The attendance of e-cigarette users at stop smoking services:

a mixed methods study

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Declaration

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Abstract

Background: Stop smoking services (SSSs), combined with pharmacotherapy, are more effective for quitting smoking than other aids used alone, including e-cigarettes. SSS uptake has nonetheless declined for six years. Amidst pressure on council budgets, this declining footfall has led to many areas reducing or discontinuing services. When making cuts, councils often cite widespread vaping and suggest this indicates smokers nowadays need SSSs less. This PhD aimed to investigate whether vaping amongst smokers can influence SSS use and, if so, how this occurs.

Methods: A systematic review synthesised evidence on sociodemographic differences in e-cigarette use from 58 studies identified across seven databases. Repeat cross-sectional survey data was collected from 2,139 current smokers through questions added into the 'Smoking Toolkit' survey. Multivariable logistic regression assessed associations between SSS uptake and: a) e-cigarette use; b) knowledge/belief statements about e-cigarettes or SSSs. Finally, 46 semi-structured interviews were undertaken with smokers and SSS professionals at three sites. Principles of framework analysis were applied to examine factors influencing smokers' decisions to use e-cigarettes or SSSs, including potential impacts of differences in perspectives between smokers and SSS professionals.

Findings: Systematic review results suggested higher e-cigarette use among younger adults, males and people of white ethnicity. Survey data showed smokers who vaped were more likely than others to report both past and planned SSS uptake. Further analyses showed beliefs about e-cigarettes' effectiveness and familiarity with vaping were associated with decisions to use SSSs. Semi-structured interviews indicated a range of views on potential risks from vaping. These appeared to be key factors influencing – for smokers – their e-cigarette use, and – for services – the support provided in relation to e-cigarettes.

Conclusion: Smokers using e-cigarettes remain keen to use SSSs. Given social gradients in smoking rates, removing opportunities to access such services may have retrograde health impacts for society's most vulnerable people.

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Dedication

For Dad.

You may not be here to see this come to fruition, but you knew about the seed of the idea and if anyone laid the flowerbed it was you.

Finishing this throughout April has meant you've been very much in my mind, not least because of those lines you loved so much:

> *"Whan that Aprille with his shoures soote*
> *The droghte of Marche hath perced to the roote,*
> *And bathed every veyne in swich licour,*
> *Of which vertu engendred is the flour"*

This one's for you.

1st May 2019

Contents

Declaration *2*

Abstract *3*

Acknowledgments *4*

Dedication *6*

Contents *7*

List of Tables and Figures *11*

Abbreviations *12*

PART I: CONTEXT *13*

Chapter 1: Background *14*

1.1 Introduction **14**

1.2 Aims and objectives **16**

1.3 Overview of thesis methods **16**

1.4 Thesis structure **22**

1.5 Role of candidate **24**

1.6 Ethical clearances **24**

1.7 References **25**

Chapter 2: Literature review *29*

2.1 The burden of tobacco **29**

2.2 The rise of e-cigarettes and associated research **31**

2.3 Stop smoking services: history and recent challenges **35**

2.4 Inequalities and access **37**

2.5 Health decision-making and behaviour change **42**

2.6 The relationship between e-cigarettes and stop smoking services **45**

2.7 Conclusion **49**

2.8 References **50**

Chapter 3: Research paper – Systematic review of evidence on sociodemographic differences in e-cigarette use *63*

3.1 Introduction **63**

3.2 Research paper cover sheet **64**

Abstract **66**

Background **66**

Method **66**

Results **67**

Discussion **69**

Conclusion **70**

Declarations **71**

References **71**

PART II: RESULTS *73*

Chapter 4: Research paper – Population survey of e-cigarette use and behavioural support uptake *74*

4.1 Introduction **74**

4.2 Research paper cover sheet **75**

Abstract **78**

Background **80**

Method **82**

Results **87**

Discussion **91**

Conclusion **94**

Declarations **95**

References **97**

Chapter 5: Research paper – Population survey of knowledge and beliefs about e-cigarettes and behavioural support *101*

5.1 Introduction **101**

5.2 Research paper cover sheet 102

Abstract 105

Background 106

Method 107

Results 112

Discussion 115

Conclusion 118

References 119

Chapter 6: Research paper – Qualitative study of decisions to use e-cigarettes or behavioural support 122

6.1 Introduction 122

6.2 Research paper cover sheet 123

Abstract 126

Background 127

Methods 128

Findings 130

Discussion 138

Conclusion 142

References 143

PART III: DISCUSSION 147

Chapter 7: Discussion and Conclusion 148

7.1 Introduction 148

7.2 Summary of findings and comparison with existing literature 150

7.3 Limitations 166

7.4 Implications and recommendations 168

7.5 Conclusion 175

7.6 References 176

APPENDICES.....*182*

APPENDIX A – Systematic review: example of full electronic search strategy (MEDLINE) **182**

APPENDIX B – Systematic review: effect direction plot.....**183**

APPENDIX C – Qualitative workstream: supplementary recruitment information **195**

APPENDIX D – Qualitative workstream: recruitment flyer **197**

APPENDIX E – Qualitative workstream: participant information sheets.....**198**

APPENDIX F – Qualitative workstream: consent form.....**207**

APPENDIX G – Qualitative workstream: topic guides **208**

APPENDIX H – Ethical clearances **213**

List of Tables and Figures

Chapter 1

Table 1: Links between objectives and chapters 22

Chapter 3

Figure 1: PRISMA flow chart..... 68

Chapter 4

Table 1: Sample characteristics 88

Table 2: Sample characteristics by dual use of combustible tobacco/e-cigarettes or combustible tobacco/NRT..... 89

Table 3: E-cigarette or NRT use and past uptake of SSSs amongst current smokers of combustible tobacco..... 90

Table 4: E-cigarette or NRT use and planned uptake of SSSs amongst current smokers of combustible tobacco..... 90

Chapter 5

Table 1: Sample characteristics..... 112

Table 2: Knowledge/beliefs and past or planned SSS uptake among current smokers 113

Chapter 6

Table 1: Participant characteristics..... 129

Table 2: Views expressed about vaping within different groups of interviewees..... 131

Table 3: Summary of stop smoking service positions on e-cigarettes and individual staff views..... 137

Chapter 7

Table 1: Summary of latest data on sociodemographic subgroups reporting highest current use of e-cigarettes and stop smoking services..... 154

Abbreviations

AOR	Adjusted Odds Ratio
ASH	Action on Smoking and Health
CI	Confidence Interval
COM-B	Capability Opportunity Motivation model of Behaviour change
HBM	Health Belief Model
HSI	Heaviness of Smoking Index
LSHTM	London School of Hygiene & Tropical Medicine
MTSS	Motivation To Stop Scale
NCSCT	National Centre for Smoking Cessation and Training
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NIHR	National Institute for Health Research
NRT	Nicotine Replacement Therapy
OR	Odds Ratio
PHE	Public Health England
PROGRESS	Place of residence, Race, Occupation, Gender, Religion, Education level, Socioeconomic status and Social Capital
RCT	Randomised Controlled Trial
REC	Research Ethics Committee
RR	Relative Risk
SD	Standard Deviation
SES	Socioeconomic Status
SSS	Stop Smoking Service
STS	Smoking Toolkit Study
TPD	Tobacco Products Directive
UCL	University College London
WHO	World Health Organisation

PART I: CONTEXT

Chapter 1: Background

1.1 Introduction

E-cigarettes remain one of the most topical and vigorously debated issues in public health today. Since their arrival into European and US markets over a decade ago, uptake has increased dramatically, both internationally and within the UK; here, for instance, 5.4-6.2% of all adults are estimated to be currently using them, as of 2018.(1) Research into the potential risks and benefits of vaping has also expanded enormously over this time, with 1,097 publications recorded in 2018 alone.(2) The research that has been undertaken to date into their effectiveness as tobacco quit aids is, however, limited and inconclusive.(3,4) Moreover, academic interest potentially appears to be shifting elsewhere, with bibliometric analysis suggesting an increasing research focus on issues around youth uptake and a declining interest in areas concerning 'cessation'.(2)

In contrast to e-cigarettes, a well-established evidence base exists for stop smoking services (SSSs) which - combined with pharmacotherapy - have been shown to be more effective than other measures alone.(5) In England, SSSs are commissioned by local authorities and most commonly provide face-to-face support from qualified practitioners, as well as stop smoking medications. During several sessions over the course of weeks or months, a smoker is encouraged to set a quit date, before being advised on how to prepare for it and then given support following the 'jumping off point' to manage cravings, to use pharmacotherapy correctly and - if desired - to wean off any nicotine replacement products. Around 90% of services also offer telephone support and around 50% offer group sessions. The latest research from Action on Smoking and Health (ASH) and Cancer Research UK (CRUK) shows the impact that budget pressures are having on local authorities, however.(6) Only 56% of councils still maintain a 'universal' SSS (i.e. one accessible to any smokers in their area) staffed by stop smoking specialists or wellbeing/lifestyle counsellors, as other models have increasingly emerged in recent years. Approximately 22% of local authorities have moved from specialist services to 'integrated lifestyle' services (providing smoking support alongside advice on diet, alcohol and physical activity), for instance, while in 9% of areas the only assistance provided to smokers is from pharmacists and GPs.(6)

Despite the strong evidence of their effectiveness,(5) uptake of SSSs has nonetheless now been dwindling for six consecutive years (2012/13-2017/18), dropping between 11% and 23% annually over this period.(7) In the context of ongoing, sustained pressure on council public health budgets, it is this declining footfall that has led to SSSs in many areas being scaled back considerably and some even being completely discontinued.(6) When making these cuts, councils have frequently cited the widespread popularity of e-cigarettes and suggested that this indicates smokers have less need for SSSs nowadays.(8–11) Meanwhile, there has been increasing recognition nationally about the importance of investigating whether e-cigarette use could be impacting smokers' uptake of more effective cessation options such as behavioural support.(1,7,12,13) The single English study to date that considered this as one of several outcomes reported inconclusive findings, so this remains an ongoing concern.(14) As Filippidis et al. have argued, "the question of whether the availability of e-cigarettes will displace other methods, and the impact of such a displacement, should be closely evaluated".(13)

This research gap has in fact become even more important to address in light of emerging evidence suggesting the potential effectiveness of e-cigarettes when used specifically within the context of SSSs. Routine data suggests, for instance, that SSS clients who use e-cigarettes in combination with behavioural support have comparable quit rates to those using licensed pharmacotherapy,(4) and this picture was recently supported by the first major RCT on this specific issue.(15) Yet far more SSS clients currently use licensed medicines compared to e-cigarettes.(4,16) The 2018 Public Health England (PHE) report on e-cigarettes therefore included a conclusion that "if ECs [e-cigarettes] are contributing to higher success rates, Stop Smoking Services in England may be missing an opportunity to maximise cessation outcomes for smokers who use their service".(4) Researchers such as Salloum et al. have similarly flagged up that "more investigation is needed, including qualitative studies, of perceptions about evidence-based pharmacological and behavioural cessation therapies, as well as investigation into patient-provider interactions related to e-cigarette use".(17) This thesis set out to address these research gaps.

1.2 Aims and objectives

The aim of this thesis is to investigate whether, amongst English smokers (the 'population'), the use of e-cigarettes (the 'exposure') could be influencing their use of SSSs (the 'outcome') and, if so, how this is occurring.

Three objectives underpin this aim:

- Objective A: To understand, within English smokers (the 'population'), how use of e-cigarettes (the 'exposure') varies across sociodemographic groups, and to consider this in relation to existing data on how use of SSSs (the 'comparator') varies across the same population;
- Objective B: To investigate whether, amongst English smokers (the 'population'), use of e-cigarettes (the 'exposure') is associated with use of SSSs (the 'outcome'), including in comparison to NRT use (the 'comparator');
- Objective C: To investigate, amongst English smokers (the 'population') what factors (the 'exposures') influence decisions to use either e-cigarettes or SSSs (the 'outcomes'), including the potential impact each can have on the other.

1.3 Overview of thesis methods

1.3.1 Systematic review

First, I undertook a systematic review to synthesise the available evidence on sociodemographic differences related to e-cigarettes. This involved systematically searching seven major electronic research databases, without any restrictions on publication year or geography, as well as undertaking a trawl of 12 grey literature databases and key websites (an example of my search strategy is available at Appendix A). Primary outcomes were e-cigarette awareness, trial ('ever use') and current use. Cross-sectional and longitudinal studies were included if they contained subgroup analysis of any of the PROGRESS Plus sociodemographic groups (place of residence,

race/ethnicity, occupation, gender, religion, education level, socioeconomic status and social capital, with 'Plus' signifying additional categories such as age, disability and sexual orientation). Data from the 58 eligible studies were extracted and checked, before an established tool originally created by the Joanna Briggs Institute (JBI) was adapted to assess quality and risk of bias. Results were drafted into a narrative review, where detailed outcome data were contained within an 'effect direction plot' (available at Appendix B), a technique for visually displaying reported impacts developed by Thomson and Thomas.(18) Across all the outcomes, I found that e-cigarettes appeared to have achieved greater reach among older adolescents and younger adults, males and people of white ethnicity. Awareness and 'ever use' were also greater in subpopulations with relatively higher educational attainment.

1.3.2 Quantitative workstream

I then collected new repeat cross-sectional survey data from 2,139 current smokers through the addition of 6 new questions into the Smoking Toolkit Study (STS), a long-running, nationally representative survey in England.(19) The analyses of these new data primarily assessed associations between e-cigarette use and past or planned uptake of SSSs through the use of multivariable logistic regression to adjust for potential confounding variables. Analyses also examined sociodemographic differences in these associations through the inclusion of interaction terms. In summary, dual users of tobacco and e-cigarettes were more likely than other current smokers to report having accessed SSSs in the past and intending to take up these services in the future. Smokers who 'dual used' nicotine replacement therapy (NRT) and tobacco reported similar findings.

The STS questions furthermore collected information about knowledge and beliefs – including those relating to e-cigarettes – that could be influencing the use of SSSs. In a separate piece of analysis using data from the same 2,139 respondents, multivariable logistic regression was again used to assess associations between these knowledge and belief variables and past or planned SSS uptake. Similarly, interaction analyses again examined potential sociodemographic differences in the associations, as well as differences between 'dual users' of e-cigarettes and tobacco versus other smokers. I

found that, among current smokers, beliefs about e-cigarette effectiveness and familiarity with vaping (both knowing how to vape oneself and knowing others who vaped) were associated with decisions to access SSS support. These decisions were also associated with familiarity with SSSs themselves, as well as with perceptions of SSSs (including convenience, likely time commitments and anticipated welcome) and valence of any previous SSS uptake. Interaction analyses suggested that, for some of these variables, differences existed between smokers of different gender, social grade and vaping status.

1.3.3 Qualitative workstream

For my qualitative workstream, I conducted 46 semi-structured interviews with current and recent ex-smokers (n=29), as well as SSS professionals (n=17), at three research sites in England, each comprising an SSS and its surrounding local 'catchment' area. For smokers, these interviews explored factors influencing their decisions around using behavioural support or e-cigarettes (as Pearson et al. have stated, qualitative research is arguably the most appropriate for these kinds of "in-depth explorations of reasons for [e-cigarette] use").(20) For SSS professionals, interviews explored characteristics of their service's policy on e-cigarettes and how this was translated into practice, as well as individuals' own views on e-cigarettes. They thus provided insights into how both SSS policies on e-cigarettes and individual practitioners' own beliefs about them could be influencing the attendance of some of their potential clients. All interviews were based on topic guides that were adapted as necessary depending on an individual's specific background (e.g. some questions about SSS or vaping experiences were less appropriate for non-SSS users or non-vapers). Interviews also left space for discussion of any areas that were of particular interest for individual interviewees. Supplementary materials relating to the recruitment and consent arrangements for the qualitative workstream, as well as examples of topic guides used, are included at Appendices C to G.

Analyses were based on the principles of framework analysis,(21) with findings framed using the 'COM-B' model of behaviour change.(22) In a heavily populated field, COM-B has the strong advantage over previous models and theories of being based on a wide-ranging, transparent and systematic synthesis of preceding research. Like all models, it

is not perfect – in particular, it has been criticised by Ogden who perceives it as removing valuable theory variability.(23) In addition, had I been researching smoking relapse, other frameworks such as the 'Stages of Change' or 'Transtheoretical' model would arguably have incorporated that concept more naturally. Yet, as a theoretical framework, it has proved a coherent and robust foundation for a broad range of research across the field of smoking cessation and beyond. It has been applied productively, for instance, to studies examining the uptake of vaping and behavioural support respectively, as well as research into smoking-related behaviours more generally.(22,24–26) COM-B's pragmatism has also led to it being used to underpin the SSS commissioning guidance provided by PHE to local authorities.(27) Framing my findings using it should therefore have the added advantage of facilitating the dissemination and impact of my final recommendations.

Overall, I found that both smoker and SSS participants reported a range of individual views on the potential risks of long-term vaping; these appeared to be key factors influencing – for smokers – their use of e-cigarettes, and – for services – the scope of advice and support they provided in relation to e-cigarettes. Conversely, the two groups differed in their perceptions of how much opportunity services were providing for educating smokers about e-cigarettes and for helping with ongoing nicotine addiction after quitting smoking. Further important influences reported by smokers on their use of e-cigarettes often overlapped with influences on their use of SSSs.

1.3.4 Mixed methods

This thesis uses a 'mixed methods' approach to address its overall aim. Widely used within the social sciences, mixed methods research involves collecting and analysing both qualitative and quantitative data.(28) There are a number of reasons for this choice. Most fundamentally, it derives from the overall epistemological grounding of my research since, throughout this work, I have been guided by the philosophy of 'subtle realism' described by Mays and Pope:

> *"Other authors agree that all research involves subjective perception and that different methods produce different perspectives, but, unlike the anti-realists, they*

> *argue that there is an underlying reality which can be studied. The philosophy of qualitative and quantitative researchers should be one of 'subtle realism' – an attempt to represent that reality rather than to attain 'the truth'".*(29)

In my case, I have been interested in both the perspectives of smokers who are answering fixed questions in the context of a face-to-face but computer-assisted survey and the perspectives of smokers and SSS professionals when they are able to elaborate at length in response to more fluid questions during a semi-structured interview. In both the quantitative and qualitative work, the responses provided will have been influenced to varying degrees by the specific environment of the interview as well as by the unique interaction with the interviewer (myself in the case of the qualitative interviews). This influence will have resulted, for instance, from the rapport or dynamic created with an individual interviewee, as well as the inherent characteristics (ethnicity, gender, age etc.) of myself as the qualitative data collector or the Ipsos-MORI employees as the quantitative ones. So while I believe there is 'an underlying reality' to why people make decisions in this area, this will be a reality which varies from one individual to another (and perhaps even from one day to another) and which no single research method has exclusive access to. Mixing methods therefore surely gets us closer to understanding the complexity of this 'underlying reality' than collecting either quantitative or qualitative data alone. Related to this, the acknowledgment of my own 'subjective perception' is another reason for my use of framework analysis, given its recognition that there are often 'a priori' deductive concepts which a researcher is interested in and that not all themes therefore need to emerge inductively from the data.

Studies into the value of mixed methods approaches suggest that - where they are feasible - they can strengthen the validity of research's conclusions and potentially provide fuller, richer insights into phenomena than data collected by a single method.(30–32) A key element of this is the integration of different data types which, it has been argued, provides more assurance in the robustness of results by bringing together the advantages of each individual method while minimising limitations.(33) Others suggest that the approach is more inclusive as it incorporates diverse perspectives or that it facilitates the generation of recommendations for further

studies.(34,35) Conversely, concerns have occasionally been raised that individual researchers often have insufficient expertise to examine issues using both approaches, or that mixed methods designs are sometimes employed in situations where collecting either quantitative or qualitative data in isolation would actually be more appropriate for costs and timeframes.(36) In light of these criticisms, I undertook a broad range of training over the course of my research programme into key aspects of both qualitative and quantitative methods. As for the appropriateness of combining qualitative and quantitative methods for my particular research questions, there are already precedents demonstrating that this approach can reveal unanticipated factors shaping the use of smoking cessation services.(37,38) Furthermore, Tashakkori and Teddlie argue that "if there is a strong possibility that one might get incomplete and unsatisfactory answers, shorter and less expensive paths that provide such answers are not desirable".(36) In my case, I was fortunate to have sufficient time and funding to do justice to both quantitative and qualitative workstreams. I also felt that both sets of proposed data were necessary in order to address my specific objectives fully.

One further key question to address up front is what I really mean by 'mixed'. It has been argued that insufficient thought is sometimes given to how different methods being mixed will complement each other and be combined, which can risk qualitative elements being subordinated to quantitative ones.(36) In my own case, I have undertaken 'convergent' mixed methods research, a recognised design whereby separate quantitative and qualitative findings are examined alongside each other in order to validate findings.(33,39) Drawing on a widely used typology,(40) my mixed methods approach informed my overall research programme through the concepts of 'development', 'complementarity' and 'expansion':

- My systematic review collated existing quantitative studies relating to e-cigarette use and helped to identify population groups of interest for later tests of sociodemographic interactions within my quantitative data ('development');
- The questions decided upon for the quantitative workstream, and emerging insights from my STS data analysis, also informed the broader discussion areas included in the topic guides for the semi-structured interviews ('development');

- These interviews in turn allowed the STS question areas to be investigated at greater length and depth ('complementarity'), drawing out real-life experiences of smokers and extending the range of inquiry to include emergent themes as well as the incorporation of SSS professional views ('expansion').

Given the 'research paper' format of this PhD, the qualitative and quantitative workstreams' findings are initially presented separately, as this has facilitated the submission of my results to various journals, before key findings from both datasets are brought together for full consideration within the thesis. The following section provides further details on my overall thesis structure.

1.4 Thesis structure

A short outline of the thesis's structure is presented here for ease of reference. Table 1 also shows the chapters and page ranges that address my different objectives.

Table 1: Links between objectives and chapters

Objective	Objective summary	Addressed in chapters
A: To understand, within English smokers *(the 'population')*, how use of e-cigarettes *(the 'exposure')* varies across sociodemographic groups, and to consider this in relation to existing data on how use of SSSs *(the 'comparator')* varies across the same population	How is e-cigarette use *(the 'exposure')* patterned across society compared to SSS use *(the 'comparator')*?	3,7
B: To investigate whether, amongst English smokers *(the 'population'),* use of e-cigarettes *(the 'exposure')* is associated with use of SSSs *(the 'outcome')*, including in comparison to NRT use (*the 'comparator'*)	Is e-cigarette use *(the 'exposure')* associated with SSS use *(the 'outcome')*?	4,7
C: To investigate, amongst English smokers *(the 'population')* what factors *(the 'exposures')* influence decisions to use either e-cigarettes or SSSs *(the 'outcomes'),* including the potential impact each can have on the other	What factors *(the 'exposures')* influence e-cigarette or SSS use *(the 'outcomes')*?	5,6,7

Part I provides context to the thesis as a whole. Chapter 1 concludes with a brief summary of the ethics clearances obtained for this programme of work, while Chapter 2 presents a narrative literature review enabling the findings that follow to be placed

within the broader research landscape. Chapter 3 provides additional important research context in the form of the first of four research papers: the systematic review into sociodemographic differences in e-cigarette use published in *Tobacco Control*.(41) Part II contains the findings from the quantitative and qualitative workstreams within three further research papers. Firstly, Chapters 4 and 5 present the two papers using STS data. Chapter 4 assesses the association between e-cigarette use and SSS uptake while Chapter 5 assesses the associations between various knowledge and belief variables and SSS uptake. These chapters include the versions of the papers that were, at the time this thesis was examined, being finalised for submission to the journals *Thorax* (Chapter 4) and *Drug and Alcohol Dependence* (Chapter 5) respectively. They have since been updated to incorporate minor corrections recommended by my Viva examiners. Chapter 6 is my qualitative results paper containing the findings from my 46 semi-structured interviews which, at the time this thesis was examined, was in the process of being sent for peer review by the first journal approached, *Addiction*. Similarly, it has subsequently been updated to incorporate minor corrections recommended by my Viva examiners. Finally, in Part III, the findings from the various research papers are explored in more depth, structured by the thesis's three objectives. Chapter 7 therefore contains a full discussion integrating my quantitative and qualitative results, as well as presenting implications and final concluding remarks.

