast, the median appointment time for endodontic treatment (‘open & dress pulp’) was consistently longer than the 15-20 minutes routinely available (42 minutes 16 seconds in GDP and 25 minutes 52 seconds in OOH). In a business environment where time is money and where reimbursement for dentists from NHSE is the same irrespective of treatment provided, there is an obvious temptation for dentists

to provide antibiotics as the quickest and for some patients most desirable outcome. Further research to determine realistic appointment lengths in different settings and to explore effective approaches to incentivising the provision of dental procedures rather than antibiotics during urgent dental care is suggested in order to inform NHS contracting and commissioning of urgent dental care. Consideration of inclusion of such incentives within the on-going NHS dental contract arrangements would be desirable to ensure that dentistry is forward thinking in its approach to antibiotic stewardship.

5.6.1.2 Implications for practice / future research

For NHS dental practices and clinics providing urgent primary dental care to patients in England, the findings of this study will provide useful understanding about the influences on treatment decisions and act as a sound basis for development of interventions aimed at improving the provision of urgent dental care, including reduction in dental antibiotic prescribing.

Differences in how the factors influence treatment decisions in different contexts (GDP vs OOH settings and high vs low rate antibiotic prescribing practices) reinforce the findings of other researchers who have noted that interventions need to be designed so that they take account of clinician's varying roles and changing priorities, including when they work in different contexts (Germeni et al., 2018). By presenting the factors contextualised to urgent dental care settings and showing how they have been noted to vary between clinical cases/clinicians/clinical settings, this study provides a source of detailed information for use during the design of flexible, theory-informed interventions aimed at modifying behaviour (such as antibiotic prescribing) during urgent NHS dental appointments in GDP and OOH settings. It reflects the realist manta 'What works, for whom and in what circumstances?' or put another way 'Why does a programme work in Wigan on a wet Wednesday and why does it then fail in Truro on a thunderous Thursday?' (Pawson and Manzano-Santaella, 2012).

Understanding of the patient perspective relating to urgent dental appointments and antibiotics has been extended through this research although further research is suggested to understand specific issues, such as the tipping point at which patients stop believing that they need/stop demanding antibiotics. The ability for patients to engage with clinicians in shared decision making is currently the focus of a NICE guideline development. Having sufficient time and patients with a sufficiently high level of health literacy are two of the key elements required for shared decision making (Elwyn et al., 2012). Time for a truly shared decision, including the ability to return another day having considered the options, is not possible in relation to urgent dental appointments, where the risk of dental infection spread or leaving patients in consider

pain would be unacceptable. As also found during the study, many dental patients attending for urgent dental appointments have reduced levels of literacy generally. A strong education may be important in both navigating health care and making choices about personal health behaviours (Zimmerman et al., 2015). For these reasons, further research to explore the extent to which decisions during urgent dental appointments can be supported and shared is required.

Analysis of the factors relating to the 'skills' domain of TDF suggests that those delivering urgent dental care in the OOH setting feel that they become more proficient in their skills for providing general dentistry (not just urgent dental care). Together with the findings in the research that foundation dentists are not always being given the time or encouragement to develop their skills relating to urgent dental care, there is a clear opportunity to develop the dental workforce in relation to urgent dental care during the foundation training year. Furthermore, with the publication of a commissioning standard for Urgent Dental Care alongside the NHS Tier 2 specialties, presents the opportunity for recognition of the aspects of general dentistry which differentiate them from the other specialties. As identified during this research, the ability to use their oral surgery skills to undertake extractions or endodontic skills to open & dress a pulp as well as patient management skills to calm an anxious patient give general dental practitioners the skills to deliver care to patients with acute dental conditions which are no longer current skills for those who have entered one of the dental specialties. A further differentiator identified during the research is the need for general dentists to maintain an enduring and trusting relationship with patients in order to run a successful dental practice, compared to specialists who generally see patients to provide specific treatments.

Inequality between care available for those people with access to a regular dentist and those who attend only for urgent dental appointments was noted. Lack of access to definitive treatment for this latter group represents a patient safety issue for those who enter the cycle of temporary treatment (including repeated antibiotic use) as found in the study. For those receiving definitive treatment in the OOH setting, the inequality in quality of life may be significant if the ability to function normally (eat, speak and smile) afterwards was impaired as a result of the treatment provided (for example, extraction was of a front tooth). The March 2018 GP Patient Survey, which covered access to NHS dental services, showed that 78% of people who had not been to the practice before reported success in getting an appointment with an NHS dentist and in some areas that figure was below 60% (NHSE, 2018a). Younger adults and ethnic minorities also reported a lower success rate. With these vulnerable groups being subject to the inequity of care found between those with a regular dentist and those who attend only urgent appointments, the results suggest a widening of the oral health inequalities for

vulnerable patients. Further research to evaluate the impact of the recently published Urgent Dental Care commissioning standard should be planned in order to ensure narrowing of this inequality gap (NHSE, 2019a).

Clinical academics may find useful the successful mitigation strategies (section 5.4.5.1) which were designed and used during actual clinical encounters and follow-up interviews. When an allegation of poor quality treatment was against one of the participating dentists was received by the researcher during one of the follow-up interviews, the process for raising concerns in the project protocol was implemented. This involved signposting the participant to the relevant dental practice's complaints process. Furthermore, whilst the researcher was able to provide feedback to individual dentists in a developmental way about the pattern of treatments provided across their recruited patient participants and about the two cases they had listened to on the audio-recording, no need to whistle blow due to patterns of inappropriate behaviour were identified.

5.6.1.3 Themes from data synthesis & interpretation

Analysis of the study transcripts found a wide range of dentist and patient-related factors which influence the provision of treatment to adults presenting in primary NHS dental care with acute dental problems. The factors were found at the level of individual dentists (micro-level e.g. treatment skills), GDP/OOH dental clinic (meso-level e.g. incentives) and wider socio-economic context (macro-level e.g. access for people to routine and urgent dental care). For a complex intervention to tackle inappropriate treatment during urgent dental appointments, an awareness of the factors at each of these levels is really important (Brocklehurst, P.R. et al., 2019).

The complexity of the urgent dental care context is further highlighted by exploration of the multiple perspectives found within many of the factors. These differences within a single factor may encompass both barriers to and drivers of the behaviour, depending on how they work or are experienced by individuals in the particular context. This concept may be illustrated with a simple yet fundamental example relating to dentist's beliefs about antibiotics. A polarisation of views was expressed among the dentists and dental nurses interviewed about the NHSE slogan 'Antibiotics Don't Cure Toothache'. Reasons for these differences are likely related to the way in which they were initially trained and have added incrementally to their knowledge through experience and continuing professional development (Gabbay and le May, 2010). Another example underpinning the 'guidance-practice gap' factor is the preference for dentists to seek advice from trusted colleagues rather than published guidelines. A systematic review has reported a cautious approach by dentists in high-income countries to basing clinical decisions on official sources of information (Isham et al., 2016). Dentists

preferred to seek advice from an experienced or specialist colleague or to participate in face-to-face meetings. This important finding has influenced the nature of the intervention developed in Chapter 6 to reduce unnecessary use of antibiotics.

Basing behaviour change interventions on factors which may be experienced in different ways by different dentists risks unintended consequences. For example, analysis of the 'feedback loops' factor found one dentist who had learned through experience that antibiotics were an effective shortcut. In contrast to logic models which use the factors as the basis for developing a theory of behaviour change, dark logic models attempt to predict this sort of harmful consequences which may result from the implementation of interventions (Bonell et al., 2015). The range of perspectives relating to the factors identified during this study will inform the selection of BCTs as part of the process of planning a complex intervention to change antibiotic prescribing behaviour intervention development (see Chapter 6).

Some dentists, some patients and some dental nurses believed that antibiotics could provide an effective temporary relief of symptoms and that this was necessary before definitive treatment could be provided at a follow-up appointment. The belief that antibiotics could be a patient safety risk was found among dentists working in dental practices with lower rates of antibiotic prescribing, whereas the belief that antibiotic problems were more about a public health issue for society was associated with those working in practices with higher rates of antibiotic prescribing. Whilst the literature included some research on dentists' knowledge and beliefs about antibiotic resistance as a public health problem (Murti and Morse, 2007) (Cope, A.L. et al., 2014). (Mansour et al., 2018), only one study was found which addressed the safety risks for individual patients, including from antibiotic-associated diarrhoea/*C. difficile* and severe allergy (Zwetchkenbaum et al., 2015).

Other beliefs from the patient perspective included their ability to delay definitive treatment such as a dental extraction. Little has been published in peer reviewed journals about the patient perspective on dental antibiotics other than passing references in studies of other issues. A study of patient expectations relating to emergency dental appointments found that patients expectations for antibiotics were often conditional on the dentist deciding that they were necessary (Anderson, 2004). Another study about 'emotionally relevant situations' explored a case study in which a dentist's approach to declining to prescribe antibiotics for a patient presenting in pain had resulted in conflict (Chapman, H. R. et al., 2015). Neither of these studies, however, explored patient beliefs about antibiotics. Outside of the dental context, people's thoughts and feelings about antibiotics and resistance were explored through a series of interviews and focus groups undertaken for Wellcome Trust by GoodBusiness (Wellcome_Trust, 2015). Antibiotic resistance was found to be poorly

understood, and it was only when it felt direct, personal and relevant that people took note.

The study found that some patients were persistent in their demand for antibiotics during urgent dental appointments. This provides evidence to counter recent assertions in the medical literature that clinician reports of patient expectations are unsubstantiated (Glover et al., 2019). Glover et al state that '*it is doubtful that patients want their GPs to behave in professionally inappropriate ways by prescribing antibiotics needlessly*' yet this is exactly the behaviour observed during the study relating to GDPs. One patient reported that he '*pushed it*' to try to get antibiotics and another called himself a '*selfish baboon'* in his desire to get antibiotics.

A cycle of repeated attendance for antibiotics rather than dental procedures was identified for some patients, including those using it as a strategy to defer definitive treatment. It was also found to be linked to those without access to a regular dentist, which one of the OOH clinics had introduced a policy to address: To encourage dentists to provide definitive solutions for the dental problem (such as extraction), treatments provided by dentists during unscheduled dental care sessions were monitored; those prescribing antibiotics to more than 10% of their patients were challenged to reduce it. Whilst this was reported to have reduced the number of repeat attendances by preventing people entering a cycle of temporary treatment such as repeated antibiotic prescription, the result was that appointments appeared more like an impersonal medical encounter to treat a problem than individualised care centred on a person (Clayman et al., 2017). Facilitating individualised care through shared decision making between patients and clinicians is a recognised approach to address this as well as addressing the power imbalance between clinicians and patients, which is also a recognised issue (Joseph-Williams et al., 2014) (Joseph-Williams et al., 2017). Shared decision making is known to require more time than is usually available during urgent appointments (Caverly et al., 2018). Research to explore the best way to facilitate shared decision making during urgent dental appointments could have broad applicability across healthcare.

Equality of access to the right urgent dental care at the right time and in the right place has been addressed to some extent by the recently published NHS urgent dental care commissioning standard (NHSE, 2019a). Difficulties with the system in place until recently may be illustrated by the introduction in 2015 of the international charity DentAid to provide free outreach dental care for homeless and vulnerable people across the UK, including Dewsbury in West Yorkshire (DentAid, 2019). Failure to attend routine appointments has been reported as a predictor of health inequalities, including premature death, in other healthcare settings and especially associated with mental health problems (McQueenie et al., 2019). For these patients, existing primary

healthcare appointment systems were found by McQueenie and co-workers to be ineffective and their recommended interventions should be developed to increase attendance by these patients. Further research is suggested to ensure that all patients with acute dental conditions are accessing the right care at the right time and in the right place.

5.6.2 Limitations

5.6.2.1 Reflection on the ethnographic approach

Ethnographic research has seldom been undertaken in dentistry, although its value as a methodological approach is starting to gain traction (Allen, 2018) (Hulme et al., 2016) (Harris et al., 2018). Nettleton's seminal ethnography of dentistry in England explored dental power and knowledge using Foucault's concepts of gaze and power to theorise pain and fear (Nettleton, 1992). With the two objectives of this study being to investigate dentist-related and patient-related factors influencing treatment during urgent dental appointments was deemed well suited to the task.

This study has been described as ethnographic rather than an ethnography as it used the principles of ethnography across a number of research sites and for a relatively limited period of time. In this way, it explored how dental teams provided urgent care in the real world and the influences on decision making, including whether to prescribe antibiotics. A strength of this work was the number of urgent care appointments studied, triangulation of the results with the published literature and between dentists and patients, employment of both healthcare and non-healthcare professionals as researchers and also the rich insight gained through follow-up interviews with the patients and members of the dental team. This allowed consideration of factors from different perspectives and identification of factors that may have been unconsciously overlooked in previously published studies which were based on self-reported data.

Concerns inherent to ethnographic research which limit this study include: observation bias (the tendency for people to modify their behaviour because they know they are being studied otherwise known as the Hawthorne Effect (McCambridge et al., 2014)); and selection bias (where only those patients, dentist and dental nurses comfortable to be recorded consent to participate in the study). A study exploring the threat of these phenomena to the validity of research found that audio-recording of primary medical care consultations about depression had no significant impact on any of the dependent variables assessed (Henry et al., 2015). By contrast, a study investigating whether the use of questionnaires and audio-recording of appointments impacted on antibiotic prescribing by GPs found a 29% reduction in inappropriate prescribing of antibiotics to paediatric patients with viral conditions when observed (46% vs 17%) (Mangione-Smith et al., 2002). The authors concluded that observational studies (such as this

ethnographic research) in urgent dental care would likely underestimate the frequency of inappropriate antibiotic prescribing. For this reason, only a qualitative study of the factors associated with treatment decisions by dentists for adults with acute conditions was studied rather than attempting a quantitative study about the decisions and their appropriateness.

Whilst the researchers were interested in decisions about why some dentists prescribe antibiotics rather than dental procedures more often during urgent dental appointments, this specific interest was not highlighted to the participants. Furthermore, none of the participants or local research staff knew the researchers before the study. It is possible that those at the research sites may have been aware or guessed the interest in antibiotics and that it may have affected whether they prescribed antibiotics during the course of the study and the nature of the views about antibiotics which they shared with the researcher during follow-up interviews. As the Hawthorne effect is assumed to improve behaviour in relation to guidelines, then it would follow that participants in the study would have been prescribing antibiotics less freely during the study period, which would have influenced the nature of the factors found associated with their treatment decisions.

The concept of the Hawthorne Effect was also identified in the results as it is a component of the ‘accountability’ factor. Dentists working in an OOH clinic where managers regularly provided targeted feedback and challenged individuals to achieve low rates of antibiotic prescribing were more conscious and careful about antibiotic prescribing decisions. Monitoring and feedback is known to be a successful strategy for reducing high rates of antibiotic prescribing by dentists, although its longer term success in maintaining these lower rates has not yet been proven (Elouafkaoui et al., 2016).

As with qualitative research more generally, the relatively small sample sizes and subjectivity of data interpretation are limitations of ethnographic research which impact on generalisability of the results to other populations (Goodson and Vassar, 2011). By focusing this ethnographic study on the specific population of interest for subsequent intervention development (general dentists delivering care to adults with acute dental conditions during urgent NHS appointments in England) sample size problems were addressed. By engaging a wide range of stakeholders to check meaning and assist the interpretation of the data, this limitation on sample size was minimised. By triangulation of the findings with the framework of factors identified in Chapter 3, the study was able to identify factors influencing dental antibiotic prescribing which not previously reported in the literature, such as the ‘lifetime impact’ of urgent dental procedures.

Focusing the research on GDP practices with different antibiotic prescribing patterns (high and low rates of antibiotic prescribing) enabled identification of good practice as

well as reasons why some dentists prefer to prescribe antibiotics rather than deliver a dental procedure. Undertaking the research using this ethnographic approach also allowed contextualisation of the factors to the particular setting of interest: urgent NHS dental care for adult patients in England. The importance of understanding the context (complex system) within which the behaviour is taking place has been reiterated in the current draft new guidance from the MRC on complex intervention development (Craig et al., 2019). Interventions tend to be sensitive to context and it has been proposed that public health intervention studies can be most useful if they state clearly how context has shaped the findings, including how context was taken into account in intervention development and to which contexts the evidence applies (Craig et al., 2018).

Selection bias includes the challenge of gaining access to sites to conduct observation which is a recognised problem with observational research. Gaining sufficient rapport at the sites to facilitate the research is known to pose further difficulties. Negotiations with different staff groups with different priorities and interests are required. Acceptance within the culture is essential for the capture of high quality ethnographic data. This brings with it a further challenge: the risk of the researcher losing objectivity and focus on the research agenda if they become too immersed in the setting (‘going native’) (Stewart et al., 2008). Ways in which these issues were encountered and addressed during the study are discussed in sections 5.4.3, 5.4.4 and 5.4.5..

Reflecting on the inclusion of direct observations as part of this study has identified both positive and negative aspects. Positives were the ability to interpret what was occurring during the appointments where the audio-recordings were difficult to transcribe and the benefit of a third-party view in relation to objective identification of factors associated with treatment decisions. Issues recorded by the observers which seemed important to the dentist’s treatment decisions included the language barrier (‘patient management’) and difficulties for patients accessing routine primary dental care (‘access’). Other issues such as distracting background noises in the surgery (such as opening of packets and getting equipment out of drawers) and typing notes on the computer rather than looking at the patient during urgent dental appointments, were also identified by the observers. Whilst of wider interest, these additional issues did not appear to influence treatment decisions and so were not reported in the results section of this study. A major negative to including direct observations within the study was the significant time and cost requirements, including employing the observers as temporary members of staff, health and safety risk assessments, coordination of dates for observations when the observer was available at the same time as the participant dentist, dental nurse and member of local support staff trained to consent patients to the study. Furthermore, for practical reasons associated with the unpredictable nature of urgent dental appointments in GDP, the observations were only possible in the OOH

setting. In comparison to the large number of appointment transcripts from audio-recorded appointments, the number of direct observations was very much lower. In hindsight, the additional cost of undertaking direct observations was significantly higher than the value derived from the direct observations in relation to answering the research question.

5.6.2.2 Challenge of research in primary dental care

A challenge identified during this research in NHS primary dental care has been the high turnover of the dental workforce, an issue which was also recognised during the INCENTIVE trial (Hulme et al., 2016). A number of times during the course of the study, participating dentists left employment with the practice and within a year of the fieldwork being completed, nine of the eleven dentists had left the practice/clinic at which they were working. This is a recognised problem nationally with significant numbers of NHS dentists coming and going within a year: in 2016/17, there were 1,520 leavers and 1,547 joiners in-year, or 3,067 (12.8%) working for only part of the year (NHSDigital, 2017). In addition to turnover of the workforce delivering NHS primary dental care, there were also serious recruitment difficulties in some parts of the country and a shift in the make-up of the workforce, with a significant drop in new registrations from both UK and other origins such as the European Union (EU) (2019). Additionally since completion of the fieldwork, the OOH dental services which participated in the study have been recommissioned and neither of the providers which participated in the research now delivers urgent NHS dental care.

Many times during the course of the study, dentists, dental nurses and research support staff recruited to participate in or support the research withdrew from the study when they left the practice. Fortunately this did not prevent achievement of sufficient cases for in-depth study nor saturation of factors; it did however increase the workload of the researcher (WT) recruiting and training research support staff and consenting participant dentists and dental nurses. Lack of capacity for research in addition to delivering dental care services (often due to staff absences for example due to illness or maternity leave) was the reason given most often by practices which declined to participate in the study. This issue is linked to the ‘workload’ and ‘competing demands’ factors identified as influencing treatment decisions. As discussed earlier, self-selection of practices which had sufficient capacity to participate in the study is a recognised bias of this study.

Practices providing a greater amount of private dental care within the NHS/private care mix seemed better able to cope with undertaking research. The researchers interpreted this as related to business decisions for ratios of support staff available in practice to ensure that private patients received the enhanced experience of dental care (from first

to last contact with the practice) for which they were paying private fees. Practices providing only NHS care appeared to have less capacity and flexibility to engage in additional activities (such as research), especially at times of increased workload for example during holiday periods when one dentist may be covering emergencies for other dentists whilst they are away on annual leave. Further research to compare capacity/capability within a practice to engage in additional activities (such as research) with antibiotic prescribing rates would be an area for further research. The NIHR Clinical Research Network is also wanting to evaluate this area to determine requirements to grow the research portfolio (Pavitt, 2019). Its findings could identify approaches to managing workload with wider reaching implications for dental teams than just antibiotic prescribing rates. As stress levels have also been related to workload, for example, this provides important insight into resilience for members of the dental team.

The environmental context in which urgent dental care is delivered and hence in which a behaviour change intervention is planned has been found to be in a state of flux. It was a challenging setting for research and will continue to be a challenging setting in which to make fundamental changes to improve antibiotic stewardship and prescribing patterns of dentists.

5.6.2.3 Limitations of sampling

Predicting in advance the sample size required for qualitative research to achieve its aims is inherently tricky. Whilst the sample of eleven dentists was only a small proportion of the 24,308 dentists who performed NHS dental activity in England during 2017/18 (NHSDigital, 2018), it was sufficient to achieve the sampling strategy aim of saturation of results.

The approach to maximum variation sampling underpinning recruitment of GDP/OOH sites and dentists to the study still resulted, to some extent, in a self-selecting sample as there were many potential participants who declined the invitation to take part. Of those who explained their reasons, concern about the dental practice team's capacity to take part based on their current workload was often cited. It is unclear whether the practices which participated in the study had more capacity than other practices to participate or whether the local staff were more confident and/or keen to engage in new challenges in order to contribute to the future of the profession. Whatever the reasons, it would be expected that a random sample of practices would provide an even more extreme set of experiences or views relating to the factors identified. Due to the workload/capacity issues identified by the research support staff at dental practices recruited to the study, it was agreed with the practices that only one dentist per GDP would participate in the study. This minimised disruption for the research support staff

responsible for recruiting patients into the study but meant more sites were required in order to recruit sufficient cases into the study. Informal discussion with other researchers has identified that recruitment issues are commonly encountered by others undertaking research in primary dental care in England. For example, one recent doctoral researcher recruited his research sites through contacts he had through social media (Hurst, 2019). A strength of this study was that none of the practices were known to the researchers in advance of the study and none had participated in research before. This brought with it other operational challenges from the local research staff and participant dentists/dental nurses who were naive to research and required much support for recruiting and obtaining valid consent and collecting data. Recruiting dentists trained overseas was particularly difficult, even though dentistry is one of the most diverse professions in the UK (Norrie, 2017), with over 20% of the workforce trained in the European Union/European Economic Area (EEA - outside of the UK) and more from outside of the EU. Interestingly, recruitment of just one overseas dentist to the study is in line with the response rate to a survey undertaken on behalf of the GDC in which 7% of respondents were EEA qualified and 5% who qualified elsewhere and entered UK dentistry through the Overseas Registrants Exam (eVenture, 2018).

Recruitment of patients to the study was undertaken by locally employed research support staff – usually the practice manager or receptionist. For patients to be recruited and consented to the study, there needed to be the right combination of individuals all available at the same time at the research site: participant dentist, dental nurse, research support staff and adults with acute conditions attending for an urgent NHS dental appointment who was eligible, willing and able to participate. This was found to be a situation which occurred less frequently than the GDP teams had anticipated in advance and recruitment took longer than the one or two months initially envisaged by most of the research sites. In the OOH context, the need to coordinate with the availability of an observer and the frequent staff rota changes further exacerbated this difficulty of recruiting, consenting and undertaking the audio recordings.