As per London School of Hygiene & Tropical Medicine's (LSHTM's) 'research paper style thesis' format, the various results chapters are included in the form of manuscripts for journals. In the case of the systematic review (Chapter 3), this is the published version so is presented as formatted and printed within *Tobacco Control*. For readability purposes, the other three manuscripts have been formatted to align with the rest of the thesis, with the relevant reference list provided at the close of each chapter. Wherever possible, repetition between sections has been minimised, although there is inevitably some similarity in parts of the methods sections for Chapters 4 and 5 given they employed data from the same participants. For the purposes of preserving anonymity, care has been taken in Chapters 6 and 7 to ensure no identifying details are included for individuals or research areas (given, for instance, that each SSS has only one manager).

1.5 Role of candidate

This PhD research was funded by a National Institute of Health Research (NIHR) Clinical Doctoral Research Fellowship. I therefore went 'out of programme' (OOP) from my training as a public health specialty registrar for the three year period and instead held a fixed-term contract with LSHTM. As well as the research skills developed during this time, I was therefore also able at various points to gain some further teaching experience by supporting a number of the university's MSc modules.

Each of my results papers involved co-authors but, in each case, I had overall lead responsibility for conceptualisation, data collection, analysis, drafting and revision, with guidance and input from my supervisors as required. Both my own responsibilities and those of co-authors are detailed fully in the methods sections of Chapters 3 to 6, as well as in the 'contributors' paragraphs within Chapters 3 and 4. The 'research paper cover sheets' at the start of each results chapter also summarise my contribution in each case.

1.6 Ethical clearances

The programme of research contained within this thesis received all necessary ethical approvals through submissions to the LSHTM Research Ethics Committee (REC, reference 11672) and the Social Care REC (reference 11672, IRAS ID 223311). Although my study did not involve social care settings or organisations, the Research Ethics Service's position is that Social Care REC review is the most appropriate option for studies like mine that use qualitative methods, such as semi-structured interviews, without involving any change in treatment or clinical practice.(42) Local NHS R&D requirements were furthermore fully met at each of the three research sites in advance of any interviews commencing, while overall HRA approval was also sought and obtained (reference 17/LO/0414, IRAS ID 223311). Full copies of approval letters are contained in Appendix H.

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Chapter 2: Literature review

2.1 The burden of tobacco

Tobacco remains one of the greatest public health challenges faced globally.(1) The demonstration by twentieth-century researchers of the array of risks faced by tobacco users may have prompted the steady declines in prevalence currently being observed in many higher-income countries,(2) but over 1.1 billion people, or 20.2% of the world's adult population, still smoke, as of 2018.(3) The associated health and economic burdens are therefore vast: globally, tobacco is still responsible for one in ten of all deaths (an estimated six million annually) and is the second highest risk factor for morbidity and premature mortality.(1,2) Its contribution to world-wide disease burdens is in fact increasing, with this varied morbidity in turn placing severe pressure on health services.(2,3) Estimates suggest 5.7% of global health expenditure is directed towards smoking-attributable diseases, and the total economic cost from smoking has been calculated to amount to almost 2% of the world's entire gross domestic product (GDP).(4) It also hits the world's poorest the hardest, as research indicates tobacco is driving increases in health inequalities in nations with the most enduring rates of smoking.(5,6) At a global level, disadvantaged smokers aged between 35 and 69 have been shown to have far higher mortality rates than others.(7)

These stark patterns are very much evident within the UK, where smoking remains the biggest cause of preventable morbidity and mortality,(8) as well as a leading driver of health inequalities.(9) Here, 15.1% of the adult population smoke (2017 data), equating to some 7.4 million people,(10) resulting in over 474,000 hospital admissions annually from smoking and 200 deaths each day from preventable smoking-related diseases.(9) Although overall prevalence of smoking in adults is declining slowly, latest data suggests that this is not the case for some vulnerable groups, such as pregnant women, and that the gap in smoking rates between higher and lower socioeconomic groups remains unchanged.(11) Around 50% of UK smokers who cannot, or do not wish to quit will die prematurely as a result of their tobacco use, each losing on average a decade of their life.(12) Costs borne by the NHS are in the region of £2.6billion annually, with

smoking estimated to reduce the UK's GDP overall by approximately £11billion each year.(9) The Government's current main aim for tackling this, as outlined in the *Tobacco Control Plan* published by the Department of Health and Social Care (DHSC) in 2017, is to reduce the prevalence of smoking in adults in England to 12% or less by 2022.(9)

Efforts such as these to reduce prevalence in higher-income countries like the UK have the advantage that most of the general population now has an awareness of tobacco's overall negative impacts on health, including its role in causing lung cancer and heart disease.(13) Furthermore, smokers are generally not willing addicts. Two thirds of them report a desire to quit,(14) while over 80% of smokers report high levels of discontent from their regret about having taken up tobacco and their disappointment at failing to quit.(15) Most smokers, after all, take up the habit in adolescence (when they have less understanding about the tenacity of nicotine addiction), before going on to regret it later as adults.(16,17) In the US, for instance, 90% of smokers start by the age of 18, 95% by age 21 and around 99% by age 25.(18)

The reasons why so many smokers wish to quit but cannot are diverse and complex. Fundamentally, nicotine is of course a powerfully addictive stimulant. Yet, beyond this, there are a vast array of psychological, pharmacological and social factors that influence smoking behaviour.(19) Smoking initiation has been shown, for instance, to be predicted by: impulsivity, socioeconomic status (SES), mental health challenges, genetics and having friends or parents who smoke.(19,20) Moving from initiation to regular smoking can meanwhile be predicted by: alcohol use, levels of parental support, smoking attitudes, academic interest, and - again - socioeconomic status and having friends who smoke.(19,20) Decisions about whether or not to quit are influenced by how much pleasure someone derives from smoking as well as how much they enjoy the sense of identity of being a smoker.(21) Perceived benefits from smoking in terms of relieving stress, managing weight, improving concentration and facilitating socialising have also been shown to predict someone's likelihood of making a quit attempt.(21) Yet amongst those smokers who do take action to try to quit, most still choose relatively ineffective methods for attempting this. Going 'cold turkey' without any pharmacological quit aids, for instance, is the most common technique used by smokers in such attempts, despite being one of the least effective options available.(22)

Conversely, the most effective option - attending a local stop smoking service (SSS) to receive support from a trained practitioner, alongside pharmacotherapy - is being chosen by a declining minority.(23)

2.2 The rise of e-cigarettes and associated research

Despite there still being limited data on their effectiveness,(24–26) electronic cigarettes (also known as e-cigarettes) have also been used by increasing numbers of smokers over the last decade in their efforts to quit tobacco use; after 'cold turkey', they are now easily the second most popular quit method in England.(22) E-cigarettes are battery-powered devices which heat a liquid solution, usually containing nicotine, into an aerosol or 'vapour', hence the term 'vaping' to denote the act of using them. Since their introduction into European and North American markets in around 2006/07, e-cigarettes have emerged as a highly disruptive technological development.(27) The array of devices, most commonly termed e-cigarettes or 'vapes', have proven attractive to many smokers given that they mimic the behavioural aspects of smoking and deliver nicotine while avoiding the vast majority of toxins produced by the combustion of tobacco (the predominant risk factor for smoking-related disease). As a result, the global market for e-cigarettes has grown to the point where it is now expected to reach US$26billion by 2023,(28) although significant variation exists internationally in the availability of these devices given the diverse regulatory approaches adopted by different countries.(29) In Great Britain, following a rapid rise in uptake prior to 2015, subsequent prevalence has remained relatively stable, with various surveys reporting approximately 5.4%-6.2% of adults to be using e-cigarettes, as of 2018.(30) As is the case with nicotine replacement therapy (NRT), the majority of these users are current smokers.(30,31) Among smokers as a whole, prevalence of current use in 2018 stood at around 14.9%-18.5%, with only 37.2% of smokers reporting never having used an e-cigarette at any point.(30) Of the smokers using them, the most common reason stated is to help with giving up conventional/combustible cigarettes;(25,32) indeed, such 'dual using' smokers have been shown to have greater motivation to quit tobacco than other smokers (AOR 1.95, 95% CI = 1.10 to 3.46).(33)

This rapid uptake of e-cigarettes seen in Great Britain and elsewhere has led to a corresponding surge in research aiming to more fully understand both their potential risks and benefits,(34) but some divisions remain within the public health community on the topic.(35,36) Health concerns are frequently raised, for instance, about the individual constituents of e-cigarette liquid and the potential long-term harms from inhaling these,(37) with many studies assessing the impacts of e-cigarette vapour down to a cellular level.(38) Part of the challenge is the speed with which the industry and its technology has developed over recent years. As 'second generation' and 'third generation' modifiable devices have increasingly proved preferable to vapers over the 'first generation' of early 'cigalike' e-cigarettes,(39–41) research has perhaps struggled to keep pace with the market.

Amidst this fluid context, and in light of the tobacco industry's increasing absorption of smaller manufacturers, some prominent figures have argued for caution from policy-makers and regulators or even outright bans on the use of e-cigarettes.(36,42) Indeed, internationally, diverse approaches have been taken amongst the 98 countries that have national e-cigarette regulations in place, with 29 forbidding e-cigarette sales entirely.(30) A recent study argued that regulations primarily reflected whether e-cigarettes are classed by individual nations as tobacco, consumer or medicine products.(29) The authors found that adverts for e-cigarettes were prohibited in 51% of the countries that have regulations, while 38% had banned vaping in 'public places'. Safety standards were mandated in 38% of countries with regulations, while 'market authorisation' was needed to sell these devices in 25% of them.(29) Within the UK, the 'UK Tobacco and Related Products Regulations 2016' implemented the European Union Tobacco Products Directive (TPD), which contained regulations on e-cigarettes and refills, including - notably - restrictions on marketing, stronger safety standards, clearer labelling requirements and a 20mg/ml cap on nicotine concentrations.(29,43) Canada has adopted a relatively similar approach to the UK through its Tobacco and Vaping Products Act, which encompasses e-cigarette production, selling, product warnings and marketing. It aims to limit youth access and prevent uptake whilst enabling a harm reduction approach for adult smokers that allows them to continue to purchase e-cigarettes.(30) Conversely, in Australia, electronic cigarettes containing nicotine are

banned from being sold until one is licensed as an effective smoking cessation tool by their National Health and Medical Research Council.(30)

Broader, societal risks from e-cigarettes that have been increasingly debated and researched include the threat that non-smokers will take them up before moving onto tobacco (often termed the 'gateway hypothesis') and the associated argument that widespread acceptance of vaping could 'renormalise' smoking-related behaviour, thus undoing decades of hard-won progress in tobacco control.(34,35) The risk of non-smoking youngsters initiating regular e-cigarette use is an area which has caused considerable alarm in the US in particular, often centred around the specific 'Juul' brand. With rates of past-year vaping amongst 12th graders (final year high school students) rising in one survey from 27.8% to 37.3% between 2017 and 2018,(44) the US Surgeon General termed their teen vaping situation an "epidemic".(45) Linked to this, the Food and Drug Administration (FDA) has tried to clamp down on any targeted marketing of e-cigarettes towards children by manufacturers such as Juul, threatening to ban non-compliant companies from the marketplace.(18) A key difference between the UK and the US in this area is the 20mg/ml nicotine cap that the aforementioned 'UK Tobacco and Related Products Regulations 2016' introduced into the UK, based on the EU's TPD. As yet, such constraints on nicotine concentrations in Juul and similar devices have not been implemented across the US.(30)

These differences in regulations may be a key factor in explaining why England has not to date experienced a spike in adolescent vaping like the US, with e-cigarette use amongst teenagers here remaining at very modest levels and predominantly being reported in those who are also smoking.(30) Although 'ever use' of e-cigarettes among youngsters has slowly risen, the most recent (2018) data from regular surveys by Action on Smoking and Health (ASH) show that only 1.7% of 11-18 year olds are regular vapers and only 0.2% of this age group are never-smokers but regular vapers.(30) This picture appears to be echoed across Great Britain, with a recent repeat cross-sectional study finding "little evidence that renormalisation of youth smoking was occurring during a period of rapid growth and limited regulation of e-cigarettes from 2011 to 2015".(46) That study did however observe a "marginally significant slowing in the rate of decline for regular smoking" among young teens between 2010 and 2015 when e-

cigarettes were surging in popularity across the UK market. Prospective cohort research adds stronger notes of caution. A study of 3,800 Scottish 11-18 year olds in 2015/16 showed, for instance, that 'never smoking' participants who had tried e-cigarettes were more likely to then also try tobacco (AOR 2.42, 95% CI = 1.63 to 3.60).(47) Similarly, follow-up of almost 3,000 young teens in England in 2014/15 found that e-cigarette use at baseline was strongly associated with initiating smoking within the following twelve months (AOR 4.06, 95% CI = 2.94 to 5.60).(48) The recent introduction of Juul devices into the UK market, including the supermarket sector, potentially gives further cause for concern, particularly in light of cross-sectional evidence that teens' exposure to e-cigarette shop displays is associated with their intention to use e-cigarettes (as strongly, in fact, as tobacco exposure is associated with their intention to smoke).(49) Continued vigilance from researchers therefore seems likely in this area, for instance through close monitoring of trends in the respective rates of teen smoking and vaping, since these remain the best proxies we have for establishing gateway effects.(50)

As alluded to earlier, some of the public health community remains divided on the topic of e-cigarettes,(51) which - it has been argued - may reflect the inherent tension between harm reduction and abstinence perspectives towards tobacco.(52,53) Yet despite these ongoing areas of contention, a consensus has emerged across the substantial majority of the public health and academic community that e-cigarettes - while unlikely to be risk-free in absolute terms - are likely to be far less dangerous than smoking. The most widely-cited estimate suggests a 95% risk reduction is likely for e-cigarettes versus smoking.(25,54,55) Systematic syntheses of research in this area indicate a lack of credible evidence to date to challenge the resulting recommendations that smokers switching to e-cigarettes are likely to receive significant health gains compared to those who do not.(24,25) One modelling estimate suggests, for instance, that switching smokers onto e-cigarettes would save 6,000 early deaths annually for every million smokers who make the transition.(56) Yet news reporting of individual studies continues to lead to alarmist headlines, often by conflating e-cigarettes with tobacco products.(57) This media influence may partly explain why surveys frequently show considerable public uncertainty on the issue. Lay understanding of the likely relative risks of vaping compared to smoking is low among adults, for instance, and indeed worsening over time; this picture is also reflected in data focusing specifically on

smokers and ex-smokers.(31,58–60) British youngsters have similarly been shown to often have inaccurate harm perceptions relating to e-cigarettes and nicotine.(61,62) There have therefore been repeated calls by many researchers for clearer evidence on relative harms to be provided to the public.(63,64)

Another key question which has generated considerable discussion is how effective e-cigarettes truly are for quitting smoking, and whether their use is associated with the uptake of other routes to quitting, including SSSs. While there are a range of motivations reported for e-cigarette use spanning harm minimisation, convenience, enjoyment, social acceptability and consideration of others, the vast majority (83-85%) of dual users of e-cigarettes and tobacco report using their devices to try to quit smoking.(65,66) Indeed, dual users are more likely to want to quit smoking than other smokers.(65) So how effective are they for this purpose? Estimates have often suggested that e-cigarettes could be having a significant impact on population level quit rates,(25,56,67) with one analysis concluding that they may have been contributing up to around 57,000 new quits in England every year.(25) The overall evidence base for them as quit aids is still fairly limited, however, with most research to date having been in the form of prospective cohort studies.(25) A 2016 Cochrane review did find e-cigarettes containing nicotine to be more effective for quitting than those without nicotine but judged the quality of the evidence in the two identified trials as 'low' or 'very low'.(24) Other recent systematic reviews involving meta-analyses have produced conflicting results, most likely due to varying inclusion criteria relating to observational studies.(25) The ongoing paucity of randomised research in this field thus remains a concern, but one very recent RCT - not yet included in any systematic reviews - was notable for comparing e-cigarettes directly to NRT, with both provided alongside structured behavioural support. It found highly significant differences ($p<0.001$), with greater one-year abstinence for the e-cigarette group versus the NRT users (RR 1.83, 95% CI = 1.30 to 2.58).(26)

2.3 Stop smoking services: history and recent challenges

This most recent trial is particularly important for examining e-cigarette use in the context of SSSs.(26) As such, it essentially marks the first RCT to contribute towards our

understanding of the relationship between e-cigarettes and the most effective means of quitting smoking as yet identified: behavioural support combined with pharmacotherapy.(68,69) The English SSSs, which provide such support, have been shown to increase a smoker's odds of quitting by up to four times,(69) while evaluations have also demonstrated their high cost-effectiveness.(70) Established in 2000, following publication of the UK Government's 1998 White Paper 'Smoking Kills',(71) their original aim was to provide access to behavioural support, free at the point of use, as well as prescribed pharmacotherapy, for every smoker in the country who wanted help to quit. This support has traditionally been provided by qualified practitioners either one-on-one or in group settings. During several sessions over the course of weeks or months, a smoker is encouraged to set a quit date, before being advised on how to prepare for it and then given support following the 'jumping off point' to manage cravings, to use pharmacotherapy correctly and – if desired – to wean off any nicotine replacement products. The services are assessed primarily by a 'four week quit rate' measure, with 85% of reported quits requiring validation through carbon monoxide readings.(72)

This new network of services tripled its reach and impact over the first decade of its existence, although, from early on, considerable differences were observed between areas in terms of their footfall and quit rates, with the latter also varying markedly between individual practitioners.(73–75) This led to the establishment by the Department of Health in 2008 of the National Centre for Smoking Cessation and Training (NCSCT), designed to tackle differences in practitioners' training levels and their adherence to evidence-based practice.(74,76) The NCSCT role has therefore involved upholding standards, providing training, sharing best practice and establishing minimum standards for practitioners. This has no doubt played an important part in the success of the UK model (and the subsequent development of similar services in increasing numbers of countries around the world);(77) evaluations have shown, for instance, that the effectiveness of an individual SSS is associated with its uptake of the training provided by the Centre.(78)

NCSCT currently recommends that services should have a full-time manager and a 'core group' of qualified advisers working from evidence-based protocols to provide one-to-one and group sessions, supplemented by any medications recommended by the

National Institute for Health and Care Excellence (NICE). (72) The NCSCT's standards for services sit alongside commissioning guidance provided by Public Health England (PHE) to councils (since April 2013, following the Health and Social Care Act of 2010, public health in England has been commissioned through local authorities, rather than the 151 Primary Care Trusts that preceded this).(79) Yet each local authority area is essentially free to determine what kind of service to commission, or whether to commission one at all,(79) and the English network of services has faced major structural upheavals in recent years.(11) The considerable cuts made to public health budgets and the knock-on reconfigurations of services' commissioning arrangements have very likely played a part in the sustained declines in footfall experienced by SSSs,(11,80) which have seen overall attendance rates fall for the last six consecutive years, from 2012/13-2017/18.(23) Recent research by Cancer Research UK and ASH (using survey data collected in August/September 2018) shows that only 56% of local authorities now commission a universal SSS.(11) Many have instead combined their SSS with lifestyle services (incorporating, for instance diet, alcohol and physical activity), despite evidence now showing that this is a relatively ineffective approach for helping people to quit smoking, particularly amongst more disadvantaged groups.(11,81) Other areas only provide such support to specific target groups such as pregnant smokers, while 3% have even cut all support entirely, leaving over 100,000 English smokers with no access to any service at all from their local authority.(11)

2.4 Inequalities and access

2.4.1 Tobacco's role in health inequalities

Fully understanding the potential impact of these recent changes to English SSSs requires situating them in the context of broader work on health inequalities and access to healthcare. Over recent decades, researchers have delineated with increasing clarity the engrained health inequalities that exist across UK society, as well as the central role that smoking plays in exacerbating these. Acheson argued, for instance, that smoking was responsible for more than 50% of the difference in the risk of early mortality between the most affluent and most deprived parts of the UK.(82) Indeed, smoking has subsequently been shown to be closely linked both to deprivation and to lower

education, associations that are sadly increasing over time.(5,7,83) As well as higher smoking prevalence, more disadvantaged groups have been shown to have higher levels of addiction and lower perceptions of self-efficacy when it comes to quit attempts.(84,85) Marmot also famously demonstrated that people in the most deprived areas of England were likely to die seven years earlier overall than people in the most affluent areas,(86) a gap which is now thought to have grown even two years greater since his seminal report.(9) By arguing for much greater focus on the 'social determinants of health', Marmot's report drew policy-makers' attention out towards the 'social inequalities' that drove health inequalities, and an increasing awareness developed that the causes of such inequalities were complex and not limited to socioeconomics. At a national level, this renewed focus on inequalities may have fed into the decision that the 2012 Health and Social Care Act would compel health organisations to take account of a requirement to tackle health inequalities. With regards to smoking specifically, the 'Tobacco Control Plan for England' has a stated aim to "reduce the inequality gap in smoking prevalence between those in routine and manual occupations and the general population".(9) There has also recently been an increased recognition of health inequalities related to race or ethnicity, which are now known to affect these groups at all life stages.(87)

2.4.2 E-cigarettes and inequality considerations

Amidst the vigorous academic and media discussions on e-cigarettes outlined earlier, there are some less obvious research gaps related to inequalities that have potentially been under-examined to date. The impact that e-cigarettes could be having on smoking-related health inequalities is, for instance, an arguably neglected area. As part of this PhD's programme of work, a systematic review was thus undertaken to collect and analyse the international literature on sociodemographic differences in awareness of e-cigarettes and prevalence of ever and current use. Full results are outlined in the published paper in the next chapter, but in summary, awareness, ever use and current use (usually defined as respondents having used e-cigarettes within the last 30 days) appeared to be particularly prevalent among older adolescents and younger adults, males, and people of white ethnicity. Awareness and ever use were also higher in those with intermediate or high levels of education. At the time of the review, data from the

UK was very limited but more recent survey data, brought together in PHE's 'Vaping in England' report,[1] shows e-cigarette use to be higher in men and amongst 25-34 year olds.(30) Although they use different measures, the same surveys broadly agree in indicating that vaping is higher amongst lower socioeconomic groups. This is logical given the high proportion of vapers who also use tobacco (often termed 'dual users') and the well-documented inverse relationship between smoking and socioeconomics.(5,31) A recent analysis of Smoking Toolkit Study (STS) data assessed this with useful granularity, analysing vaping rates separately in all adults, recent ex-smokers (<1 year since quitting) and longer-term ex-smokers (>1 year since quitting).(88) This study underpinned an important point made in the PHE report that:

> *"The social gradient of vaping in long-term ex-smokers may suggest that those from higher social groups are using EC [e-cigarettes] to quit smoking and then stop use while those from more disadvantaged groups continue use. If vaping among long-term ex-smokers is protective against relapse to smoking, this gradient will have a positive impact on health inequalities, if vaping is not protective against relapse it may exacerbate health inequalities. No evidence is available on this yet."*(30)

Other research has shown that vapers' preferences for specific generations of devices vary by their education level and age.(89)

2.4.3 Stop smoking services: access for vulnerable groups

The concept of access to healthcare is also highly relevant to any discussion of health inequalities, given it has been shown to be fundamental to health outcomes and to have a direct impact on life expectancy.(90,91) Tudor Hart's 'inverse care' law famously stated that services tended to be more available in wealthier areas with less need.(92) Yet broader barriers clearly constrain access too: less affluent groups, for instance, are less likely to access preventative services even when they are available.(93) Although, as a concept, access has not been consistently defined, researchers have increasingly

[1] A full discussion of the PHE report's findings in relation to my systematic review is contained in Chapter 7.

recognised that it involves more than just a simple linear relationship between availability and use. More nuanced approaches have therefore emerged in recent years that move past cumulative measures of available services and levels of usage.(94) Instead, financial, organisational, social or cultural barriers - it has been argued - can all come into play in determining the uptake of healthcare by different groups.(95) One particularly influential contribution in this area has been the concept of candidacy, a synthetic construct first proposed by Dixon-Woods et al. to describe "the ways in which people's eligibility for medical attention and intervention is jointly negotiated between individuals and health services".(96) Candidacy is noteworthy for moving beyond earlier, more limited and static focuses on service utilisation since it is defined as "a dynamic and contingent process, constantly being defined and redefined through interactions between individuals and professionals, including how 'cases' are constructed".(96)

In terms of access to healthcare for smokers specifically, the provision of effective support for people who are trying to quit is clearly vital for tackling the health burdens of smoking and for any attempts to reduce associated health inequalities. Indeed, this was highlighted internationally as far back as 2003 by the 'World Health Organization Framework Convention on Tobacco Control' which emphasised in Article 14 that signatory countries should endeavour to:

> *"a) design and implement effective programmes aimed at promoting the cessation of tobacco use, in such locations as educational institutions, health care facilities, workplaces and sporting environments; (b) include diagnosis and treatment of tobacco dependence and counselling services on cessation of tobacco use in national health and education programmes, plans and strategies, with the participation of health workers, community workers and social workers as appropriate; (c) establish in health care facilities and rehabilitation centres programmes for diagnosing, counselling, preventing and treating tobacco dependence"* (97)

Such services have played a particularly key role in attempts, within the UK and elsewhere, to tackle the stubborn health inequalities that are fuelled by smoking's

strong association with deprivation and lower education.(5,7,83) Smokers from more deprived backgrounds, for instance, were one of the key targets for the English SSSs from their inception, along with pregnant women and younger smokers.(98) This focus reflected the fact that disadvantaged smokers have historically proved most challenging to recruit into behavioural support.(99,100) Today, NICE continues to recommend that SSSs target vulnerable groups,(101) and this is now an area where SSSs have had considerable success. Several evaluations have demonstrated the services' effectiveness at recruiting smokers from more deprived areas,(74,98) although these disadvantaged SSS clients have been shown to be less likely than others to successfully quit, probably due to their lower likelihood of completing treatment programmes.(102,103) Indeed, service uptake is small across the board: a total of 274,021 smokers set quit dates through SSSs in 2017/18, equating to 4.6% of the estimated 5.9m current smokers in England.(10,23) The most recent year's data from NHS Digital show that by far the greatest number of quit attempts recorded within SSSs come from the 'routine and manual' group of smokers (71,635/274,021 in 2017/18, with no other group exceeding 40,000/274,021), who are also the socioeconomic group most likely to be current smokers,(10) though successful quits are highest in four other socioeconomic groups (managerial and professional occupations, intermediate occupations, the retired and prisoners).(23)

In terms of broader demographic differences, despite men being more likely to be current smokers than women (16.4% vs 12.6%),(10) the NHS Digital data show slightly higher numbers of females setting quit dates than males (145,281/274,021 vs 128,740/274,021 in 2017/18), although male users have higher rates of successful quits than females (52% vs 49%).(23) In terms of age, smoking rates are highest amongst 25-34 year olds, followed by 18-24yr olds, but broadly decline with increasing age, with lowest rates seen in the over 65s.(10) Yet more quit dates are set by 45-59 year olds than other age groups, followed by 18-34 year olds.(23) Meanwhile, a clear pattern is evident in rates of actual quits, which increase with advancing age: the over 60s are therefore the most successful group, with 56% of such smokers reporting having quit after using the service.(23) Quit rates appear to be broadly similar across ethnic groups, despite large variations in current smoking by ethnicity (7.9% among people of Chinese ethnicity through to 20.4% for people self-defining as 'mixed

ethnic').(10,23) Geographically, smoking rates range from 3.6% in Rushcliffe to 26.1% in Lincoln, while quit rates similarly vary considerably by local authority area, ranging from 88% in Staffordshire to 24% in Cumbria.(10,23)

Research is unfortunately still limited on how to improve access to services like these, including for vulnerable groups, which is an important gap given barriers to service access can have particularly big impacts amongst more disadvantaged groups.(98) Internationally, studies to date have often focused on the success of quit attempts amongst different groups of smokers once recruited into behavioural support (or other community-based quit programmes), rather than the facilitators and barriers that actually influence their attendance in the first place.(104,105) A survey of German smokers asked about their use of all smoking cessation aids, with the authors concluding that the leading reasons for lack of uptake were being 'overly self-confident' as well as having a perception that such aids were not helpful.(106) Some limited quantitative work in the US and qualitative work in the Netherlands has also sought to specifically identify why deprived smokers do or do not access behavioural support.(107). Within the UK, meanwhile, a small number of qualitative studies have examined potential influences on SSS uptake amongst disadvantaged smokers, illustrating a range of barriers to attendance, including low awareness of services, as well as misperceptions about their availability, effectiveness and cost.(108,109) One Scottish study combined interviews with cancer patients, their family members and hospital-based health professionals, identifying facilitators and barriers to patients' quit attempts.(110) Influences on smokers included stress, a "desire to maintain personal control" and a disconnect between their smoking and their health, including their cancer diagnoses. Interviews with clinicians, meanwhile, highlighted barriers that could prevent them discussing smoking with patients including concerns about the sensitivity of the topic, insufficient opportunities to raise it, a sense of it not being their responsibility and a lack of awareness about SSSs.(110)

2.5 Health decision-making and behaviour change

Examining how smokers make decisions about quit routes such as SSSs also requires some consideration of the literature on health decision-making, including behaviour

change. The influential psychological theorist Fishbein defined a belief as "a probability judgment that links some object or concept to some attribute" using the example of someone who believes that a pill (the object) is a depressant (the attribute).(111) As Green et al. explain, beliefs can therefore be broadly defined as "cognitive constructs".(112) For Fishbein, an intention, meanwhile, is "a probability judgement that links the individual to some action", while behaviour is "an observable action that is quantifiable on either a dichotomous (i.e. he did/did-not perform action *X*) or a continuous scale (he donated £0 to £*X* to a charity)".(111)

A wide array of models and theories, which incorporate beliefs and behaviours in various ways, have been proposed for understanding why people make different choices relating to their health, as well as how such decisions could best be influenced to promote healthier behaviours. A delineation of each of these is beyond the scope of this thesis but an overview of some of the most important and relevant is presented here. The 'Health Belief Model' (HBM) was one of the earliest such health decision-making models proposed and has been one of the most widely cited of all over the years.(112) Posited initially by Hochbaum,(113) and then expanded by Rosenstock,(114) it puts beliefs at the heart of health behaviours. In the case of negative events, choices are determined by perceptions of: one's personal susceptibility, the seriousness of the event in question, the effectiveness of the course of action recommended to avoid it, and the acceptability of the burdens or costs involved in taking the recommended action. It was later augmented with further dimensions of 'self efficacy', 'health motivation' and 'cues to action' (both internal and external).(112) Meta-analyses have, however, cast doubt on how well the HBM predicts behaviour, while researchers have criticised its omission of elements such as impulsivity, social pressures, intention or self-control.(115–117)

The 'Stages of Change' or 'Trans-theoretical' model has also proved highly influential, described by Armitage, for instance, as "arguably the dominant model of health behaviour change, having received unprecedented research attention".(118) Its cyclical nature has led to it being commonly used to study behaviours where people have the potential for relapse. As the name suggests, it involves a series of steps or phases that people can pass along from 'precontemplation' through 'contemplation', 'determination'

and ‘action’, followed by ‘maintenance’ to protect the person who has made the positive choice from ‘relapse’ (failing which, they start back round the cycle again). Stages of Change has long been particularly popular in smoking cessation work internationally, but it too has had its utility called into question in recent years by systematic review findings which have suggested that stage-based interventions for quitting smoking are no more effective than others.(119) Other criticism has queried its use in settings beyond smoking, pointing to concerns with: its internal validity; the descriptive nature of most studies using it; and the ethics of targeting interventions at people deemed to be ‘change ready’ (thus excluding those deemed to be ‘not change ready’).(120–122)

More recently, the ‘Behaviour Change Wheel’, developed by Michie, van Stralen and West, aimed to systematically synthesise this pre-existing multitude of models and theories.(123) The COM-B model at its centre posits that behaviour is a product of *motivation* (reflective and automatic brain processes), *capability* (psychological and physical capacities) and *opportunity* (factors outside or beyond an individual). It seeks to facilitate – through the framework’s outer rings, as well as its accompanying Behaviour Change Technique Taxonomy – the development of interventions to address identified barriers to behaviour change.(124) Despite an uneasiness voiced by Ogden that systematisation like this can constrain valuable theory and practice variability,(125) the COM-B has been employed as a theoretical framework across a broad range of studies in health and beyond. In recent years, for instance, it has been used internationally for research areas ranging from auditory rehabilitation to sexual counselling and mental healthcare provision.(126–128) Within the smoking cessation sector specifically, it has become the central model of smoking behaviour change in England, where it underpins the SSS commissioning guidance provided by PHE to local authorities.(79) Meanwhile, research in the UK and beyond has applied the framework to the uptake of vaping and behavioural support respectively, as well as to smoking-related behaviours more generally.(116,129–131)

2.6 The relationship between e-cigarettes and stop smoking services

Previous research has recommended that behaviour change theories such as COM-B can illuminate how smokers' views on e-cigarettes (particularly views on their potential harms) may be influencing psychosocial factors related to decisions to quit tobacco.(132) There is equally a need, as argued elsewhere,(133) to better understand how smokers' perceptions of e-cigarettes' potential risks could be impacting their choices around different smoking cessation routes. In particular, the psychological basis for smokers' decisions to use e-cigarettes instead of - or combined with - SSSs is an area where very little is known to date. One US cross-sectional survey suggested that amongst dual users of combustible tobacco and e-cigarettes, almost all age groups were as likely to access behavioural support as other smokers.(134) Similarly, a UK time series analysis using data from 2006-2015 also found no clear evidence for an association at a population level between e-cigarette use and uptake of behavioural support from SSSs. Evidence remains inconclusive, however,(30) and this is therefore a particularly important research area to address in light of persistent concerns that e-cigarette use could be affecting more effective routes to quitting smoking, including behavioural support.(30,135,136)

SSS staff themselves perceive the advent of the vaping market as an important factor in the declining attendance rates seen by their services, a view echoed by NHS Digital in their interpretation of this service attendance data.(23,137) In other words, some smokers who would otherwise have accessed SSSs may be choosing to try to quit through vaping alone. This perception could even be having a concrete impact on the availability of services being provided to smokers. Several councils have tried to use the popularity of e-cigarettes within society as part of a rationale for decommissioning their local SSS entirely.(138–141) Critics have identified a perceived influence from the tobacco industry in these cuts, arguing that such decisions play into industry's false narrative that tobacco control and SSSs have been rendered redundant through widespread e-cigarette availability.(139) One national body has also warned that e-cigarettes cannot be assumed to be 'picking up the slack' from the declining uptake of other routes to quitting smoking.(142) Similarly, two very recent publications, one a

prospective cohort study of 'dual users' and one a cross-sectional survey of long-term vapers, suggest significant interest amongst such groups in accessing other cessation options for smoking and/or vaping.(143,144)

It is important therefore that e-cigarettes are not viewed reductively as being mutually exclusive from other quit options such as behavioural support. There have, after all, been significant efforts within England to bring the two quit routes together, combining - as PHE puts it - the most popular option for smokers with the most effective.(145) The inclusion of e-cigarettes within services is not universally welcomed, however. Several international public health bodies, notably including the World Health Organization, remain very wary about e-cigarettes and their potential incorporation by health services.(146,147) As Chapman points out, the US Preventive Services Task Force (which has a similar role to NICE in England) concluded that "current evidence is insufficient to recommend electronic nicotine delivery systems (ENDS) for tobacco cessation in adults", advising instead that health professionals point smokers towards quit aids with a stronger evidence base.(148) Studies of health professionals in the USA and Holland suggest strong concerns about e-cigarettes, with the majority of respondents displaying negative attitudes towards them.(149–151) As noted by Farrimond and Abraham though,(152) there may be some signs that attitudes are starting to shift, with two recent US studies suggesting physicians may be discussing e-cigarettes with patients more over time and could do so even further if additional evidence emerges to support them.(153,154)

In England, policy-makers have certainly been amongst the most liberal in the world when it comes to encouraging e-cigarette use as a smoking cessation option.(29) The English SSSs have been recommended by several national organisations such as PHE, ASH and NCSCT to work with smokers who own their own devices and to provide them with the same behavioural support they would give to any other smokers.(25,155,156) PHE, for instance, has issued public advice stating that:

> *"Anyone who has struggled to quit should try switching to an e-cigarette and get professional help. The greatest quit success is among those who combine using an e-cigarette with support from a local stop smoking service… These [SSSs] should*

provide behavioural support to those smokers wanting to quit with the help of an e-cigarette".(157)

NICE has meanwhile adopted a fairly nuanced approach. Licensed pharmacotherapies containing nicotine are of course already recommended by them to help people in their efforts to quit tobacco.(101) Following the EU Tobacco Products Directive, which came into force in the UK in May 2016, e-cigarettes can be licensed as either consumer or - if they make claims about reducing harm or helping with quitting smoking - medicinal devices.(158) The latter route involves considerable regulatory hurdles and, at present, no e-cigarettes have to date been licensed by the Medicines and Healthcare products Regulatory Agency (MHRA) and recommended by NICE for prescription on the NHS. As such, NICE advises that smokers should receive guidance on e-cigarettes from health services but does not explicitly specify e-cigarettes as one of its recommended cessation tools for SSSs.(101)

Individual services have therefore had to make their own decisions based on the advice from these different bodies and in the context of a challenging, often polarised public discourse on e-cigarettes within the media. These novel devices have presented a particularly unusual challenge for practitioners given they essentially represent a market-driven innovation that has not been developed from within the health sector.(27) Services certainly deserve credit for having been proactive in this area from a very early stage; as far back as 2012/13, some 71% of SSSs reported already having a policy in place about advice to be given on e-cigarettes.(159) Yet research on how they have been negotiating this terrain in practice - i.e. how far e-cigarettes are in reality being incorporated within SSSs - is still very limited to date. A recent systematic review with a broad focus on the beliefs and practices of all healthcare professionals regarding e-cigarettes showed that most of the research literature in this area comes from the USA.(160) The authors found that, overall, healthcare professionals held "diverse views about the efficacy of ENDS [e-cigarettes] and expressed wariness over their potential health effects", with endorsement of e-cigarette use seeming to be decided primarily based on "patient health status, the presence of other competing risk factors and patient preferences". In England, a small number of quantitative studies have been undertaken specifically with SSS practitioners and clients.(133,159,161) These have focused

primarily on levels of e-cigarette use amongst smokers but also align in indicating an unease amongst some SSS practitioners towards e-cigarettes. Beard et al., for instance, found in 2014 that 11% of practitioners warned their clients about e-cigarettes' safety.(159) Hiscock et al., meanwhile, showed that the views of practitioners towards e-cigarettes had become more positive over time, with 42% agreeing that e-cigarettes were 'a good thing' in 2016, compared to 15% in 2011.(161) They also concluded, however, that "low use of e-cigarettes by clients and practitioner opinions suggest that further education of SSS staff is needed if they are to adopt the current service recommendations about e-cigarettes".(161) Finally, Sherratt et al. showed in a small 2015 study (n=319) that SSS clients' perceptions of e-cigarette risks appeared to be related to their own current or former e-cigarette use.(133)

Three qualitative studies have also been undertaken in this area. Tamimi interviewed 15 clients and 13 practitioners in South East England in 2014/15, concluding that "both groups demonstrated uncertainty with regards to the status, efficacy and risks associated with e-cigarettes".(162) Sherratt et al. (2015) interviewed 20 SSS-using smokers in the North West of England; as with their separate quantitative study,(133) they found e-cigarette safety was a primary concern for smokers, with participants "largely express[ing] uncertainty regarding e-cigarette safety and efficacy, with some evidence of misunderstanding".(163) Most recently, a 2018 study by Farrimond et al. involved 25 SSS staff in the South West of England.(152) Findings suggested that some SSSs were badging themselves as 'e-cigarette friendly' but that there was no agreement over what that meant. The authors also pointed to an 'ongoing nervousness' about e-cigarettes in wider council stakeholders at a local level.(152)

More recent quantitative data that is emerging on the effectiveness of incorporating e-cigarettes within SSSs is unlikely to be reflected by these earlier studies. Yet, given this data is suggesting SSS clients using an e-cigarette may have comparable quit rates to clients using other pharmacotherapies, it could be expected to have a significant impact on views in this area. In 2016 unadjusted service monitoring data, for instance, smokers using e-cigarettes had a median quit rate of 63%, higher than those smokers using other pharmacotherapies.(145,161) The 2019 *New England Journal of Medicine* study discussed earlier is the first randomised trial on this issue and showed significant

increases in one-year abstinence for the group of clients using e-cigarettes compared to those using NRT.(26) Interestingly, despite this emerging data on the effectiveness of combining e-cigarettes and SSSs, routine data suggests very few attendees are using e-cigarettes in comparison to other pharmacotherapies.(145,161) This may in part reflect under-reporting by SSSs who have only recently had to become familiar with capturing data on e-cigarettes, in contrast to licensed pharmacotherapies on which they have been recording usage for years. Yet, as mentioned above, others see this as suggestive evidence that dual users of e-cigarettes and tobacco are less likely than other smokers to want to access behavioural support – in other words, that e-cigarettes are undermining other, more effective routes to quitting smoking.

2.7 Conclusion

As this chapter has shown, a range of evidence gaps still exist in relation to e-cigarettes. These, I would argue, are receiving varying levels of research focus and so being filled at different speeds. This thesis aims to address one key area of uncertainty that I believe has received particularly insufficient focus to date in comparison to its potential implications. It therefore examines the influence that the use of e-cigarettes amongst smokers could be having on their likelihood of trying other ways to quit smoking, including potential associated impacts on inequalities.

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Chapter 3: Research paper – Systematic review of evidence on sociodemographic differences in e-cigarette use

3.1 Introduction

The first of my research papers is presented in this chapter. As an initial step in my programme of research, I conducted a systematic review of the evidence base on sociodemographic differences in awareness, 'ever use' and current use of e-cigarettes. This collected data on sociodemographic differences in these outcomes within England which I could then assess alongside existing data on sociodemographic differences in stop smoking service (SSS) usage (see Chapter 7). It thus allowed Objective A of this thesis to be addressed: 'To understand, within English smokers *(the 'population')*, how use of e-cigarettes *(the 'exposure')* varies across sociodemographic groups, and to consider this in relation to existing data on how use of SSSs varies across the same population'. However, given the major, broader research gap in this area, I decided to expand the scope of the review to worldwide literature, within which I would still be able to assess the specific English picture. The final review, entitled 'E-cigarettes and equity: a systematic review of differences in awareness and use between sociodemographic groups', was published by *Tobacco Control* in December 2016. The article's online supplementary material - including an example of the electronic search strategy and a copy of the full 'effect direction plot' - is available at Appendices A and B.

3.2 Research paper cover sheet

The signed cover sheet for this research paper is included on the following page.

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RESEARCH PAPER COVER SHEET

Please note that a cover sheet must be completed for each research paper included within a thesis.

SECTION A – Student Details

Student ID Number	309900	**Title**	Mr
First Name(s)	Gregory		
Surname/Family Name	Hartwell		
Thesis Title	The attendance of e-cigarette users at stop smoking services: a mixed methods study		
Primary Supervisor	Prof Mark Petticrew		

If the Research Paper has previously been published please complete Section B, if not please move to Section C.

SECTION B – Paper already published

Where was the work published?	Tobacco Control		
When was the work published?	December 2016		
If the work was published prior to registration for your research degree, give a brief rationale for its inclusion			
Have you retained the copyright for the work?*	**No** OPEN ACCESS CC-BY	Was the work subject to academic peer review?	**Yes**

*If yes, please attach evidence of retention. If no, or if the work is being included in its published format, please attach evidence of permission from the copyright holder (publisher or other author) to include this work.

SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	
Please list the paper's authors in the intended authorship order:	
Stage of publication	Choose an item.

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Conceived and refined study; executed search strategy and screened initial results of literature searches (with support from co-author ST); selected studies for inclusion, extracted data and appraised data (with support from co-author ST); analysed and interpreted findings; drafted and critically revised manuscript. Supervisors MP & ME provided further guidance and input as required at each stage.

SECTION E

Student Signature	[redacted]
Date	01/05/19

Supervisor Signature	[redacted]
Date	01/05/19

OPEN ACCESS

E-cigarettes and equity: a systematic review of differences in awareness and use between sociodemographic groups

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ABSTRACT

Objective To assess whether electronic cigarette (e-cigarette) awareness, 'ever use' and current use vary significantly between different sociodemographic groups.

Design Systematic review.

Data sources Published and unpublished reports identified by searching seven electronic databases (PubMed, MEDLINE, Web of Science, EMBASE, Global Health, PsycINFO, CINAHL Plus) and grey literature sources.

Study selection Systematic search for and appraisal of cross-sectional or longitudinal studies that assessed e-cigarette awareness, 'ever use' or current use, and included subgroup analysis of 1 or more PROGRESS Plus sociodemographic groups. No geographical or time restrictions imposed. Assessment by multiple reviewers, with 17% of full articles screened meeting the selection criteria.

Data extraction Data extracted and checked by multiple reviewers, with quality assessed using an adapted tool developed by the Joanna Briggs Institute.

Data synthesis Results of narrative synthesis suggest broadly that awareness, 'ever use' and current use of e-cigarettes may be particularly prevalent among older adolescents and younger adults, males, people of white ethnicity and—particularly in the case of awareness and 'ever use'—those of intermediate or high levels of education. In some cases, results also varied within and between countries.

Conclusions E-cigarette awareness, 'ever use' and current use appear to be patterned by a number of sociodemographic factors which vary between different countries and subnational localities. Care will therefore be required to ensure neither the potential benefits nor the potential risks of e-cigarettes exacerbate existing health inequalities.

INTRODUCTION

Electronic cigarettes (e-cigarettes) are battery-powered devices which heat a liquid solution, usually containing nicotine, into an aerosol or 'vapour'. Such products have proven attractive to many smokers given that they mimic the behavioural aspects of smoking and can deliver nicotine while avoiding the vast majority of toxins produced by the combustion of tobacco (the predominant risk factor for smoking-related disease).[1]

E-cigarette use has increased rapidly over recent years. In Great Britain, for instance, there are an estimated 2.8 million adults currently using them (6% of the adult population).[2] However, despite such rapid uptake and their corresponding public profile, major research questions remain in relation to their true effectiveness as aids for quitting smoking and to possible health outcomes arising from sustained 'vaping'.[3] For instance, the authors of a recent Cochrane review found only two trials that followed participants for at least 6 months, rating their confidence in the evidence as low by GRADE standards.[4] Very little is also known about variations in e-cigarette awareness and use between different sociodemographic groups; in other words, how these outcomes are patterned across society. The need for such equity-focused analyses is particularly pressing in light of evidence that smoking is significantly more common in the lowest income groups and is the leading cause of health inequalities.[5] Although it has been argued that e-cigarettes could reduce inequalities,[6] most tobacco control interventions exacerbate them (only tobacco tax has been shown to reduce inequalities),[7 8] and evidence on diffusion of innovations suggests that early adopters tend to be more affluent than other groups.[9] This raises the possibility that if e-cigarettes prove effective at enabling quitting, they may in fact further widen—rather than reduce—inequalities in smoking.