A convenience sampling approach was taken to patient recruitment at this stage to give the practices the best chance of having the right mix of people and capacity to collect data. In discussion with the PI during the course of the research, the researcher (WT) was reminded that the primary role of these members of practice staff was to support busy GDP and OOH clinics to deliver normal business. As found by Goodwin and colleagues (Goodwin et al., 2018). During investigation of how and why capitation affects general dental practitioners' behaviour, ensuring the success of the dental business for the benefit of both patients and members of the dental team can influence

behaviour. Undertaking research in primary dental care has inherent challenges relating to its priority relative to business needs.

As with recruitment of the research sites and dentists/dental nurses, there were many patients who were not recruited and some who declined to participate. It is unclear whether including those who were not approached or who declined to participate in the study were significantly different to other adults presenting for urgent dental appointments. It is, therefore, an important bias for the study (Goodwin et al., 2018).

The appropriate number of qualitative interviews has been widely debated by academics and 'between 12 and 60' has been offered as a guide (Baker et al., 2012). Saturation was judged to have been achieved after analysis of 10 cases, although it was only possible to judge this retrospectively by 'running over' and then reviewing to confirm no additional themes were identified from further analysis. Fortunately, saturation of themes had been reached before one of the dentists dropped out at the follow-up interview stage (when he retired from dentistry) and so his drop-out from the study was concluded to have likely minimal impact on the results.

5.6.2.4 Limitations of data collection

Significant limitation on the audio-recording sound quality was found relating to some of the research sites due to the amount and volume of background noise (in particular from the dental suction unit and the opening of packaged equipment). In some cases, transcription of the appointment audio-recording was virtually impossible due to this background noise. These distractions were evident throughout the appointment as arrangements were being made for treatment to commence.

For at least one other case, the transcription was difficult due to the incomprehensible communication style of the patient, as confirmed by records from the direct observation (see Appendix C.6.2). In another case, the patient spoke very quietly, as confirmed by records from the direct observation (see Appendix C.6.3). Where neither the patient nor the dentist could be heard distinctly, it is assumed that the surgery had difficult acoustics/echoes (see Appendix C.6.2) or that the microphone was placed in a suboptimal location. Unlike in GP research where individual microphones can be attached to the clinician and patient, during appointments in a dental surgery, this has implications for cross-infection control. Further research to identify ways of using technology to cancel out dental surgery background noise from audio-recordings and to assist the verbatim transcription of appointments, including those where an individual is speaking quietly or does not speak English fluently. The opportunity to make and store such audio-recording routinely as part of patient records could reduce the detail required (and hence time taken) for typing notes which meet GDC requirements for 'contemporaneous, complete and accurate' dental records ((GDC, 2015b)). Moving the

balance of the dentist's away from the computer (as identified in Appendix C.6.4) towards communicating with the patient and providing care could be transformational in relation to service delivery. It could also provide a wealth of data for researching what actually happens during dental appointments.

Previous studies have looked at noise from dental equipment use during procedures, such as anxiety related to the sound of a dental drill ((Muppa et al., 2013)) and the hazard of noise exposure to members of the dental team (Szymańska, 2000). The impact of background noise on dentist-patient communication does not, however, seem to have been investigated. Further research to understand the importance of this coincidental finding is warranted.

As the focus of the research was to identify factors relating to the dentist-related factors which could be tackled in order to reduce antibiotic prescribing by dentists, it seems appropriate that these interviews were undertaken from a dentist rather than patient (i.e. anyone who is not a member of a dental team) perspective. It would have been interesting, however, to compare the results with non-dentist interviewers using the same semi-structured interview proforma to see whether additional insight would have been gained. As other healthcare researchers from UK universities have been undertaking studies with dentists and patients during the same period as this doctoral research including about the provision of urgent dental care, further research would be interesting to compare and contrast the results obtained in order to increase their generalisability (Harris, 2018) (Currie, 2018).

5.6.2.5 Limitations of data analysis

The demographic data was described only in terms of the range, median and interquartile ranges as the study was not designed to include statistical analysis of these data. Nevertheless, outlier demographic data was noted, associated largely with care provided by the foundation dentist who was able to spend significantly longer with patients than would be practical for a GDP working as an Associate or in OOH.

For analysis of qualitative data, there are a range of possible approaches for analysis including: ethnographic accounts, conversation analysis and thematic analysis. Whilst ethnographies often produce largely descriptive ethnographic accounts, this was not an appropriate analytical approach for this study which required a more succinct synthesis in order to inform the development of an evidence-based complex intervention to reduce antibiotic prescribing by dentists during urgent NHS dental appointments (Nippert-Eng, 2015). Conversation analysis involves analysing sequences of interactions in order to look at what is said and how it is said (pitch, tone, speed etc.) (Schegloff, 2007) (Albury et al., 2019). This approach was considered for analysing the appointment transcripts. After some detailed consideration, it was decided that the cost

benefit derived from such an analysis to informing intervention development did not warrant the time and resources which would be required to undertake conversation analysis. Thematic analysis involved discovering and interpreting meaning within data (Ritchie et al., 2013). The process of inductive (bottom up) thematic analysis is described in Chapter 3: data is worked through line by line iteratively to produce a new theory or set of themes linked strongly to the data. The risk of inductive thematic coding is that it may be so close to the data that it fails to produce results which answer the research question of interest to the researcher. (Braun and Clarke, 2006). A deductive (top down) approach to thematic analysis is driven by the researcher's interest, so tends to produce a less rich but more focused set of results which are controlled by the researcher's interests. Coding of the follow-up interview to identify dentist-related factors which influence treatment during urgent NHS dental appointments used the list of codes identified from the systematic review in Chapter 3. Recognising that Chapter 3 related to just one type of treatment in urgent dental care (antibiotic prescribing) the researchers ensured that they remained open to identifying additional themes for inclusion in the theory being developed to underpin development of a behaviour change intervention. In this way, four additional themes were found. No similar list of factors existed for analysis of the patient-related factors; for this reason inductive thematic analysis was undertaken to identify patient-related factors which emerged from the data.

5.7 Conclusion

By using an ethnographic approach to explore the factors associated with antibiotic and other types of treatment provided during urgent NHS dental appointments, this study has provided a resource rich with information for those wishing to design urgent dental care services and develop behavioural interventions. A theory-informed, evidence base on which to build an intervention to reduce antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England has been produced. In addition, evidence about the quickness of the 'quick fix' presented by antibiotics and the existence of demand for them by some (but not all) patients has been demonstrated. Managing patient anxiety and lack of dedicated slots for unscheduled appointments in some dental practices were seen to contribute to stress.

Many of the factors identified in the comprehensive list were found to act on or to be experienced by different dentists in different ways at different times. When subsequently designing interventions to reduce dental antibiotic prescribing, this will be an important consideration to ensuring the right care for the right patient at the right time.

Chapter 6 - Developing a complex intervention to reduce prescribing of antibiotics in urgent dental care

6.1 Introduction

This Chapter is about planning an evidence-based, theory informed complex intervention to reduce antibiotic prescribing for adults with acute dental conditions during urgent NHS dental care in England. Based on coproduction, this research developed a theory of change and logic model for the design of an intervention building on the evidence base identified during the preceding chapters.

The behavioural and social sciences have been increasingly appreciated as fundamental to the development of effective interventions aimed at improving people's health and modifying clinician/patient behaviours (PHE, 2018c). Interventions attempting to change antibiotic prescribing behaviour have been regularly reported in the scientific literature, largely in hospital and primary medical care settings, yet few have been explicitly designed using behaviour change theory (Charani et al., 2011; PHE, 2015a).

6.1.1 Complex interventions

As described in Chapter 2, understanding of the term 'complex intervention' has been changing over time, with an increasing emphasis on the dynamic system within which the intervention is intended to achieve its effect. As shown through the earlier Chapters of this thesis, dental antibiotic prescribing during urgent dental care is a complex and dynamic system with different factors being relevant to different dentists in different contexts (e.g. GDP versus OOH settings).

Complex systems have been described as having multiple levels: micro-, meso- and macro-levels (Liljenström and Svedin, 2005).In Chapter 3, these levels were identified as clinician-related, patient-related, clinical context-related and wider social-political context. In this Chapter, micro-level relates to the individual dentist and their interactions with patients and the dental practice/clinic environment for urgent NHS dental appointments. Meso-level relates to service commissioning and organisational issues such as contractual arrangements between the NHS and the dental practice. Macro-level relates to the wider socioeconomic context in England (including healthcare policy and regulation).

Interventions to support behaviour change tend to be more successful when underpinned by behavioural theory (Abraham et al., 2009). As described in Chapter 2, the coherent suite of tools and techniques developed by UCL CBC and its partners (Michie et al., 2014; Carey et al., 2018) has underpinned the evidence collection and

theoretical modelling of factors associated with the decision by dentists whether to prescribe antibiotics for adults with acute conditions during urgent dental appointments.

6.1.2 The problem of antibiotics in urgent dental care

Unnecessary/inappropriate prescribing of antibiotics is fuelling the global public health problem of antibiotic resistance as well as being responsible for additional patient safety problems due to adverse events (HMG, 2019a). With dentistry responsible for 5% of all NHS antibiotic prescriptions and as much as 80% used unnecessarily, this research planned new ways to change the prescribing behaviour of dentists (Cope, A.L. et al., 2016b; Tulip and Palmer, 2008). Whilst the decision to prescribe an antibiotic is ultimately the responsibility of the dentist, the philosophy of shared decision making which underpins patient-centred healthcare means that the patient's contribution to the dentist's decision may be significant (Coxeter et al., 2015). A comprehensive list of factors influencing dentists' treatment decisions for adults with acute conditions was identified through a systematic review of the literature (presented in Chapter 3) together with an ethnographic study (in Chapter 5). The ethnographic research also explored patient-related factors in more detail to understand the range of factors influencing them during urgent NHS dental appointments in England. This included understanding in more detail why some patients felt they needed antibiotics and why some patients set out to negotiate in order to receive an antibiotic prescription. In order to ensure the effect of the intervention may be monitored, the utility of routinely-collected data relating to NHS dental antibiotic prescribing in England was explored in Chapter 4. The conclusion was that significant improvements were required in the accuracy and completeness of datasets before they could be used for that purpose.

6.1.3 Existing dental AMS interventions

To understand the context into which this new intervention to reduce antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England would fit, this section briefly reviews what is known from the published literature. A systematic review of dental AMS interventions found sparse literature relating to primary dental care: the results of two RCTs were reported, both from the UK (Löffler and Böhmer, 2017). An RCT of outreach visits by pharmacists to dental practices in Wales demonstrated significant reductions in 'inappropriate' antibiotic prescribing (Seager et al., 2006). A more recent RCT in Scotland (published during the course of this doctoral research) showed reductions in total antibiotic consumption, assessed using routinely-collected data, were possible (Elouafkaoui et al., 2016). Neither RCT demonstrated long term reductions in antibiotic prescribing nor assessed harm to the patient associated with reduced antibiotic prescribing. The Löffler

systematic review also reported on the success of clinical audits using evidence-based UK guidance to reduce antibiotic prescribing rates (FGDP, 2012; Palmer, N. et al., 2001; Chate et al., 2006). In addition, an on-going RCT in Germany (the DREAM study) has been exploring the impact of an educational programme (focused largely on prophylactic prescribing for infective endocarditis) on overall dental antibiotic prescribing rates, together with microbiological analyses for antibiotic resistant oral streptococci (Loffler et al., 2014).

Early in the course of this doctoral research, an embryonic dental AMS toolkit was published by PHE (in collaboration with a wide stakeholder group) which drew together a range of existing tools (PHE, 2016a). This built on the concept of the TARGET on-line toolkit for prescribers in primary medical care (RCGP, 2015). Initially PHE's dental AMS toolkit included patient-facing resources (posters and leaflets), guidance, education & training and a self-audit tool for clinicians. The toolkit has continued to evolve as new tools have become available, for example the inclusion of guidance on analgesic prescribing for toothache and on-line, scenario-based education about dental antibiotic stewardship (BAOS, 2019). To maximise their impact, new tools planned as part of the APTiTUDE complex intervention within this Chapter should complement existing tools within the PHE dental AMS toolkit.

Evaluation of the TARGET toolkit in primary medical care has been undertaken through a pragmatic RCT of outreach visits by pharmacists to general practices, which demonstrated significant reductions in antibiotic prescribing (McNulty et al., 2018). A qualitative evaluation of TARGET undertaken in parallel with the RCT found that clinicians wanted less background on AMR and suggested that workshop sessions should be centred around clinical cases and allow more time for action planning (Jones et al., 2017). Participants in the TARGET evaluation reported they particularly valued the TARGET Treating Your Infection resource (used during consultations with patients) and comparative data about how their practice antibiotic prescribing compared with others (RCGP, 2015). This evaluation provides a model for evaluation of the PHE dental AMS toolkit including new APTiTUDE tools planned within this Chapter, as well as being a source of evidence about the utility of elements of the toolkit for knowledge transfer from the medical to dental environment.

A slightly different approach has been taken by NHS Education for Scotland's quality improvement programme on infection control and decontamination (NES, 2019). Feasibility and acceptability testing of a whole dental team approach has proved successful: Training in Practice interventions to Target Antibiotic Prescribing (TiPTAP). Evaluation through an RCT is planned.

6.2 Aim

To inform the development of a theoretically plausible complex intervention to reduce antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England.

6.3 Objectives

Building on the evidence-base described in Chapters 4 about factors which influence prescribing, the objectives are:

Objective A – Theory of change

To develop a theory of change aimed at reducing antibiotic prescribing behaviour for adult patients with acute conditions during urgent appointments in England.

Objective B – Logic model

To develop a logic model informed by behavioural science, with knowledge transfer from the GP context, as appropriate.

Objective C – Co-development of components

To outline how components of the complex intervention could be co-developed with key stakeholders, to produce new tools for addition to the national dental AMS toolkit.

6.4 Method

Planning a complex intervention to reduce prescribing of antibiotics in urgent dental care was undertaken in accordance with the Behaviour Change Wheel approach and using associated tools from the Human Behaviour Change Project (HBCP) (Michie et al., 2017; Michie et al., 2014) and using evidence about decision making in urgent NHS dental care from the earlier Chapters of this thesis,

6.4.1 Underpinning behavioural theory and models

A plethora of behavioural science theories exist for use by researchers when analysing evidence, identifying a coherent theory of change and constructing a model on which to base new behaviour change interventions (Michie et al., 2014). To address this, the TDF was produced by Michie and her team to simplify and integrate 33 theories and 128 key theoretical constructs in order to provide a basis to underpin the development of interventions (Michie et al., 2005). As described in Chapter 3, mapping the factors to the TDF was designed to facilitate the subsequent development of the evidence-base, theory-informed APTiTUDE complex intervention to reduce antibiotic prescribing for adults during urgent dental appointments.

Similarly, a wide range of methods for the development of healthcare interventions exist. By integrating 19 of these methods, Michie *et al* produced the Behaviour Change Wheel, with the COM-B model at its hub (Michie et al., 2011). Based on three essential conditions: Capability, Opportunity and Motivation to achieve behaviour change, this

model has been linked to the TDF for understanding mechanisms of action. Most recently, the BCTs for specifying interventions have been linked directly to the TDF domains through the Theory & Techniques Toolkit (TTT) (Michie et al., 2011; Carey et al., 2018). In this way, TDF, BCW, COM-B and TTT dovetail together into a suite of tools which have been used for development of the APTiTUDE complex intervention. When deciding on this approach, however, other methods for developing healthcare interventions were considered. So numerous are the options that a taxonomy with eight categories has been produced: (O'Cathain et al., 2019).

1. Partnership
2. Target-population centred
3. Theory- and evidence-based
4. Implementation-based
5. Efficiency-based
6. Stepped or phased based
7. Intervention-specific
8. Combination

The 'theory and evidence-based' category was a logical place to start for developing the 'theoretically plausible APTiTUDE complex intervention' described in the aim of this study. This category includes the TDF and BCW (Michie et al., 2011) and Intervention mapping (Bartholomew et al., 2016). Currently, many academic groups researching behaviour change in the UK are using the UCL team's integrated suite of tools, which presents opportunities for joining up research findings. A weakness of the Michie approach, however, is its reductionist nature meaning that the underpinning mechanisms of behaviour can be more obscure and finding the links can be difficult (Hansen et al., 2017).

Intervention mapping was also considered as an alternative approach for the APTiTUDE intervention development. Developed originally for health promotion interventions, it also takes a stepwise approach to intervention development but has the advantage over BCW that it places more emphasis on the underpinning behavioural theory to understand the behaviour components and their interactions. Training for intervention mapping was unavailable in the UK and also more expensive, so this approach was rejected on account of its relatively few advantages over the UCL CBC suite of tools and high barriers to accessing training in the approach (Bartholomew et al., 2016; Hansen et al., 2017).

A co-production approach employing a stakeholder group with broad membership was constituted in order to ensure the range of levels at which it was anticipated that the intervention might need to work for optimum results were represented. Members: the study's PPIE contributors (individuals from the UoL SMILE AIDER PPIE forum) and

others (from Newcastle and London) who had expressed an interest in the study and who had lived experience of urgent dental problems); 1 general dental practitioner and 2 dental nurses who had participated in the ethnographic study; 1 dentist who had been introduced to the study by the postgraduate dental dean in the South West of England; 1 dentist who had expressed an interest through a restricted dental social media group and who was trained in a European dental school; 1 Office of the Chief Dental Officer Clinical Leadership Fellows (a dentist working in the East of England); 1 dental nurse from Leeds Dental Institute's Acute Dental Care department with experience of working in a local OOH dental clinic; 1 service manager from one of the OOH research sites which participated in the ethnographic study; 1 service manager from a corporate provider of NHS general dental services (which did not participated in the study but was interested in the possibility of being involved with the follow-on evaluative study). In addition, a Consultant from PHE, a postgraduate Dean from HEE and three of the PhD supervisors (JATS, RRCM and SHP).

As noted by Oliver et al (2019), however, there is no definitive agreement among researchers about what it means or why it is generally seen as a beneficial and there are clear risks attached, such as tensions which can arise between the stakeholders (Oliver et al., 2019). As also highlighted by Oliver, the cost of co-production was high with lay members and self-employed members of the dental team being paid as temporary members of UoL staff. The time and cost of setting up and delivering this arrangement was significant, although the researchers recognise that without it members of the dental team would not have been willing or able to shoulder the financial burden of taking a day away from clinic to participate. Providing definitive evidence for the benefit of coproduction is difficult. However, an example from the APTiTUDE stakeholder group is the additional insight gained from group discussion prompted by the graphic record of the meeting in relation to communication skills and the emotional energy on display relating to the role plays which had not been identified as a priority factor from the desk-top prioritisation exercise. The combination of co-production and creatively formatted workshops proved invaluable at engaging the stakeholders to work together in order to draw out and understanding the multiplicity of factors from the dentist, patient and other perspectives. It also allowed capturing of the language and imagery the stakeholders used to describe and relate to products and services in their own words. As with other qualitative work, however, the results have only limited generalisability. By engaging a different range of dentists and patients in the stakeholder group to those who had been involved with the ethnographic fieldwork, including from across England rather than restricted only to Lancashire and West Yorkshire, some degree of improvement to generalisability may have been achieved. As with all research based on purposive sampling, it is impossible to say whether

another group of individuals would have identified the same priorities or given the same guidance on intervention development. It is notable, however, that those who participated from Cornwall and Southampton recognised the same issues as those from Cumbria and .Newcastle.

Similarly, the use of creative approaches to the stakeholder workshops may have produced different results to those from a more traditionally structured process such as a Delphi study (McMillan et al., 2016). However, whilst Delphi is ideal for use when individuals are unable to come together to discuss and share ideas, it can take long periods of time to reach consensus. Small group/focus group discussion with a flexible scoring system at the first stakeholder workshop and nominal group technique at the second were selected as the means of gaining a quick consensus from the participants about their values and perspective about what would be important for inclusion with the intervention. It provided an authentic list of priorities from the group in a short timescale and enabled group discussion to provide additional insight which would have been more difficult to solicit from a remote, Delphi approach. Similarly the graphic record at the first meeting and the advertising/role play exercises at the second meeting were designed to spark imagination and elicit insight from the experts in a more creative way. Whether a more traditional approach to a meeting, with more formal processes would have produced a more or less valuable set of results (list of priority factors) is not possible to say. Nonetheless, it is important that the list produced was owned by the stakeholders who felt that it was authentic and reflected their collective view. A formal set of minutes for each meeting to ensure a more traditional record of each meeting was made.

With reference to O'Cathain's taxonomy, a 'combination' approach was employed to plan an evidence-based, theory-informed intervention to reduce antibiotic prescribing for adults with acute conditions in NHS primary dental care in England (O'Cathain et al., 2019). Evidence from Chapter 3 and 4 were combined with theory from the BCW and focused through coproduction on elements which the stakeholders felt would be most likely to achieve reductions in dental antibiotic prescribing. The remaining factors help to characterise the context within which the intervention will be implemented.

Two reporting guidelines for complex intervention development were considered for this study: Template for Intervention Description and Replication (TIDieR) (Hoffmann et al., 2014) and Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare (CReDECI 2) (Möhler et al., 2015) TIDierR relates to the description of interventions and has been advocated by Cochrane to ensure completeness in reporting in research studies (Hoffmann et al., 2014; Cochrane_Training, 2019). CReDECI2 relates to the development and evaluation of complex interventions (Möhler et al., 2015). As this study aims to plan a new complex

intervention, the CReDECI2 framework seemed more appropriate. However, upon close inspection, it was found to be based on an understanding of complex interventions as composed of several interacting components (Möhler et al., 2015). Whilst this aligns with the MRC's extant guidance (Craig et al., 2008), an on-going review of the guidance on complex interventions has found that definition to be 'somewhat outdated' (Skivington et al., 2018). Revised MRC/NIHR guidance is anticipated imminently which will place greater emphasis on 'a wider understanding of the complex contexts (systems)' (Craig et al., 2019) The importance of understanding the dynamic context in which dental antibiotic prescribing occurs was demonstrated in Chapter 5. For these reasons, whilst the CReDECI2 approach was used to guide reporting of the complex intervention development, 'context' was given more emphasis by reporting on it before 'intervention components' rather than afterwards (see Figure 6-1) (Möhler et al., 2015). Furthermore, the reporting of 'interactions' was extended to include interactions with the context rather than focusing only on interactions between the components of the intervention.

Figure 6-1 Stages of intervention development reporting. Adapted from CReDECI2 (Möhler et al., 2015) by swapping the order of reporting to reflect the increased emphasis placed on 'context' by behavioural and implementation science.