Reviews in this area have largely considered overall population levels of awareness and use, without drilling down to analyse subgroups,[10] or have been limited to compositional chemical safety issues.[11]

Our review therefore aimed to provide the first comprehensive assessment of whether e-cigarette awareness, 'ever use' and current use varied significantly across different sociodemographic groups.

METHODS

A full protocol for this systematic review was developed a priori and is registered with the PROSPERO international prospective register of systematic reviews (ID: CRD42015024163) at http://www.crd.york.ac.uk/PROSPERO.

Search strategy

We searched seven databases (PubMed, MEDLINE, Web of Science, EMBASE, Global Health, PsycINFO, CINAHL Plus) for cross-sectional or longitudinal studies reporting on e-cigarette awareness, 'ever use' or current use. No search limits were set on study design (other than excluding intervention studies; see below), characteristics of participants or language of publication, but only studies published from 2006 onwards were retrieved, reflecting the nascence of viable e-cigarette markets around the world. Given research into these relatively novel devices is currently still limited, we were able simply

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to restrict our search syntax to synonyms for e-cigarettes, without requiring further search filters, thus reducing the risk of missing relevant studies. We also undertook a search of 12 grey literature databases and key websites. Further details of the search strategy are available in the online supplementary material file.

Study selection and inclusion criteria

We included cross-sectional or longitudinal quantitative studies that reported at least one of the following outcomes: e-cigarette awareness, 'ever use' and current use. Studies predominantly defined awareness as having heard of e-cigarettes, 'ever use' as having tried an e-cigarette at least once in a respondent's lifetime and current use as having used e-cigarettes within the past 30 days. We included studies that used any form of summary measure for the included outcomes. Other than the aforementioned 2006 cut-off, there were no temporal or geographical restrictions: studies with international, national or subnational populations were included. Included studies had to sample both e-cigarette users and non-users, and needed to include subgroup analysis by one or more PROGRESS Plus sociodemographic group (PROGRESS Plus is an established taxonomy for classifying sociodemographic differences, with 'PROGRESS' standing for place of residence, race, occupation, gender, religion, education level, socioeconomic status and social capital, while 'Plus' represents additional categories such as age, disability and sexual orientation).[12] We excluded intervention studies (due to our focus on real-world behaviour) and studies whose samples were restricted to e-cigarette users (due to a lack of information in such studies about the wider population these users were drawn from) or to patient populations (due to these samples not being directly comparable to other general population studies in our review).

After references that were obviously irrelevant had been removed, abstracts and titles of potentially relevant studies were independently screened against the eligibility criteria by one of two reviewers, who also both screened a 10% sample of each other's exclusion decisions. The full texts of all remaining studies were then obtained and assessed independently by two reviewers. Any discrepancies at each of these stages were resolved through discussion between the two reviewers, and with a third reviewer as required.

Data extraction and risk of bias assessment

Following piloting of a data extraction form, one of two reviewers extracted data and assessed the risk of bias for each included study. Each reviewer then conducted their own assessment of risk of bias for all of the other reviewer's studies, and repeated the data extraction for a 25% sample of these. Discrepancies were resolved through discussion with a third reviewer. Data on the following factors were extracted: country, setting, population, study design, sampling methods, sample size, response rate, outcome measures reported and demographic subgroup analyses undertaken.

Risk of bias was assessed by two reviewers, adapting a tool developed by the Joanna Briggs Institute (JBI) specifically for studies of prevalence.[13] We summarised risk of bias using the resulting 12 criteria and rated each study as high-quality, medium-quality or low-quality evidence depending on how many criteria were met.[i]

[i]Supplementary appendices with full details on the definitions used for the high, medium and low categories are available from the authors.

We extracted the available outcome measures on e-cigarette awareness, 'ever use' and current use, including the results of statistical tests (95% CIs or p values) for sociodemographic subgroup differences, where authors reported them. Studies which did not report any such statistical tests—and therefore provided only very weak evidence—were still included, for several reasons: in the case of one PROGRESS Plus group (occupation), the only evidence of any kind available came from such a study; in some circumstances, such studies were the only ones from a particular setting or country; and a sensitivity analysis showed that removing these types of studies did not materially affect the overall conclusions of the review.

In the narrative synthesis we undertook, we presented results in terms of relative differences in our outcomes between sociodemographic groups and summarised findings in an adapted effect direction plot.[14] Meta-analyses were not possible given the heterogeneity of study designs (longitudinal, cross-sectional and repeat cross-sectional), settings (35 different countries), populations (studies often focused, for instance, on specific age groups), outcome measures (particularly for current use) and delineations of PROGRESS Plus subgroups (for instance, the different spatial categories for 'place of residence'), as well as the lack of reported CIs within some studies. Providing point estimates for worldwide differences in awareness and use would also have been meaningless and potentially misleading for anyone seeking to use the results of the review to inform local or national action. Textual summaries therefore sought to elucidate the complexity and breadth of the data. This narrative synthesis of the results used the labels 'high-quality', 'medium-quality' and 'low-quality' evidence, based on the aforementioned risk of bias assessment. The studies providing better quality evidence were emphasised by giving them prominence in our results summaries; low-quality evidence was reported, particularly where it was the only evidence available, but it was treated with caution. Summary findings reported in the Discussion section were based on any clear patterns emerging from the high-quality and medium-quality evidence. Study quality was also tabulated in the effect direction plot (see online supplementary table).

RESULTS

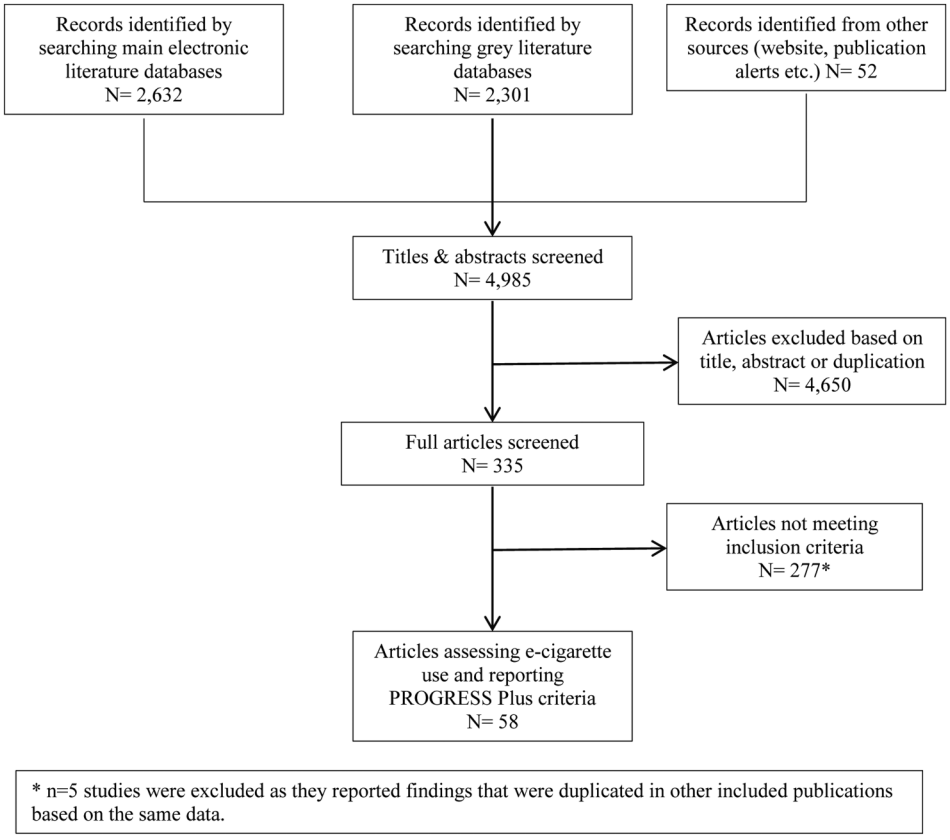
We screened 4985 references and assessed the full text of 335 documents (figure 1). Fifty-eight studies from countries worldwide met our inclusion criteria: six longitudinal studies, 47 cross-sectional surveys and five repeat cross-sectional surveys. Twenty-one of these studies reported on awareness of e-cigarettes, 43 on 'ever use' and 32 on current use (see online supplementary table). Sample sizes reported ranged from 184 to 79 202 and were drawn from 35 nations around the world (all high-income countries). All studies used self-reported outcome measures that were of unknown validity or reliability due to the lack of research to date on such measures.

Place of residence

Sixteen studies reported subgroup analysis by place of residence, with 8 studies reporting this for the outcome of e-cigarette awareness, 10 for 'ever use' and nine for current use. Only one study was rated as high-quality evidence, eight as medium quality and seven as low quality. Overall, while some differences were observed, no consistent themes emerged across the high-quality and medium-quality studies, perhaps because of the very varied countries and subregions sampled.

The highest quality study found no significant difference in e-cigarette awareness between urban and rural teenage boys in the

Figure 1 PRISMA flow chart.



USA,[15] while two medium-quality European studies found higher 'ever use' in urban areas compared with rural ones.[16 17] One of these also reported on current use, finding this same urban > rural relationship existed for that outcome in Poland,[17] as it did in a medium-quality 2014 study of South Korean high school students.[18] The medium-quality 2013 International Tobacco Control (ITC) Four-Country Survey showed awareness and 'ever use' of e-cigarettes was higher in the countries where e-cigarettes were legal (USA and UK) than those where they were banned (Canada and Australia), though—interestingly—similar differences in current use were not observed between the countries.[19]

Race/ethnicity

Twenty-eight studies reported subgroup analysis by race or ethnicity, with nine studies reporting this for the outcome of e-cigarette awareness, 19 for 'ever use' and 14 for current use. Three studies were rated as high-quality evidence, eight as medium and 17 as low. Overall, the most consistent findings from the better quality studies related to evidence of greater e-cigarette awareness and use among white populations compared with other ethnic groups. Almost all studies reporting this outcome came from the USA.

The 2013 ITC Four-Country Survey showed overall higher awareness among white/English-speaking adult smokers than non-white/non-English-speaking ones.[19] This finding of higher awareness among respondents of white ethnicity was echoed across adult and teenage samples in all but one of the higher quality and medium-quality studies that examined the outcome in the USA.[15 20–24] For 'ever use', this same association with white ethnicity existed in four out of the five higher quality and medium-quality studies reporting significant differences,[20 25–27] while there was no such clear pattern of findings among the lower quality studies. Fewer studies reported on current use, but two of the three (medium and low quality) general population samples of adults in the USA also found higher current use in white respondents than those of various other ethnic groups.[23 28] A number of other studies of adults reported no significant differences between ethnicities for 'ever use',[23 29–34] or for current use.[27 33 35–38]

Occupation

Only one study attempted subgroup analysis by occupation: a low-quality 2013 European Union (EU) survey that reported on awareness.[39] Although statistical tests were not reported, the data suggested retired people might be less likely than other groups to be aware of e-cigarettes.

Gender

Forty-six of the included studies reported subgroup data on gender, with 15 studies reporting this for the outcome of e-cigarette awareness, 34 for 'ever use' and 24 for current use. Four studies were rated as high-quality evidence, 12 as medium and 32 as low. Overall, all three outcomes were more prevalent among male respondents in many of the high-quality and medium-quality studies.

In all seven of the studies that reported statistically significant differences in awareness between males and females—which were mostly from the USA and four of which were high or medium quality—this outcome was higher in males.[19 20 22 30 33 40 41] The two high-quality studies that reported on 'ever use' found no significant gender differences between children in Wales or adult smokers in the USA.[31 42] However, of the medium-quality studies that reported significant differences, four out of five samples (from the USA and Poland) found 'ever use' to be greater among males,[17 23–26] and three out of four (from the USA, Poland and South Korea) found the same to be the case for current use.[17 18 23 24] Several other studies found no significant differences for gender.

Education level

Twenty-six studies in the review reported subgroup data on education level, with nine studies reporting this for the outcome of e-cigarette awareness, 18 for 'ever use' and 13 for current use. Three studies were rated as high-quality evidence, seven as medium and 16 as low. There was a broad pattern among the higher quality research of awareness and use (particularly 'ever use') being positively associated with higher levels of educational attainment.

Of the nine studies reporting on awareness (mainly from the USA), seven found statistically significant differences and, in each case, awareness was higher in subgroups with a greater level of educational attainment.[15 19 21–23 30 33 40 41] For 'ever use', the two high-quality studies (both involving samples of adult smokers in the USA) also found the least 'ever use' in the groups with the lowest educational attainment,[20 31] while findings were more mixed in the medium-quality and low-quality studies, where around half of the studies reported no statistically significant differences between subgroups.[19 23 25 27 29 30 43–45] For current use, the ITC Four-Country Survey found that, overall, participants with higher levels of educational attainment were more likely to report current use,[19] while another medium-quality study (from the USA) found the inverse.[23] Low-quality studies tended to report higher current use in the least educated groups,[23 28 33 36] or find no significant results.[27 40 45–47]

Socioeconomic status

Twenty-three studies reported subgroup analysis by socioeconomic status (SES) of respondents, with five reporting this for the outcome of e-cigarette awareness, 18 for 'ever use' and seven for current use. Two studies were rated as high-quality evidence, seven as medium and 14 as low. Overall, no clear patterns emerged in studies reporting SES data.

The medium-quality 2013 ITC Four-Country Survey found that higher income participants were more likely to report awareness and 'ever use' in the USA, UK, Australia and Canada.[19] However, none of the other high-quality and medium-quality studies found any statistically significant differences between different SES groups for any of the three outcomes,[16 21 22 25 26 31 42 48] with the exception of a 2014 South Korean study indicating higher current use among more affluent high school students.[18] Lower quality studies tended to find mixed or non-significant results.[16 25 26 28 29 31 42 43 48–53]

Disability or health status

Only four studies reported data on disability or health status related to our outcomes, with one study rated as high-quality evidence, two as medium and one as low. The one study to report on awareness—a medium-quality 2014 national survey of adults from the USA—found no significant differences by health status.[21] For 'ever use', a high-quality 2012 national US study of adult smokers found that better self-reported health status was associated with this outcome,[20] while a medium-quality 2014 study of adult current and former smokers from eight US 'market areas' found no significant differences.[25] The one (low-quality 2014 US) study to report on current use found this to be associated with medical illnesses, greater depressed mood and greater alcohol use.[37]

Sexual orientation

Only two studies reported data on sexual orientation related to our outcomes, with one of these rated as medium-quality evidence and the other rated as low. The medium-quality study—a 2014 online survey of adults from the USA—found that awareness was not associated with sexual orientation.[22] The low-quality 2014 survey from the USA found higher rates of current use in lesbian, gay and bisexual respondents compared with respondents who were heterosexual or did not specify a sexual orientation.[28]

Age

Forty-eight studies reported subgroup analysis by age of respondents, with 18 reporting this for the outcome of e-cigarette awareness, 38 for 'ever use' and 22 for current use. Three studies were rated as high-quality evidence, 11 as medium and 34 as low. The overall direction of evidence pointed to older adolescents and young adults driving levels of awareness and use of e-cigarettes: findings from all the higher quality studies and many of the other studies fitted this pattern.

High-quality and medium-quality studies with samples from the USA, UK, Canada, Australia and Italy showed greater awareness in older adolescents compared with younger children, and in younger adults compared with older ones.[15 19–21 24 40] Throughout the high-quality and medium-quality studies which identified statistically significant differences for 'ever use' (10 studies from the aforementioned five countries, plus Poland and the EU more widely),[16 17 19 20 23–25 27 31 40] and for current use (4 studies from Italy, USA, South Korea and Poland),[17 18 24 40] these outcome measures were again greatest in older children and younger adults. Lower quality studies found fewer significant differences, often lacking sufficient statistical analysis, but those that did were virtually unanimous in observing the same patterns of higher use in older adolescents and younger adults.[28–30 36 43–45 51 53–55]

DISCUSSION

Principal findings

We systematically reviewed both published and grey literature for studies reporting sociodemographic differences in e-cigarette awareness, 'ever use' and current use. We found variability in social patterning across all outcomes, but have drawn attention to findings that tend to recur in the high-quality and medium-quality studies. Across all the outcomes, we found that e-cigarettes appear to have achieved greater reach among older adolescents and younger adults, males and people of white ethnicity. For awareness and 'ever use', this was also the case for subpopulations with relatively higher educational attainment. Studies varied in how they defined these characteristics. For the other PROGRESS Plus characteristics we examined, findings were too inconsistent to enable us to identify a pattern supported by higher quality evidence, and in the case of sexual orientation, disability/health status and occupation the evidence base is still very small. The only previous review to investigate a related research question included 23 studies and did not incorporate any quality assessment.[56] Hence, studies with conflicting findings were synthesised without reference to the direction of effects suggested by the best available evidence. That review did not identify studies that found distinct patterns of use across racial/ethnic groups, which the authors suggested could have been due to included studies being underpowered to test this association. It reported conflicting evidence relating to e-cigarette use when comparing subpopulations with different educational levels. In common with our review, it highlighted greater use among young adults.

Strengths and limitations

We have followed Cochrane guidance and PRISMA reporting standards for systematic reviews. An extensive search was

performed of published and grey literature from the first seven years that e-cigarette markets have been expanding throughout the developed world (2006 to October 2014, when our searches were run). There are, however, limitations to our study. Our review did not explore e-cigarette use in specific clinical populations (we focused on general population samples to ensure we were comparing like-for-like as far as possible). However, the best way of demonstrating links between, for instance, mental illness and e-cigarettes would arguably be through any general population samples that performed subgroup analysis by mental health status. Our inclusion criteria would have included such studies (under the health status/disability PROGRESS Plus subgroup), but none showed up in our various database searches. While our quality assessment was based on an established tool for prevalence studies,[13] the tool has been tailored to our requirements for this review and these adaptations are not validated. In addition, we appraised studies with reference to our specific review question; a study could in theory use robust methods for addressing its own research question but less robust methods for addressing the reviews. Like all reviews, we were limited by the evidence available and its reporting. For instance, most studies reporting current use defined this as any use of e-cigarettes within the past 30 days, which might have included some people who had simply tried e-cigarettes recently rather than become regular users. Unfortunately, there were insufficient studies using a tighter definition to enable us to assess the sociodemographic determinants of strictly regular e-cigarette use. There is of course also a risk that publication bias may exist, in which studies with non-significant findings in relation to awareness and use may be less likely to be published. However, the large proportion of studies in the review reporting non-significant findings—and the fact that these were often smaller studies and often fell into the lower quality of evidence category—may indicate that this bias is unlikely to be exerting a major influence on our review. Similarly, despite our wide-ranging searches, no eligible low-income or middle-income country studies came up in our trawls. There is no clear way of assessing the degree to which this reflects a bias in the body of research that has been conducted versus any bias in the databases we searched. Our databases certainly will have had an English language and high-income country bias, but it is also probable that there is not yet any significant volume of research on e-cigarettes from low-income and middle-income countries—like all new technologies, e-cigarettes will have spread much more quickly among high-income country markets initially. Finally, we took the decision not to include smoking of conventional cigarettes as a variable for analysis. Doing so would have pulled in an extremely large amount of data not directly relevant to our research question and introduced further heterogeneity (given differences in how smoking status was recorded across studies). While it might have allowed us to analyse issues such as the 'gateway' hypothesis that young non-smokers may be moving from e-cigarettes on to tobacco, such questions are already being addressed effectively through other research more directly focused on this area.[1 6]

Implications for research, policy and practice

While e-cigarettes are widely assumed to be safer than combustible tobacco, the long-term health impacts of vaping are as yet unknown. It is therefore important to understand how far e-cigarette familiarity and adoption vary between different social groups, since this can inform monitoring work to ensure any risks from e-cigarettes do not widen existing health inequalities. Conversely, studies such as these can also help ensure any opportunities offered by e-cigarettes as aids for quitting smoking are distributed fairly across society. The fact that younger and more educated groups may have been particularly likely to trial e-cigarettes is of course not a cause for concern in itself, since this is a common pattern among early adopters of technologies generally.[9] However, greater future research focusing specifically on e-cigarette users who have successfully quit smoking would be valuable in helping to monitor any inequality implications. It would be useful, for instance, to understand whether these e-cigarette users, like smokers generally, are more likely to be from lower socioeconomic groups or not. Similarly, future studies should stratify their findings by relevant sociodemographic groups, to ensure that further subgroup analyses are possible, and should consider more precise measures of current use to capture this concept more accurately. For instance, the US Centre for Disease Control (CDC) defines 'frequent smoking' as smoking cigarettes on 20 or more days out of the past 30.[57] Further studies could adopt this as an easily understandable metric for e-cigarette use, which would additionally allow for useful comparisons with US studies. More precision around the specific types of e-cigarettes being used—and particularly whether they contain nicotine or not—would also be valuable (few studies in our review asked respondents about this), as would a review specifically focusing on studies involving samples of particular patient groups, since these were excluded from our study. Finally, future research should be sensitive to the fact that increasing studies will be emerging from middle-income and low-income countries as e-cigarettes gain further traction in those markets.

We have not reviewed findings on quitting/uptake of smoking, dual usage of e-cigarettes and traditional combustible cigarettes, or health outcomes. Some of these research questions will, we assume, be addressed over time as e-cigarette research begins to consider medium-term and long-term outcomes. Indeed, this review should help lay the foundations for effective public health action in this area. While we must wait for evidence of longer term impacts of e-cigarettes to accumulate, this study provides a baseline early indication of the reach these products have established among different population subgroups. It thus provides an essential first step towards monitoring the population and health inequality impacts of e-cigarettes with more clarity and granularity as these technologies diffuse through societies.

CONCLUSIONS

E-cigarette awareness, 'ever use' and current use appear to be patterned by a number of sociodemographic factors. While the evidence is frequently inconsistent, our review has allowed us to

What this paper adds

- Electronic cigarette (e-cigarette) awareness, 'ever use' and current use are patterned by a number of sociodemographic factors.
- These outcomes appear to be most prevalent in older children, younger adults, males, people of white ethnicity and—particularly for awareness and 'ever use'—those with relatively higher educational levels.
- Further attention may be required to ensure neither the potential benefits nor the potential risks of e-cigarettes are allowed to increase existing health inequalities.

identify older children, younger adults, males and people of white ethnicity as the groups more likely to be aware of, to have ever used and to currently use these products. Awareness and ever use also appear to be greater in people with relatively higher educational levels. This study thereby highlights the importance, in research and practice, of carefully recording sociodemographic determinants of e-cigarette use and potential outcomes of such use (quitting or uptake of smoking, as well as health outcomes) to ensure that e-cigarettes do not widen existing health inequalities.

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Contributors GH conceived the study, which all authors then helped refine. GH and ST executed the search strategy and screened the initial results of the literature searches, selecting the studies for inclusion, appraising and extracting data from the included studies, and analysing and interpreting the findings. At each of these stages, ME and MP provided further guidance and input as required. GH, ST and ME drafted the manuscript, which all authors then contributed to critically revising. GH is the guarantor. All authors have full access to all of the data (including tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

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PART II: RESULTS

Chapter 4: Research paper – Population survey of e-cigarette use and behavioural support uptake

4.1 Introduction

The second of my research papers is presented in this chapter. For this thesis's quantitative workstream, nationally representative survey data was obtained from new questions added to the Smoking Toolkit Study (STS), combined with some existing questions from the STS. This paper thus provides the data to address Objective B of this thesis: 'investigating whether, amongst English smokers *(the 'population')*, use of e-cigarettes *(the 'exposure')* is associated with use of SSSs *(the 'outcome')*, including in comparison to NRT use *(the 'comparator')*'. The paper here, entitled 'Use of e-cigarettes and attendance at stop smoking services: a population survey in England', was initially submitted to the *BMJ* where it passed several editorial decisions over a number of weeks before ultimately being rejected prior to review. This chapter includes the version of the paper that, at the time this thesis was examined, was being finalised for submission to *Thorax*. It has since been updated to incorporate minor corrections recommended by my Viva examiners.

4.2 Research paper cover sheet

The signed cover sheet for this research paper is included on the following page.

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Student ID Number	309900	**Title**	Mr
First Name(s)	Gregory		
Surname/Family Name	Hartwell		
Thesis Title	The attendance of e-cigarette users at stop smoking services: a mixed methods study		
Primary Supervisor	Prof Mark Petticrew		

If the Research Paper has previously been published please complete Section B, if not please move to Section C.

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Where was the work published?			
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Please list the paper's authors in the intended authorship order:	Greg Hartwell, Matt Egan, Jamie Brown, Triantafyllos Pliakas, Mark Petticrew
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SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Conceived and designed study (with analytical/ statistical guidance from co-authors JB & TP); analysed and interpreted data (with analytical/statistical guidance from co-authors JB & TP); drafted manuscript. Supervisors MP & ME provided further guidance and input as required at each stage.

SECTION E

Student Signature	[redacted]
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Supervisor Signature	[redacted]
Date	01/05/19

Use of e-cigarettes and attendance at stop smoking services: a population survey in England

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Abstract

Objectives: To assess any association between dual use of e-cigarettes and combustible tobacco with past and planned future uptake of stop smoking services.
Design: Repeat cross-sectional survey.
Setting: England.
Participants: Participants were drawn from the Smoking Toolkit Study, a nationally-representative, face-to-face survey of adults (16+), between February and November 2017. Data were aggregated on 2,139 smokers reporting current smoking of cigarettes or other tobacco products.
Main outcome measures: Associations between use of e-cigarettes or nicotine replacement therapy (NRT) and past or planned uptake of stop smoking services were assessed using multivariable logistic regression. Analyses included adjustment for various possible confounders.
Results: Dual users of combustible tobacco and e-cigarettes were more likely than other smokers to report having accessed stop smoking services in the past (AOR 1.43, 95% CI = 1.08 to 1.90) and intending to take up these services in the future (AOR 1.51, 95% CI = 1.14 to 2.00). Dual users of combustible tobacco and NRT were also more likely than other smokers to report both having accessed stop smoking services in the past (AOR 2.10, 95% CI = 1.51 to 2.93) and intending to do so in the future (AOR 2.30, 95% CI = 1.66 to 3.18).
Conclusions: Despite speculation that e-cigarette use might deter smokers from using stop smoking services, this study found that dual users of combustible tobacco and e-cigarettes are more likely to report past uptake and intended future uptake of such services, compared to smokers not using e-cigarettes. Smokers who used NRT reported similar findings.

What is already known on this topic

- Attendance at stop smoking services has been declining for six consecutive years, despite the effectiveness of these services for supporting smokers to quit.
- Falling attendance has been attributed by some to the growing popularity of e-cigarettes, and several English local authorities have justified cuts to their services by claiming that the prevalence of e-cigarette use amongst smokers reduces the need to provide such behavioural support.

What this study adds

- This repeat cross-sectional survey of English smokers assessed associations between use of e-cigarettes and past or planned uptake of stop smoking services.
- Both past and planned uptake of stop smoking services was higher amongst those smokers who were also users of e-cigarettes, suggesting that such services should continue to be regarded as an important source of support for smokers even when they use e-cigarettes.

Background

3.2 million adults are estimated to be using e-cigarettes in Great Britain, as of 2018, comprising 6.2% of the population and representing an increase of 2.5 million users since 2012.(1) Current tobacco smokers who also vape predominantly do so with the aim of quitting smoking; e-cigarettes are in fact now the most popular quitting aid in England, with approximately a third of smokers who were trying to give up in early 2019 using one in their most recent quit attempt.(1,2) Behavioural counselling, of the kind provided by the English stop smoking services (SSSs), is a far less common choice for smokers,(2) despite evidence suggesting such support is the most effective route available for quitting smoking when combined with pharmacotherapy.(3–6) Overall attendance at these services in England has recently dropped for a sixth consecutive year (2012/13-2017/18),(7) which is of particular consequence for smoking-related health inequalities since SSSs have proven particularly effective at supporting smokers from lower socioeconomic groups to quit.(8,9) It has been suggested that trends in the use of e-cigarettes and the use of SSSs may be linked.(7,10,11) We aimed to assess the association between dual use of e-cigarettes and combustible tobacco with past and planned future uptake of SSSs.

As well as reflecting structural factors such as local authority budget cuts and changes to public health commissioning arrangements, the decline in the uptake of SSSs could be related to the widespread use of e-cigarettes.(12) Although the SSSs do not prescribe e-cigarettes, they have been advised by national bodies such as Public Health England (PHE), the National Centre for Smoking Cessation and Training (NCSCT) and Action on Smoking and Health (ASH) to offer their services to smokers who have purchased their own devices and provide them with the same behavioural support they give to those who are using licensed pharmacotherapies.(13–16) Unadjusted observational data from 2016 indicate that smokers using e-cigarettes in conjunction with licensed medicines have the highest quit rates of all SSS users.(7,14,17) Yet the number of smokers combining their e-cigarettes with SSS behavioural support remains low, as of 2016/17.(18) Some smokers who would otherwise have accessed the services may therefore be choosing to try to quit through vaping alone, either out of personal preference or as a result of their local SSS being cut back.(19) Several councils have

even posited the popularity of e-cigarettes within society as part of a rationale for decommissioning their local SSS entirely,(19–23) despite warnings elsewhere that e-cigarettes cannot be assumed to be 'picking up the slack' from the declining uptake of other routes to quitting smoking.(24)

Research has only recently begun to explore the extent to which the use of e-cigarettes by smokers may affect the use of behavioural support offered by services such as the English SSSs. A US cross-sectional survey suggested that amongst dual users of combustible tobacco and e-cigarettes almost all age groups were as likely to access behavioural support as other smokers.(25) A UK time series analysis using data from 2006-2015 also found no clear evidence for an association at a population level between e-cigarette use and uptake of behavioural support from SSSs, while not being designed to assess possible sociodemographic interactions or understand possible mechanistic associations with related knowledge and beliefs.(26) No studies outside the US, however, have to our knowledge examined sociodemographic differences in uptake of behavioural support amongst dual users of combustible tobacco and e-cigarettes. Furthermore, no studies anywhere have examined such smokers' intended future use of this support – a variable with important implications for the long-term viability of these particularly effective services – or to control for important knowledge and beliefs that could also be influencing uptake of services. Our study therefore aimed to examine past and planned future uptake of SSSs among people who dual use e-cigarettes and combustible tobacco, selected from a representative sample of English smokers, including an exploration of potential sociodemographic differences in these outcomes. Specifically, we investigated the following research questions:

1. Is there any association between dual use of e-cigarettes/combustible tobacco with previous and planned future uptake of the SSSs?
2. Does any such association persist after adjusting for related knowledge and belief variables, and sociodemographic and smoking characteristics?
3. Is any such association moderated by sociodemographic group?
4. To what extent is any such association specific to e-cigarettes, or is it also observed with dual use of nicotine replacement therapy (NRT) and combustible tobacco?

Method

Design

The data for this repeat cross-sectional study were collected through the ongoing Smoking Toolkit Study (STS), a monthly cross-sectional survey.(27) Small output areas consisting of ~200 households are selected using a random location sampling design, and interviewers are then assigned quotas to fulfil within areas set on gender, working status and tenure, before face-to-face computer-assisted interviews are conducted with one member of each household. Participants are recruited from the general population (previous research has demonstrated the STS's national representativeness on smoking-related and sociodemographic characteristics), with each monthly wave collecting a sample of approximately 1,700 adults aged 16 or over.(27)

Study population

Data were collected between February and November 2017 from 13,735 adults in England, with each wave providing a unique sample of individuals (i.e. no repeat interviews took place). The sample was created from those 2,313 respondents, pooled from the multiple waves, who reported current smoking of cigarettes (whether factory-made or hand-rolled) or other tobacco products (such as pipes or cigars) every day or regularly, at the time of interview.

Measures

Measurement of e-cigarette and NRT use

Existing STS questions provided data on current use of e-cigarettes and/or NRT. Interviewees were asked the questions "Which, if any, of the following are you currently using to help you cut down the amount you smoke?", "Do you regularly use any of the following in situations when you are not allowed to smoke?" and "Can I check, are you using any of the following either to help you stop smoking, to help you cut down or for any other reason at all?". Current e-cigarette use was defined as anyone selecting

'Electronic cigarette' from the lists of possible responses to any of these questions, with current NRT use defined as anyone choosing 'Nicotine gum', Nicotine lozenge', 'Nicotine patch', 'Nicotine inhaler\inhalator', 'Nicotine mouthspray' or 'Another nicotine product' from the same lists. Respondents were able to select multiple products if relevant. NRT products can be obtained by smokers either over-the-counter or on prescription from GPs or SSSs; for the purposes of this study, however, differentiating the source of any NRT used was not relevant to our research questions.

Measurement of outcomes

The primary outcome variables were previous use of SSS ('past uptake') and intention to access the services in future ('planned uptake'). Data for these came from participants' answers to the questions: "Have you ever sought help from an NHS stop smoking service at any point in the past?" and "How likely or unlikely are you to consider seeking help from your NHS stop smoking service at any point in the future?". For the "past uptake" question, responses of 'Yes' were coded as 1 and 'No' were coded as 0. The intended future use question was a single-item measure with five response options: (1) 'Very likely', (2) 'Fairly likely', (3) 'Neither likely nor unlikely', (4) 'Fairly unlikely' and (5) 'Very unlikely'. For analysis and interpretation, data were dichotomised to reflect any reported future intention to access services (1-2) vs no reported future intention (3-5).

Measurement of potential confounders

Our analysis plan specified confounders *a priori*, with the exception of two sensitivity analyses outlined below. Data were used from existing STS questions on sociodemographics and smoking-related factors. Sociodemographics included age, gender, ethnicity (dichotomised into white vs non-white) and social grade (dichotomised into ABC1 vs C2DE, with the former including managerial, professional and intermediate occupations, and the latter including small employers and own account workers, lower supervisory and technical occupations, semi-routine and routine occupations, never workers and long-term unemployed).

Potentially confounding smoking-related factors were also analysed using existing STS questions. For intention to quit smoking, the 'Motivation To Stop Scale' (MTSS) was

used.(28) Participants were thus asked “Which of the following best describes you?”. Those answering “I REALLY want to stop smoking and intend to in the next month”, “I REALLY want to stop smoking and intend to in the next 3 months” or “I want to stop smoking and hope to soon” were coded 1 and those answering “I REALLY want to stop smoking but I don't know when I will”, “I want to stop smoking but haven't thought about when”, “I think I should stop smoking but don't really want to” or “I don't want to stop smoking” were coded 0. Past year quit attempts were assessed by the question “How many serious attempts to stop smoking have you made in the last 12 months?”. Those reporting no attempts were coded as 0 and those reporting one or more were coded as 1. Nicotine dependence was assessed using the established ‘Heaviness of Smoking Index’ (HSI), obtained by summing a respondent’s categorised number of cigarettes smoked per day and their time from waking until first cigarette of the day (the index ranges from 0 to 6: the higher the score, the higher the dependence on nicotine).(29)

Participants also answered questions relating to knowledge and beliefs that could potentially influence attendance at SSSs or use of e-cigarettes. They were asked: “To what extent do you agree or disagree with each of the following statements?

1. I know people who use e-cigarettes;
2. I know people who have attended NHS stop smoking services;
3. I think e-cigarettes are a convenient way to quit smoking;
4. I think NHS stop smoking services are a convenient way to quit smoking;
5. I think learning how to use e-cigarettes takes up a lot of time;
6. I think using NHS stop smoking services takes up a lot of time;
7. I know how to use e-cigarettes if I want to;
8. I know how to access NHS stop smoking services if I want to;
9. Most of my family and friends accept my e-cigarette use;
10. Most of my family and friends accept my smoking;
11. If I was to use NHS stop smoking services, I would have to travel far;
12. If I attended an NHS stop smoking service in the future, I think I would be made to feel welcome”.

We again based response options on five-point Likert scales ('Strongly agree', 'Tend to agree', 'Neither agree nor disagree', 'Tend to disagree' and 'Strongly disagree') and dichotomised these into the first two responses vs all others. For the question "Do you think NHS stop smoking services currently offer their support to smokers who are using e-cigarettes to try to quit smoking, or not?", respondents simply chose 'Yes' or 'No', while "Out of these two approaches for quitting smoking, which do you think would be more likely to help someone to quit?" had the response options 'Using e-cigarettes', 'Getting support from NHS stop smoking services' or 'Both equally likely'. This was dichotomised into those who chose SSSs as the most effective approach vs those who chose the other two responses. Finally, participants reporting previous SSS uptake were also asked "Overall, to what extent did you find the NHS stop smoking service you attended helpful or not for your efforts to quit smoking?". Response options were 'Very helpful', 'Fairly helpful', 'Not very helpful' and 'Not at all helpful' which was dichotomised into the first two responses versus the final two.

Testing of questions

Seventeen members of the public with varied experiences of smoking, using e-cigarettes and accessing SSSs were recruited purposively at the outset of the research to provide some face validity testing of the new survey questions that were proposed to be asked through the study. These people reviewed the draft questions by email and submitted written feedback on the merits of the questions overall, as well as any specific wording within them that could be clearer. Seven subject matter experts (tobacco researchers, national policy-makers, survey specialists and SSS staff) were also consulted in the same way.

Statistical analyses

Our planned analyses and sample size calculation were pre-registered publicly on Open Science Framework (accessible at www.osf.io/ur3j8). Descriptive statistics were produced for sociodemographic and smoking-related variables, with chi-squared tests (for the categorical variables) and *t* tests (for the continuous ones) undertaken to examine potential differences in these characteristics by use of e-cigarettes or NRT (see

Table 1). Primary analyses investigated the impact of dual use (of combustible tobacco and e-cigarettes or NRT respectively) on SSS uptake (past or planned respectively), adjusting for smoking and sociodemographic co-variables. These furthermore assessed interactions between the two dual use variables and key sociodemographics (i.e. age, sex, social grade, ethnicity) on past or planned SSS uptake.

These analyses were structured as follows. First, initial multivariable logistic regression models (M1) were produced for exploratory analyses of knowledge and beliefs concerning e-cigarettes and SSSs. These examined the impact of each knowledge/belief variable in turn on uptake of SSSs (past and planned respectively), after adjusting for the smoking-related and demographic co-variables. Secondly, we developed unadjusted logistic regression models (M2) examining the impact of the two dual use variables on the SSS uptake variables to provide crude odds ratios (ORs, with associated 95% confidence intervals). Thirdly, we developed the final models (M3) examining the impact of each of the dual use variables in turn on each of the SSS uptake variables in turn, after adjusting for *a priori* variables and other statistically significant knowledge/belief variables ($p<0.05$) identified in M1, in order to produce final adjusted ORs with associated 95% confidence intervals. In these final models, we also examined the interaction between each of the dual use variables and key sociodemographic variables (socioeconomic status, age, gender and ethnicity) on each of the uptake variables. This involved developing different 'interaction' models, each model having the interaction term in question (e.g. dual use of combustible tobacco and e-cigarettes x sex), which adjusted for all *a priori* and other statistically significant variables (as in M3). Following these pre-registered analyses, some further unplanned sensitivity analyses explored, in the M3 models, the impact of including two potentially relevant further variables. These therefore involved further adjusting for use of NRT (when examining dual use of e-cigarettes and combustible tobacco) or e-cigarettes (when examining dual use of NRT and combustible tobacco), as well as adjusting for past uptake of SSS (when examining planned future uptake of SSS). All analyses were undertaken using SPSS v24.

Results

Out of a total of 2,313 current smokers who were interviewed, complete data on key co-variables (HSI, age and gender) was provided by 2,189 (94.5%) of these (Table 1). Those excluded due to such missing data were significantly less likely to be female or white ($p<0.05$) than those who remained in the sample.

Dual users of e-cigarettes and combustible tobacco did not differ from other smokers by most sociodemographic characteristics (Table 2), but were significantly more likely to be white and to live in the North of England. Dual users of NRT and combustible tobacco were significantly older than other smokers, as well as being more likely to have a disability or to live in the South of England, but less likely to live in the North of England or to be heterosexual. Both groups of dual users were also more likely than other smokers to report an attempt to quit smoking within the previous year and an intention to quit smoking in the future.

21.6% of participants (472/2189) had accessed a SSS in the past and, similarly, 23.2% (508/2189) planned to do so in future. In the unadjusted analyses (Tables 3 and 4), dual users of combustible tobacco and e-cigarettes were more likely than other smokers to report having accessed the services in the past (OR 1.93, 95% CI = 1.51 to 2.45) and intending to access them in the future (OR 1.53, 95% CI = 1.20 to 1.95). Dual users of combustible tobacco and NRT were also more likely than other smokers to report both having accessed SSSs in the past (OR 2.93, 95% CI = 2.20 to 3.91) and intending to do so in the future (OR 3.04, 95% CI = 2.28 to 4.04).

Table 1: Sample characteristics

	Study sample (n=2,189)
Demographic characteristics	
Age, Mean (SD)	43.5 (17.3)
Female, %	49.7%
White, %	90.0%
Social grade C2DE, %	56.7%
No post 16 qualifications, %	60.9%
With disability, %	17.4%
Heterosexual, %	87.4%
Region: North, %	32.2%
Central, %	29.7%
South, %	38.1%
Smoking characteristics	
Current tobacco use, %	100%
Current e-cigarette use, %	18.2%
Current NRT use, %	10.2%
Past SSS use, %	21.6%
Intended future SSS use, %	23.2%
Intention to quit smoking, %	33.1%
Past year quit attempt, %	29.9%
HSI Index, Mean (SD)	1.72 (1.51)

NRT: nicotine replacement therapy; SD: Standard deviation; North: North East, North West, Yorkshire & Humber; Central: East Midlands, West Midlands, East of England; South: London, South East, South West; HSI: Heaviness of Smoking Index (the higher the score, the higher the dependence on nicotine);

Table 2: Sample characteristics by dual use of combustible tobacco/e-cigarettes or combustible tobacco/NRT

	All smokers (n=2,189)	**Dual e-cig/tobacco use**		**p***	**Dual NRT/tobacco use**		**p***	**Tobacco use only**		**p***
		Yes	***No***		***Yes***	***No***		***Yes***	***No***	
Demographic characteristics										
Age, Mean (SD)	43.5 (17.3)	43.0 (16.5)	43.6 (17.5)	0.555	47.0 (16.9)	43.1 (17.3)	0.001*	43.1 (17.4)	44.6 (16.9)	0.086
Female, %	49.7%	50.9%	49.4%	0.590	54.3%	49.1%	0.147	48.6%	52.6%	0.109
White, %	90.0%	93.2%	89.3%	0.019*	90.1%	90.0%	0.961	89.1%	92.6%	0.018*
Social grade C2DE, %	56.7%	54.6%	57.2%	0.359	54.3%	57.0%	0.439	57.3%	55.0%	0.352
No post 16 qualifications, %	60.9%	61.7%	60.8%	0.747	60.5%	61.0%	0.896	60.6%	61.9%	0.585
With disability, %	17.4%	18.9%	17.1%	0.381	22.4%	16.9%	0.038*	16.5%	20.0%	0.058
Heterosexual, %	87.4%	89.4%	87.0%	0.191	82.5%	88.0%	0.020*	87.6%	86.9%	0.653
Region: North, %	32.2%	36.8%	31.1%	0.027*	25.6%	32.9%	0.026*	32.2%	32.1%	0.971
Central, %	29.7%	29.1%	29.8%	0.764	29.1%	29.8%	0.851	29.7%	29.6%	0.969
South, %	38.1%	34.1%	39.1%	0.065	45.3%	37.3%	0.020*	38.1%	38.3%	0.943
Smoking characteristics										
Intention to quit smoking, %	33.1%	51.6%	29.0%	<0.001*	58.3%	30.3%	<0.001*	25.9%	53.8%	<0.001*
Past year quit attempt, %	29.9%	50.9%	25.2%	<0.001*	59.2%	26.6%	<0.001*	21.7%	53.3%	<0.001*
HSI Index, Mean (SD)	1.72 (1.51)	1.78 (1.43)	1.71 (1.53)	0.382	1.79 (1.49)	1.71 (1.51)	0.484	1.71 (1.52)	1.77 (1.47)	0.374

NRT: nicotine replacement therapy; SD: Standard deviation; North: North East, North West, Yorkshire & Humber; Central: East Midlands, West Midlands, East of England; South: London, South East, South West; HSI: Heaviness of Smoking Index (the higher the score, the higher the dependence on nicotine); Tobacco use only: current smokers of combustible tobacco with no current use of e-cigarettes or NRT

After adjustment for demographic characteristics, smoking-related variables, and key knowledge and belief variables, these associations all remained statistically significant (Tables 3 and 4).

Table 3: E-cigarette or NRT use and past uptake of SSSs amongst current smokers of combustible tobacco

		Past uptake of SSS		
		% [n]	**OR [95% CI]** ***Unadjusted model***	**AOR [95% CI]** ***Final model****
Dual e-cig/tobacco use	*No*	19.3% (346/1790)	1.00	1.00
	Yes	31.6% (126/399)	**1.93 (1.51-2.45)**	**1.43 (1.08-1.90)**
Dual NRT/tobacco use	*No*	19.3% (380/1966)	1.00	1.00
	Yes	41.3% (92/223)	**2.93 (2.20-3.91)**	**2.10 (1.51-2.93)**

* Final model controlled for: demographic variables (age, gender, ethnicity, socioeconomic status), smoking-related variables (intention to quit, past-year quit attempts, nicotine dependence), and significant knowledge and belief variables (knowing people who used e-cigarettes, knowing how to use e-cigarettes, knowing people who had used SSSs, thinking SSSs were a convenient way to quit, knowing how to access SSSs, thinking they would be made to feel welcome by SSSs, and thinking SSSs were more effective than e-cigarettes)

Table 4: E-cigarette or NRT use and planned uptake of SSSs amongst current smokers of combustible tobacco

		Planned uptake of SSS		
		%[n]	**OR [95% CI]** ***Unadjusted model***	**AOR [95% CI]** ***Adjusted model****
Dual e-cig/tobacco use	*No*	21.7% (389/1790)	1.00	1.00
	Yes	29.8% (119/399)	**1.53 (1.20-1.95)**	**1.51 (1.14-2.00)**
Dual NRT/tobacco use	*No*	20.8% (409/1966)	1.00	1.00
	Yes	44.4% (99/223)	**3.04 (2.28-4.04)**	**2.30 (1.66-3.18)**

* Final model controlled for demographic variables (age, gender, ethnicity, socioeconomic status), smoking-related variables (intention to quit, past-year quit attempts, nicotine dependence), and significant knowledge and belief variables (knowing people who used e-cigarettes, thinking e-cigarettes were more effective than SSSs, knowing people who had used SSSs, thinking SSSs were a convenient way to quit, thinking lots of time was needed to access SSSs, knowing how to access SSSs, thinking they would be made to feel welcome by SSSs, finding past use of SSSs helpful, thinking dual tobacco/e-cigarette users were eligible for SSSs, and thinking SSSs were more effective than e-cigarettes)

No sociodemographic interactions were observed for social grade, age or ethnicity for any outcomes. A significant interaction was observed for gender when examining the association between dual combustible tobacco/NRT use with future uptake of SSSs. For females, dual combustible tobacco/NRT use significantly increased their odds of intending to access an SSS in future (OR 3.40, 95% CI = 2.19 to 5.28), but this was not the case for males (OR 1.45, 95% CI = 0.90 to 2.35). Similar interactions for gender were not evident in analyses of any other outcomes.