6.4.2 Theoretical basis

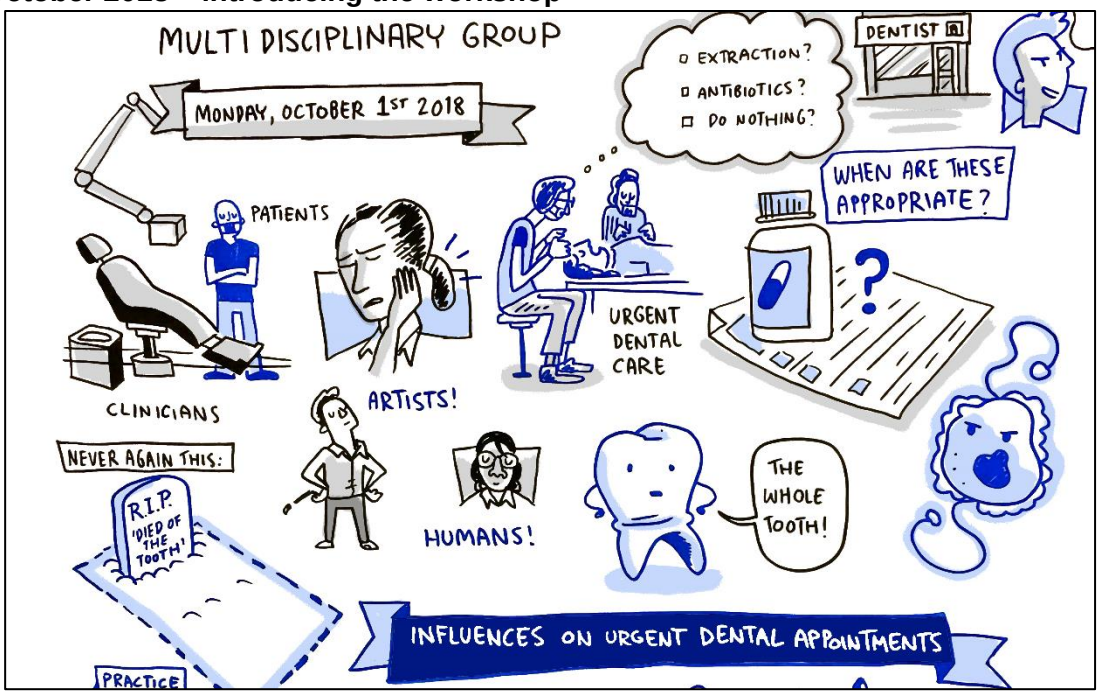
Development of a theory of change for the APTiTUDE complex intervention to enable a reduction in antibiotic prescribing during urgent NHS dental care in England was based on the COM-B model. As shown in Chapter 5 (Figure 5-15), the factors found to influence dentists' treatment decisions were mapped to the COM-B model via the TDF. To focus intervention development on a prioritised list of potentially modifiable influences, a half-day meeting of the study's multidisciplinary stakeholder group was held on 1st October 2018. The workshop agenda is included in Appendix DD1 and a summary of the attendees is shown in Table 6-1.

Table 6-1 Stakeholder group meetings attendees - 1st October 2018

4 Patient Public Involvement & Engagement representations	2 from the ethnographic study area 2 from elsewhere in England
4 NHS general dentists	1 from the ethnographic study 3 from elsewhere in England
3 dental nurses	2 from the ethnographic study 1 from the ethnographic study area
2 NHS dental service managers	1 from the ethnographic study 1 from elsewhere in England
2 policy makers	1 from PHE 1 from HEE
3 PhD supervisors	2 healthcare researchers 1 clinical academic

To assist visualisation of the factors influencing antibiotic prescribing by dentists and interactions between them, an illustrator produced a graphic record of the workshop, including its process, results and stakeholder's ideas for intervention components and implementation. An extract of the record, illustrating specifically the introductory part of the meeting, is shown in Figure 6-2.

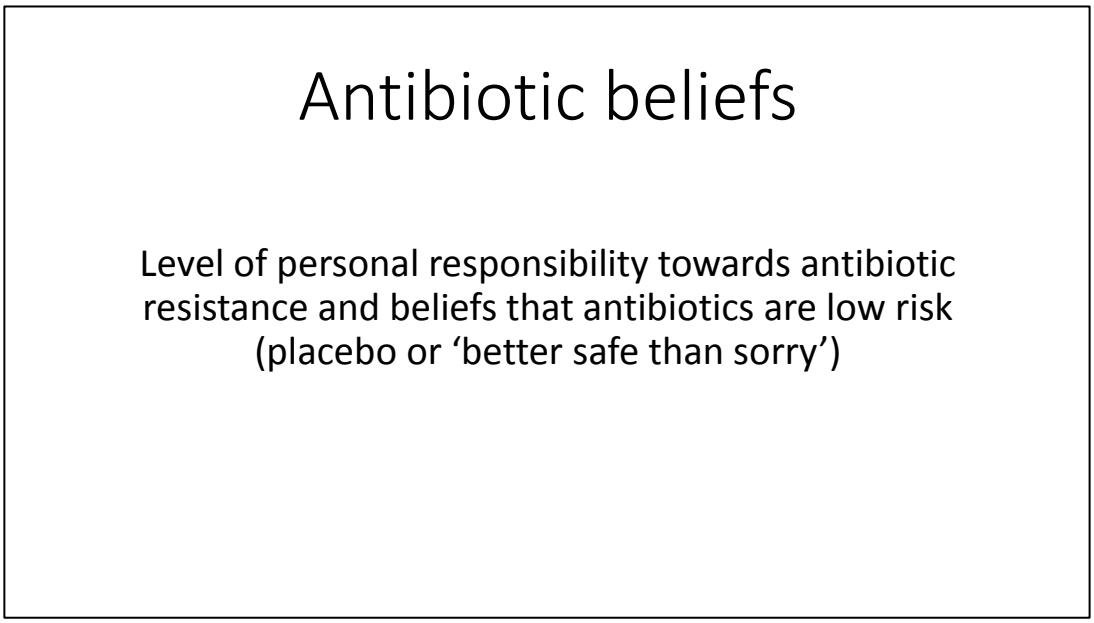
Figure 6-2 Extract from the graphic record of the stakeholder meeting on 1 October 2018 – introducing the workshop



After a brief introduction to the project and its emerging findings, the stakeholders worked together in three groups to explore, understand and prioritise the 31 potentially modifiable factors which had been identified during the ethnographic study (known as

TRUCE – TReatment during Urgent dental Care: an Ethnographic study). The groups were provided with a set of 31 flash cards (one for each factor, including the short title and definition – see Figure 6-3.

Figure 6-3 Example of a flashcard used during the workshop



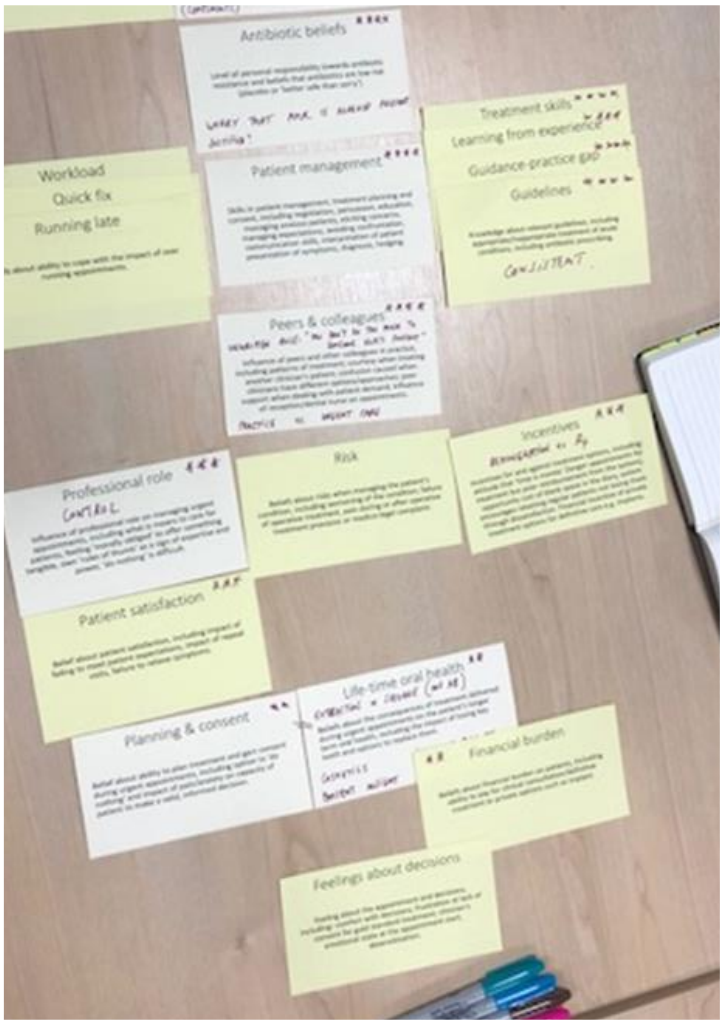
The task for each group was to identify 'top priorities' which they felt should be the focus for developing an intervention to reduce dental antibiotic prescribing. To avoid stifling creative thinking, no further instructions were provided. Each group devised its own scoring system which were subsequently translated into a form compatible with the * rating devised by Group 1 so that the results could be combined. Each of the groups also chose to annotate the cards with their thoughts. In addition, the illustrator recorded additional discussion in the graphic record. An extract of the summary score sheet including a description of how the scores were aligned has been presented in Table 6-2. The scores for each group were combined by calculating an average of the * rating to identify the highest priority factors. No cut off between high and lower priority was established in advance; this was established by inspection following combination of the scores.

One of the groups also explored links between the factors by arranging the flashcards on the desktop (see Figure 6-4).

Table 6-2 Extract from the scoring summary and associated comments from the graphic record

	Group 1 (Star rating devised by Group1)	**Group 2** (4* = Group agreed and/or highlighted the factor as important)	**Group 3** (4* = top 8; 3* = middle; 2* = bottom 8)	**Average Score**
Patient influence	5* Complaints	4* (Patient influence & culture) Patients expect to feel better Patient used to having abs Regular attenders might be easier Patients go elsewhere – lost revenue/complaint Patient anxiety- influence to go for easier option (B)	4*	4.5*
Antibiotic beliefs	4* Worry that AMR is already present. Justified?	4*	4*	4*

Figure 6-4 Desktop identification of some links between factors



6.4.3 Context

The potentially modifiable influences which were not identified as priorities for the intervention by the stakeholders were nevertheless important contextual factors. In accordance with Mills and colleagues (Mills et al., 2019), these factors were classified by the researchers as either ‘inner context’, or ‘outer context’. Inner context related to the micro-level of the individual dentist and mapped to the TDF domains: ‘behavioural regulation’, ‘beliefs about consequences’, ‘emotion’, ‘goals’, ‘knowledge’, ‘memory/decision processes’, ‘professional identity’, ‘skills’ and the non-modifiable factors relating to dentist and practice characteristics. Outer context related to the meso-level organisational issues and macro-level to wider social and economic issues, which mapped to the TDF domains: ‘environmental context/resources’ and ‘reinforcement’ Features of each contextual factor where differences between settings were identified in Chapter 5 have been summarised in order to assist understanding of the dynamic complexity of the context and to inform the future development of a facilitation strategy as part of the complex intervention (Mills et al., 2019).
Mapping of the elements currently within the PHE dental AMS toolkit was undertaken to enable subsequent assessment of the interactions between the new APTiTUDE intervention components and existing tools.

6.4.4 Intervention components

Identification of candidate BCTs for changing antibiotic prescribing behaviours associated with each of the prioritised influences on behaviour was undertaken using the TTT which maps TDF domains directly to BCTs (HBCP, 2018; Carey et al., 2018). Only BCTs where ‘conclusive links to the evidence base’ had been identified in the TTT were selected as candidate BCTs (identified as green boxes in Figure 6-5).

Figure 6-5 Excerpt from the Theory & Techniques Tool (TTT) showing a selection of the behaviour change techniques (BCTs) relating to the 'beliefs about consequences' domain of the Theoretical Domains Framework (TDF). Source:(HBCP, 2018)

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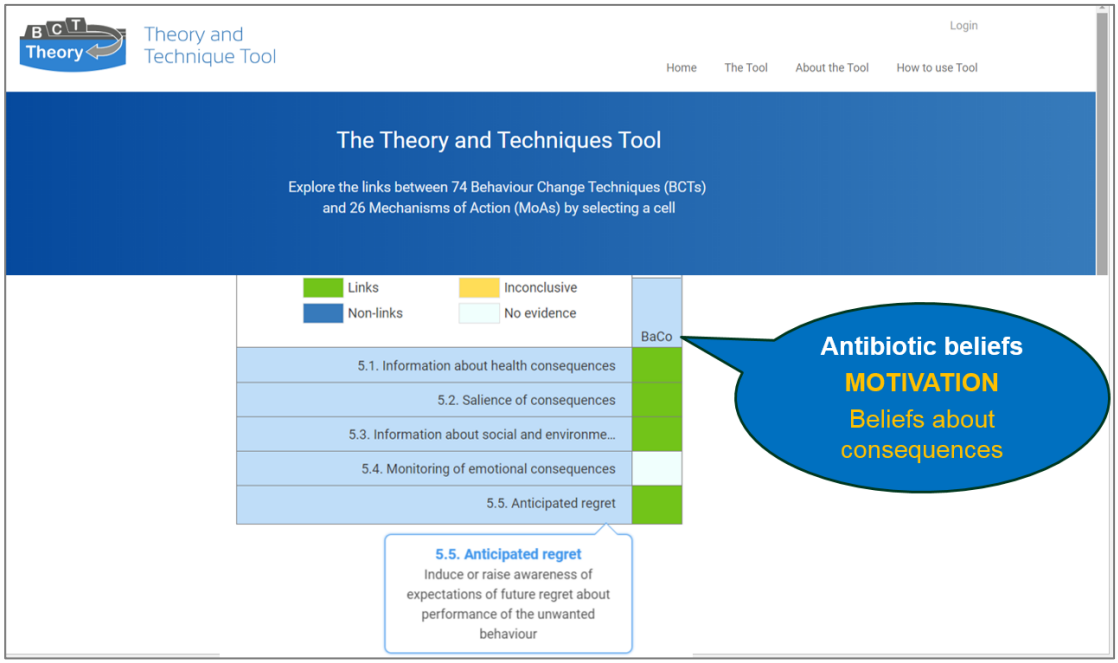


Shortlisting of candidate BCTs to include within the complex intervention was undertaken by the researcher (WT) through application of the APEASE criteria (see Table 6-3). Details of the assessment are presented in Appendix DD2.

Table 6-3 APEASE Criteria. Source: Adapted from (Michie et al., 2014).

Affordability	Can it be delivered in budget?
Practicability	Can it be delivered as designed?
Effectiveness/cost effectiveness	Does it work? Is it value for money?
Acceptability	Is it judged appropriate by stakeholders?
Side effects/safety	What is the potential for unintended consequences?
Equity	Will it affect disparities in health & wellbeing?

Identification of intervention components was guided also by reference to the 'potential targets for optimising care' identified for each of the factors identified in Chapter 5 Table 5-14 to Table 5-16. Opportunities for knowledge transfer from the medical context were considered using the published evaluations of the TARGET toolkit and the GRACE/INTRO intervention for RTIs (as discussed in Chapter 3)

At a second meeting of the study's stakeholder group (on 14 January 2019), the priority factors, BCTs for one potential new APTiTUDE intervention (for motivating change by addressing beliefs) were reviewed through group discussion and confirmed as appropriate. The agenda for that meeting is included at Appendix DD3.

6.4.5 Interactions

Interactions between the intervention components were identified using the TTT to find which intervention functions addressed more than one of the factors (via reference to associated TDF domain). Potential interactions between the intervention components and the contextual factors were also explored using the TTT.

6.4.6 Logic model

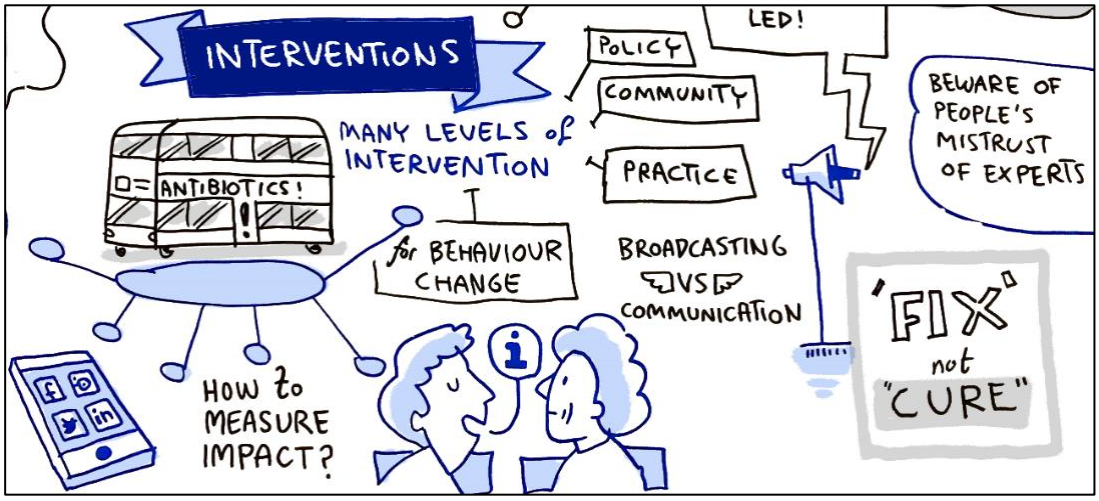
At the APTiTUDE stakeholder meeting on 14 January 2019, the elements of the logic model (priority factors to be addressed and BCTs to address them) were reviewed and agreed as its vision for delivery of a complex intervention to reduce antibiotic prescribing for adult patients during urgent NHS dental appointments in England. From this co-creation exercise with the APTiTUDE stakeholder group, a programme-level logic model for the complex intervention was produced to summarise the theoretical basis for the complex intervention, including:

- the public health and patient safety problems of dental antibiotic prescribing;
- influences on dentist's behaviour which stakeholders identified as a priority to be tackled in order to reduce antibiotic prescribing
- components of a complex intervention that can be tailored to context and stage of the programme delivery
- an overview of the short-term behavioural outcomes
- a summary of the contribution it should make to delivery of the UK Vision for tackling AMR in terms of patient safety and public health (HMG, 2019a).

6.4.7 Co-developing a new tool

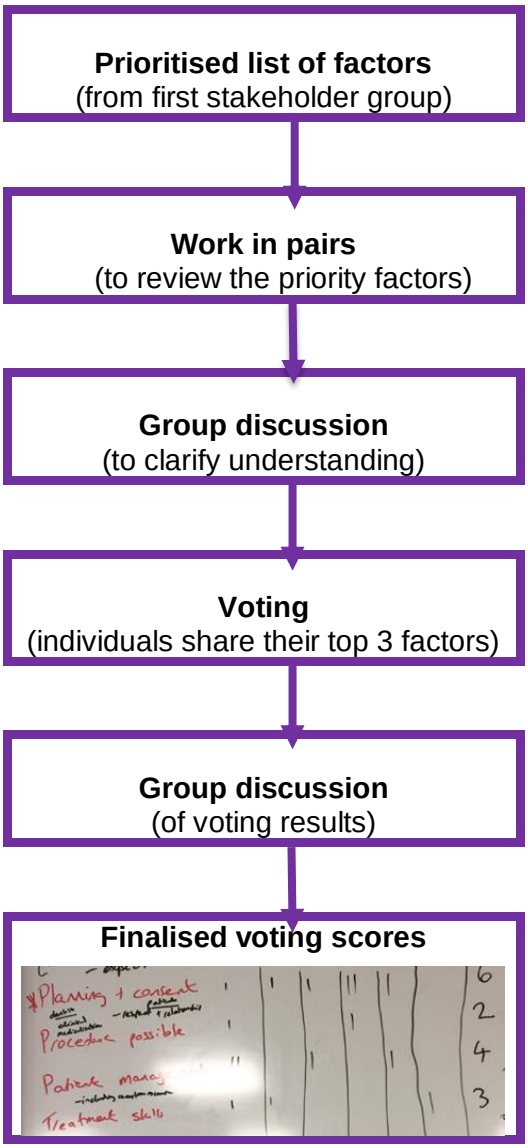
The second meeting of the study stakeholder group aimed to guide development of one of the new tools for the APTiTUDE complex intervention. It was run as a theatre-workshop facilitated by the Theatre of Debate charitable organisation in response to guidance from the stakeholders at their stakeholder meeting about the value of engaging dental teams and patients through narratives (see Figure 6-6). A professional script writer and a producer participated in the workshop.

Figure 6-6 Extract from the graphic record of the stakeholder meeting on 1 October 2018 – possible interventions



First the stakeholders selected one of the APTiTUDE intervention components as the focus of their work. Next they used Nominal Group Technique (NGT) (through the steps shown in Figure 6-7) to prioritise the APTiTUDE factors to include within the intervention (McMillan et al., 2016).

Figure 6-7 Steps of the Nominal Group Technique prioritisation exercise undertaken at the stakeholder group January 2019, including an excerpt from the finalised rankings. Adapted from: (McMillan et al., 2016).



Key messages for dentists and patients to include within the intervention (in order to address the factors) were then identified through two exercises with the stakeholders working in pairs: a) an advertising exercise to write headlines or slogans about the priority factors; and b) a role play exercise about urgent dental appointments. Ideas for developing the intervention were discussed and delegates were shown an example of a video monologue intervention which had been developed for the Wellcome Trust by Theatre of Debate in order to explore a complex medical ethics issue (Campus, 2018). The results of the second stakeholder group were summarised as a component-level logic model to underpin the development of one components of the APTiTUDE programme logic model.

6.5 Results

6.5.1 Theoretical basis

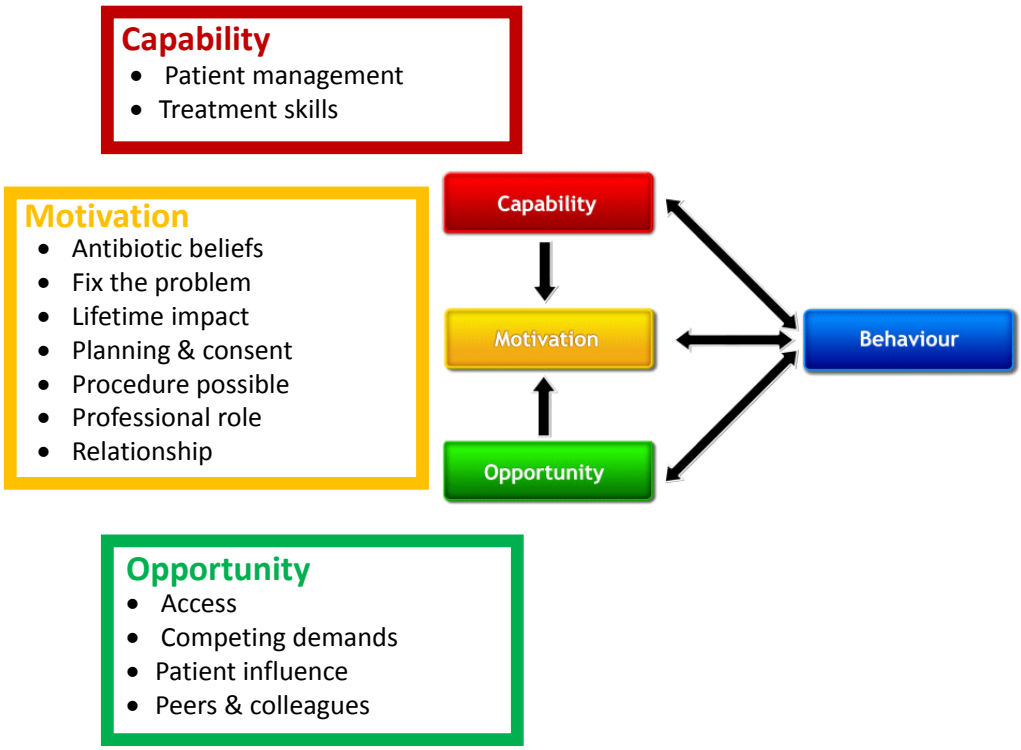
The scores allocated to each factor following discussion by the three stakeholder working groups ranged from 0 to 5*. Averages across the groups range from less than 1* to 4.5*. Factors which included a 4* score (highest priority) from at least one of the groups as well as an average of more than 3* were selected as the 'high priority' factors. The 13 high priority factors identified are presented in alphabetical order together with their associated TDF domain (see Table 6-4).