Sensitivity analyses further adjusted for use of NRT (when examining dual use of e-cigarettes and combustible tobacco) or e-cigarettes (when examining dual use of NRT and combustible tobacco), as well as for past uptake of SSS (when examining planned future uptake of SSS). Results were very similar to those produced by the original analyses: dual users of e-cigarettes and combustible tobacco remained more likely than other smokers to have accessed a SSS in the past (AOR 1.43, 95% CI = 1.08 to 1.91) and to plan to do so in the future (AOR 1.40, 95% CI = 1.05 to 1.88), as did dual users of NRT and combustible tobacco (AOR 2.10, 95% CI = 1.51 to 2.93 for past uptake, and AOR 2.03, 95% CI = 1.45 to 2.84 for planned uptake).

Discussion

Amongst current smokers, those who were also using e-cigarettes were more likely to report having accessed SSSs in the past and to report an intention to access these services in the future. These associations between service uptake and dual use (of combustible tobacco and alternative forms of nicotine delivery) were not specific to e-cigarettes: they could also be found amongst dual users of NRT and combustible tobacco.

To our knowledge, this research is the first of its kind to combine data on e-cigarette use with data about past and intended future uptake of behavioural support. It therefore has particular relevance to current debates around the popularity of e-cigarettes and their potential impact on the uptake of SSSs by smokers. Another key strength is its use of a representative sample of the English population. Limitations of the study include the inability of cross-sectional research to establish causal relationships, though cross-

sectional associations can nonetheless be indicative and have an important role to play in guiding future research. Our study furthermore relied, in part, on data gathered using novel questions. Although there were no relevant established questionnaire tools from which to take our new questions regarding SSS uptake, their face validity was tested beforehand with a range of smokers reporting varying levels of e-cigarette use. The use of self-reported data from a single point in time means recall bias may have affected responses around past behaviour, while social desirability bias may have influenced reported future actions or answers to knowledge/belief questions.

Future larger studies could attempt to tackle this by using longitudinal cohort designs to follow up respondents and assess how far reported intentions to access services translate into actual uptake. It is also possible that our finding of a positive association between the different dual use groups and intended future SSS uptake reflects residual confounding – i.e. this association may be caused by a smoker's general motivation to quit smoking more than anything particularly to do with SSS. This concept of 'intention to quit' was however captured by the 'Motivation to Stop Scale' (MTSS), an established variable used regularly for broader published analyses of STS data (28). Finally, some caution is needed when generalising our findings to other populations internationally. The level and cost of behavioural support available to smokers varies widely internationally, while the regulatory framework for e-cigarettes within the UK is considerably different to that in many other countries.(11,30,31) Globally, 98 countries have national e-cigarette regulations in place, with 29 countries forbidding e-cigarette sales entirely.(11) Even amongst nations where sales are permitted, there are very diverse legislative approaches being taken on areas such as marketing, labelling, safety standards and nicotine limits.(30) For instance, the 'UK Tobacco and Related Products Regulations 2016' enforced a nicotine cap of 20mg/ml on devices and refills, while the US does not have a national limit on nicotine concentrations in this way.(11)

This study aligns with other recent research that has not found e-cigarette use to be associated with reduced uptake of behavioural support.(25,26) Our findings in fact suggest a modest positive association, with dual users of combustible cigarettes and either e-cigarettes or NRT significantly more likely than other smokers to have engaged with services previously and to plan to access them in future. A plausible explanation is

that, given the majority of smokers using e-cigarettes or NRT do so in an attempt to quit smoking,(14) the increased reports of past and planned SSS uptake among these smokers may reflect their willingness to consider other quit methods beyond e-cigarettes and/or NRT. It is also likely to reflect the fact that some previous SSS users will have been introduced to e-cigarettes or NRT by the services directly and given encouragement and advice on using them, leading to more sustained use of such products compared to non-attenders of services. Alternatively, it is even possible that experiences with other satisfying sources of nicotine stimulate thoughts about quitting and boost self-efficacy; previous research suggests, for instance, that e-cigarette use can encourage quitting, including for smokers who have not previously been contemplating it.(32) Finally, this phenomenon may be linked to financial considerations for smokers. A wide range of studies have shown that smokers report lower costs of e-cigarettes, compared to combustible cigarettes, as a major incentive for using them,(33) while other research has demonstrated the responsiveness of e-cigarette demand to price changes, suggesting this may be even greater than the equivalent price elasticity of (combustible) cigarette demand.(34) It has also been shown that the free or subsidised pharmacotherapy offered by the English SSSs is positively associated with quit attempts.(35) It is thus plausible that smokers who are motivated to try to switch from combustible tobacco to e-cigarettes for economic reasons are likely to also be attracted to this offer of free or subsidised pharmacotherapy from SSSs.

The null findings for virtually all interactions with sociodemographics appear surprising given the international literature on use of e-cigarettes suggests that that outcome is patterned by age, gender and ethnicity.(36) For our study design, however, use of e-cigarettes was a predictor not an outcome, since we were primarily interested in the impact of e-cigarette use on uptake of behavioural support, and only amongst current dual users of combustible tobacco and e-cigarettes (rather than all vapers). More relevant is the US study in this area which found older dual users (65+) of combustible tobacco and e-cigarettes to be more likely than other smokers to report accessing behavioural support.(25) It is possible our sample size was not sufficient to detect more subtle sociodemographic interactions. Similarly though, it is possible that the behaviour of UK smokers in this area simply is not the same as those in the US, given the aforementioned international differences in regulatory landscapes and availability of

behavioural support, which are certainly striking when specifically comparing the UK with the US. Also of note is the lower proportion of smokers in our sample reporting an intention to access behavioural support than the most relevant study from the US (~23% vs ~35%).(37) This difference is to be expected, however, given the US study only investigated future intention to access such support amongst those smokers who intended to quit within the following month. Our research, on the other hand, was interested in asking this question to all smokers regardless of the existence or timeframe of a quit intention.

Conclusion

We found both past and planned uptake of SSSs were higher amongst those smokers who were also users of e-cigarettes, even after controlling for 'intention to quit' and other potential confounders. **So, in summary, rather than wanting to 'go it alone', smokers using e-cigarettes were more keen to receive additional support to quit from SSSs than other smokers.**

Our study has clear relevance for ongoing debates about the relationship between e-cigarette use and the uptake and provision of other quit methods including behavioural support. Several national organisations, such as PHE, NCSCT and ASH have recommended that local authorities - and the SSSs they commission - should welcome and support smokers who wish to use electronic cigarettes in their efforts to quit combustible tobacco.(13,15,16) Elsewhere, however, it has been suggested that widespread e-cigarette use may be reducing the need for SSSs, an argument that has formed part of the rationale for cutting such services in a number of English local authorities.(10,19–23) Our findings clearly call into question the credibility of this latter position. Rather than assuming that the continued decline in SSS attendance is linked to e-cigarette use, alternative explanations should therefore be considered including, for example, the significant cuts made to local authority public health budgets that fund such services.(38) Dual users of e-cigarettes and combustible tobacco in fact want the help to quit smoking that these SSSs offer.

Declarations

Abbreviations

AOR: Adjusted odds ratio; CI: Confidence interval; HSI: Heaviness of Smoking Index; NRT: Nicotine replacement therapy; SSS: Stop smoking service; STS: Smoking Toolkit Study.

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Authors' contributions

GH, ME, JB and MP conceived and designed the study. TP and JB provided analytical/statistical expertise. GH analysed and interpreted the data and drafted the manuscript. ME, JB, TP and MP revised the manuscript critically for intellectual content. All authors read and approved the final manuscript. GH is study guarantor.

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Data sharing

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Ethical approval for the Smoking Toolkit Study was granted originally by the UCL Ethics Committee (ID 0498/001) and participants provided fully informed consent before taking part. This project received further ethical approval from the LSHTM Observational Research Ethics Committee (reference 11672). The data were not collected by UCL or LSHTM and were anonymised when received by LSHTM.

Transparency statement

The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been registered and explained.

Consent for publication

Not applicable.

Competing interests

All authors have completed the Unified Competing Interest form (available on request from the corresponding author) and declare that: JB has received unrestricted research funding from Pfizer, who manufacture smoking cessation medications, but declares no financial links with tobacco companies or e-cigarette manufacturers or their representatives. All authors declare there are no other relationships or activities that could appear to have influenced the submitted work.

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Chapter 5: Research paper – Population survey of knowledge and beliefs about e-cigarettes and behavioural support

5.1 Introduction

The third of my research papers is presented in this chapter. As in Chapter 4, this piece of work uses nationally representative survey data obtained from new questions added to the Smoking Toolkit Study (STS). Whereas the previous paper focused on measuring associations between dual use of e-cigarettes/tobacco and stop smoking service (SSS) uptake, this paper uses quantitative evidence to assess specific psychosocial factors that may be influencing smokers' decisions on SSS uptake, including the potential role of knowledge and beliefs relating to e-cigarettes. This, therefore, provided the data to address - in combination with Chapter 6 - Objective C of this thesis: 'investigating, amongst English smokers *(the 'population')* what factors *(the 'exposures')* influence decisions to use either e-cigarettes or SSSs *(the 'outcomes')*, including the potential impact each can have on the other'. The paper here, entitled 'Knowledge and beliefs related to e-cigarettes and behavioural support and associations with support uptake: a population survey in England' had not yet been submitted to a journal for consideration at the time this thesis was examined, but was being finalised for submission - to *Drug and Alcohol Dependence* - alongside completion of the thesis. It has subsequently been updated to incorporate minor corrections recommended by my Viva examiners.

5.2 Research paper cover sheet

The signed cover sheet for this research paper is included on the following page.

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RESEARCH PAPER COVER SHEET

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SECTION A – Student Details

Student ID Number	309900	**Title**	Mr
First Name(s)	Gregory		
Surname/Family Name	Hartwell		
Thesis Title	The attendance of e-cigarette users at stop smoking services: a mixed methods study		
Primary Supervisor	Prof Mark Petticrew		

If the Research Paper has previously been published please complete Section B, if not please move to Section C.

SECTION B – Paper already published

Where was the work published?			
When was the work published?			
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SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	Drug and Alcohol Dependence
Please list the paper's authors in the intended authorship order:	Greg Hartwell, Matt Egan, Jamie Brown, Triantafyllos Pliakas, Mark Petticrew
Stage of publication	**Not yet submitted**

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Conceived and designed study (with analytical/ statistical guidance from co-authors JB & TP); analysed and interpreted data (with analytical/statistical guidance from co-authors JB & TP); drafted manuscript. Supervisors MP & ME provided further guidance and input as required at each stage.

SECTION E

Student Signature	[redacted]
Date	01/05/19

Supervisor Signature	[redacted]
Date	01/05/19

Knowledge and beliefs related to e-cigarettes and behavioural support and associations with support uptake: a population survey in England

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Abstract

Background: While attendance rates at stop smoking services (SSSs) have declined for the last six years, e-cigarettes have become the most common quit aid chosen by English smokers, which has led to claims that these devices may have reduced demand for the behavioural support offered by SSSs. We aimed to assess whether knowledge and beliefs related to the SSSs and e-cigarettes were associated with either previous or planned future use of SSSs.

Methods: Current adult smokers in England (n=2,189) provided data through a nationally-representative, face-to-face survey between February and November 2017. Multivariable logistic regression assessed associations between agreement with knowledge and belief statements and past or planned SSS uptake.

Results: Knowledge and belief statements about e-cigarettes: Past and planned SSS uptake were associated with *knowing other people who vaped* (AOR 1.79, 95% CI = 1.35 to 2.38 for SSS past use, AOR 1.43, 95% CI = 1.09 to 1.88 for planned use) and *believing that e-cigarettes were less effective than SSSs* (AOR 1.33, 95% CI = 1.06 to 1.65 for SSS past use and AOR 2.35, 95% CI = 1.89 to 2.93 for planned use). Past SSS use was furthermore associated with *knowing how to use e-cigarettes* (AOR 2.01, 95% CI = 1.54 to 2.63), while planned SSS uptake was also associated with *perceiving 'dual users' of e-cigarettes and combustible tobacco as eligible for SSSs* (AOR 1.32, 95% CI = 1.06 to 1.63). Knowledge and belief statements about SSSs: Past and planned SSS uptake were associated with: *knowing how to access SSSs* (AOR 4.66, 95% CI = 3.25 to 6.69 for past use and AOR 2.00, 95% CI = 1.49 to 2.68 for planned use); *expecting to be welcomed by SSSs* (AOR 1.99, 95% CI = 1.53 to 2.58 for past use and AOR 2.91, 95% CI = 2.19 to 3.87 for planned use); *perceiving SSSs as convenient* (AOR 1.73, 95% CI = 1.39 to 2.16 for past use and AOR 3.07, 95% CI = 2.43 to 3.87 for planned use); and *knowing other people who had used SSSs* (AOR 3.39, 95% CI = 2.71 to 4.24 for past use and AOR 1.59, 95% CI = 1.27 to 1.99 for planned use). Planned SSS uptake was also associated with reporting *helpful past experiences of SSSs* (AOR 5.61, 95% CI = 3.57 to 8.82) and negatively associated with *believing SSS attendance required lots of time* (AOR 0.61, 95% CI = 0.47 to 0.79).

Conclusions: Perceptions of e-cigarette effectiveness and familiarity with vaping (both knowing how to vape oneself and knowing others who vape) are positively associated with decisions to access SSS support. Such decisions are similarly associated with familiarity with SSSs themselves, as well as with perceptions of SSSs (including convenience, likely time commitments and anticipated welcome) and valence of any previous SSS uptake.

Keywords: Stop Smoking Services, Access, E-cigarettes, Knowledge, Beliefs

Background

Current evidence indicates that behavioural counselling, of the kind provided by stop smoking services (SSSs) within England, is the most effective route for quitting smoking when combined with pharmacotherapy.(1–3) Attracting smokers to SSSs has nonetheless proved increasingly challenging in recent years, with the overall number of people accessing them in England recently dropping for a sixth consecutive year (2012/13-2017/18).(4) E-cigarettes have meanwhile become increasingly popular with English smokers and are now their most commonly used quit aid: as of 2018, 14.9-18.5% of current smokers vape,(5) and the majority of these are doing so in order to try to quit smoking.(6,7)

Previous qualitative research suggests that smokers, particularly from disadvantaged backgrounds, are influenced by both internal and external factors when deciding whether to attend SSSs.(8–10) Beliefs about the effectiveness of SSSs are particularly influential, as well as fears about how smokers will be received or welcomed by the services (including their expectations of being judged by practitioners, for instance).

Service monitoring data, as well as the first randomised trial in this context, suggest that smokers using e-cigarettes may have amongst the highest successful quit rates of all SSS users.(4,6,11) This has led to calls from several national organisations for SSSs to welcome those smokers who wish to quit tobacco using e-cigarettes, even if the services

cannot prescribe such devices themselves.(12–14) Existing research has generally studied e-cigarettes in isolation from other quit methods, however. Little is known, for instance, about how smokers' knowledge and beliefs about e-cigarettes could relate to their decision-making around other smoking cessation options. Understanding the factors influencing such decisions is a particularly important research gap given ongoing debate about whether e-cigarettes could be depressing uptake of potentially more effective routes to quitting tobacco, including behavioural support.(5,15,16)

Our study aimed to examine whether knowledge and beliefs about e-cigarettes and SSSs, which could potentially influence uptake of SSS behavioural support, were associated with either previous or planned use of these services. This included an exploration of potential differences in these outcomes between sociodemographic groups and between 'dual users' of e-cigarettes and combustible tobacco versus other smokers. Our specific research questions were:

1. Are there any associations between knowledge and beliefs about e-cigarettes and SSSs with previous and planned use of the services?
2. Do any such associations persist after adjusting for sociodemographic and smoking characteristics?
3. Are any such associations moderated by dual use of e-cigarettes or sociodemographic group?

Method

Design

This was a repeat cross-sectional study using data collected between February and November 2017 via the Smoking Toolkit Study (STS), a long-running monthly survey. For each monthly wave of the STS, a sample of approximately 1,700 adults (aged 16+) is recruited from the general English population. Sampling is a hybrid between random location and quota: small output areas of approximately 200 households are stratified by a geodemographic ordering of the population and randomly selected. Within areas,

trained interviewers undertake face-to-face interviews with a single member of a household until pre-specified quotas are fulfilled tailored to the areas. The national representativeness of the STS across a range of smoking-related and sociodemographic characteristics has been shown previously.(17)

Study population

The sample for our specific study constituted the 2,313 respondents, pooled across monthly waves between February and November 2017, who were currently smoking combustible cigarettes (either hand-rolled or factory-produced) or other tobacco products (e.g. pipes or cigars) daily or regularly at the point at which they were interviewed.

Measures

New questions were added to the STS relating to uptake of SSSs (both past and planned), as well as knowledge and beliefs that could potentially influence attendance at these services. Seventeen members of the public with varied experiences of smoking, using e-cigarettes and accessing SSSs were recruited purposively at the outset of the research to provide some face validity testing of the new survey questions that were proposed to be asked through the study. These people reviewed the draft questions by email and submitted written feedback on the merits of the questions overall, as well as any specific wording within them that could be clearer. Seven subject matter experts (tobacco researchers, national policy-makers, survey specialists and SSS staff) were also consulted in the same way.

The data on SSS uptake were provided by answers to the questions: “Have you ever sought help from an NHS stop smoking service at any point in the past?” and “How likely or unlikely are you to consider seeking help from your NHS stop smoking service at any point in the future?”. For the former question, we coded ‘Yes’ responses as 1 and ‘No’ responses as 0. For the planned uptake question, we used a single-item measure with five possible responses: ‘Very likely’, ‘Fairly likely’, ‘Neither likely nor unlikely’, ‘Fairly unlikely’ and ‘Very unlikely’. For the purposes of analysis, we dichotomised data into

any reported intention to access SSSs in future ('Very likely or 'Fairly likely') vs no reported intention (all other responses).

Data on knowledge and beliefs – including around e-cigarettes – that could be influencing attendance at SSSs were obtained from answers to further questions. Participants were asked "To what extent do you agree or disagree with each of the following statements?

1. I know people who use e-cigarettes;
2. I know people who have attended NHS stop smoking services;
3. I think e-cigarettes are a convenient way to quit smoking;
4. I think NHS stop smoking services are a convenient way to quit smoking;
5. I think learning how to use e-cigarettes takes up a lot of time;
6. I think using NHS stop smoking services takes up a lot of time;
7. I know how to use e-cigarettes if I want to;
8. I know how to access NHS stop smoking services if I want to;
9. Most of my family and friends accept my e-cigarette use;
10. Most of my family and friends accept my smoking;
11. If I was to use NHS stop smoking services, I would have to travel far;
12. If I attended an NHS stop smoking service in the future, I think I would be made to feel welcome".

We again based response options on five-point Likert scales ('Strongly agree', 'Tend to agree', 'Neither agree nor disagree', 'Tend to disagree' and 'Strongly disagree') and dichotomised these into the first two responses versus all others. For the question "Do you think NHS stop smoking services currently offer their support to smokers who are using e-cigarettes to try to quit smoking, or not?", respondents simply chose 'Yes' or 'No', while "Out of these two approaches for quitting smoking, which do you think would be more likely to help someone to quit?" had the response options 'Using e-cigarettes', 'Getting support from NHS stop smoking services' or 'Both equally likely'. This was dichotomised into those choosing SSSs as the most effective approach versus those choosing the other two responses. Finally, participants reporting previous SSS uptake were also asked "Overall, to what extent did you find the NHS stop smoking

service you attended helpful or not for your efforts to quit smoking?". Response options were 'Very helpful', 'Fairly helpful', 'Not very helpful' and 'Not at all helpful' which was dichotomised into the first two responses versus the final two.

We specified potential confounders *a priori* within our analysis plan. For smoking-related and sociodemographic variables, data were available from existing STS questions which use well-established classifications and scales. The 'Motivation To Stop Scale' (MTSS), for instance, asks "Which of the following best describes you?".(18) We coded 'intention to stop smoking' as 1 for any participants answering "I REALLY want to stop smoking and intend to in the next month", "I REALLY want to stop smoking and intend to in the next 3 months" or "I want to stop smoking and hope to soon" and coded it as 0 for anyone answering "I REALLY want to stop smoking but I don't know when I will", "I want to stop smoking but haven't thought about when", "I think I should stop smoking but don't really want to" or "I don't want to stop smoking". Similarly, we assessed nicotine dependence using the established 'Heaviness of Smoking Index' (HSI). This sums a smoker's categorised number of cigarettes smoked per day and the time they go between waking and having their first cigarette (the index ranges from 0 to 6, with higher scores indicating higher nicotine dependence).(19) The STS also provided our data on past year quit attempts via answers to the question "How many serious attempts to stop smoking have you made in the last 12 months?". We coded as 0 any smokers who reported zero attempts and coded as 1 any who reported one or more such attempts.

Sociodemographic variables were gender, age, ethnicity (which we dichotomised into white versus non-white) and social grade (which we dichotomised into ABC1 vs C2DE, with the former including managerial, professional and intermediate occupations, and the latter including small employers and own account workers, lower supervisory and technical occupations, semi-routine and routine occupations, never workers and long-term unemployed).

For interaction analyses, these measures were also combined with data on use of e-cigarettes, provided by the existing STS questions: "Which, if any, of the following are you currently using to help you cut down the amount you smoke?", "Do you regularly

use any of the following in situations when you are not allowed to smoke?" and "Can I check, are you using any of the following either to help you stop smoking, to help you cut down or for any other reason at all?". 'Dual use' of e-cigarettes and combustible tobacco was therefore classified as any respondent choosing 'Electronic cigarette' from the response options provided for any of these three questions.

Statistical analyses

Summary descriptive tables were created for the outcomes plus all other key variables. We then used logistic regression to conduct analyses of how past and planned SSS uptake varied by each knowledge/belief variable, after adjusting for smoking-related and demographic co-variables. First, unadjusted models (M1) examined the association of each knowledge/belief variable with each of the SSS uptake variables to provide crude odds ratios (ORs) with associated 95% confidence intervals. Secondly, final models were developed (M2) examining the adjusted association of each of the knowledge/belief variables on each of the SSS uptake variables, after adjusting for *a priori* variables (age, gender, ethnicity, social grade, intention to quit, past-year quit attempts and nicotine dependence), in order to produce final adjusted ORs with associated 95% confidence intervals.

We then used the M2 models to also examine interactions between each of the knowledge/belief variables and dual use of e-cigarettes or key sociodemographic variables (age, gender, ethnicity and socioeconomic status) on each of the SSS uptake variables. This involved developing different 'interaction' models, each model having the interaction term in question (e.g. 'thinks SSSs are convenient way to quit' x sex), which adjusted for all *a priori* variables (as in M2). Statistical corrections (such as Bonferroni or Siddak's) were not applied given these were exploratory analyses designed to inform hypothesis-generating for future studies. All analyses were undertaken as outlined in advance in our analysis plan (pre-registered on Open Science Framework, accessible at www.osf.io/ur3j8). SPSS v24 was used to conduct all analyses.

Results

Of the 2,313 participants interviewed, 2,189 (94.5%) provided complete data on our key co-variables (HSI, age and gender). Participants excluded as a result of missing data on these variables (5.0% due to incomplete HSI data, 0.4% for age data and 0.1% for gender) were significantly more likely to be male and not of white ethnicity ($p<0.05$) compared to those forming the final sample. Participant characteristics are shown in Table 1.

Table 1: Sample characteristics

	Study sample (n=2,189)
Demographic characteristics	
Age, Mean (SD)	43.5 (17.3)
Female, %	49.7%
White, %	90.0%
Social grade C2DE, %	56.7%
No post 16 qualifications, %	60.9%
With disability, %	17.4%
Heterosexual, %	87.4%
Region: North, %	32.2%
Central, %	29.7%
South, %	38.1%
Smoking characteristics	
Current tobacco use, %	100%
Current e-cigarette use, %	18.2%
Current NRT use, %	10.2%
Past SSS use, %	21.6%
Intended future SSS use, %	23.2%
Intention to quit smoking, %	33.1%
Past year quit attempt, %	29.9%
HSI Index, Mean (SD)	1.72 (1.51)

NRT: nicotine replacement therapy; SD: Standard deviation; North: North East, North West, Yorkshire & Humber; Central: East Midlands, West Midlands, East of England; South: London, South East, South West; HSI: Heaviness of Smoking Index (the higher the score, the higher the dependence on nicotine); Tobacco use only: current smokers of combustible tobacco with no current use of e-cigarettes or NRT

Out of 2,189 smokers, 21.6% had accessed a SSS in the past and 23.2% planned to do so in future. Results of analyses are shown in Table 2.

Table 2: Knowledge/beliefs and past or planned SSS uptake amongst current smokers

	Agreement with knowledge/belief statements		Ever use of SSS			Planned future use of SSS		
			% reporting SSS ever use (n)	*Model 1: OR (95% CI)*	*Model 2: AOR [3] (95% CI)*	*% reporting SSS planned use (n)*	*Model 1: OR (95% CI)*	*Model 2: AOR [3] (95% CI)*
E-cigarettes	Knows people who use e-cigs	No	14.6% (75/512)	1.00	1.00	16.6% (85/512)	1.00	1.00
		Yes	23.7% (397/1677)	**1.81 (1.38-2.37)**	**1.79 (1.35-2.38)**	25.2% (423/1677)	**1.69 (1.31-2.19)**	**1.43 (1.09-1.88)**
	Thinks e-cigs are convenient way to quit	No	21.0% (279/1327)	1.00	1.00	21.4% (284/1327)	1.00	1.00
		Yes	22.4% (193/862)	1.08 (0.88-1.33)	1.03 (0.83-1.28)	26.0% (224/862)	**1.29 (1.06-1.58)**	1.22 (0.98-1.51)
	Thinks lots of time needed to learn to use e-cigs	No	21.8% (428/1961)	1.00	1.00	23.2% (454/1961)	1.00	1.00
		Yes	19.3% (44/228)	0.86 (0.61-1.21)	0.77 (0.54-1.11)	23.7% (54/228)	1.03 (0.75-1.42)	1.03 (0.73-1.45)
	Knows how to use e-cigs	No	14.3% (91/637)	1.00	1.00	17.7% (113/637)	1.00	1.00
		Yes	24.5% (381/1552)	**1.95 (1.52-2.51)**	**2.01 (1.54-2.63)**	25.5% (395/1552)	**1.58 (1.25-2.00)**	1.28 (1.00-1.65)
	Thinks family & friends accept e-cig use [1]	No	28.9% (33/114)	1.00	1.00	35.1% (40/114)	1.00	1.00
		Yes	33.0% (93/282)	1.21 (0.75-1.94)	1.16 (0.70-1.91)	27.7% (78/282)	0.71 (0.44-1.13)	0.67 (0.41-1.10)
Stop smoking services	Knows people who have used SSS	No	14.3% (210/1471)	1.00	1.00	18.7% (275/1471)	1.00	1.00
		Yes	36.5% (262/718)	**3.45 (2.79-4.26)**	**3.39 (2.71-4.24)**	32.5% (233/718)	**2.09 (1.70-2.56)**	**1.59 (1.27-1.99)**
	Thinks SSSs are convenient way to quit	No	16.4% (170/1037)	1.00	1.00	12.5% (130/1037)	1.00	1.00
		Yes	26.2% (302/1152)	**1.81 (1.47-2.24)**	**1.73 (1.39-2.16)**	32.8% (378/1152)	**3.41 (2.73-4.25)**	**3.07 (2.43-3.87)**
	Thinks lots of time needed to access SSS	No	21.7% (352/1622)	1.00	1.00	24.9% (404/1622)	1.00	1.00
		Yes	21.2% (120/567)	0.97 (0.77-1.22)	0.96 (0.75-1.22)	18.3% (104/567)	**0.68 (0.53-0.86)**	**0.61 (0.47-0.79)**
	Knows how to access SSS	No	6.8% (37/541)	1.00	1.00	12.0% (65/541)	1.00	1.00
		Yes	26.4% (435/1648)	**4.89 (3.44-6.94)**	**4.66 (3.25-6.69)**	26.9% (443/1648)	**2.69 (2.03-3.57)**	**2.00 (1.49-2.68)**
	Thinks family & friends accept smoking	No	22.2% (199/896)	1.00	1.00	26.0% (233/896)	1.00	1.00
		Yes	21.1% (273/1293)	0.94 (0.76-1.15)	0.99 (0.79-1.23)	21.3% (275/1293)	**0.77 (0.63-0.94)**	0.86 (0.69-1.07)
	Thinks would have to travel far to use SSS	No	22.1% (419/1899)	1.00	1.00	23.6% (448/1899)	1.00	1.00
		Yes	18.3% (53/290)	0.79 (0.57-1.08)	0.72 (0.52-1.00)	20.7% (60/290)	0.84 (0.62-1.14)	0.89 (0.65-1.23)
	Thinks would be made to feel welcome by SSS	No	14.0% (91/652)	1.00	1.00	10.4% (68/652)	1.00	1.00
		Yes	24.8% (381/1537)	**2.03 (1.58-2.61)**	**1.99 (1.53-2.58)**	28.6% (440/1537)	**3.45 (2.62-4.53)**	**2.91 (2.19-3.87)**
	Found past use of SSS helpful [2]	No	N/A	N/A	N/A	20.8% (36/173)	1.00	1.00
		Yes				60.2% (180/299)	**5.76 (3.73-8.88)**	**5.61 (3.57-8.82)**
	Thinks dual e-cig/tobacco users eligible for SSS	No	20.8% (283/1359)	1.00	1.00	20.9% (284/1359)	1.00	1.00
		Yes	22.8% (189/830)	1.12 (0.91-1.38)	1.10 (0.88-1.36)	27.0% (224/830)	**1.40 (1.14-1.71)**	**1.32 (1.06-1.63)**
E-cigs vs SSSs	Thinks e-cigs are more effective than SSS	No	21.9% (406/1855)	1.00	1.00	25.1% (466/1855)	1.00	1.00
		Yes	19.8% (66/334)	0.88 (0.66-1.18)	0.85 (0.62-1.15)	12.6% (42/334)	**0.43 (0.31-0.60)**	**0.40 (0.28-0.57)**
	Thinks SSS are more effective than e-cigs	No	20.2% (287/1421)	1.00	1.00	17.9% (254/1421)	1.00	1.00
		Yes	24.1% (185/768)	**1.25 (1.02-1.55)**	**1.33 (1.06-1.65)**	33.1% (254/768)	**2.27 (1.85-2.78)**	**2.35 (1.89-2.93)**

[1] n=396, as question only asked to respondents reporting current use of e-cigs; [2] n=472, as question only asked to respondents reporting any past ever use of SSS; [3] Model 1 was unadjusted, while Model 2 controlled for demographic variables (age, gender, ethnicity, socioeconomic status) and smoking-related variables (intention to quit, past-year quit attempts, nicotine dependence)

In the final adjusted models (M2), two knowledge/belief variables related to e-cigarettes were associated ($p<0.05$) with both having accessed SSSs in the past and planning to do so in future: knowing people who used e-cigarettes (AOR 1.79, 95% CI = 1.35 to 2.38 for past uptake and AOR 1.43, 95% CI = 1.09 to 1.88 for planned uptake) and thinking that e-cigarettes were less effective than SSSs (AOR 1.33, 95% CI = 1.06 to 1.65 for past uptake and AOR 2.35, 95% CI = 1.89 to 2.93 for planned uptake). One further e-cigarette variable was associated only with past use of SSS: knowing how to use e-cigarettes (AOR 2.01, 95% CI = 1.54 to 2.63). Similarly, one such variable was associated only with planned SSS uptake: thinking dual users of e-cigarette and combustible tobacco users were eligible for SSSs (AOR 1.32, 95% CI = 1.06 to 1.63).

With regards to knowledge/belief variables related to the SSS themselves, four of these were associated with both having accessed SSSs in the past or planning to do so in future: knowing people who had used SSSs (AOR 3.39, 95% CI = 2.71 to 4.24 for past uptake and AOR 1.59, 95% CI = 1.27 to 1.99 for planned uptake); thinking that SSSs were a convenient way to quit smoking (AOR 1.73, 95% CI = 1.39 to 2.16 for past uptake and AOR 3.07, 95% CI = 2.43 to 3.87 for planned uptake); knowing how to access SSSs (AOR 4.66, 95% CI = 3.25 to 6.69 for past uptake and AOR 2.00, 95% CI = 1.49 to 2.68 for planned uptake); and thinking they would be made to feel welcome by SSSs (AOR 1.99, 95% CI = 1.53 to 2.58 for past uptake and AOR 2.91, 95% CI = 2.19 to 3.87 for planned uptake). Two further SSS variables were associated only with planned uptake: having found past use of SSSs helpful (AOR 5.61, 95% CI = 3.57 to 8.82); and thinking lots of time was needed to access SSSs (AOR 0.61, 95% CI = 0.47 to 0.79; NB: inversely associated, unlike the others).

In analyses of interaction effects, interactions ($p<0.05$) were observed in relation to several e-cigarette variables. These interaction analyses showed that for smokers in higher social grades the odds of having accessed SSSs in the past were associated with knowing people who used e-cigarettes (AOR 2.80, 95% CI = 1.70 to 4.60) but this was not the case for those in lower social grades (AOR 1.40, 95% CI = 0.99 to 1.98). Meanwhile, for smokers in lower social grades, odds of planned SSS uptake were negatively associated with the belief that e-cigarettes were more effective than SSSs

(AOR 0.23, 95% CI = 0.13 to 0.41), but this was not the case for those in higher social grades (AOR 0.67, 95% CI = 0.42 to 1.07). The odds of planned SSS uptake were also negatively associated with a belief that lots of time was needed to access such services with a larger negative association among smokers who were 'dual using' e-cigarettes with their combustible tobacco (AOR 0.34, 95% CI = 0.20 to 0.60) compared with those who were not (AOR 0.72, 95% CI = 0.54 to 0.96).

Further interaction effects were observed in relation to several SSS variables. The association between having accessed SSSs in the past and the belief that the SSSs were a convenient way to quit was greater for men (AOR 2.32, 95% CI = 1.65 to 3.27) than for women (AOR 1.39, 95% CI = 1.04 to 1.86). Conversely, intending to access SSSs in future and having judged past use of SSSs to be helpful was more strongly associated for women (AOR 8.40, 95% CI = 4.49 to 15.71) than for men (AOR 3.36, 95% CI = 1.73 to 6.51). Finally, the association between future SSS uptake and the belief that one would be made welcome by the SSSs was found to be greater for lower social grades (AOR 4.04, 95% CI = 2.67 to 6.12) than for higher ones (AOR 2.03, 95% CI = 1.36 to 3.03).

Discussion

Our study uses a large, nationally representative sample of the English population to generate evidence-based hypotheses in relation to an important research gap: what knowledge and beliefs influence smokers when deciding whether or not to access behavioural support, the most effective route available to quitting smoking.(1) Specifically, our results demonstrate that knowledge and beliefs about e-cigarettes and SSSs are often closely intertwined. In this discussion, we place these findings within the context of wider literature, to suggest possible explanations for these cross-sectional relationships, before suggesting hypotheses for future, larger studies to explore.

Our study marks an important quantitative contribution to a largely qualitative evidence base. To our knowledge, it constitutes the only quantitative study to date to examine how knowledge and beliefs about e-cigarettes may be influencing past or future uptake of behavioural support. It thus provides a first contribution to filling an important research gap, given ongoing debate as to whether e-cigarettes' popularity

could be depressing uptake of more effective routes to quitting.(12,15,16) Smokers in our adjusted analyses who reported having acquaintances who used e-cigarettes were more likely to have accessed SSSs in the past and to plan to do so in future, while past SSS use was also associated with reported knowledge of how to use e-cigarettes oneself. This result aligns with recent survey findings that exposure to other people's e-cigarette use may have some beneficial effects on smokers' quitting motivation and behaviour,(20) perhaps by normalising attempts to quit, as well as with broader research suggesting e-cigarettes are not viewed by smokers as being in competition with, or mutually exclusive from behavioural support.(21,22) Indeed, recent studies have indicated that both current and ex-smoking vapers have an appetite to access other forms of treatment such as behavioural support.(23,24)

Knowledge and beliefs about the SSSs themselves were also associated with past and future service uptake. In this respect, our study builds on qualitative findings about the importance of organisational and logistical barriers to service attendance.(8,10) We found, for instance, that perceptions of SSSs' convenience and of time commitments involved were significant influences on whether a smoker planned to attend the services. Our finding regarding the importance of the kind of welcome a smoker anticipates from SSSs also reinforces previous insights into how services need to promote themselves as being non-judgmental about people's smoking behaviours.(8,9) One previous mixed methods study has suggested that expectations of SSS effectiveness are a strong predictor of motivation to use these services.(25) Our own study expanded this to include comparative views on e-cigarettes, showing that believing SSSs were more effective than e-cigarettes predicted both past and planned use of the services.

Our analysis of sociodemographic interactions revealed two instances with clear differences between smokers from different socioeconomic backgrounds, where variations in smoking-related behaviours are common.(26,27) The fact that the association of past SSS uptake with knowing people who used e-cigarettes was significant only for smokers in higher and not lower social grades may reflect residual confounding around motivation to quit. We aimed to reduce the risk of such residual confounding by capturing the concept of 'intention to quit' as precisely as possible through the MTSS, an established scale frequently used for broader published analyses

of STS data.(18) Nonetheless, the finding may simply reflect the lower motivation to quit observed elsewhere among smokers from lower social grades,(20) and a similar greater willingness among higher social grade smokers to experiment with multiple quit aids or routes. Higher social grades appeared, after all, no less likely to plan to attend SSSs even if they believed e-cigarettes were a more effective option, perhaps suggesting this greater propensity to try different options.

Limitations of our study include the fact that causal relationships cannot be established through cross-sectional research, though exploratory analyses such as ours can nonetheless be influential in indicating directions of travel for future research. We also had to rely on self-reported data collected using new questions, as no validated survey tools existed on this particular topic. To compensate for this, our questions were developed with subject matter expert input and had their face validity tested in advance with a range of smokers who reported varying levels of vaping. Finally, future cohort study designs could follow up participants over time, to assess how far intention to access services translates into actual uptake. However, in the absence of such studies, reported intentions are the best proxies we have to establish future attendance, not least since meta-analytic evidence has demonstrated the direct, albeit attenuated link between changing intentions and changing behaviours.(28)

Our findings show that reported knowledge and beliefs about vaping have significant associations with planned SSS uptake, including the perception that dual users of e-cigarettes and tobacco are eligible for SSS support. From this, we can hypothesise that changing these beliefs about eligibility for SSSs - for instance through the provision of clearer information to the public about SSS eligibility criteria - may influence intentions to access these services. Furthermore, results suggest a hypothesis that social connections with other vapers may also be important in influencing knowledge of different quit routes and normalising quitting behaviour, perhaps through discussions with these friend and family ‘precedents’. This may in turn influence smokers’ own thoughts about quitting, including the intention of some to access SSSs.

Conclusion

In summary, current smokers' knowledge and beliefs about e-cigarettes and SSSs were often closely intertwined. Their plans to access behavioural support were associated with their vaping knowledge/beliefs (including their views on e-cigarettes' effectiveness and knowing people who vaped), as well as with their knowledge/beliefs about the support itself (included services' expected convenience, warmth of welcome and time commitments).

Interaction analyses suggested that, for some of these variables, differences existed between smokers of different sexes, social grades and levels of e-cigarette use. These findings suggest several hypotheses that have clear relevance for decision-makers, commissioners and practitioners alike, and thus merit testing by future studies. For instance, the extent to which vaping beliefs may have a bearing on service attendance will be of considerable interest across the smoking sector as they add weight to recent and repeated calls for SSSs to be 'e-cigarette friendly'.(12–14) More broadly, in the context of six years' of declining uptake,(4) SSSs will no doubt find this study and associated future research valuable for informing efforts to recruit more smokers through the doors of their highly effective services.

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Chapter 6: Research paper – Qualitative study of decisions to use e-cigarettes or behavioural support

6.1 Introduction

The fourth of my research papers is presented in this chapter. For this qualitative workstream, a series of semi-structured interviews was held with current and ex-smokers reporting a range of levels of e-cigarette use and a range of attendance histories at stop smoking services (SSSs). Concurrent interviews took place with SSS staff and key stakeholders in the same three geographic areas. The previous paper (Chapter 5) used quantitative evidence to assess specific psychosocial factors that could be influencing smokers' decisions on SSS uptake, including the potential role of knowledge and beliefs relating to e-cigarettes. This qualitative paper built on this through in-depth analysis of smokers' views on these issues, as well as through the incorporation of professionals' perspectives, thus enabling a richer understanding of many of the issues highlighted in Chapter 5. Furthermore, this workstream provided interviewees with opportunities both to introduce new viewpoints and to voice more nuanced opinions about some of the topics included previously in my survey questions. The data collected – in combination with Chapter 5 - therefore enabled me to address Objective C of this thesis: 'investigating, amongst English smokers *(the 'population')* what factors *(the 'exposures')* influence decisions to use either e-cigarettes or SSSs *(the 'outcomes')*, including the potential impact each can have on the other'. The paper here, entitled 'Understanding decisions to use e-cigarettes or behavioural support to quit tobacco: a qualitative study of current and ex-smokers and stop smoking service staff', at the time this thesis was examined, was in the process of being sent for peer review by the first journal approached, *Addiction.* It has subsequently been updated to incorporate minor corrections recommended by my Viva examiners. Supplementary material relating to this qualitative workstream is available at Appendices C to G.

6.2 Research paper cover sheet

The signed cover sheet for this research paper is included on the following page.

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Student ID Number	309900	**Title**	Mr
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Surname/Family Name	Hartwell		
Thesis Title	The attendance of e-cigarette users at stop smoking services: a mixed methods study		
Primary Supervisor	Prof Mark Petticrew		

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Stage of publication	**Submitted**

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Conceived and designed study; conducted data collection; conducted analysis; drafted manuscript. Supervisors MP & ME provided further guidance and input as required at each stage.

SECTION E

Student Signature	[redacted]
Date	01/05/19

Supervisor Signature	[redacted]
Date	01/05/19

Understanding decisions to use e-cigarettes or behavioural support to quit tobacco: a qualitative study of current and ex-smokers and stop smoking service staff

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Abstract

Aim To examine factors influencing current and ex-smokers' decisions to use e-cigarettes or behavioural support, including the potential impact of any differences in perspectives between smokers and their local stop smoking services (SSSs). **Design** Semi-structured qualitative interviews. **Setting** SSSs and surrounding local areas in England, UK. **Participants** Interviewees (n=46) were current or recent smokers (n=29) and SSS staff or stakeholders (n=17). **Measurements** Interview topic guides explored influences on smokers' choice of quit method and characteristics of support offered by their local SSSs. **Analysis** Principles of framework analysis were adapted, with the COM-B model of behaviour change used to frame findings. **Findings** Current and ex-smokers were similar to SSS professionals in showing a range of individual views on the potential risks of long-term vaping; findings informed the development of a 'vaping' typology. For smokers, these differing views on risk appeared to be motivating them to use (or not use) e-cigarettes while, for professionals, they seemed to be influencing the advice and support offered by SSSs in relation to e-cigarettes. Smoker and SSS interviewees differed, however, in their perceptions of whether local services provided information about e-cigarettes and whether they offered support to clients who had quit tobacco to then quit any ongoing addiction to e-cigarettes or NRT. Other important influences on smokers' uptake of quit aids included: cost considerations, past experiences and concerns about e-cigarettes/NRT maintaining nicotine addiction. **Conclusions** Smokers' decisions to use e-cigarettes and behavioural support appear to be determined by a range of influences. In particular, both smokers and SSS professionals display very varied views about the potential risks of e-cigarettes, which has relevance for the provision of behavioural support as well as the uptake of vaping. SSSs seeking to attract more 'dual users' of tobacco and e-cigarettes may use these findings to inform their recruitment efforts.

Keywords: Smoking, E-cigarettes, Stop smoking services, Behavioural support, Qualitative, COM-B

Background

The majority of adult smokers report a desire to quit and, between 2015 and 2019, around 30% attempted to do so in a given year (1,2). The UK stop smoking services (SSSs) were established in 1999 to provide pharmacotherapy and behavioural support to any smokers desiring additional assistance to quit. The services have been repeatedly evaluated and shown to increase a smoker's odds of success up to fourfold (3,4), yet their attendance rates have been dropping for six consecutive years, from 2012/13-2017/18 (5). In contrast, e-cigarettes are by far the most common aid used by UK smokers trying to quit (2), with an estimated 3.2 million adults now vaping, as of 2018, up from 700,000 in 2012 (6). The evidence base for e-cigarettes is inevitably still emerging however, particularly in relation to their effectiveness as quit aids and their health impacts for long-term users (7).

Service monitoring data and other SSS reporting suggest that smokers who combine behavioural support with e-cigarettes may have amongst the highest quit rates of all SSS users (8,9). There have thus been repeated calls by national bodies for SSSs to welcome smokers using e-cigarettes and to provide them with behavioural support (10,11). Many SSSs do now brand themselves 'e-cigarette friendly', but surveys of services in recent years have suggested that advice provided on e-cigarettes varies across England and that many individual practitioners continue to have concerns about recommending vaping (8,12–14).

While previous research has examined broad reasons for e-cigarette use amongst vapers (15–17), and – to a more limited extent – general influences on SSS uptake (18–20), there is currently little knowledge about how decisions to use e-cigarettes might relate to decision-making around accessing behavioural support. This is particularly important to understand in light of concerns that e-cigarettes could potentially undermine the uptake of more effective routes to quitting smoking, such as SSSs (5,21–23).

Models of behaviour change, which have always been integral to the SSSs' work (24,25), offer a useful way of understanding smokers' decision-making in this area. The Stages of

Change model, for instance, has long been influential internationally in smoking cessation work, despite systematic research casting doubt on its effectiveness (26). The COM-B model, part of the wider Behaviour Change Wheel framework (27), is now more favoured within the smoking cessation sector in the UK and beyond (28,29), and also underpins Public Health England's SSS commissioning guidance for local authorities (30). COM-B posits that behaviour is a product of motivation (reflective and automatic brain processes), capability (psychological and physical capacities), and opportunity (factors external to an individual). Previous research has demonstrated its applicability to the uptake of vaping and behavioural support respectively (28,31), as well as to smoking-related behaviours more generally (27).

This paper aims to examine factors influencing smokers' decisions to use e-cigarettes or behavioural support, including the potential impact of any differences in perspectives between smokers and their local SSSs. It uses the COM-B model to frame these factors thematically and to understand any inter-relations between them.

Methods

Ethical approval was received from an NHS Research Ethics Committee (REC), as well as the host university's REC. Data were collected through 46 semi-structured interviews in three sites with 29 current and ex-smokers and 17 SSS staff and stakeholders (stakeholders included local authority commissioners and public health consultants).