Table 6-4 Priority factors identified by the stakeholder group for intervention development and the associated TDF domain.

Factor	TDF Domain
Access	Environment context/resources
Antibiotic beliefs	Belief about consequences
Competing demands	Environment context/resources
Fix the problem	Goals
Lifetime impact	Belief about consequences
Patient influence	Social influences
Patient management	Skills
Peers & colleagues	Social influences
Planning & consent	Beliefs about capabilities
Procedure possible	Beliefs about capabilities
Professional role	Professional role & identity
Relationship	Goals
Treatment skills	Skills

Presenting the factors within the COM-B model (in the same way as in Chapter 5) produced a theoretical model of behaviour for the APTiTUDE intervention development. As shown in Figure 6-8, the 13 factors covered all areas of the COM-B model: 2 were about the 'capability' of dentists, 4 were about influences based on 'opportunity' and 7 related to dentists' 'motivation'.

Figure 6-8 Behavioural model for APTiTUDE intervention development



The graphic record of the TRUCE multidisciplinary stakeholder is presented in Figure 6-9. Only those factors which the illustrator felt had been discussed in most depth were included in the record. Some of the terminology/factor names were adjusted slightly following the workshop, such as 'lifetime oral health implications' became 'lifetime impact'. Additional insight about the factors was gained during group discussion stimulated by the illustration. For example, the dentists all reported being asked by patients, on occasions, for particular treatments. When requested to extract teeth all of the dentists agreed that they were comfortable refusing to provide the procedure requested. When requested to prescribe antibiotics, some of the dentists reported difficulty declining the request. This suggested that the dentists possess the skills to decline specific requests and after further discussion the group concluded that it was beliefs about antibiotics ('what harm can they do') which underpinned the difference in response. A graphic record of the stakeholder workshop held on 1 October 2018 to prioritise factors influencing the prescription of antibiotics to underpin the development of the APTiTUDE complex intervention is presented in Figure 6-9

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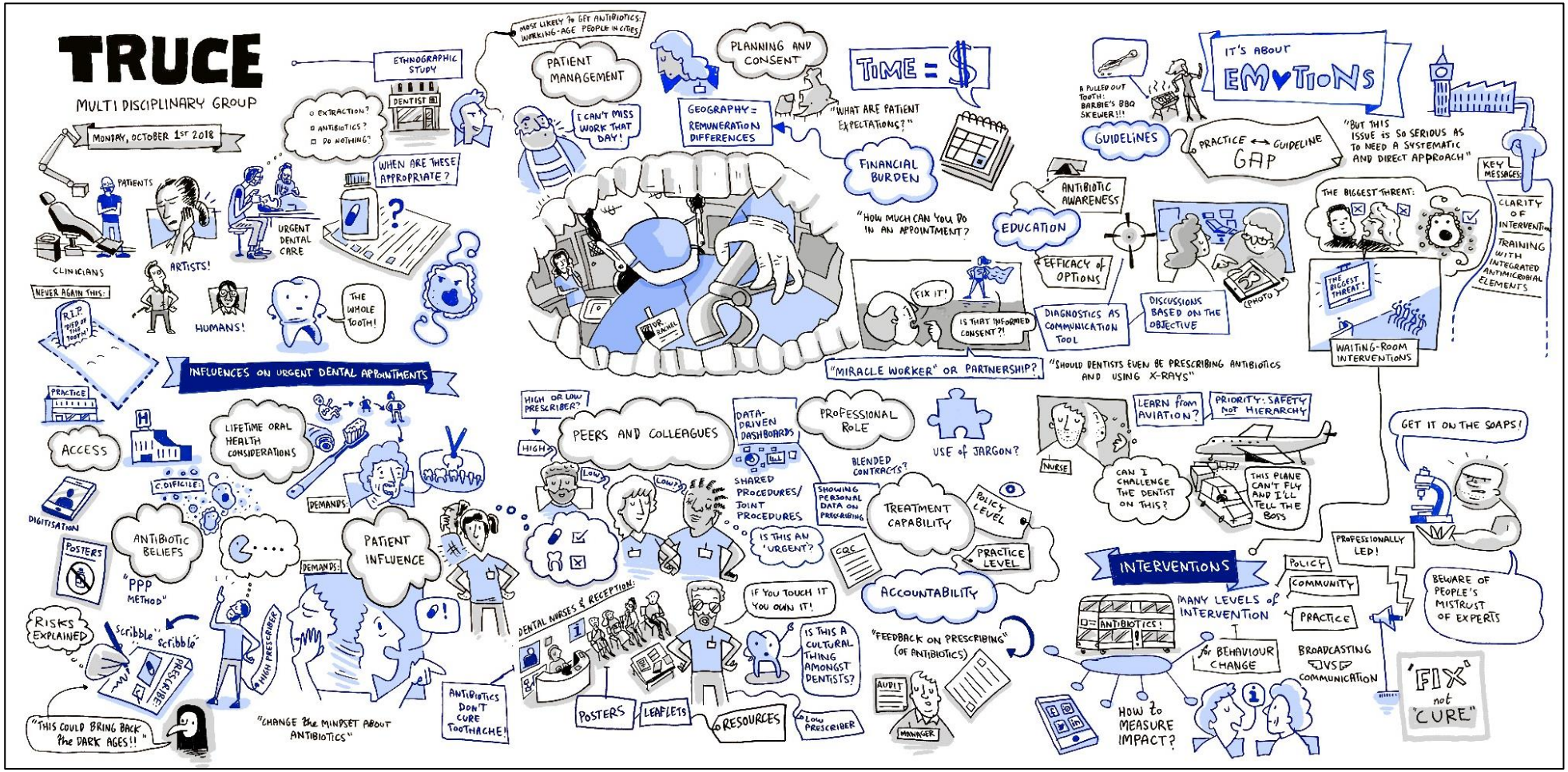
Figure 6-9 Graphic record of the stakeholder workshop on 1 October 2018 to prioritise factors associated with antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments.



6.5.2 Context

From the full list of 34 factors identified in Chapter 5, 23 were identified as contextual factors as they were not identified as priorities for the complex intervention. Outer context factors relating to the macro-level included access and healthcare context which are addressed in more detail below.

Access to primary and secondary care services was identified by the stakeholders as the highest priority factors to be address. They noted, however, that this was a servicing commissioning issue to address and that access issues differed across the country. The testing, evaluation & implementation strategy will need to address levels of access in each of the test areas.

The PHE dental AMS toolkit is an important element of the healthcare context within which the new intervention will be implemented. A summary of its contents and a mapping to the TDF is presented in Table 6-5. Each component of the toolkit is coloured according to its corresponding category within the COM-B model: capability (red), opportunity (green) and motivation (yellow).

Table 6-5 Mapping of the elements of the existing Public Health England Dental Antimicrobial Stewardship (AMS)Toolkit against the Theoretical Domains Framework (TDF) and COM-B model. As previously, the colours reflect: COM-B capability (red); opportunity (green) and motivation (yellow).

Elements of the existing toolkit	TDF domain
Resources	
Patient information leaflet & poster	Social influences
Antibiotic Guardian website	Knowledge
Guidance	
Drug prescribing for dentists)	Knowledge
Education & training tools (on-line)	
Dental care and dental antibiotics	Knowledge
Generic antibiotic resistance course	Belief about consequences
Audit tool & action planning	
Self-audit tool	Behavioural regulation

Of the 23 contextual factors, 15 of them were found (in Chapter 5) to vary between settings. A summary of the way in which they were found to vary (as an important element of understanding the context for antibiotic prescribing in urgent NHS dental care) is provided in Table 6-6.

Table 6-6 Tables of contextual factors which differ between settings

Factors	GDP v OOH	High vs low rate GDP
Access	GDP - Ability to undertake watchful waiting for regular patients. OOH – one off appointments.	
Accountability	GDP some audit OOH - all routinely audited	
Efficacy of treatment		High – antibiotics seen as less stress than procedures Low – procedures seen as quicker fix than antibiotics
Fear of outcome	GDP worried about hurting patients OOH dentists expressed no emotion about outcome	
Feedback loop	GDP routine feedback from patients OOH no feedback about outcome	
Feelings about decisions		High – no feelings expressed Low –pride or frustration about antibiotic use
Guidance-practice gap		High – practice based on antibiotics cure toothache Low – practice based on antibiotics don't cure toothache
Guidelines & Information		High BNF main source of information Low – treatment guidelines used
Habits		High – routinely prescribe antibiotics for urgent care Low – routinely provide treatment
Healthcare context	GDP - No use of '*Antibiotics don't cure toothache*' posters. Dental teams used to working together. OOH some use of posters/leaflets. Individuals only come together to deliver patient care.	
Incentives	GDP paid by UDA OOH paid per session	

Factors	GDP v OOH	High vs low rate GDP
Lifetime impact	GDP provide treatment over time OOH – one off appointment	
Relationship	GDP – goal for enduring relationship OOH – goal for happy patient in appointments only	
Risk perception	GDP – temporary treatment fine with definitive follow-up OOH – provide definitive treatment at urgent appointment as risk of only temporary treatment	
Workload	GDP – time for consent not raised OOH – prolonged time for consent process due to new patients each time.	

6.5.3 Intervention components

A total of 36 candidate BCTs were identified using the TTT and short listed to 17 BCTs using the APEASE criteria (see Appendix DD2). The selected BCTs together with the 'potential targets for optimising care' from Chapter 5 are presented in Table 6-7

Table 6-7 Intervention components (Behaviour Change Techniques selected by application of the APEASE criteria) and potential opportunities to optimise care through the APTiTUDE intervention.

The colours reflect the COM-B elements of: capability (red); opportunity (green),motivation (yellow) and behaviour change techniques (blue).

TDF Domains (Prioritised factors)	**Selected Behaviour Change Techniques (BCTs) (from Appendix D2)**	**Opportunities for interventions to optimise care (from Chapter 5 Tables 4-14 to 4-16)**
Skills (Patient management) (Treatment skills)	Instructions on how to perform the behaviour Behavioural practice/rehearsal	Tools to assist patient-dental team engagement during urgent dental appointments, including sharing information and decisions with images not just words.
Beliefs about capabilities (Planning & consent) (Procedure possible)	Instructions on how to perform the behaviour Behavioural practice/rehearsal Verbal persuasion about capability	Facilitating dentists to share experience and stories about ways to manage urgent dental conditions in accordance with guidance, using practical techniques which go beyond textbooks.
Beliefs about consequences (Antibiotic beliefs) (Lifetime impact)	Information about health consequences Salience of consequences Information about environmental & social consequences Anticipated regret Information about emotional consequences	Personalising the risks of antibiotic use as they relate to patient safety rather than public health. Guidance on the use of delayed prescribing in dentistry
Goals (Fix the problem) (Relationship)	Goal setting (behaviour) Review behavioural goal(s)	Developing tools to: - refocus the provision of urgent dental care towards patient safety and the patient's perspective of the need; - manage patient expectations with respect to antibiotics for treating acute dental problems.
Professional/social role & identity (Professional role)	No BCTs conclusively linked with this domain	Nil
Environmental context/resources (Access) (Competing demands)	Practical support Prompts & cues Reduced exposure to cues for the behaviour Adding objects to the environment	Further research to identify the appropriate length of slots for urgent dental care and enforceable contract terms which ensure sufficient dedicated urgent appointment slots are available.
Social influences (Patient influence) (Peers & colleagues)	Social comparison Information about others' approval Social rewards	Developing resources to managing patient expectations – for use before/during urgent appointments which break patient's association about the need for antibiotics.

During this mapping exercise, it was found that the 'professional role & identity' domain of TDF was not associated with any BCT. In addition, it became clear that addressing the problem of improving 'access' to primary and secondary care dental services across England was beyond the scope of this study. For the purposes of intervention development, these factors were moved to the wider set of contextual factors (see Figure 6-11) rather than being targets for behaviour change.

The TARGET toolkit evaluation identified views of the GPs with respect to each element of the toolkit (Jones et al., 2017). In response to the question 'Would you use the resource?', only four of the eight elements scored more than 50%. Of these four tools, only 'information about delayed prescribing' and the 'Treating your infection leaflet' for use during patient consultations were not already included within the dental AMS toolkit. Both of these relate to potential elements of the APTiTUDE intervention identified in Appendix DD2 and may be amenable for knowledge transfer to dentistry.

Evaluation of the GRACE/INTRO web-based training tool included the use of a point-of-care test and a communications skills package (including a booklet to be used during patient consultations) (Yardley et al., 2013). None of the intervention components identified from the evaluation matched the priority factors for the APTiTUDE tool, although the booklet for use during patient consultations may provide some insight for development of the tool to assist patient-dental team engagement identified Table 5-14 'Patient Management'.

6.5.4 Interactions

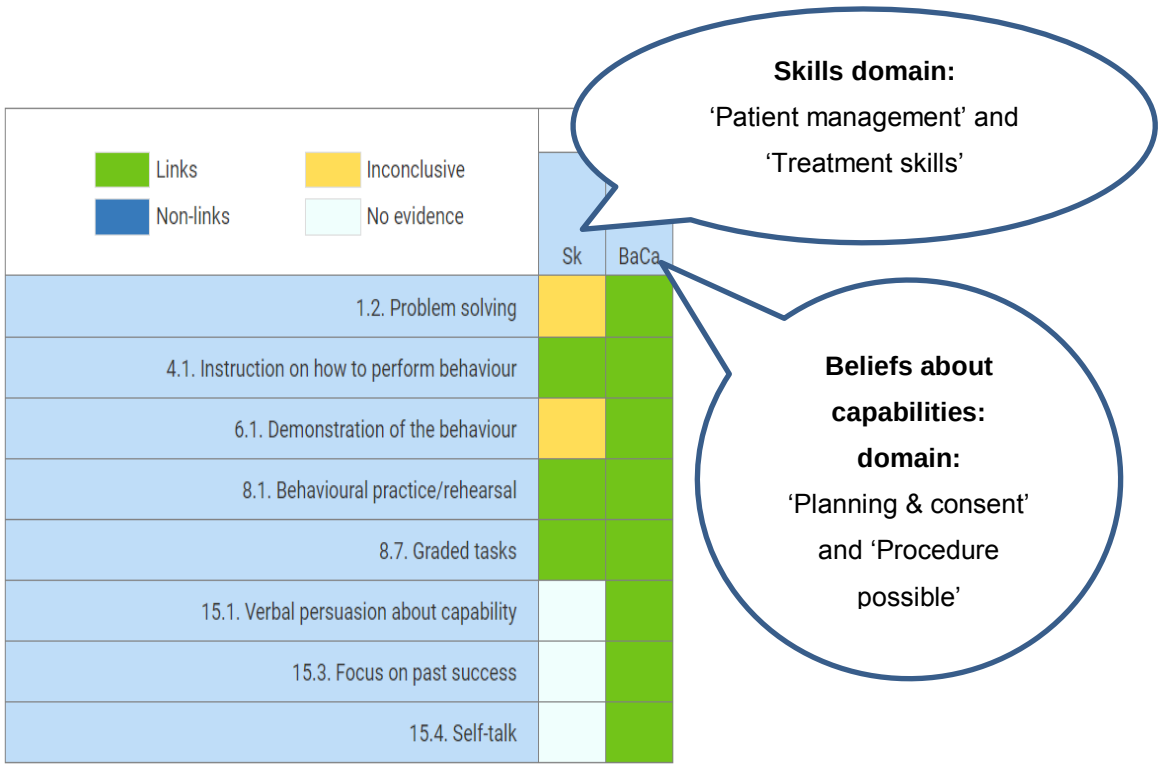
An extensive range and number of interactions were found between the contexts in which the intervention will be implemented and the components of the intervention – as well as between the various components of the interventions themselves. Potential interactions between elements of the planned APTiTUDE intervention and the context in which it may be implemented were too numerous to identify them all. An illustrative set of interactions are presented below to exemplify the complexity of the APTiTUDE behaviour change intervention.

Considering the PHE Dental AMS Toolkit as an important element of the context within which NHS dentists prescribe antibiotics, interactions with the APTiTUDE complex intervention were found in relation to 'social influences' (see Table 6-5): patient facing leaflets and posters within the toolkit aim to address patient influences. Also an interaction exists with 'beliefs about consequences' where generic on-line training about AMR aims to address beliefs about antibiotics. No interaction between the PHE toolkit and the APTiTUDE complex intervention exists in relation to the 'knowledge' domain (as knowledge was not identified as a high priority to be addressed). Practical 'skills' training and 'beliefs about capabilities' do not currently feature in the PHE dental

AMS toolkit but were identified as a priority for inclusion with the APTiTUDE intervention.

Interactions *between* components of the planned APTiTUDE intervention exist in relation to the TDF skills domain ('patient management' and 'treatment skills' factors) and beliefs about capabilities domain ('planning & consent' and 'procedure possible' factors). The BCTs for these domains are shown in Figure 6-10 of eight potential BCTs for the intervention, three are identified as addressing both the 'skills' and 'beliefs about capabilities' domains.

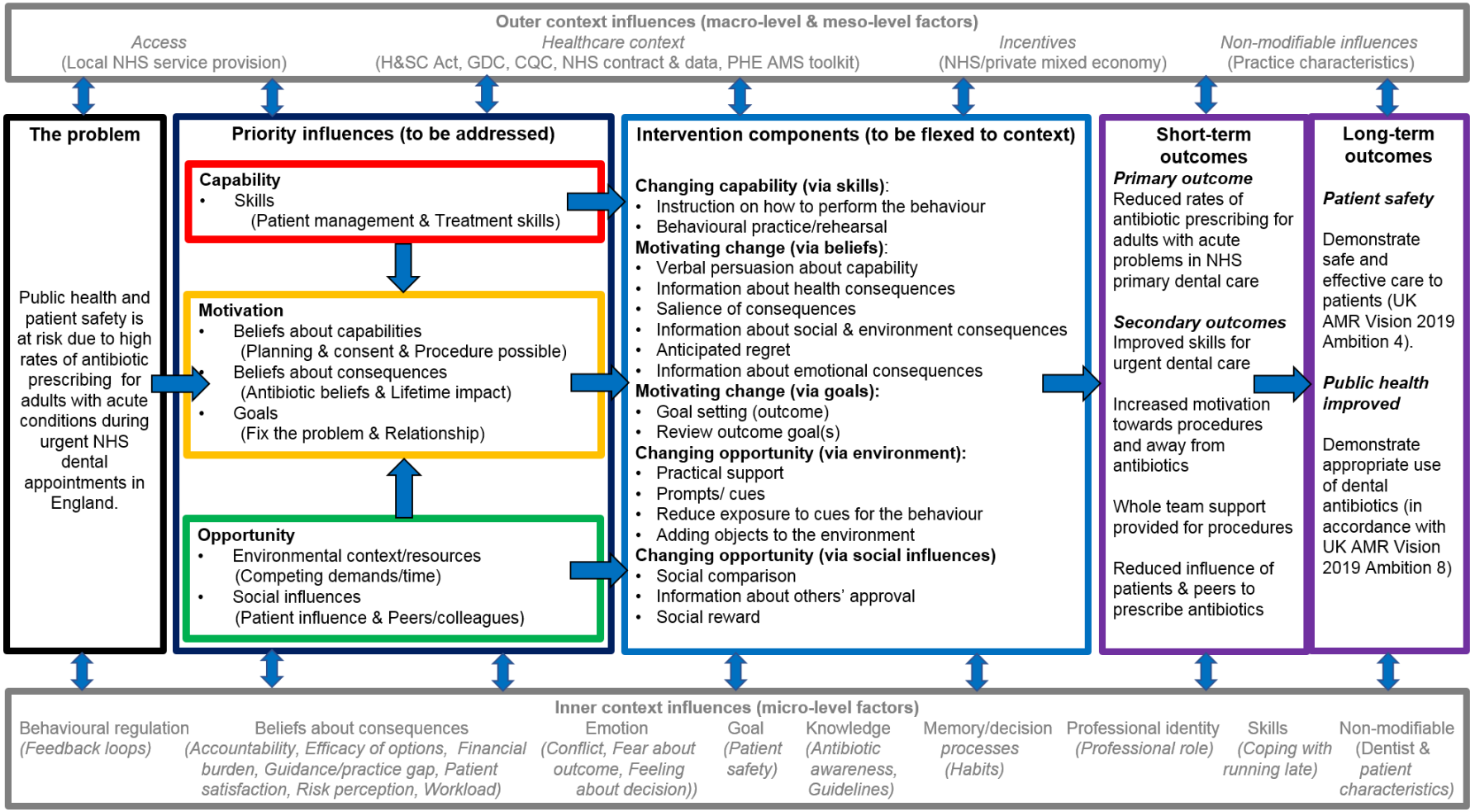
Figure 6-10 Extract from the Theory & Techniques Tool (TTT) showing interactions between the Behaviour Change Techniques to address the Skills and Beliefs about Capabilities domains. Source: (HBCP, 2018).



6.5.5 Logic model – APTiTUDE programme

The logic model presented in Figure 6-11 provides a graphical representation of the theoretical basis for the APTiTUDE complex intervention, its components, context and the extensive nature of interactions between its elements.

Figure 6-11 Logic model for the APTiTUDE programme



6.5.6 Co-development of a new tool: storytelling using monologues

Through the NGT prioritisation exercise (see 6.4.7), the stakeholders reached consensus that they wanted to focus their intervention tool development towards three factors: 'planning & consent', 'patient management' and 'antibiotic beliefs'. These related to the APTiTUDE logic model's 'motivating change via beliefs' intervention component in Figure 6-12. The role play exercise revealed strong feelings and emotions associated with some urgent dental appointments. From the advertising exercise, three headline messages were identified that they wanted to address:

(a) personalisation of meaning about the risks of antibiotics (e.g. grandparents not wishing their grandchildren to grow up in a world where antibiotics do not work);

(b) only prescribing antibiotics when necessary; and

(c) antibiotics do not fix toothache.

After viewing the Wellcome Trust video monologues (Campus, 2018), the stakeholders considered that adopting an online visual arts approach could be a fresh medium for this health problem, offering good reach and with good potential to be highly impactful. Their ambition was to create a set of video monologues/podcasts that could be watched/listened to individually or together as part of a whole dramatic story in order to engage the audience by evoking debate. With reference to the BCTs/intervention components (see Table 6-7), they directed that the resource should incorporate 'information about health consequences,' 'information about emotional consequences', 'salience of consequences' and 'anticipated regret'. They also advised that each video should finish with a question aimed at: stimulating discussion, encouraging additional information to be sought and/or challenging the thinking of those engaging with the resource. Whilst the stakeholders accepted that these final questions were the domain of the researchers, they recognised the craft involved in storytelling. They advised that the researchers should provide the script writer and producer with the clinical context but allowing artistic freedom to deliver the storyboards and scripts which should then be checked and refined for clinical acceptability (Schneider et al., 2014). The stakeholders identified that between three and five monologues seemed appropriate and stated that they should be written for a wide audience of professionals and the public so they could be used in a variety of ways. In relation to motivating dentists to change their beliefs, the tool was envisaged to be used during face-to-face training events or peer reviews, including educational outreach provided by facilitators at dental practices and/or clinics. A network of dental AMS guardians across the country was suggested as a way of disseminating the message.

The component-level logic model presented in Figure 6-12 provides a graphical representation of the way in which the intervention component could be operationalised, specifically concerning dentists' motivations with respect to antibiotic prescribing. It identifies the intervention components from the APTiTUDE programme logic model, together with the inputs, activities and outputs planned to deliver the outcomes. As shown in the logic model, it aims to motivate dentists to reduce their antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments by personalising the risks of antibiotic use as they relate to patient safety rather than public health and tackling their 'beliefs about 'planning & consent'.

Figure 6-12 Component level logic model for the storytelling tool and an image of the video-monologues aimed at motivating change by addressing beliefs about consequences.

APTiTUDE components	Inputs	Activities	Outputs	Short-term outcomes	Long term outcomes
Information about health consequences Salience of consequences Anticipated regret Information about emotional consequences	Storytelling tool Antimicrobial stewardship engagement event outline Resources and facilitators Other routes to dental team via training courses, peer reviews and social media.	Personalisation of salient health consequences of dental antibiotics use through engagement with dentists. Facilitating dentists to share experience Antibiotic stewardship engagement events for dental teams	Reduced desire to prescribe antibiotics for adults with acute dental problems during urgent NHS appointments. Increased understanding of the risks of using antibiotics.	Increased motivation towards procedures and away from antibiotics.	Demonstrate appropriate use of antibiotics (in accordance with UK AMR Vision 2019 Ambition 8)

6.6 Discussion

6.6.1 Key findings

Using the evidence identified earlier in this thesis about factors which influence prescribing and through co-production, the logic model for a theoretically plausible complex intervention for the reduction in antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England has been produced. The APTiTUDE programme logic model provides a graphical outline of how the NHS can holistically address reducing antibiotic prescribing by dentists through embracing individual dentist, practice and wider healthcare context levels. Underpinned by the detailed analysis of each factor and how they vary between settings which was elucidated in Chapter 5, the logic model illustrates the dynamic nature of the context within which antibiotic prescribing during urgent NHS dental appointments occurs and will need to be addressed. Specifically it provides a one page overview of:

- the public health and patient safety problems of dental antibiotic prescribing;
- influences on dentist's behaviour which stakeholders identified as a priority to be tackled in order to reduce antibiotic prescribing
- components of a complex intervention that can be tailored to context and stage of the programme delivery
- an overview of the short-term behavioural outcomes
- a summary of the contribution it should make to delivery of the UK Vision for tackling antimicrobial resistance in terms of patient safety and public health (HMG, 2019a).

The APTITUDE logic model will have different purposes in the life of a dental antibiotic stewardship program, including during the program design, testing and evaluation and implementation stages. As highlighted in the introduction, the role of logic models is changing and it has been suggested that traditional logic models may be inappropriate for healthcare interventions that need to adapt to a dynamic context; in these situations logic models which enable facilitators to prospectively assess the settings they will be working in and to develop context-sensitive facilitation strategies have been advocated (Mills et al., 2019). New MRC guidance anticipated in late 2019 is expected to provide more clarity about their future role, including for presenting a summary of programme theory and implementation ideas to funders (Skivington et al., 2018).

The APTITUDE logic model can be seen, therefore, as a key stage for intervention development planning. It will generate new tools for the on-line PHE dental AMS toolkit (PHE, 2016a); goal setting and quality improvement approaches for the new NHS

dental contract; and workforce development recommendations relating to urgent dental care for HEE's advancing dental care programme (NHSE, 2019a). The aim of the APTiTUDE programme is to drive change in an evidence-based manner, with the addition of resources which enable tailoring for interventions to meet the needs of each dental practice or clinic: one size will not fit all (Ackerman et al., 2013).

Opportunities for knowledge transfer from primary dental care to dentistry appear to be fewer than originally anticipated. As identified in Chapter 3, the GRACE/INTRO evaluation of a communication tool and point-of-care test for use during consultations for patients with RTIs identified a number of factors that worked with GPs and had potential for translation into the urgent dental care setting. However, comparison of the factors identified from GRACE/INTRO matched with the APTiTUDE priorities. As identified during the stakeholder group and also by Newlands and colleagues in 2016, it may be that dentists already possess the communication skills required to decline to provide patients with treatment about which they are uncomfortable e.g. extracting teeth. The issue relating to antibiotics appears to be linked more closely to dentists' beliefs about the safety of providing antibiotics to patients. Existing tools within the PHE dental AMS toolkit were found to focus predominantly on enabling dentists to optimise their prescribing of antibiotics by addressing the 'capability' aspect of the COM-B model – by providing the guidelines for dentists and patient facing information about antibiotic resistance. Only one resource in the PHE toolkit addressed issues of motivation and this is a generic resource about antibiotic resistance. Motivation has been identified as a key areas for the APTiTUDE intervention with six of the eleven priority factors relating to it.

Three new intervention components have been identified to complement existing tools within the PHE Dental AMS toolkit. Each will focus on a different level of the context: individual dentist; dentist-patient interaction; and wider organisational-level. At the level of individual dentists, an intervention is planned to address the beliefs of dentists with respect to antibiotics. This is the intervention for which the story-based engagement tool has been developed through co-production and is included in Figure 6-12. Further development of the intervention of which this tool will play a part will include exploring opportunities for a network of dental antibiotic guardians to deliver educational outreach and facilitation to identify a tailored package of training and tools to reduce local rates of antibiotic prescribing. Facilitating dentists to share experience and stories about ways to manage urgent dental conditions in accordance with guidance, using practical techniques which go beyond textbooks, may also be a feature of this intervention. A tool for use during consultations to support the dentist-patient interaction is planned to assist patient-dental team engagement during urgent dental appointments, including sharing information and decisions with images not just words

(as identified in Table 5-14 ‘Patient management’). An organisational level tool to motivate change by setting goals and providing social comparisons will rely on access to personalised prescribing data and may be facilitated also by the dental AMS guardians.

The research underpinning this intervention development has provided a detailed snap-shot in time of the factors driving dental antibiotic prescribing. It has identified powerful disincentives for dentists to use antibiotics appropriately and for some dentists, antibiotics were seen to provide ‘shortcuts’ in terms of managing their workload and keeping patients happy. The nature of dentistry as a business which needs to remain profitable in order to continue to deliver NHS services may seem strange to healthcare providers elsewhere in the NHS (Goodwin et al., 2018). It is known that dentists are strongly influenced by financial incentives (Brocklehurst, P. et al., 2013) and this seems to have influenced high participation rates in a pilot peer review on dental AMS run by Cheshire & Merseyside’s NHS Local Dental Network in 2014 (compared to other parts of the country where no remuneration for participation has been provided). Taking account of financial incentive/disincentive/penalties will be important during planning of the complex intervention and its evaluation, including issues which can be anticipated such as NHS dental contract reform and those which cannot be anticipated at present (BDA, 2019).

A financial uplift for the purposes of improving dental AMS across NHSE is highly unlikely. Introducing an incentive for dental AMS as a key performance indicator for quality improvement within the NHS dental contract could see a step-change occur, as whole dental teams become focused on reducing inappropriate use of antibiotics. As described in Chapter 4, however, a fundamental change needs to occur in relation to routinely-collected prescribing and/or dispensing data for it to be sufficiently robust to be used in this way. Until such data are available, therefore, any system of setting targets and monitoring achievement against them will be based on self-reporting at the practice/clinic level. With the right leadership, such an approach can be successful, as identified at one of the OOH research sites that participated in the ethnographic study (Chapter 5). Dentists were made to feel a strong sense of accountability for their antibiotic prescribing patterns through regular feedback about personal antibiotic prescribing rates compared to colleagues working at the same site and over the same period. Rates of antibiotics being prescribed to less than 10% of patients attending for an urgent dental appointment in one of the most deprived and ethnically diverse areas of the country were achieved (Shahid S, 2013).

Non-financial incentives towards providing optimal care/prescribing (or rather disincentive/penalties away from providing poor care/prescribing) already exist via the GDC and CQC. The GDC Professional Conduct Committee can and does include

inappropriate prescribing of antibiotics on charge sheets for dentists as it relates to inadequate management of patients (GDC, 2016). CQC is legally required by the Health & Social Care Act's Code of Practice on the Control and Prevention of Infection to take AMS into consideration when inspecting practices, although to date it has not taken a proactive role in this respect (Milne, 2019). As a result of this research's findings, an approach was made to the GDC and the CQC about strengthening their approach to dental antibiotic stewardship through leadership.

The need to shift messages about antibiotics away from the macro-level population based issues such as numbers of deaths and cost to the economy was previously recognised by Wellcome Trust in its 2015 report on the consumer perspective (Wellcome_Trust, 2015). Indeed, it went on to recommend running joint awareness campaigns for doctors and the public so that the two would be 'mutually reinforcing'. This approach was advocated by the APTiTUDE stakeholder group and underpinned the video-monologue scripts developed as part of the APTiTUDE intervention. Getting the messaging right for both audiences to ensure that the monologues were engaging, dramatic and believable from both perspectives required carefully handling. Evaluation of this novel approach will build on approaches used for research-based theatre (Beck et al., 2011; Schneider et al., 2014)**.**

6.6.2 Strengths and weaknesses

A theoretically sound plan for a plausible intervention has been produce. The potential of coproduction for developing tools for the new APTiTUDE complex intervention has been demonstrated. The next steps will include continued development of the tools for the APTiTUDE intervention in parallel with a testing, evaluation and implementation strategy. A robust and appropriate method of evaluating the complex intervention will need to be found, guided by the forthcoming MRC/NIHR guidance on complex interventions (Craig et al., 2019) This will likely include exploration of the varying characteristics and multiple influences on the intricate, dynamic system relating to each practice/clinic and clinician recruited into the study. In addition, a trigger to initiate the change and feedback loops to maintain momentum will be essential (Braithwaite et al., 2018). This may, for example, come from a renewed emphasis from the CQC with respect to its existing responsibility for ensuring practices are taking their responsibilities to AMS seriously (in accordance with the Health & Social Care Act Code of Practice on the Prevention & Control of Infections as described in Chapter 1). To measure progress towards achievements of the intervention's outcomes (reduction in antibiotic prescribing for adults with acute dental conditions without increases in harm to patients), improvements will be required in NHS digital systems. The utility of routinely-collected data relating to dental antibiotic use by NHS dentists was discussed

in Chapter 4; electronic prescribing (as advocated by NICE) would address this problem but may be some years away from implementation across NHS dentistry in England. Linkage of dentistry into NHS electronic healthcare records systems is also anticipated and would provide the means to track patients between healthcare settings so as to monitor harm experienced in relation to reduced antibiotic prescribing. With delays to the introduction of these digital solutions for dentistry likely, identification of alternative methods to collect data for the evaluation project will need to be included as mitigation in the testing, evaluation and implementation strategy. Careful planning of this mitigation approach would be required to ensure that data collection methods did not become an unintended part of the intervention. A similar study with GPs found that antibiotic prescribing was highly susceptible to the Hawthorne effect with reductions in antibiotic prescribing achieved simply because clinicians changed their behaviour on account of being monitored (Mangione-Smith et al., 2002). However, Ackerman and colleagues (Ackerman et al., 2013) found that what works to reduce antibiotic prescribing for acute bronchitis by one GP or in one practice will not necessarily work for another due to contextual differences; providing options for local tailoring was advocated. The TARGET toolkit is based on this concept and its evaluation by McNulty and colleagues might be appropriate model for the APTiTUDE intervention (McNulty et al., 2018). This would entail a pragmatic RCT of an educational intervention in GDP and OOH dental clinics that introduces prescribers to the range of tools available within the entire PHE dental AMS tool. Such a trial should also incorporate learning from the RCT undertaken by Seager et al (2006) of educational outreach visits to dental practices in order to introduce antibiotic prescribing guidelines and patient information leaflets. The cost-benefit of such a trial will need to be considered in the light of the emerging MRC guidance for evaluation of complex interventions that may provide new, more suitable evaluative approaches.

Traditional logic models are increasingly shown to be ineffective at describing the way in which interventions addressing complex, adaptive problems work. Logic models are often used to provide a visual representation of the programme theory's mechanism and contextual issues thought to influence outcomes of interest (Moore et al., 2015).Programme theory describes how interventions are expected to generate their outcomes and under what conditions (Rogers, 2008). However, logic models have been criticised for being overly simplistic and failing to capture features of systems, such as in relation to dynamic contexts and the adaptiveness of individuals (Craig et al., 2019). Whilst developing a novel approach to deriving logic models which adapt to different and changing contexts, a typology of logic models in healthcare research (see Figure 6-13) was recently described (Mills et al., 2019). It is based on two factors: 1) the way in which factors are presented, simply listed or described in terms of their

interrelationships; and 2) whether the context is included when describing the intervention.

Figure 6-13 Typology of logic models. Adapted from: (Mills et al., 2019)

		Intervention	
		Excluding context	Including context
Model factors	Listed only	Type 1	Type 2
	Interrelationships described	Type 3	Type 4

This flexible and dynamic approach has been designed to enable researchers/facilitators to assess the settings they will be working in prospectively and to develop context-sensitive facilitation strategies (Mills et al., 2019). This approach is being incorporated into the forthcoming update by MRC and NIHR of the guidelines on developing and evaluating complex interventions (Craig et al., 2019). The logic model developed for this study was a Type 4 as it included both context for the intervention and made some attempts to drawn out interrelationship between the components.
A strength of this study was the significant breadth and depth achieved in understanding about the factors underpinning antibiotic prescribing for adults presenting with acute dental conditions to NHS primary care dentists in England. Underpinning the identification of these factors was cutting edge behaviour change science from the UCL CBC (in collaboration with University of Cambridge, University of Aberdeen, University of Minnesota and funded by the Medical Research Council). This included personal correspondence with Rachel Carey, the author of the TTT, to ensure that the new on-line tool was being used in an appropriate way to identify BCTs directly from domains of the TDF (Carey, 2019).

6.6.3 Implications for practice/future research

The broad range of contextual factors found in this doctoral research to influence the decision of dentists whether to prescribe antibiotics fits well with this new approach. Similarly, its multi-level approach to tackling factors which were identified at individual, interpersonal and wider levels is also in line with the new thinking. Given the complexity of interrelations between the factors as well as the range of ways in which individuals experience each factor, it is clear that a bundle of tools for dental AMS will be required

to allow tailoring for individual needs. A structured intervention framework for facilitators to use when tailoring approaches for individual practices/clinics seems to be an appropriate way ahead to provide this flexibility (Newton, J. et al., 2006).

Work is in progress to develop all elements of the APTiTUDE programme logic model. Delivery of some of those aspects will rely on influencing NHSE, PHE and HEE to make adjustments to the way in which they currently support service delivery. An example is workforce development relating to the skills required by those delivering urgent dental care (NHSE, 2019a).The next step for this research will be to continue to develop the new tools alongside a testing, evaluation and implementation plan for the APTiTUDE intervention within the context of the existing PHE dental AMS toolkit. As described earlier, this will incorporate the latest MRC guidance on complex interventions which is anticipated for imminent publication (Craig et al., 2019). Bringing the stakeholder group together again to develop the plan will help ensure that dental teams and patients see the point of the new intervention, believe it will work, and that it will not disrupt currently working practices in a major way. In this way, the Normalisation Process Theory proposes that end users will invest effort into making the intervention work (Murray et al., 2010). This theory underpinned the evaluation by Pope and colleagues (2013) of a single computer-aided decision support system for NHS emergency and urgent care call-handling in three different settings, which highlighted the challenges of implementing even one new tool in different context and the value of a facilitator with resources to making it happen on an on-going basis (Pope et al., 2013). Recognising that urgent NHS dental care is provided in many practices/clinics across England, it is anticipated that the APTiTUDE implementation plan will include a facilitation strategy to enable facilitators to devise tailored plans which best fit the needs of the practice/clinic with which they are working (Mills et al., 2019).

In order to evaluate the intervention, as described in Chapter 4, the ability to measure outcomes relating to the rate of antibiotic prescribing at practice and ideally at individual level will be important. In addition, monitoring patient health status for any adverse consequences/harms will require joining up of healthcare systems to enable access to medical histories and tracking of patients between settings.

6.7 Conclusion

Reducing antibiotic prescribing reduces the risk to individual patients and to the general population from antibiotic resistant infections and other adverse outcomes. Plans for an evidence-based, theory-informed complex intervention to reduce antibiotic prescribing for adults with acute conditions in NHS primary dental care are presented. A logic model to underpin the intervention is based on a detailed exploration of the nature of the behaviour and emerging thinking from implementation and complexity scientists

about how to get evidence into practice. This doctoral research has provided a broad and deep analysis of the factors influencing dentists to prescribe antibiotics to adult patients with acute conditions in NHS primary dental care. Whilst reference has been made to interconnections between some of the factors, no systematic analysis of the nature of the systems-level behaviours has been attempted. The opportunity to undertake secondary analysis of this study's ethnographic data could prove fruitful in terms of deepening understanding of the emergent, dynamic system. Insight gained from such studies relating to decision making in urgent dental care and/or about antibiotic prescribing may provide new avenues for interventions to reduce still further dental antibiotic prescribing.

Plans for testing and evaluation of the complex intervention to ensure that it has a highly positive impact without causing harm to patients will draw on the latest thinking from implementation science about how to deal with the multiple forces and variables influencing dental antibiotic prescribing. Beyond the test and evaluation phase, rolling out the behaviour change programme across NHS dentistry will require access to high quality data for measuring improvements. An effective trigger mechanism to stimulate change and adoption across NHS primary dental care will be dependent upon leadership from senior stakeholders and will benefit from the involvement of the GDC, CQC, PHE, HEE and NHS.

Chapter 7 - Conclusion

7.1 Introduction

A detailed understanding of antibiotic prescribing for adults with acute dental conditions from the study of real world urgent NHS dental appointments and prescribing data underpinned the development of a theory-informed behaviour change logic model to inform the planning of a complex intervention to reduce dental antibiotic prescribing. By adding evidence postulated to enable reduced dental antibiotic prescribing in England, this research aimed to contribute towards delivery of the national AMR programme. With a sparsity of published research about antibiotic prescribing decisions for acute dental conditions, and a plethora of research from across primary healthcare research, this thesis sought opportunities to translate knowledge from the medical to dental context. The starting point was an umbrella review (systematic review of systematic reviews) of factors influencing antibiotic prescribing for adults with acute conditions across primary healthcare settings. A systematic review of the published literature relating to antibiotic prescribing for adults with acute dental conditions followed. By comparing and contrasting factors between primary care settings, it was found that some of the factors identified from the umbrella review across primary healthcare had not been reported in the published dental studies within the systematic review of primary dental care.

As the systematic review was based on studies which used self-reported data by dentists, an ethnographic study of urgent NHS dental appointments was conducted in order to understand influences in the real world. It explored decisions about treatment for adults with acute dental conditions including but not limited to antibiotic prescribing from both the dentist and patient perspectives. Within the limitations of the sampling structure, differences were identified between GDP and OOH dental clinics and between practices with higher rates and lower rates of antibiotic prescribing. A comprehensive list of influences on treatment during urgent dental appointments was produced, together with insight into the motivations behind dentists' decision making and the context within which those decisions are made. All of the factors identified in the umbrella review across primary healthcare were identified during analysis of the ethnographic data from urgent dental appointments. In addition to the two factors unique to dentistry reported from the systematic review in primary dental care, an additional four factors were identified from the ethnographic study in GDP and OOH. Exploration of routinely-collected NHS prescribing datasets was undertaken to inform recruitment to the ethnographic study of practices. It also provided insight into how routinely-collected dental prescribing datasets might assist (or not) evaluation of interventions to reduce antibiotic prescribing.

In November 2016, a website of existing dental antibiotic stewardship resources was collated by the ESPAUR dental subgroup, led by PHE (PHE, 2016a). Evolution of the toolkit has continued apace and it is now widely recognised as being at the forefront within the international dental community (Kell, 2019; Thompson, W et al., 2019a). Rather than re-inventing the wheel, the opportunity to develop new tools through the APTiTUDE study to complement those already within the toolkit is timely. By leveraging the considerable potential for mutual benefits, it is efficient in terms of achieving reach across the dental community and economy of resources that might be available to develop, refine and evaluate them in collaboration.

Application of a suite of behavioural science theories, tools and techniques has underpinned the development of the proposed evidence-based, theory-informed APTiTUDE complex intervention. New tools to complement those already within the UK dental AMS toolkit have been planned to enable an enhanced contribution from dentistry towards national antimicrobial resistance goals. In addition, a co-production approach to intervention development has been demonstrated, involving a stakeholder group comprising: PPIE contributors, dentists, dental nurses, NHS service managers and consultants/officials from NHSE, PHE and HEE. Ultimately, the research was about reducing the risk to patients and wider society from antibiotics and antibiotic resistant infections. To achieve this, the following research questions were answered:

1. What does the published literature tell us about factors associated with the decision *whether* to prescribe antibiotics for adults with acute conditions during urgent appointments across primary care, including dentistry?
2. To what extent could routinely-collected NHSE data contribute to the development and evaluation of an evidence-based, theory-informed intervention to reduce antibiotic prescribing during urgent NHS dental appointments?
3. What factors influence treatment of adults with acute conditions during urgent NHS dental appointments in England?
4. Can the theoretical knowledge base inform the development of a plausible complex intervention to reduce antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England?

7.2 Summary of findings

Each research question was answered in a specific chapter of the thesis and the findings are summarised within each of the respective chapters. A synthesis of the findings is presented below, showing how an evidence-base was created and behaviour theory applied in order to undertake development of a complex intervention aimed at reducing dental antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England, where the majority of dental antibiotic prescribing occurs in the UK.

7.2.1 Factors associated with antibiotic prescribing for adults with acute conditions

Evidence of thirty factors associated with the decision whether to prescribe systemic antibiotics for adults with acute conditions across primary healthcare (including primary dental care) was found. Two of these factors were unique to dentistry, associated with the dentist's beliefs and skills relating to the provision of dental procedures (in accordance with guidance) during urgent dental appointments. To enable reductions in dental antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments, therefore, a broader understanding was required to understand the dentist and patient-related factors influencing treatment decisions, including but not limited to antibiotic prescribing. This was undertaken through ethnographic research in GDP and OOH dental clinics.

7.2.2 Antibiotic use across NHS primary dental care: exploring routinely-collected data

Routinely-collected NHS data relating to dental prescribing was found to be currently insufficient for monitoring rates of antibiotic prescribing by dentists in England. The practice-level, data, however, were adequate to inform recruitment of a selection of GDPs with higher and lower rates of antibiotic prescribing to the ethnographic study. Significant improvements to the way in which antibiotic prescribing data are collected will be required if these data are to be robust enough for use as quality indicators, for example as an element of future NHS dental contract management.

7.2.3 Treatment in urgent dental care: an ethnographic study

Ethnographic research in NHS primary dental care produced rich insight into treatment decisions (including antibiotic prescribing) during urgent dental appointments. In addition to the thirty factors identified from published literature through the umbrella review of primary healthcare and the systematic review of primary dental care, four factors were identified through this ethnographic study as influencing treatment during urgent dental appointments. Of these, patient influence was a major factor in the

decision whether to prescribe antibiotics. Exploration of treatment and associated decisions from the patient perspective identified 19 factors which influenced their experience of urgent dental appointments. Beliefs about the impact of antibiotics on personal health and safety (especially the immediacy of some risks) were particularly important influences on both dentists and patients, including their attitudes towards and willingness to use antibiotics for acute dental conditions.

Many of the factors identified were found to be dependent on context, acting on or being experienced by different dentists in different ways at different times. To ensure the right care for the right patient at the right time, therefore, a complex intervention is needed, to provide a bundle of components which can then be tailored according to the specific context.

7.2.4 Planning a complex intervention to reduce prescribing of antibiotics for adults during urgent NHS dental appointments

Throughout the evidence gathering stages, the factors identified were linked to behavioural science by application of the TDF. This enabled the creation of a theory of change for a complex intervention based on the COM-B model, which is also part of the same coherent suite of behavioural theories, tools and techniques. Intervention components were identified to address priority factors, including dentists' beliefs about antibiotics and their patient management/treatment skills relating to acute conditions. This is summarised in the APTITUDE strategic logic model that provides in a graphical format how the NHS may holistically address reducing antibiotic prescribing by dentists through embracing individual, dentist-patient and wider healthcare context levels. Specifically it provides a one page overview of:

- the public health and patient safety problems of dental antibiotic prescribing
- influences on dentists' behaviour which stakeholders identified as a priority to be tackled in order to reduce antibiotic prescribing
- components of a complex intervention that can be tailored to context and stage of the programme delivery
- an overview of the short-term behavioural outcomes
- a summary of the contribution it should make to delivery of the UK vision for tackling AMR in terms of patient safety and public health (HMG, 2019a).

The APTiTUDE strategic logic model will have different purposes in the life of the APTiTUDE dental antibiotic stewardship programme, including during the planning, development, testing, evaluation and implementation stages (Craig et al., 2019). During the planning stage, the key stakeholders brought together broad perspectives for co-creating the strategic logic model, including setting guiding principles of enhancing, tailoring and driving change in an evidence-based manner. In agreeing an approach for delivery of the intervention, the stakeholders co-created an operational logic model

which included the development of new tools to deliver the APTiTUDE programme. Central to this operational logic model is the stakeholders' vision that the intervention must engage with rather than broadcasting messages to dentists and patients. Following the delivery of work in progress to develop the APTiTUDE programme, the logic model will be central to a funding application for testing and evaluating the intervention.

The APTITUDE operational logic model is, therefore, a key stage for intervention development planning. It will generate new tools to complement those within the on-line PHE AMS toolkit (PHE, 2016a); goal setting and quality improvement approaches for the new NHS dental contract; and workforce development recommendations relating to the urgent dental care commissioning standard (NHSE, 2019a). Elements of the operational logic model have been presented in Chapter 6 which show how two new engagement tools are being developed as part of the plan to deliver motivational and environmental changes in order to reduce antibiotic prescribing for adults with acute conditions during urgent dental appointments in England.

7.3 Discussion of findings

Powerful disincentives for NHS dentists in England to use antibiotics appropriately have been identified through this research. Antibiotics were seen to provide 'shortcuts' in terms of managing dentists' workloads, keeping patients happy and ensuring the practice balances its needs for running a profitable dental business in order to deliver NHS services (Goodwin et al., 2018).There is potential for antibiotic prescribing to be more tightly controlled, including by CQC taking a more proactive approach to its role with respect to the Health & Social Care Act Code of Practice on the Prevention & Control of Infection (DH, 2015), introduction of e-prescribing as recommended by the NICE Quality Standard on Antimicrobial Stewardship (NICE, 2016a), and inclusion of AMS as recommended enhanced continuing professional development (GDC, 2019a) and NHS contractual terms (BDA, 2019).

Unpicking this complex environment in order to identify opportunities for changing antibiotic prescribing habits of dentists has been an interesting challenge. Coproduction and creatively formatted workshop approaches proved invaluable to drawing out and understanding the multiplicity of factors from the dental team (including practice business perspective), patient and other stakeholder perspectives.

A gap within the current PHE dental AMS toolkit was identified in relation to the 'motivation' elements of the COM-B model. Providing information about the consequences of using antibiotics which are salient to the individual in terms of health, emotional, social and environmental impacts were suggested from behavioural science as intervention components to address this issue. Through interviews with the dentists,

dental nurses and patients as part of the ethnographic research, it was clear that antibiotic resistance was an issue which dental teams and most patients understood, yet from which they felt somewhat disconnected. Those dentists who did recognise a personal connection to the antibiotic resistance agenda described the problem as a patient safety risk with potentially immediate and catastrophic consequences for individual patients (such as the risk of anaphylactic reaction). In 2015, a Wellcome Trust study to explore the consumer (patient) perspective on antibiotic resistance concluded similarly that "*the focus of the resistance 'story' needed to shift away from macro factors, such as number of deaths, cost to the economy and epidemics/ pandemic*" (Wellcome_Trust, 2015). Using storytelling is a concept advocated by Gabbay & Le May (2011) to embed knowledge in an efficient way across primary care. Work is in progress to develop a tool to address the motivational components includes the novel challenge of using a dramatic, storytelling approach to engaging the audience about the consequences of using antibiotics unnecessarily.

On initial consideration, it appeared that there could be numerous opportunities to translate interventions from the extensive knowledge base in primary medical care to dentistry. The detailed analysis of antibiotic prescribing for acute dental conditions during urgent NHS dental appointments, however, has found significant differences in the detail of the factors. For example, none of the interventional components of the GRACE/INTRO intervention identified in Chapter 3 as having potential for translation to dentistry were identified as priorities in Chapter 6 for the dental intervention (Thompson, W et al., 2019b). TARGET is a toolkit for use in primary medical care across NHSE (RCGP, 2015). It includes a series of leaflets designed to act at the prescriber-patient level during consultations that have been produced to serve as 'non-prescription' forms to reassure patients about self-limiting conditions such as viral RTIs and encourage self-management. As acute dental problems are not usually self-limiting or amenable to self-management, significant modification would be needed for a dentist-patient level tool to address different factors. The APTiTUDE work programme arising from this thesis is incorporating a range of intervention components (such as information about the health consequences of antibiotics and dental infections) into an engagement tool at the prescriber-patient level.

7.4 Implications for policy and patient care

Reducing the unnecessary use of antibiotics across healthcare is key to slowing the pace of development of antibiotic resistant infections. This research has shown the multifaceted nature of the problem relating to dental antibiotic prescribing, including at the micro (dentist), meso- (organisational) and macro- (national policy) levels. Proposed new engagement tools being planned for the dental AMS tool are at the

micro-level. NHS practice-level targets for access to urgent dental care and quality improvement in relation to antibiotic prescribing would be at the meso-level. Clarification of the guidance for back-up/delayed antibiotic prescribing would be at the macro-level. More significant opportunities at the macro-level are complicated by a blurring of leadership responsibilities across the dental profession, shared between PHE, NHSE, HEE, GDC, FGDP, CQC, and BDA FGDP as well as the organisations which provide dental care to patients (including corporate and independent businesses, social enterprises and NHS Trusts). This splitting of responsibilities illustrates the complex challenge of driving any change within the dental profession. All of the organisations have a role to play, yet coordinating them to contribute fully towards delivery of the national antibiotic stewardship plan over the last 5 years has proved a challenge for PHE. The PHE-led ESPAUR dental subgroup had its final meeting during 2019 and there is no new national dental AMR plan to match the 2019-2024 national AMR plan. Leadership on dental AMS in the UK requires all of the organisations to play their part and to recognise that PHE has the overall responsibility for coordinating dentistry's contribution towards delivering the national AMR plan.

Reform of NHSE's dental contracts and digital systems present significant opportunities. Electronic prescribing would streamline the process of prescribing/dispensing as well as enabling access to valid, reliable datasets with timely information across NHS primary dental care. Recognising the challenge of establishing e-prescribing across dentistry, however, solutions need to be found to enable some improvement more quickly. For example, computer generated prescriptions and amendment of the NHS dental contract treatment codes so that they are linked to the 'antibiotic item given' item within the FP17 clinical data set (as shown in section 4.6.6) could be a quick win to improving the NHS Dental Services dataset.

Whilst the focus of this thesis has been to minimise antibiotic use, it is of course vital to guard against under-prescribing of antibiotics which are essential drugs when infection causes threat to life. Evaluation of the complex intervention to reduce dental antibiotic prescribing will, therefore, need to ensure that reductions can be achieved without increasing the rate of adverse events. In preparation for such a trial, ways of monitoring adverse outcomes across healthcare need to be developed, including the ability to track patients between settings through connectivity of electronic medical and dental records.

Looking outside of the UK, significant opportunities exist to translate this research into new contexts. Having led the dental AMS research symposia at the International Association for Dental Research (IADR) General Session in London during 2018 and Vancouver during 2019, interest in the UK toolkit and its evolving tools is clear. Furthermore, as a member of the World Dental Federation team producing its White

Paper on dental AMS, the opportunity exists to share the findings of this research and work with colleagues around the world to support a solution-drive approach for their specific healthcare contexts.

7.4.1 Work in progress

7.4.1.1 Monitoring & goal setting - CQC

The Health & Social Care Act Code of Practice on the Prevention & Control of Infection already requires practices to monitor antibiotic use and places a duty on the CQC to take account of this during practice inspections. Each practice manager should, therefore, already be able to identify high prescribers within their practice/clinic. To date, the CQC has avoided assigning high priority to review of antibiotic audits within its practice inspections because it "*cannot use a lack of antibiotic audits as evidence of a breach of regulation.*" (Milne, 2019). In the light of the Code, it is recommended that CQC reconsiders its position with respect to antibiotic prescribing; CQC has an important leadership role to play in ensuring all providers of dental care in England use antibiotics appropriately "*to optimise patient outcomes and to reduce the risk of adverse events and antimicrobial resistance*." (DH, 2015).

In the absence of formal system drivers pushing practices to identify high prescribing individuals within their practice or practice-level goals for quality improvement, goal setting to drive down prescribing rates will be voluntary at least in the short term. Opportunities to encourage practices to provide monitoring and feedback to their prescribers and to address prescribers with high rates should be explored by those responsible for NHS dental contracts at either national or local level.

7.4.1.2 Urgent dental appointment – skills development package

Skills for delivering urgent dental care require a multidisciplinary approach and hands-on training course covering patient management and treatment skills (including both oral surgery and endodontic disciplines). Opportunities to incorporate antibiotic stewardship into the opportunities are being discussed with HEE as part of the implementation of the urgent dental care commissioning standard (NHSE, 2019a).

7.5 Implications for research

Throughout this research, recommendations for future action, research and consideration have been highlighted. This section highlights work in progress and suggests an APTiTUDE programme of future research relating to antibiotic stewardship and urgent dental care that will necessitate infrastructure development in parallel to support joining up primary healthcare systems across dentistry, medicine and pharmacy.

7.5.1 Work in progress

7.5.1.1 Toolkit components – storytelling & urgent appointment guide

Development and acceptability testing of two new tools for inclusion in the national dental AMS toolkit is underway.

7.5.1.2 Educational outreach sessions on dental AMS

The national dental AMS toolkit enhanced by the additional of complementary new tools resulting from APTITUDE (see section 7.1) will need to be evaluated. To achieve this we can learn from the quantitative testing and evaluation of the TARGET toolkit that was undertaken through a RCT of educational outreach sessions to introduce members of the general practice team to the TARGET tools (McNulty et al., 2018).

7.5.2 Suggested programme of future research

7.5.2.1 Dental antibiotic stewardship

- Exploration of sociodemographic predictors of variation in dental antibiotic prescribing using practice and patient postcodes.
- Development of definitions of appropriate/inappropriate and necessary/unnecessary in relation to dental antibiotic prescribing.
- Exploration of the extent to which dental antibiotic prescribing rates can be safely reduced and consideration of the viability of establishing threshold ‘high rates’ of antibiotic prescribing for different contexts.
- Investigation of patient beliefs about dental antibiotics in order to find the tipping point at which patients stop believing that they need/stop demanding antibiotics.

7.5.2.2 Urgent dental care

- Service and delivery of urgent dental care to drive improved dental antibiotic stewardship and patient care in the era of AMR: to determine realistic urgent dental appointment lengths; how to deliver and tailor the Dental AMS Toolkit to drive behaviour change around antibiotic prescribing; how to incentivise procedures rather than prescribing to drive appropriateness of care; and how to deliver shared decision making in the urgent care setting.

7.5.2.3 Primary dental care services research

- Research about leadership, team dynamics and emotional well-being in primary dental care and urgent dental appointments in order to understand their impact on clinical outcomes and resilience/stress within the NHS dental workforce.

7.5.2.4 Joining up healthcare systems

- Process improvement research to find efficient ways to join up healthcare processes and records across medicine, dentistry and pharmacy, including medicines prescribing and optimisation, access to medical histories and tracking patients between healthcare settings.

7.6 Conclusion

Dame Sally Davies, the UK Chief Medical Adviser has stated that the risk from antibiotic resistance is comparable to that from global terrorism and AMR is included on the national risk register of civil emergencies alongside climate change. Estimates are that it will be responsible for around 10 million deaths per year by 2050. Healthcare professions have been challenged to halve inappropriate antibiotic use so as to slow the pace of its development. Misuse of antibiotics in urgent dental care is an extensive and multifaceted problem.

This doctoral research has been developing new, evidence-based, theory-informed approaches to enabling reductions in antibiotic prescribing for adults with acute conditions during urgent NHS dental appointments in England. Work continues to develop and feasibility test the complex intervention which will complement tools within the existing PHE dental AMS toolkit. Opportunity now exists to translate the findings into new contexts around the world.

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Appendix A Umbrella review across primary care & systematic review of primary dental care – Search strategy examples

A1 Umbrella review across primary care - example of the search strategy used to identify potentially relevant papers

Database: Ovid MEDLINE <1946 to June Week4 2018>		
1	(antibiotic* or antimicrobial* or antibacterial*).tw	378594
2	Exp Anti-Bacterial Agent/	652024
3	Exp Drug Resistance, Microbial/	148523
4	1 or 2 or 3	852626
5	Limit 4 to (English language and humans)	428287
6	(prescri* or overprescri* or underprescri*).tw	157831
7	Exp Prescriptions/	31443
8	Exp Drug Prescriptions/	30089
9	Exp Inappropriate Prescribing/	2205
10	6 or 7 or 8 or 9	170770
11	Limit 10 to (English language and humans)	138060
12	(Emergenc* or Urgent or Unschedul* or Out of Hour* or Acute* or Abscess* or Infection* or Triag*).tw	2252202
13	Exp Emergencies/	38211
14	Exp Emergency Treatment	110010
15	Exp Triage/	10108
16	12 or 13 or 14 or 15	2343855
17	Limit 16 to (English language and humans)	1544058
18	(Primary care or General Practi* or Family practi* or Doctor* or Physician* or Nurse practitioner* or Medic or Medics).tw	506804
19	Exp Primary Health Care/	138001
20	Exp Health Services/	1934186
21	Exp General Practitioners/	6197
22	Exp Physicians, Family/	15802
23	Exp Physicians, Primary care/	2613
24	Exp General Practice/	71983
25	Exp Family Practice/	63917
26	Exp Practice Patterns, Physicians/	52415
27	Exp Emergency Medicine/	12269
28	Exp Emergency Medical Services/	123156
29	Exp Ambulatory Care Facilities/	51571
30	Exp Ambulatory Care/	50017
31	Exp Professional Practice/	240019
32	Exp Medical Staff/	26291
33	Exp Nurse Practitioners/	16846
34	Exp Practice Management, Medical/	10058
35	Exp Staff Development/	8647
36	18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35	2525916

37	Limit 36 to (English language and humans)	1897172
38	5 and 11 and 17 and 37	4472
39	Limit 38 to systematic reviews	292

A2 Systematic review of primary dental care - example of the search strategy used to identify potentially relevant papers

Database: Ovid MEDLINE <1946 to June Week4 2018>		
1	(antibiotic* or antimicrobial* or antibacterial*).tw	378594
2	Exp Anti-Bacterial Agent/	652024
3	Exp Drug Resistance, Microbial/	148523
4	1 or 2 or 3	852626
5	Limit 4 to (English language and humans)	428287
6	(prescri* or overprescri* or underprescri*).tw	157831
7	Exp Prescriptions/	31443
8	Exp Drug Prescriptions/	30089
9	Exp Inappropriate Prescribing/	2205
10	6 or 7 or 8 or 9	170770
11	Limit 10 to (English language and humans)	138060
12	(emergenc* or urgent or unschedul* or out of hour* or acute* or abscess* or infection* or triag*).tw	2252202
13	Exp Emergencies/	38211
14	Exp Emergency Treatment	110010
15	Exp Triage/	10108
16	12 or 13 or 14 or 15	2343855
17	Limit 16 to (English language and humans)	1544058
18	(dental* or dentist*).tw	212715
19	Exp Dentists/	17847
20	Exp General Practice, Dental/	4675
21	Exp Dental Care/	31093
22	Exp Dental Health Services/	36040
23	Exp Practice Patterns, Dental/	2078
24	Exp Dental Staff/	2413
25	Exp Practice Management, Dental/	11069
26	18 or 19 or 20 or 21 or 22 or 23 or 24 or 25	238274
27	5 and 11 and 17 and 26	270
28	Limit 16 to (English language and humans)	236

A3 Summary of the potentially relevant papers found using each database search

	Umbrella review across primary care	**Systematic review of primary dental care**
MedLine 1946 to June Week 4 2018	292	236
PsychInfo 1806 to June Week 4 2018	7	1
Embase Classic+Embase 1947 to June Week 4 2018	268	328
Web of Science-Science Citation Index	284	223
EThOS	8	2
TOTAL	**859**	**790**

Appendix B Identifying Potential Research Sites

B1 Template letter inviting expressions of interest

Ref: DREC/120416/WT/202 v1.1 dated 24 October 2016

[*Insert date*]

Dear [*Dental Provider*]

TRUCE Study: TReatment during Urgent dental Care in England. An Invitation to Participate

This letter is to invite you and your practice to participate in a project about urgent NHS dental care in England. I am a general dental practitioner in Lancashire as well as a PhD student with the University of Leeds. My study seeks to understand patient and professional influences on urgent NHS dental care, by observing what happens during urgent appointments.

The project is financially supported by the National Institute for Health Research and generous reimbursement for time taken on research activities will be available for those selected to participate. Attached is a short summary of the research. The information sheet is aimed at dentists and dental nurses who are considering participation.

The practice would also need to nominate a local Principal Investigator, likely a senior dentist whose role it would be to liaise with me, and there will be opportunities for one or more of your junior members of staff to assist with managing the research on site at your practice).

If you would like to express an interest in participating with the research, please complete the attached form and email it back to me. Alternatively, if you have any further questions, please do contact me on dnwt@leeds.ac.uk, if possible by [*insert date*].

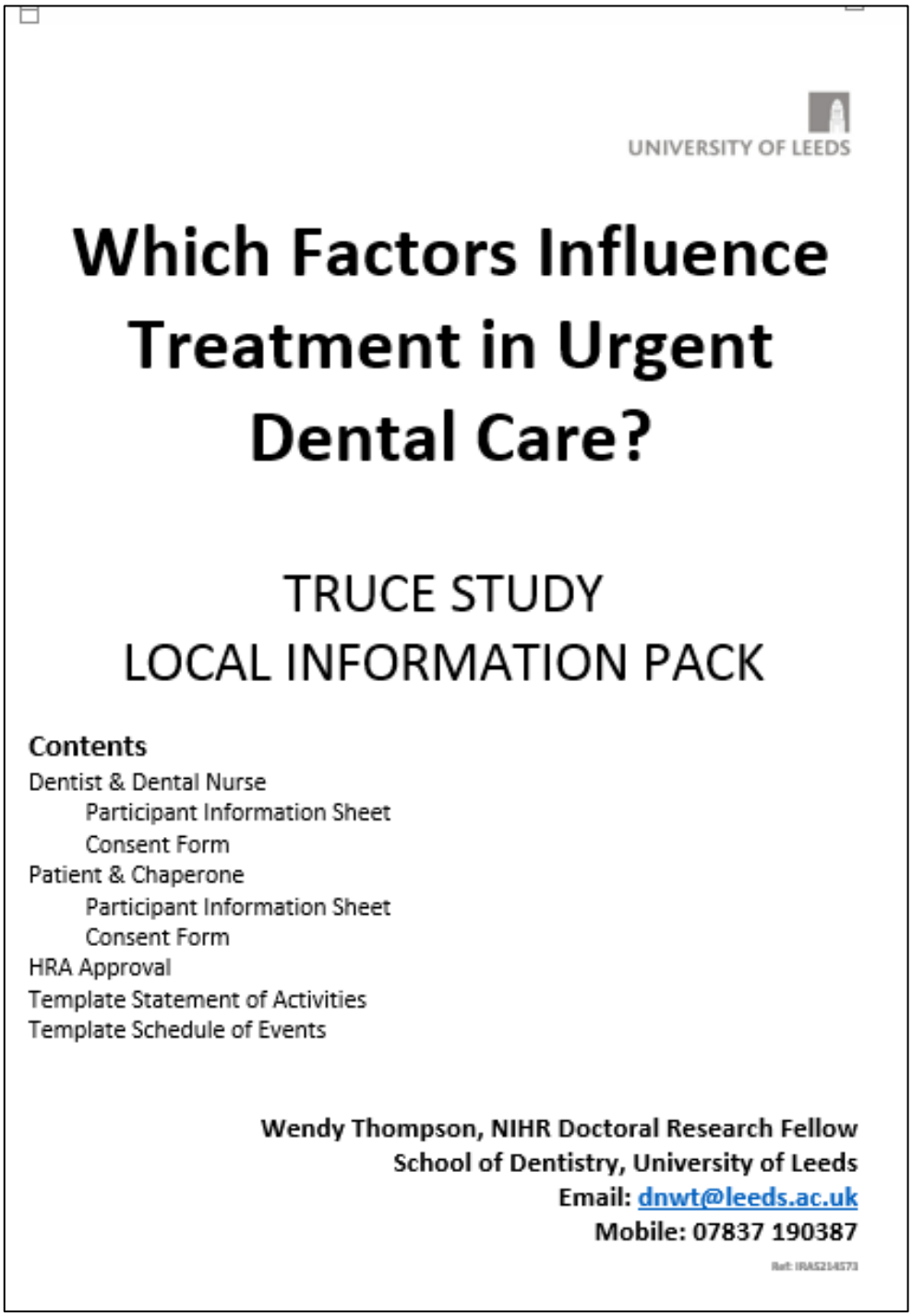
Yours sincerely,

Wendy Thompson
Doctoral Research Fellow and General Dental Practitioner

Appendix C TReatment during Urgent dental Care: an Ethnographic study

C1 Local Information Pack

C.1.1 Cover Sheet of Local Information Pack



UNIVERSITY OF LEEDS

Which Factors Influence Treatment in Urgent Dental Care?

TRUCE STUDY
LOCAL INFORMATION PACK

Contents

Wendy Thompson, NIHR Doctoral Research Fellow
School of Dentistry, University of Leeds
Email: dnwt@leeds.ac.uk
Mobile: 07837 190387

Ref: IRAS214573

C.1.2 Dentists' and Dental Nurses' Participant Information Sheet

PARTICIPANT INFORMATION SHEET FOR DENTISTS & DENTAL NURSES:

Which factors in dentist-patient interactions influence treatment in urgent dental care?

We are studying the factors that influence treatment in urgent dental care and would like to include your experiences in our research. If you agree, a selection of your urgent dental appointments will be audio-recorded and some of those appointments may also be observed. You do not have to take part. If you would prefer us not to include you in our study that is fine. Before you decide whether or not you are happy to be part of it, please read the following information.

What is the purpose of this study?

This study aims to investigate which factors in dentist-patients interactions influence treatment in urgent dental care. The NHS defines urgent dental care as 'dental and facial pain not controlled by over-the-counter preparations' and/or 'dental and soft tissue acute infection.' It does **not** include 'trauma to the dental arches', 'haemorrhage' or 'rapidly increasing swelling around the eye or throat', which is defined by the NHS as emergency dental treatment. The study involves:

- ***Observing and/or audio-recording*** of urgent dental appointments;
- ***Analysis*** of the recordings to identify influences on decision making;
- ***Questionnaires*** for dentists and dental nurses to record their thoughts after each appointment;
- ***Interviews***: by telephone with some clinicians and patients to explore influences in more detail.

This is an observational study to understand influences on the normal provision of urgent dental care within the NHS. There is NO intention to judge clinical decisions made and the researchers will have NO access to patient clinical records.

Who is doing the study?

Wendy Thompson is a PhD research student and also a dentist; this study will form part of her research. Professor Gail Douglas is Wendy's PhD supervisor. The observer will be Marion Bowman, a research assistant and not a dental professional.

Who is being asked to participate?

Patients attending for urgent dental care. Only adult patients (aged over 18) who are willing and able to consent will be included. Any patient who is accompanied by a minor (aged under 18) or by someone who is not willing and able to consent to participate will be excluded from the study.

What will be involved if I take part in this study?

Training and Consent: An introduction to the study, together with training, will be provided which qualifies for 1 hour of CPD. After this, you will be invited to sign and date a consent form, stating that you agree to participate in the study. There will be at least 24 hours between this and recruiting the first patient to the study. You will not need to consent patients to the study as another trained member of the practice staff will be responsible for this. If you take part in the study, you will participate in the following:

Audio-recordings: Up to 16 of your urgent dental appointments will be audio-recorded. Afterwards, these will be transcribed (typed up), analysed and the recording then deleted.

Participant Information Sheet for Dentists and Dental Nurses (continued)

Observations: For those appointments taking place in out-of-hours dental clinics, an observer may also be present during the appointments. She will take notes about what patients and clinicians do and say; these records will also be analysed by the researchers.
Questionnaires: After each of the audio-recorded consultations, you will be asked to complete a very short questionnaire about the appointment; these take about 30 seconds to complete.
Interview: A selection of the appointments will be identified for more in-depth study. Should these include any of your cases, you will be invited for a follow-up telephone interview lasting no more than 30 minutes. This will take place not sooner than a week after your last audio-recorded appointment. The interview will be audio-recorded, transcribed, analysed and the recording then deleted.

What are the advantages and disadvantages or risks of taking part?

Patient care will not be affected by your participation in this study; there should be no risks for you participating in this study. An advantage to participation in this study is that you will be furnished with a summary of the anonymised research results from across general dental practice and out-of-hours dental settings. Through personal reflection, this could help you understand how your normal practice fits within the overall findings. Whilst most participating clinicians will find that their practice fits within the norm of good practice, some may find themselves as outliers.

A potential disadvantage for you is the time taken for completing the questionnaires and an interview; provision has been made in the research budget to reimburse this time. During a pilot of the study at Leeds Dental Institute's Acute Dental Care department during August 2016, clinicians found that the questionnaires took around 30 seconds to complete after each appointment and the follow-up interview took no more than 30 minutes per clinician.

Can I withdraw from the study at any time?

You are free to withdraw your consent at any time up until your data is no longer individually identifiable; this will be not sooner than one week after your last audio-recorded consultation and/or interview. You do not need to give a reason for withdrawing. If you decide to withdraw, please let us know using the contact details below.

Will the information obtained in the study be confidential?

All information collected during the course of this research will be kept securely, initially within your practice/clinic and then within the University of Leeds and its systems. Audio-recordings will be destroyed once transcribed; other personally identifiable information will be destroyed at the end of the study. Anonymised data will be retained securely for 10 years after the end of the study and may be used to support other research and/or publications. Confidentiality will be respected subject to legal constraints and professional guidelines.

Who has reviewed this study?
Approval for this study has been obtained from Bradford Leeds Research Ethics Committee via the Health Research Agency approvals process.

If you would like to discuss participation in the study or for more information, please contact:
Wendy Thompson (dnwt@leeds.ac.uk – PhD Research Student).

If you have any concerns or if you wish to withdraw from the study, please contact:
Wendy Thompson (dnwt@leeds.ac.uk – PhD Research Student)); OR Professor Gail Douglas (0113 343 9214 – PhD supervisor).

THANK YOU FOR TAKING THE TIME TO READ THIS INFORMATION SHEET

C.1.3 Consent Forms for Dentists and Dental Nurses

UNIVERSITY OF LEEDS

FACULTY OF MEDICINE & HEALTH
SCHOOL OF DENTISTRY

CONSENT FORM FOR DENTISTS AND DENTAL NURSES

Title of Project: **Which factors in dentist-patient interactions influence treatment in urgent dental care?**
Name of Researcher: Wendy Thompson (PhD Student)

Please initial box

1. I confirm that I have read and understand the information sheet dated 18 January 2017 (Version 4) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time until my data can no longer be identified as mine (at least one week after my dental appointment). I can do this without giving any reason and without my legal rights being affected. ☐
3. I understand that relevant sections of my data collected during the study, may be looked at by individuals from University of Leeds or from regulatory authorities, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. ☐
4. I understand that the information collected about me will be used to support other research in the future, and may be shared anonymously with other researchers. ☐
5. I agree to take part in the above study, including being audio-recorded during the urgent dental appointments and any follow-up interview. ☐
6. I agree to the research team storing the following details for the purpose of contacting me directly to:
   a. Send me a letter of appreciation and a copy of the study results. ☐
   b. Arrange a follow-up interview, if appropriate. ☐

_____	_____	_____	_____
Participant Signature	**GDC Number**	**Name**	**Date**

Please provide your preferred contact details (phone number, email address or home/work address)

Telephone Number: _____ Email Address: _____

Home/Work Address: _____

_____	_____	_____
Signature of Person Taking Consent	**Name**	**Date**

When completed: 1 for participant; 1 for researcher site file 1; and 1 (original) to be kept in clinical records.

Ref: IRAS214573 v4 dated 18 January 2017

C.1.4 Short Information Sheet for Patients

UNIVERSITY OF LEEDS

FACULTY OF MEDICINE & HEALTH
SCHOOL OF DENTISTRY

SHORT INFORMATION SHEET FOR PATIENTS AND THEIR CHAPERONES:

Which factors in dentist-patient interactions

influence treatment in urgent dental care?

Please could we:

1. Audio-record your appointment?
2. Observe your appointment?
3. If you are the patient, contact you for a follow-up call by telephone?

You do not have to say yes!

What are we studying?

- Which factors influence treatment in urgent dental care.

Who is doing the study?

- Wendy Thompson is a PhD research student.
- If your appointment is selected for observation as well as audio-recording, Marion Bowman will be taking research notes. She is a research assistant not a dentist.

What will be involved?

- Consenting to take part.
- Audio-recording your consultation.
- Observer taking notes during your appointment, if your appointment has been selected for observation.
- Some patients will be invited to a follow-up telephone interview. The invitation would arrive in a few weeks' time. You could decline the invitation without giving a reason.

Can I withdraw from the study?

- Yes, at any time ***during the appointment or up to one week afterwards***.
- Withdrawing will not affect the dental treatment you receive.
- No need to give a reason for withdrawing.

How do I contact the research team?

Mrs Wendy Thompson (dnwt@leeds.ac.uk – PhD Research Student); OR

Professor Gail Douglas (0113 343 9214 – PhD supervisor).

C.1.5 Patients' Participant Information Sheet

UNIVERSITY OF LEEDS

FACULTY OF MEDICINE & HEALTH
SCHOOL OF DENTISTRY

PARTICIPANT INFORMATION SHEET FOR PATIENTS AND THEIR CHAPERONES:

Which factors in dentist-patient interactions

influence treatment in urgent dental care?

We are studying the factors that influence treatment in urgent dental care and would like to include your experiences in our research. If you agree, we will ~~observe and/or~~ audio-record your appointment today. You do not have to take part; if you would prefer us not to include your appointment in our study that is fine. Before you decide whether or not you are happy to be part of it, please read the following information.

What is the purpose of this study?

This study aims to investigate which factors in dentist-patients interactions influence treatment in urgent dental care (when a patient has toothache, abscess or other infection). It involves:

- ***Audio-recording*** of urgent dental appointments;
- ***Observation*** as well as audio-recording of some urgent dental appointments;
- ***Analysis*** of the recordings to identify factors influencing decision making;
- ***Interview*** by telephone (for those patients whose appointment is selected for in-depth study).

Who is doing the study?

Wendy Thompson is a PhD research student; this study will form part of her research. Professor Gail Douglas is Wendy's PhD supervisor.

If your appointment has been chosen for observation, Marion Bowman will be taking notes in your appointment. She is a research assistant, not a dental professional.

Who is being asked to participate?

Patients attending for urgent dental care and any chaperones (anyone accompanying them into the dental consultation). Only those adult patients (aged over 18 years) who are willing and able to consent will be included. Any patient who is accompanied by a minor (aged under 18 years) or by someone who is not willing and able to consent will be excluded from the study.

What will be involved if I take part in this study?

Consent: A trained member of staff will be responsible for ensuring that you understand what the study involves and that you are happy to participate. To confirm this, the patient and chaperone (anyone accompanying in the dental consultation) will be asked to sign a consent form.

Audio-recordings: Your appointment will be recorded using a digital voice recorder. Please be aware that this will include details such as discussion with the dentist about the patient's medical history. Afterwards, the recording will be transcribed (typed up), analysed and then deleted.

Observations: For those appointments taking place in out-of-hours dental clinics, an observer may also be present during the appointments. She will take notes about what patients and clinicians do and say; these records will also be analysed by the researchers.

Information Sheet for Patients (continued)

UNIVERSITY OF LEEDS

FACULTY OF MEDICINE & HEALTH
SCHOOL OF DENTISTRY

Interviews: We would like to be able to talk to some patients (but not chaperones) by telephone afterwards to ask about their experience of the urgent dental appointment. If you are selected for follow-up, this will be in a few weeks' time, at a time to suit you, and will take around 30 minutes.

What are the advantages and disadvantages or risks of taking part?

Patient care will not be affected by your participation in this study; this is an observational study to understand influences on the normal provision of urgent dental care within the NHS. The researchers will have NO access to patient clinical records. As such, there are no advantages or risks for you participating in this study.

A potential disadvantage for you is the time a follow-up interview would take if your case is selected for in-depth study. It is anticipated that follow-on interviews will take no more than 30 minutes. If selected for interview, we would work with you to find a suitable time.

Can I withdraw from the study at any time?

You are free to withdraw your consent at any time up until your data is no longer individually identifiable; this will be not sooner than one week after your consultation/interview. You do not need to give a reason for withdrawing. Withdrawing from the study will not affect the treatment you receive. If you decide to withdraw, please let us know using the contact details below.

Will the information obtained in the study be confidential?

All information collected during the course of this research will be kept securely, initially at the practice/clinic where you accessed urgent dental care and then within the University of Leeds and its systems. Audio-recordings will be destroyed once transcribed; other personally identifiable information will be destroyed at the end of the study. Anonymised data will be retained securely for 10 years after the end of the study and may be used to support other research and/or publications. Confidentiality will be respected subject to legal constraints and professional guidelines.

Who has reviewed this study?

Approval for this study has been obtained from Leeds & Bradford Research Ethics Committee via the Health Research Agency approvals process.

If you would like to discuss participation in the study or for more information, please contact:

Wendy Thompson will be pleased to talk to you about the study if you have any further questions. She is a dentist and the PhD student leading this project. She can be contacted at dnwt@leeds.ac.uk.

If you have any concerns or if you wish to withdraw from the study, please contact:

Wendy Thompson (dnwt@leeds.ac.uk – PhD Research Student)); OR Professor Gail Douglas (0113 343 9214 – PhD supervisor).

THANK YOU FOR TAKING THE TIME TO READ THIS INFORMATION SHEET

C.1.6 Patient Consent Form

UNIVERSITY OF LEEDS
FACULTY OF MEDICINE & HEALTH
SCHOOL OF DENTISTRY

CONSENT FORM FOR PATIENTS

Title of Project: **Which factors in dentist-patient interactions influence treatment in urgent dental care?**
Name of Researcher: Wendy Thompson (PhD Student)

Please initial box

1. I confirm that I have read and understand the information sheet dated 18 January 2017 (Version 4) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time until my data can no longer be identified as mine (at least one week after my dental appointment). I can do this without giving any reason and without my legal rights being affected. ☐
3. I understand that relevant sections of my data collected during the study, may be looked at by individuals from University of Leeds or from regulatory authorities, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. ☐
4. I understand that the information collected about me will be used to support other research in the future, and may be shared anonymously with other researchers. ☐
5. I agree to take part in the above study, including audio-recording of my urgent dental care appointment and any follow-up interview. ☐
6. I agree to the research team having the following details for the purpose of contacting me directly to:
   a. Send me a letter of appreciation and a copy of the study results. ☐
   b. Arrange a follow-up interview, if appropriate. ☐

_____ _____ _____
Signature **Name** **Date**

Please provide your preferred contact details (phone number, email address or other address)

Telephone:_____ Email address:_____

Home/Work Address:_____

_____ _____ _____
Signature of Person Taking Consent **Name** **Date**

When completed: 1 for participant; 1 for researcher site file 1; and 1 (original) to be kept in clinical records.
Ref: IRAS214573 v4 dated 18 January 2017

C2 Case Report Form – Part 1 (Inclusion & Eligibility)

Case Identifier:__ __ / __ __ Date of appointment (dd/mmm/yy): __ __ / __ __ __ / __ __

Part 1: Inclusion and eligibility

(to be completed by the Research Support Staff, with the patient)

Inclusion Criteria:

	Yes	No*
1. Is the patient aged 18 years and over?	☐	☐
2. Is the patient attending for NHS urgent dental care# to address: 'dental or facial pain not controlled by over-the-counter drugs' or 'acute dental or soft tissue infection?'	☐	☐
3. Is the patient willing to have his/her appointment observed and/or audio-recorded?	☐	☐
4. Is the patient able and willing to give their informed consent to participate?	☐	☐
5. If a translator is needed, is a translation service available to enable the patient to consent to participate in this research?	☐	☐

Notes:

* If any inclusion criteria are ticked NO then the patient is **not eligible** for the study.

Urgent dental care specifically **does not** include: trauma to the dental arches; uncontrolled haemorrhage following an extraction; or swelling **spreading rapidly** towards the eye or throat

Exclusion Criteria:

	Yes*	No
1. Does the patient currently have severe/debilitating pain or distress which prevents him/her consenting to participate in this research?	☐	☐
2. Is the patient attending for routine or private dental treatment?	☐	☐
3. Will the patient be accompanied during his/her appointment by someone under the age of 18 years?	☐	☐
4. Will the patient be accompanied during his/her appointment by someone who is not able and willing to consent to participate in the study?	☐	☐

Notes:

* If any exclusion criteria are ticked YES then the patient is **not eligible** for the study.

Fitness and Eligibility to Participate in the Study:

In the research support staff's opinion, on the basis of the screening assessments and Inclusion and Exclusion criteria, is the patient eligible to participate in the study?

Yes ☐ No ☐

Signature of Research Support Staff completing Part 1 of the CRF.....Date_ _ / _ _ / _ _

C3 Case Report Form – Part 2 (Registration Information)

Case Identifier:__ __ / __ __ Date of appointment (dd/mmm/yy): __ __ / __ __ __ / __ __

Part 2: Registration information

(to be completed by the Research Support Staff, with the patient)

Patient's gender ☐ Male ☐ Female

Patient's ethnicity

☐ *White British* ☐ *Other white background*

☐ *Asian or Asian British* ☐ *Black or Black British*

☐ *Chinese* ☐ *Mixed background*

☐ *Any other ethnic group* ☐ *Patient declined*

What was the last (highest) educational qualification gained by the patient?

☐ *GCSE or equivalent* ☐ *A' Level or equivalent*

☐ *College/university degree or equivalent* ☐ *Postgraduate degree or equivalent*

☐ *No formal qualifications* ☐ *Unclear/ patient decline*

Patient's postcode ☐☐☐☐ ☐☐☐☐

Patient pays NHS fees ☐ Yes ☐ No ☐ Don't know

Patient attends regular dental check-ups at this dental practice/clinic ☐ Yes ☐ No ☐ Don't know

If no, are they attending for urgent care only? ☐ Yes ☐ No ☐ N/A

Consent form has been signed by patient ☐ Yes ☐ No

Consent form signed by chaperone ☐ Yes ☐ No ☐ N/A

Signature of Research Support Staff completing Part 2 of the CRF.....Date_ _ / _ _ / _ _

C4 Case Waiting Form - Front side for Initiation at first contact

7

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TRUCE Case Waiting / Recording Instructions

(to be completed by Research Support Staff and used by Participating Dental Nurse)

CASE WAITING

(to be completed by research support staff)

When an urgent dental patient has consented to be part of the study, the research support staff should:

1) Complete the form below
2) ***Pass the form to the participating dental nurse together with the audio-recording equipment.***

Date (format DD/MMM/2017)	__ __ / __ __ __ / 2017
Scheduled appointment start time (format 24 hour clock)	__ __ : __ __
Patient's initials (not full name)	__ __ __
Case ID (from Case Screening/ID Log)	__ __ / __ __

RECORDING INSTRUCTIONS

(to be undertaken by participating dental nurse)

Just before an urgent dental patient who has been consented to the study enters the surgery, the participating dental nurse should:

1) Start audio-recording;
2) Read the following script aloud to identify the recording in an anonymised way

"Start of recording. {Date}
{Scheduled Appointment Start Time}
{Patient's initials}
{Case ID}"

After the patient has left the surgery OR IF THE PATIENT WITHDRAWS FROM THE STUDY DURING THE APPOINTMENT, the participating dental nurse should:

1) Read the following script aloud to identify the end of the recording
"End of recording {Case ID}";
2) Stop the audio-recording.

Case Waiting Form - Reverse Side with Audio-recording Instructions

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AUDIO-RECORDING EQUIPMENT – OPERATING INSTRUCTIONS

Equipment Type:

- Digital Voice Recorder (DS-7000) & Microphone (ME-33)

BEFORE PATIENT ENTERS SURGERY

Connecting Recorder and Microphone

- Unwind cable from base of microphone and plug into 'MIC' socket on left side of recorder.
- Place microphone in location suitable to pick up the voices of the patient and the dentist (if possible in front of them so their voices are naturally projected towards it)

Switching on Audio-Recording

- Switch on recorder using small grey 'POWER' slide switch on back of recorder
- 'Enter Password' will be displayed with a flashing white square:
    - press right arrow button » once so that 1 is highlighted
    - press 'OK/MENU' button **5** times – you will see ✱✱✱✱ appear
- Recorder will beep once and display your site name and then 'New File'
- Check the large silver slide switch on the right side of the recorder is set to 'STOP'
    - the notch on the slide aligns with the word STOP on the back of the recorder
    - the blue square icon on the right of the screen is slightly enlarged

Starting Audio-Recording

- To start recording, move the large silver slider up one notch to **'REC'**
    - the red circle icon on the right of the screen is slightly enlarged
    - A beep indicates the start of recording and time will start counting
    - Remember to record the scripted message before the patient arrives:
        - Start of recording. {Date} {Time} {Initials} {Case ID} (see over)

Stopping Audio-Recording

- Before stopping the recording remember the scripted message:
    - End of recording {Case ID} (see over)
- To stop recording, move the large silver slider down one notch to 'STOP'
    - A double beep indicates the end of recording.
- Switch off the recorder using the small grey 'POWER' slide switch on the back.

C5 Interview Topic Guides

C.5.1 Clinician Topic Guide

Which factors in dentist-patient interactions influence treatment in urgent dental care?

INTERVIEW TOPIC GUIDE - CLINICIANS

Lead Researcher: Wendy Thompson

Introduction: Below is a list of broad areas to be discussed in this study. The work will remain flexible with respect to participants' agendas and will investigate selected clinical cases in some details by covering the topics identified below. As is common in semi-structured work, if new ideas emerge from early data collection, we may add new topics as the study field work progresses.

Briefing:

1) Thank participant for agreeing to take part in the study.
2) Introduce self.
3) This interview is following up on the clinical recordings {and observations} to which you have already contributed for my study investigating 'Which factors in dentist-patient interactions influence treatment in urgent dental care?' The aims were described in the participant information sheet and as I advised you when setting up this interview, I have selected two of your recorded cases for in-depth study. These are: {insert case details}.
4) Differences between people and the decisions they make may arise from different perceptions, priorities and beliefs. These differences are important and we value your unique perspective.
5) If at any time during the interview you do not wish to answer a question that's okay.
6) I would like to digitally record our conversation. The recording will be typed up and everything you say will be anonymous. Your name and any other names or places you mention, will be taken out, so that people reading your interview will not know who you are or where you work.
7) Your interview will remain confidential, unless (as outlined in the consent form) it is possible that you or someone else is at risk; this would be discussed with you first.
8) If, at any stage, you wish to stop the audio-recorder, please do let me know.
9) Do you have any questions? [Note to review withdrawal process with participant]
10) Are you happy to proceed with the interview?

Topic areas to be explored:

Topic 1: Establishing the dentist's background and experience of providing urgent dental care.

Topic 2: Views on providing urgent dental care and taking part in the study.

Topic 3: Views on providing operative dentistry during urgent dental care.

Topic 4: Views on prescribing (antibiotics and/or analgesics) during urgent dental care.

Topic 5: Views on shared decision making and the consent process during urgent dental care.

Topic 6: Views on what else influences decision making that hasn't already been discussed.

In advance of the interview, any specific issues identified in questionnaires/observation field notes/transcripts related to their recorded appointments will be identified and may be used to stimulate discussion under the relevant topic area.

C.5.2 Patient Topic Guide

Which factors in dentist-patient interactions influence treatment in urgent dental care?

INTERVIEW TOPIC GUIDE - PATIENTS

Chief Investigator: Wendy Thompson

Introduction: The interviews with patients will follow-up those cases identified for in-depth study following analysis of the clinical observation field work. They will cover the broad topic areas identified below but the work will remain flexible with respect to the participants' agendas. As is common in semi-structured work, if new ideas emerge from early data collection, we may add new topics as the field work progresses.

Briefing:

1) Thank participant for agreeing to take part.
2) Introduce self.
3) This interview is following up on the clinical recording {and observation} of the urgent dental appointment, which you have already kindly contributed to my study investigating 'Which factors in dentist-patient interactions influence treatment in urgent dental care?' Details of the study were described in the participant information sheet and as I advised you when setting up this interview, we will be discussing your experiences about your urgent dental appointment.
4) Differences between people and the decisions they make may arise from different perceptions, priorities and beliefs. These differences are important and we value your unique perspective.
5) If at any time during the interview you do not wish to answer a question that's okay.
6) I would like to digitally record our conversation. The recording will be typed up and everything you say will be anonymous. Your name and any other names or places you mention, will be taken out, so that when people read your interview they will not know who you are or which dental clinic you attended.
7) Your interview will remain confidential, unless (as outlined in the consent form) it is possible that you or someone else is at risk; this would be discussed with you first.
8) If, at any stage, you wish to stop the audio-recorder, please do let me know.
9) Do you have any questions? [Note to review withdrawal process with participant]
10) Are you happy to proceed with the interview?

Topic areas to be explored:

Topic 1: Setting the Scene**:** Outline of the patient journey to his/her urgent dental appointment.

Topic 2: Views on his/her expectations of urgent dental care.

Topic 3: Views on the treatment options he/she was offered during his/her appointment.

Topic 4: Views on any prescriptions (antibiotics and/or analgesics) provided during the appointment.

Topic 5: Views on shared decision making and the consent process during this appointment.

Topic 6: Thoughts on anything else that may have influenced decision making in the appointment.

In preparation for the interview, any specific issues identified in transcripts/observation field notes of the patient's recorded clinical case will be identified and may be used to stimulate discussion or explore particular issues under the relevant topic area.

C6 Summary of Direct Observations in Out-of-Hours Dental Clinics

C.6.1 Case 95 - Data from Observation Record Form (ORF)

Questions from ORF		Observer's comments - verbatim from ORF
1	What did you notice as the patient entered the surgery	
	Patient	Not in pain. Confident young man.
	Chaperone	
	Dentist	Calm/routine, sitting in PC chair
	Dental Nurse	Waiting for instructions. Basic exam kit on exam tray.
2	How quickly did the dentist and patient gain rapport	Easily
	Comment	
Exam		
3	How compliant was the patient with the dentist's requests	Readily complied
4	How confident did the dentist seem in their diagnosis	5 - Absolutely certain
	Comment	Dentist wanted xray and explained what he thought was diagnosis (hole in tooth with infection) prior to xray received
Treatment planning		
5	What body-language did you notice?	
	Dentist-patient	Dentist confident - patient listening
	Dentist-nurse	Working well together/confident that got what needed
	Nurse-patient	
6	How was consent gained?	Verbal only
7	Were any clinical records written during the course of the appointment?	Dentist only
	Comment	Dentist explained all the time - including what xray showed with patient out of chair to see xray on pc screen. Dental nurse explained whilst putting in xray pad which was painful. Pt wants to keep the tooth. Nurse now starts to get equipment out for the procedure.
Treatment provided		
8	If operative treatment was provided, when did the nurse start preparing the equipment?	After consent gained
9	If a prescription only, who completed most of the prescription form?	No prescription given
10	If any advice leaflets were given, what were they about?	No leaflets given
Comment		Post opt to complete root canal treatment by own dentist. Dentist and nurse caring and offering support whilst pt having anaesthetic. Telling patient to breathe through nose. Patient very compliant with whole procedure. Whilst going numb, dentist writing up notes and nurse getting further supplies - so a lot of undoing wrappers. Pt just lying back in dental chair and moving

		mouth as if making chewing movements and moving jaw side to side. Before treatment started, patient breathing slowly and told dentist had no pain. Rapport with nurse who checked if patient OK before procedure started. Told pt may have to keep taking pain killers after treatment today. Dentist and nurse appeared confident in what they were doing at all times. Post-op instructions given to patient by dentist. Nurse gave address of possible dentist and to ring Monday morning. Pt listening. Patient looked in mirror when got up from the chair to see mouth. Appeared content with treatment carried out.
End of appointment		
11	What did you notice as the patient left the surgery?	
	Patient	Patient - looked in the mirror and asked if that was all and could leave.
	Chaperone	
	Dentist	Dentist wrote up notes for 5 mins.
	Dental Nurse	Nurse cleared area for next patient- very clean, professional looking space
12	How satisfied did the patient seem as they left the surgery?	5 - Completely satisfied
	Comment	Pt was satisfied but aware that this is temporary and will need to have more treatment
Overall - Patient		
13	Any communications/language difficulties?	No
14	How anxious did the patient appear?	4
15	Did the pt appear to seek reassurance during the appointment	Yes
16	Did the pt appear to pressurise the dentist during the appointment	No
17	Did the chaperone seem to influence the decision making today?	No chaperone
	Comment	Dentist and nurse offered reassurance without pt requesting it
Overall - Dental Team		
18	Did the dental nurse seem to influence the decision making today?	No
19	How stressful did the appointment seem for the dental team	1-Not stressful
20	How long did clinical records take after the patient left the surgery	5 minutes
	Comment	Having mouth open so long was painful
Overall - Organisational		

21	Did the scheduled appointment seem long enough?	Other
22	What did you notice about the surgery environment	Fairly quiet/light music on radio; echos in room and preparation fairly noisy (opening packets, getting out equipment from drawers, no purposeful banging though). Felt calm and organised. Typical dental surgery smell
	Comment	Dentist knew he can only offer first part of treatment to get out of pain today and do temp filling
Overall - Summary		
23	What appeared to be the key factors influencing treatment provided	In pain and not got regular dentist. 3rd time had emergency treatment

C.6.2 Case 119 - Data from Observation Record Form (ORF)

Questions from ORF		Observer's comments - verbatim from ORF
1	What did you notice as the patient entered the surgery?	
	Patient	Seemed humble - looked for somewhere to put scarf and bag
	Chaperone	
	Dentist	At chair near computer
	Dental Nurse	Near cupboards
2	How quickly did the dentist and patient gain rapport	Not at all
	Comment	Dentist tried very hard to gain rapport - lots of eye contact - used gestures - changed language - simple short statements, echoing, used gestures to try to explain - kept it simple - used repetition
Exam		
3	How compliant was the patient with the dentist's requests	Some compliance difficulties
4	How confident did the dentist seem in their diagnosis	4
	Comment	Very clear explanation of findings on radiograph. Dentist pointed to screen - showed hole in tooth. Explained which part to treat now and which for next dentist when registered. Consent gained - pt opted not for extraction - showed dentist how many teeth she had already lost - instead wanted treatment. Pt was clear about her preference for treatment but may not have fully understood what root canal treatment was due to language barrier.
Treatment planning		
5	What body-language did you notice?	
	Dentist-patient	Dentist calm, clear short explanations
	Dentist-nurse	Little verbal communication - in sync
	Nurse-patient	Small amount of verbal comms - praise and encouragement during active treatment
6	How was consent gained?	Verbal only
7	Were any clinical records written during the course of the appointment?	
	Comment	Actual consent was a discussion of extraction or root canal. This discussion happened partly with the dentist at the computer (face to face discussion - dentist turned around in chair near computer facing patient, making eye contact) and partly with the dentist at patient's head. Pt had a clear preference for treatment.
Treatment provided		
8	If operative treatment was provided, when did the nurse start preparing the equipment?	After consent gained
9	If a prescription only, who completed most of the prescription form?	No prescription given

10	If any advice leaflets were given, what were they about?	No leaflets given
	Comment	Patient needed second injection - was anxious about injection - I offered to have her hold my hand, she squeezed my hand very tightly throughout and made lots of noise of discomfort. The dentist and dental nurse tried to keep the patient calm & offered praise 'doing well'
End of appointment		
11	What did you notice as the patient left the surgery?	
	Patient	Patient tapped her chest to say 'thank you' from her heart
	Chaperone	
	Dentist	Dentist moved to computer to write her notes
	Dental Nurse	Tidied up near cupboards
12	How satisfied did the patient seem as they left the surgery?	5 - Completely satisfied
	Comment	Patient seemed very happy with the treatment given and profoundly thanked the team. But I wonder about how easily she will be able to register with a dentist as she is homeless - so she might not be able to complete the root canal treatment and may need further treatment. She was on antibiotics for the last 5 days, but they didn't seem to be working anymore. So whilst she seemed completely satisfied now - I wonder what will happen next.
Overall - Patient		
13	Any communications/language difficulties?	Yes
14	How anxious did the patient appear?	4
15	Did the pt appear to seek reassurance during the appointment	Yes
16	Did the pt appear to pressurise the dentist during the appointment	Yes
17	Did the chaperone seem to influence the decision making today?	No chaperone
	Comment	
Overall - Dental Team		
18	Did the dental nurse seem to influence the decision making today?	No
19	How stressful did the appointment seem for the dental team	3
20	How long did clinical records take after the patient left the surgery	5 mins
	Comment	This appointment was a bit trickier due to the language barrier. It was difficult to understand what the patient meant - unintelligible patches in speech. Also the patient did put some pressure on in relation to getting a dentist in {specific area of the city}.

Overall - Organisational		
21	Did the scheduled appointment seem long enough?	Yes but seemed tight
22	What did you notice about the surgery environment	Eye contact with pt whenever possible. Feeling calm. Neutral smell. Calm atmosphere & gentle tone established by dentist, but dentist had to speak more loudly and clearly this time due to language barrier
	Comment	
Overall - Summary		
23	What appeared to be the key factors influencing treatment provided	To get the patient out of pain - I think this was achieved - an initial clean out of the root (temporarily). However, this might not have matched the patient's expectations - she wanted to be referred to a regular dentist in {specific area of the city} and seemed to want a more thorough and permanent treatment today - not just a temporary solution e.g. pt was asking about her black gums - a second issue unrelated to her dental pain.. But the patient accepted it when the dentist explained they were not allowed to refer them to a regular dentist - just keep trying to register! Then the patient was more compliant and seemed grateful at the end. I worry though about whether the patient will be able to get further treatment for this tooth.

C.6.3 Case 129 - Data from Observation Record Form (ORF)

Questions from ORF		Observer's comments - verbatim from ORF
1	What did you notice as the patient entered the surgery	
	Patient	Entered with crutch
	Chaperone	Sat in chair in room - sat forward
	Dentist	Near chair
	Dental Nurse	In background - busy with cupboards
2	How quickly did the dentist and patient gain rapport	Easily
	Comment	Dentist: Very quickly greeted patient - asked about stick/cane - 'snow accident'. Joking with patient 'Why wasn't I invited?' Dental nurse: Reassurance when patient explained they were anxious. Later nurse reassured - whispered when talked about cleaning up tooth and need for root canal later. Both dentist and patient of Asian background - felt like this may have been a factor in instant rapport and common (?)reporter(?)
Exam		
3	How compliant was the patient with the dentist's requests	Some compliance difficulties
4	How confident did the dentist seem in their diagnosis	4
	Comment	Diagnosis was secondary caries - decay under existing filling. Lots of pain questions after xray. Cavity very deep very close to nerve but symptoms not severe enough. Honesty - presented options. Dentist seemed to be considering which option was best 'thinking outside the box' asked a lot of pain questions and seemed to think about pt's answers - seemed to be a bit of a mismatch between answers & xray - perhaps what drove dentist's later cautious treatment cleaning tooth inside not extraction)
Treatment planning		
5	What body-language did you notice?	
	Dentist-patient	Dentist took time with pain questions to decide options
	Dentist-nurse	Not involved much
	Nurse-patient	Sat on bed and held hand
6	How was consent gained?	Verbal only
7	Were any clinical records written during the course of the appointment?	Dentist only
	Comment	Consent process was in stages: dentist first presented 2 options before xray (I think) - root canal or extraction. Patient was anxious and didn't want it out. Later 'I'm just going to open up and do the first stage of root filling - don't worry you won't feel a thing' This seemed odd as don't think consent had been gained for this, only for 'cleaning'. Dentist did stress this was only temporary - pt needs follow up with own dentist.
Treatment provided		

8	If operative treatment was provided, when did the nurse start preparing the equipment?	Before consent process started
9	If a prescription only, who completed most of the prescription form?	No prescription given
10	If any advice leaflets were given, what were they about?	No leaflets given
	Comment	Treatment = cleaning out tooth - under filling and 'first stage of root canal'. Later xray & patient pain answers didn't quite match. Patient consented to cleaning inside root but some further root treatment was done. Pt doesn't have UK dentist, but dentist explained (rather quickly) how to get one and how much root canal might cost (private and NHS)
End of appointment		
11	What did you notice as the patient left the surgery?	
	Patient	Nurse helped patient get out of the chair (crutch)
	Chaperone	Walked out with patient - helped patient
	Dentist	At desk
	Dental Nurse	Paid attention to patient
12	How satisfied did the patient seem as they left the surgery?	5 - Completely satisfied
	Comment	Very satisfied - 'You're very nice' patient said at door to dentist - was smiling - seemed relieved and proud of herself.
Overall - Patient		
13	Any communications/language difficulties?	No
14	How anxious did the patient appear?	4
15	Did the pt appear to seek reassurance during the appointment	Yes
16	Did the pt appear to pressurise the dentist during the appointment	No
17	Did the chaperone seem to influence the decision making today?	No
	Comment	Anxiety of patient seemed to be successfully managed - pt much calmer at the end.
Overall - Dental Team		
18	Did the dental nurse seem to influence the decision making today?	No
19	How stressful did the appointment seem for the dental team	2
20	How long did clinical records take after the patient left the surgery	
Overall - Organisational		
21	Did the scheduled appointment seem long enough?	Yes, plenty of time

22	What did you notice about the surgery environment	Large spacious surgery - lots of space to the right. Dentist used soothing tone of voice. Nurse whispered reassurance whilst staying unobtrusive. Felt calm and confident - directed. No smell.
Overall - Summary		
23	What appeared to be the key factors influencing treatment provided	Get the patient out of pain but also to manage an anxious patient who doesn't have a UK dentist (international student) - also try to get patient to a regular dentist for stage 2 root canal treatment.

C.6.4 Case 130 - Data from Observation Record Form (ORF)

Questions from ORF		Observer's comments - verbatim from ORF
1	What did you notice as the patient entered the surgery	
	Patient	Subdued - looking down. Swollen cheek hanging down a bit. Patient young for such advanced decay (aged 37)
	Chaperone	
	Dentist	At computer - back to patient
	Dental Nurse	Behind dental chair busy with equipment
2	How quickly did the dentist and patient gain rapport	Hard to say
	Comment	On one hand, there was a lack of eye contact, dentist looked at computer & typed into it with his back to the patient. Patient explained his trouble with his teeth and pointed to different parts of his mouth & face but dentist didn't see all the gestures. Patient looked sad. On the other hand, the language used was simple, down to earth and blokey - short and to the point so the language was easily accessible.
Exam		
3	How compliant was the patient with the dentist's requests	Readily complied
4	How confident did the dentist seem in their diagnosis	5 - Absolutely certain
	Comment	Dentist looked carefully at pt's lip inside top lip and gums at the swelling and also at the upper anterior teeth. He used his finger to run it around the inside of the lips (in silence). Then he ordered an Xray - nurse set up equipment - I left the room. The xray was immediately visible on the screen and the dentist explained what the 'shadows' on the xray meant (decay). The dentist was very confident that the teeth couldn't be saved - needed extraction. Antibiotics were prescribed to bring the swelling down as extraction couldn't proceed with the swelling the way it was.
Treatment planning		
5	What body-language did you notice?	
	Dentist-patient	Dentist mostly at computer screen typing with back to patient
	Dentist-nurse	Asked nurse
	Nurse-patient	Silent
6	How was consent gained?	Verbal only
7	Were any clinical records written during the course of the appointment?	Dentist only
	Comment	
Treatment provided		
8	If operative treatment was provided, when did the	No operative treatment

	nurse start preparing the equipment?	
9	If a prescription only, who completed most of the prescription form?	Dental nurse
10	If any advice leaflets were given, what were they about?	Not sure
	Comment	
End of appointment		
11	What did you notice as the patient left the surgery?	
	Patient	Went with dentist to reception
	Chaperone	
	Dentist	Took patient to reception to complete the paperwork for the antibiotic prescription
	Dental Nurse	
12	How satisfied did the patient seem as they left the surgery?	2
	Comment	Hard to say, but patient was very sad and apprehensive and may not have accepted the need to lose all their front teeth. Didn't see a big change in patient's demeanour from start to end of appointment.
Overall - Patient		
13	Any communications/language difficulties?	No
14	How anxious did the patient appear?	4
15	Did the pt appear to seek reassurance during the appointment	Yes
16	Did the pt appear to pressurise the dentist during the appointment	No
17	Did the chaperone seem to influence the decision making today?	No chaperone
	Comment	No overt empathy was shown during the consultation.
Overall - Dental Team		
18	Did the dental nurse seem to influence the decision making today?	No
19	How stressful did the appointment seem for the dental team	2
20	How long did clinical records take after the patient left the surgery	2 mins
	Comment	Strangest relationship in the room seemed to be dentist to nurse (worked 4 handed with v. little conversation but also in-jokes) and other strange relationship was dentist to computer. Dentist to

		patient relationship not so strong (short & functional)
Overall - Organisational		
21	Did the scheduled appointment seem long enough?	Other
22	What did you notice about the surgery environment	Functional but basic - however friendly due to decorations up in waiting room. Prescription pad must have been in the equipment cupboards as nurse prepared it with patient's details
Comment		The team felt they were being given more time than usual due to the research process. There was enough time for a short information gathering, a brief exam and xray and then a short explanation of future treatment needed. However arguably as the patient was anxious and needed OHI (severe caries) one could argue that there wasn't enough time. Also not enough time for reassurance and explanations regarding the cause of the difficulties and when to go to casualty/A&E if infection got worse due to 'second rate antibiotics' - seemed likely to happen.
Overall - Summary		
23	What appeared to be the key factors influencing treatment provided	The key factor behind today's decision to prescribe antibiotics seemed to be the need to reduce swelling in order to perform multiple extractions. However as this patient cannot tolerate penicillin a 'second rate' antibiotic had to be prescribed - possibly leading to further infection and a trip to A&E for the patient. I felt concerned that this patient was anxious and didn't have a regular GDP and was facing a denture for his anteriors. It seemed that more attention to his OHI habits and anxiety could be a more preventative approach longer term, but there seemed not to be time for that - also not much empathy overtly shown. However, after the appointment, the dentist explained his frustration at the lack of options for patients like this one - not able to access NHS dental care - no one 'taking on' patients in {name of city} - possibly a 6 month waiting list leaving this patient with few options. Link made to 2006 dental contract - cap on payments to dental practices - cost of dental treatments not covered by NHS - dentist seemed angry about this on behalf of the patients.
NOTE: – Upon retirement from dentistry, the dentist associated with Case 130 left his data within the study but did not participate in a follow-up interview.		

Appendix D Intervention Co-development

D1 Agenda for stakeholder meeting - 1 October 2018

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TRUCE/APTiTUDE Multidisciplinary Group

1 October 2018 - Agenda

Purpose: To present results emerging from the TRUCE study (Treatment during Urgent Dental Care: an Ethnographic study); to check with key stakeholders that the meaning derived from these results is appropriate; and to help prioritise future actions.

Background: The TRUCE Study aims to identify factors influencing treatment during urgent dental appointments, as part of the APTiTUDE programme (Antibiotic Prescribing: Towards a reducTion in Urgent Dentistry in England). Data from the observations and follow-up interviews undertaken as part of the study are now ready for review by clinicians and people who have experienced urgent dental appointments (i.e. patients). By working together with policy makers and service commissioners, this meeting also presents the opportunity to begin to integrate the findings into health policies and service developments and to focus our future research.

Agenda

Part 1 - Clinicians and people with experience of urgent care (patients) only

13:30-13:40 Introduction to the TRUCE Study/APTiTUDE Research

13:40-13:50 Influences on urgent dental appointments - emerging results

13:50-15:00 Small groups to discuss the influences

Part 2 – Joined by policy makers from Public Health England & Health Education England

14:40-15:00 Feedback from small group discussions

15:00-16:00 Group agreement about key priorities & possible interventions

16:00-16:15 Discussion about how emerging findings fit with current policies & projects

16:15-16:30 Agreement about future developments.

D2 Candidate BCTs were shortlisted for the APTiTUDE complex intervention by application of the APEASE criteria. Source:(HBCP), 2018 #1750}.

TDF Domain (Factors)	**Behaviour Change Techniques with confirmed links to the literature, expert consensus and triangulation.**	**Application of the APEASE criteria (Affordability, Practicability, Effectiveness, Acceptability, Side effects/Safety, Equality)**
Skill (Patient management) (Treatment skills)	4.1 Instruction on how to perform the behaviour 8.1 Behavioural practice/rehearsal 8.7 Graded tasks	**4.1 Yes** **8.1 Yes** 8.7 Not practicable for this behaviour
Beliefs about capabilities (Planning & consent) (Procedure possible)	1.2 Problem solving 4.1 Instruction on how to perform the behaviour 6.1 Demonstration of the behaviour 8.1 Behavioural practice/rehearsal 8.7 Graded tasks 15.1 Verbal persuasion about capability 15.3 Focus on past success 15.4 Self talk	1.2 Not affordable at scale **4.1 Yes** 6.1 Not practicable for this behaviour **8.1 Yes** 8.7 Not practicable for this behaviour **15.1 Yes** 15.3 Risk of side effect (evidence in Table 5-16) 15.4 Not acceptable for this behaviour
Beliefs about consequences (Antibiotic beliefs) (Lifetime impact)	5.1 Information about health consequences 5.2 Salience of consequences 5.3 Information about social & environmental consequences 5.5 Anticipated regret 5.6 Information about emotional consequences	**5.1 Yes** **5.2 Yes** **5.3 Yes** **5.5 Yes** **5.6 Yes**

	9.2 Pros and cons 9.3 Comparative imagining of future outcomes 10.1 Material incentive (Behaviour) 10.8 Incentive (Outcome) 10.10 Reward (Outcome)	9.2 Risk of side effect (evidence in Table 5-16) 9.3 Not practicable for this behaviour 10.1 Not affordable 10.8 Not practicable at present – better data needed 10.10 Not practicable at present – better data needed
Goals (Fix the problem) (Relationship)	1.1 Goal setting (Behaviour) 1.3 Goal setting (Outcome) 1.5 Review behaviour goal(s) 1.6 Discrepancy between current behaviour and goal 1.7 Review outcome goal(s)	**1.1 Yes** 1.3 Not practicable at present – better data needed **1.5 Yes** 1.6 Not practicable yet – maybe in the future 1.7 Not practicable yet – better data needed
Professional role & identity (Professional role)	No BCTs are associated with this TDF domain	Nil
Environment context/resources (Access) (Competing demands)	3.2 Social support (practical) 7.1 Prompts/cues 7.5 Remove aversive stimulus 12.1 Restructuring the physical environment 12.2 Restructuring the social environment 12.3 Avoiding/reducing exposure to cues for the behaviour 12.5 Adding objects to the environment	3.2 Not practicable **7.1 Yes** **7.5 Yes** 12.1 Not practicable 12.2 Not practicable **12.3 Yes** **12.5 Yes**
Social influences	3.1 Social support (unspecified) 3.2 Social support (practical)	3.1 Not practicable 3.2 Not practicable

(Patient influence) (Peer influence)	6.2 Social comparison 6.3 Information about others' approval 10.4 Social reward	**6.2 Yes** **6.3 Yes** **10.4 Yes**

D3 Agenda for stakeholder meeting - 14 January 2019

UNIVERSITY OF LEEDS

TRUCE/APTiTUDE Multidisciplinary Group

14 January 2019

Purpose:

- To reflect on the priorities identified at our last Multi-Disciplinary Group (MDG) meeting;
- To link the priorities to new interventions aimed at reducing dental antibiotic use; and
- To guide development of those interventions, including with a professional script writer.

Background: The TRUCE Study (Treatment during Urgent dental Care: an Ethnographic study) has identified factors influencing treatment decisions through clinical research with patients and dental teams. It is part of the APTiTUDE Programme (Antibiotic Prescribing: Towards a reducTion in Urgent Dentistry in England) which aims to develop interventions to reduce dental antibiotic prescribing.

At the last MDG meeting, we identified 13 factors which seem to be priorities to be targeted by the new interventions. Using behavioural science, two interventions have been identified for development: an information sharing tool for use in dental practices; and a series of supporting on-line films/podcasts providing more information about the consequences (health, social and environmental) of using antibiotics when they aren't necessary. The MDG is asked to help shape these resources, including developing stories for the actors to tell on the films/podcast.

Homework: Please could you bring along any personal stories related to these questions?

a) Have antibiotics saved the life of someone you know?
b) What bad reaction to antibiotics have you heard about/experienced?
c) Do you know anyone who has experienced an infection which was resistant to antibiotics?

Agenda

12:45 – Catch the bug - Introductions & sharing

13:00 – Recap on factors and review priorities previously identified

13:15 – Using behavioural science to develop interventions

13:30 – Group Work – Advertising Task

14:00 – Example from Connecting Science

https://connectingscience.wellcomegenomecampus.org/what-we-do/society-and-ethics-research/new-films-abc-vs-st-georges-nhs-trust/

14:30 – Group Work – Role plays of patient-dentist interaction to develop scenario(s)/perspective(s)

15:00 – Group feedback session

15:30 – What next? The way ahead for the APTiTUDE project