Interviews were conducted from October 2017 to August 2018 at three research sites in England, each comprised of an SSS and its corresponding catchment area (see Table 1 and Supporting information).[1] The three sites were selected for broad geographical diversity (North, Central and South England) as well as to capture a range of local SSS policies towards e-cigarettes, based on advice from a small number of national and regional smoking experts. Smoker interviews were conducted in participants' homes or a public place of their suggestion. Staff and stakeholder interviews were conducted at SSS premises or local authority offices.

[1] The 'supporting information' included with this paper when it was submitted to *Addiction* were the participant recruitment grid and topic guides, available respectively at Appendices C and G of this thesis.

Table 1: Participant characteristics

Smokers	*(n=29)*
Age (years)	
Mean (range)	43(18-67)
Gender	
Male	10
Female	19
Smoking	
Current	12
Ex	17
Vaping	
Current	12
Ex	5
Never	12
SSS use	
Current	6
Ex	11
Never	12
Staff & stakeholders	*(n=17)*
Gender	
Male	5
Female	12
Role	
Manager	3
Practitioner	9
Stakeholder	5

SSS staff provided flyers to service-using smokers who then contacted the lead researcher for further details if considering participating. Non-users of SSSs were recruited through snowball recommendations from service users or via local newspaper and Facebook advertising. Participants were eligible if they were currently using tobacco or e-cigarettes or had used either regularly within the previous 18 months. SSS staff and stakeholder interviewees were identified through discussions with service managers and staff members at team meetings. Participants all gave written informed consent to be interviewed.

All interviews were conducted in person by the lead researcher using a topic guide (Supporting information). The guide for smokers focused on potential influences on their use of e-cigarettes and SSSs; the guide for SSS staff and stakeholders explored the policy their SSS had in place regarding e-cigarettes and how this was translated into practice. All interviews were audio recorded before being transcribed verbatim. Total transcript time equalled 28 hours, 38 minutes: current and ex-smoker interviews lasted from 22-49 minutes (median 35), while staff and stakeholder interviews lasted from 23-

51 minutes (median 42), Participants were offered a £20 shopping voucher to compensate them for their time.

Data were analysed using the principles of framework analysis, which has been shown to be applicable for studying influences on the uptake of behavioural support and vaping (32–34), including the role health professionals may play in such decisions (35). Using the COM-B framework, we identified data from smokers about their 'motivation', 'capability' and 'opportunities' to access different quit routes. Data from SSS staff and stakeholders provided additional insights into factors influencing opportunities for quitting that lay within the services' control. A sample of transcripts were carefully examined in order to produce initial coding frames for the smoker and staff interviews respectively. These brought together deductive codes from the topic guides with inductive codes from the reviewed transcripts and were discussed and agreed within the research team. All transcripts were then coded line by line by the lead author within NVivo 12, with the two coding frames undergoing minor refinements as required during this process. Matrices were exported to Excel to facilitate visualisation of the dataset by codes and cases. The research team then discussed several iterations of the analysis to refine underlying themes and patterns. A typology relating to vaping behaviour was developed inductively and agreed during this process. Quotations are shown below from smoker (S) and SSS professional (P) interviews.

Findings

Influences on use of e-cigarettes

In relation to smokers' views and experiences of e-cigarettes, a simple typology emerged during data analysis (Table 2). Interviewees with recent, regular e-cigarette use split into 'Finite' and 'Forever' vapers. Forever vapers expressed no specific concerns about being addicted to vaping, nor a motivation to end that addiction. Finite vapers, in contrast, were motivated to quit vaping at some point in their lives (some were currently trying to do so, whilst others said they planned to quit in future); many had concerns that e-cigarettes could carry long-term health risks and that users were

essentially prolonging nicotine addiction. Non-vapers, meanwhile, split into those who were 'Sceptical' about people vaping and those who were 'Supportive' of this. Sceptical non-vapers expressed strong doubts about e-cigarettes' safety and addictiveness, reporting no intention to vape in future, while the Supportive non-vapers believed e-cigarettes to be safer than smoking and sometimes expressed future intentions to start vaping.

Table 2: Views expressed about vaping within different groups of interviewees

		Intention to stop vaping in future	Intention to start vaping in future	Concern about possible risks from long-term vaping	Belief that long-term vaping could carry even more risks than smoking	Concerns that vapers were still essentially addicts
Vapers	*'Finite'*	Yes	-	Mixed	No	Mixed
	'Forever'	No	-	No	No	No
Non-vapers	*'Supportive'*	-	Mixed	No	No	No
	'Sceptical	-	No	Yes	Mixed	Mixed

Current and ex-smokers who had used e-cigarettes regularly: 'Finite' and 'Forever' vapers

Alongside a difference in motivation to quit e-cigarettes (see Table 2), vaping interviewees showed varying confidence and willingness to use (what they perceived to be) evidence from experts to inform their assessments of risk. Although vapers in both groups believed that vaping was a safer choice *relative to smoking*, they differed in their perceptions of the evidence of *absolute risks* from e-cigarettes. Unlike Forever vapers, Finite vapers repeatedly expressed concerns about a perceived lack of definitive evidence on e-cigarettes, which seemed to make it hard to feel capable of establishing whether or not they were harmful. These concerns motivated them to want to quit vaping:

> *"I don't think I will vape long term because I still feel like there's not enough research about* it"
> (S1: Ex-smoker, current vaper, SSS user, female)

Finite vapers often also worried that vaping was, in essence, prolonging an addiction or introducing a new one:

> *"It got to one point I actually felt like I was addicted to my e-cig and cigarettes independently…and I couldn't, couldn't give either of them up."*
> (S15: Ex-smoker, recent vaper, SSS user, male)

Attitudes towards vaping were not solely informed by interviewees' considerations of risk and addiction, however. Across both groups of vapers, interviewees perceived e-cigarettes as effective for cutting down or quitting smoking. There were recurrent views that patience and experimentation with different models of e-cigarette were key to finding a model that matched personal preferences. Vape shops were sometimes seen as important and convenient sources of expertise on what model to try and how they might use it:

> *"I think it takes a bit of learning, what to do and how, but if you go to an e-cigarette vape shop then they'll explain everything and it's, I think it would be easier than going to the NHS Stop quitting service"*
> (S19: Current smoker, current vaper, non-SSS user, female)

The perception that vaping was less expensive than smoking was also identified as a factor that increased opportunities (through economic availability) and motivation for vaping amongst both Finite and Forever interviewees:

> *"The other factor if I'm honest was because cigarettes are just going to go on going up…I'm retired now, I'm on a pension and e-cigarettes are cheaper"*
> (S25: Ex-smoker, current vaper, non-SSS user, female)

Current and ex-smokers who had never used e-cigarettes regularly: 'Sceptical' and 'Supportive' non-vapers

Amongst the Sceptical non-vapers, perceived limited capability to make an informed choice about the health risks of e-cigarettes was again a recurring theme linked to different understandings and interpretations of – and confidence in – research evidence.

Like the Finite vapers, Sceptics expressed significant concerns about the lack of testing which had been undertaken on e-cigarettes' potential harms. Many even believed e-cigarettes could be *more* dangerous than smoking, sometimes attaching greater significance to the strength of evidence on a harm rather than the severity of the harm itself:

> *"I think it's very cleverly worded, all the [e-cigarette] posters, 95% safer than tobacco. But what about that 5% I think…Tobacco is not good but then you know where you stand with tobacco, done many research… Well yeah, it's got the links to lots of horrible diseases."*
> (S8: Current smoker, non-vaper, SSS user, female)

Sceptics tended to voice doubts, often based on their own experiences, about the effectiveness and cost-effectiveness of e-cigarettes as smoking quit aids. Several also echoed concerns of Finite vapers that e-cigarette use was not true quitting, sometimes likening this disapprovingly to harm reduction practices such as substituting heroin with methadone. They frequently maintained that vapers were fundamentally still smokers:

> *"You're not really quitting smoking, you're quitting smoking cigarettes, but you're still a smoker as such aren't you, because you're vaping?"*
> (S23: Current smoker, non-vaper, non SSS user, female)

In contrast, the Supportive non-vapers reported far more confidence in assessing the relative risks of vaping versus smoking, describing the difference between the two as 'black and white' or making clear statements such as:

> *"I think vaping is very much safer than tobacco and cigarettes"*
> (S6: Current smoker, non-vaper, SSS user, male)

Some even expressed an intention to take up vaping in future:

"I'm thinking of getting a vape, so I can still be included, and at break times go outside. It might sound silly, but it's like a social glue for me"
(S4, Ex-smoker, non-vaper, SSS user, male)

Influences on uptake of behavioural support

Current and ex-smokers

Factors influencing SSS uptake were largely similar across vaping and non-vaping interviewees. Motivation to use SSSs appeared to be closely linked to past use of such services: virtually all current smokers who expressed no future intentions to access SSSs had never accessed them previously. Conversely, interviewees who had accessed SSSs almost unanimously reported positive experiences, which appeared to be key incentives for those wishing to use them again. The benefits of one-on-one contact with an adviser were frequently cited, with SSSs often described as safe spaces, offering reprieves from the public judgment felt by smokers, as well as a sense of support and hope:

"You feel so warm going in. And they really inspire you… while you're in there you can actually believe. Sometimes I wish that I was just there all the time because then I wouldn't want to smoke".
(S6: Current smoker, non-vaper, SSS user, male)

The subsidisation of stop smoking pharmacotherapies was also cited as a key motivation for wishing to access SSSs:

"That's the only place where you're going to get it free. That plays a big factor for me, the fact that it was, the NRT was free, because it helps me financially."
(S2: Ex-smoker, vaper, SSS user, female)

For other interviewees however, and particularly those who had never accessed SSSs, the provision of pharmacotherapy acted as a de-motivating factor. There was sometimes an equating of SSSs with simply the distribution of nicotine replacement therapy (NRT) – i.e. without any concept of behavioural support around that – which

was therefore unappealing to those who perceived NRT as inappropriate for themselves. Concerns here echoed some of the distrust about e-cigarettes maintaining nicotine addiction, with several interviewees dismissing NRT from SSSs as a 'backward step':

> *"You get addicted to them, they're just as bad as smoking…that's what I heard so I never tried them."*
> (S26: Current smoker, recent vaper, non SSS user, male)

Some interviewees from the Sceptical group also emphasised self-reliance and cold turkey approaches to quitting. Getting SSS support was seen as 'giving in', as demonstrating a kind of 'victim' mentality, or as failing to confront your smoking problem 'internally'.

> *"I like to think I'm quite strong willed. So, I wouldn't want to, I don't know, I don't want to have to give in and have to go get help to quit, I'll do it on my own."*
> (S20: Ex-smoker, non-vaper, non SSS user, female)

In terms of their perceived capability to use behavioural support, many interviewees were confident that they could identify (e.g. through the internet) local SSSs to attend if desired. Interviewees sometimes reported feeling 'inundated' by SSS adverts 'everywhere', yet some had nonetheless not appreciated that such services would be available in their local area. Others suggested that awareness of a SSS did not always come with an acceptance of its relevance for themselves:

> *"I see it all in the notices around, it just never registered really…I've probably seen them all around and just dodged it"*
> (S11: Ex-smoker, current vaper, SSS user, female)

Participants' perceptions of their own time resources emerged as another common barrier to accessing SSSs, in terms of both the short-term waiting (e.g. on phone calls) involved in booking slots and the long-term waiting that could then be required before appointments were available. This issue could be interpreted both as one of opportunity

(since long waiting times are barriers to availability) and also capability (since interviewees differed in their tolerance of waiting). Some interviewees voiced frustration at making a decision to quit but then having to wait days or even weeks for appointments, which could also impact smoking levels in the meantime:

> *"In that time period I think, oh I've got two weeks now until I have to stop smoking, so if anything, I smoked more. Because I was cramming them in, knowing that I was actually going to stop smoking and the appointment was imminent".*
> (S14: Ex-smoker, non-vaper, SSS user, female)

Conversely, physical distance to travel to SSSs was rarely viewed as a restriction since people generally felt they lived close to available services.

Finally, in terms of SSSs' perceived incorporation of e-cigarettes, across all groups, smokers who had accessed SSSs generally did not feel their service was particularly forthcoming on the topic of vaping. Rather, they suggested a reticence about e-cigarettes from SSSs, reporting that practitioners either provided no information on vaping or only discussed the topic if smokers raised it themselves:

> *"They said, they wouldn't mention it to me, until I mentioned it... And, yeah, not too much was said about e-cigarettes".*
> (S4: Ex-smoker, non-vaper, SSS user, male)

When e-cigarettes were discussed, the small number of smokers who reported SSSs pro-actively introducing them to e-cigarettes had gone on to find vaping helpful. Interviewees across all groups also felt that ex-smokers who were now exclusively vaping ought to have opportunities to access SSS support for help to quit their e-cigarette use. Several vapers interviewed expressed an interest in accessing their SSS for this kind of support if their own efforts to 'wean' themselves off e-cigarettes failed:

> *"Maybe they'll have more information on how I could help me to stop the actual vaping… sometimes they have better ideas than you have yourself"*
> (S1: Ex-smoker, current vaper, SSS user, female)

SSS professionals

Table 3 summarises key findings from SSS professional interviews.

Table 3: Summary of SSS positions on e-cigarettes and individual staff views

		View service as 'e-cig friendly'	Eligibility of ex-smoking vapers for SSS support	Individual staff concerns about possible risks from long-term vaping
Staff and stakeholders	*Site A*	Yes	No	No
	Site B	Yes	Capacity-dependent	Mixed
	Site C	Yes	Yes	Yes

Across the three sites, interviewees reported eagerness to attract more dual users of tobacco and e-cigarettes to their services, yet the extent to which they felt able to publicise these opportunities to smokers varied between different areas, as did individual views on vaping. Site A interviewees described their service as "very enthusiastic" and "completely broadminded" about e-cigarettes and even as going beyond "the official line" in terms of their willingness to recommend them. Furthermore, no interviewees expressed reservations about advocating vaping. The manager, for instance, was explicit in supporting people using nicotine for pleasure and rejected the idea that vaping should also be curtailed at the point of quitting smoking:

> *"Some are still hung up on the idea of people using nicotine recreationally, so they'll come at it as it's OK just for quitting, but they must stop at the end of their 12 weeks. Well it's nothing to do with them, recreational nicotine is not the big demon that people imagine".*
> (P4: SSS Manager, Site A)

Site B interviewees described the SSS as "fairly enthusiastic" or "quite positive" about e-cigarettes, with the manager stating that the service was not as proactive about vaping as some other areas due to insufficient resources. Some interviewees there were wary about advocating e-cigarettes:

> *"Vaping isn't a longer-term solution, it's something that we hope will encourage people to, number one, avoid the harmful effects of tobacco but then also eventually stop smoking completely"*
> (P17: Council-employed public health consultant, Site B)

At Site C, although interviewees here as elsewhere often described their service policy as "e-cig friendly", all practitioners interviewed expressed some reservations about e-cigarettes encouraging continued nicotine addiction. One explained, for instance, that the team tended to advise people to vape outdoors partly because they felt this was less "habit forming". There were further differences across sites regarding how much opportunity for support SSSs offered to ex-smokers, now vaping, who wished to quit their e-cigarette use too. Site A reported that they would not formally help such people, since they were not funded to do so. Site B's manager reported that individual practitioners would help as far as able to if they had capacity, whereas Site C interviewees described such people as "totally eligible" for full support.

Across all three sites, staff reported routinely asking smokers about their knowledge or past use of e-cigarettes. Participants from each site also described explaining to smokers with bad experiences of vaping that they could consider trying other devices or flavours. Staff often depicted vape shop workers as sources of expert advice and even potential partners:

> *"They've tried something that their friend suggested and they haven't liked it so they've stopped. And so I said … there's so many … the work we wanted to do with shops was to almost have like a, when you go into a deli that people could try different flavours and different strengths"*
> (P11: SSS Practitioner, Site C)

Discussion

Our study found that both smoker and SSS participants reported a range of individual views on the potential risks of long-term vaping; these appeared to be key factors influencing – for smokers – their use of e-cigarettes, and – for services – the scope of

advice and support they provided in relation to e-cigarettes. Conversely, the two groups differed in their perceptions of how much opportunity services were providing for educating smokers about e-cigarettes and for helping with ongoing nicotine addiction after quitting smoking. Further important influences reported by smokers on their use of e-cigarettes often overlapped with influences on their use of SSS.

Capability

The range of views amongst current and ex-smoker interviewees on potential risks from long-term vaping underpinned our typology and appeared to be particularly relevant for the capability dimension of the COM-B framework. The different attitudes towards vaping we observed appeared to be linked, for instance, to variations in people's perceived capability to assess the risks of e-cigarette use, which caused particular concerns for Sceptical non-vapers. This study thus provides qualitative insights into quantitative findings on harm perceptions that have previously indicated a lack of evidence on e-cigarettes as a leading concern of smokers, especially among never-vapers (36). As interviewees from this Sceptical group had generally not accessed SSSs, where information on relative harms is provided, there appears to be a need for credible, consistent communication to non-service attending smokers about the likely size of risk reduction seen with e-cigarettes versus smoking. This could in fact be welcomed by smokers, given previous research showing appetite among them for such information (31).

Evidence of risk was not the only form of knowledge shown to influence vaping, however. Understanding different e-cigarette devices and practices was also regarded as important for facilitating vaping. Indeed, some vapers echoed the widespread view among SSS staff that vape shop workers were 'experts' on these issues who should be consulted (interestingly, neither group of interviewees expressed concerns about potential associated conflicts of interests).

Opportunity

Our findings suggest that opportunities to access SSSs, for ex-smokers who are now regular vapers, may be being influenced by different e-cigarette policies adopted in individual areas. SSS interviewees at all sites described their services as 'friendly' or 'welcoming' to smokers who wished to use e-cigarettes to quit. Our study supports previous research however (8,12–14), in observing ongoing hesitancy amongst many staff towards e-cigarettes, as well as variability in support for ex-smoking vapers. SSS interviews suggested that the level of support provided to these vapers reflected not just publicly stated service-wide policies but also individual practitioners' own views on risks from long-term vaping. This could of course deter Finite vapers, who wish at some point to end their nicotine addiction, from seeking help from local SSSs. It also marks a clear contrast to our smoker interviews where views were expressed, across all groups in our typology, that such vapers should be eligible for some form of structured support to quit their e-cigarette use.

There appeared to be further disconnects between the perceptions of SSS staff that they were open and forthright about e-cigarettes, and the reported experiences of smokers who had used these services. This suggests that SSS attitudes towards e-cigarettes, as well as being diverse, are not always being communicated fully to service users. This variability in advice is of course understandable though given that services have been grappling with how to incorporate an unlicensed but unprecedentedly popular quit aid into their service alongside traditional licensed pharmacotherapy.

Finally, distance to travel to services, unlike an earlier study (18), was not reported as a barrier, which may have reflected the predominantly urban catchment areas of two of our SSSs. Perceptions of available time, as observed elsewhere (18), often appeared to be a more pressing potential barrier though, as well as occasional misunderstandings of what an SSS involved and the fact that services were available locally.

Motivation

Motivations for using or avoiding e-cigarettes and SSSs often appeared to overlap, which may be of interest for SSSs' efforts to attract 'dual users' of tobacco and e-cigarettes. For instance, contrasting attitudes towards both e-cigarettes and the NRT provided by SSSs often reflected views on whether switching from smoking to these alternatives represented a successful quit or simply maintenance of nicotine addiction. Consistent advice on this issue would thus be helpful, particularly as even SSS staff hold contrasting views that inform practice. In particular, SSSs may wish to offer clearer reassurances to prospective clients about what support they can provide – following successful quitting of tobacco – to then wean ex-smokers off any nicotine-containing products (such as e-cigarettes or NRT) they transition onto. In this respect, our typology may be useful for practitioners when assessing the attitudes and specific goals of each smoker in relation to ongoing nicotine use.

Motivation to vape also appeared, as found by others (37), to be influenced by interviewees' own positive or negative experiences of vaping, just as motivation to use SSSs was usually linked to interviewees' reported accounts of previous service use. This is unsurprising given interviewees who had attended SSSs were almost unanimous in finding the experience positive and helpful, even if they had not ultimately quit tobacco.

Limitations and strengths

Our study has some limitations. Data were collected from only three research sites all within the UK and, as such, findings are not necessarily generalisable to other settings. While COM-B was a helpful framework for analysis, we faced challenges, similar to previous research (31), with some issues that could not be neatly categorised as 'capability', 'motivation' or 'opportunity', but rather involved multiple concepts. Repeat/longitudinal interviews could show more definitively how individual smokers' behavioural support uptake and vaping interrelated over time. We did however benefit from studying SSSs in three separate regions, since previous similar research has focused on single areas (38–40). Furthermore, all interviews were conducted using a

single consistent interview method (face-to-face) rather than incorporating phone interviews, as in these earlier studies.

Our proposed typology aligns to some extent with one previously proposed in this area which sorted e-cigarette users into groups termed 'vaping as pleasure', 'vaping as medical treatment' and 'ambivalent e-cigarette use'(41). In particular, broad similarities are shared between the first group and our Forever vaper category, as well as the second group and our Finite vapers. Our own typology benefited, however, from expanding beyond vapers to incorporate all smokers, thus giving it wider relevance for SSS practitioners. To our knowledge, this is also the largest study of its kind to combine interviews with smokers and their local SSS staff. As such, results are likely to be valuable to SSSs while informing future research on decision-making around smoking cessation routes.

Conclusion

SSSs seeking to attract more dual users of tobacco and e-cigarettes may wish to use these findings to inform their recruitment efforts. Services should also consider whether they can offer clearer reassurances to prospective clients about any support they provide – following successful quitting of tobacco use – to then wean ex-smokers off nicotine-containing products they may transition onto. In this respect, the typology outlined may be useful for quickly assessing the attitudes and specific goals of individual smokers in relation to ongoing nicotine use. Finally, findings suggest varying approaches being taken – often as a result of capacity/cost pressures – towards the eligibility of ex-smoking vapers to access SSSs. Vapers who wish to end their ongoing nicotine addiction may therefore have greater options for support with this in some parts of the country than others.

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PART III: DISCUSSION

Chapter 7: Discussion and Conclusion

7.1 Introduction

This thesis aimed to investigate whether the use of e-cigarettes amongst smokers could influence their use of stop smoking services (SSSs) and, if so, how this was occurring. In order to achieve this aim, it had the following objectives:

- Objective A: To understand, within English smokers *(the 'population')*, how use of e-cigarettes *(the 'exposure')* varies across sociodemographic groups, and to consider this in relation to existing data on how use of SSSs *(the 'comparator')* varies across the same population [i.e. In summary, how is e-cigarette use *(the 'exposure')* patterned across society compared to SSS use *(the 'comparator')*?];
- Objective B: To investigate whether, amongst English smokers *(the 'population')*, use of e-cigarettes *(the 'exposure')* is associated with use of SSSs *(the 'outcome')*, including in comparison to NRT use *(the 'comparator')* [i.e. In summary, is e-cigarette use *(the 'exposure')* associated with SSS use *(the 'outcome')*?];
- Objective C: To investigate, amongst English smokers *(the 'population')* what factors *(the 'exposures')* influence decisions to use either e-cigarettes or SSSs *(the 'outcomes')*, including the potential impact each can have on the other [i.e. In summary, what factors *(the 'exposures')* influence e-cigarette or SSS use *(the 'outcomes')*?].

7.1.1 Objective A: "How is e-cigarette use patterned across society compared to SSS use?"

I first addressed Objective A by conducting a systematic review to examine an important research gap around which sociodemographic groups were most likely to be aware of e-cigarettes, to have tried them ('ever use') and to be regularly using them ('current use'). No geographical or time restrictions were imposed on my searches of 7 electronic databases, as well as the wide trawl of grey literature sources. A total of 4,985

titles and abstracts were screened, followed by 335 full texts, leading to 58 studies being included. Existing data were already available on the sociodemographic groups that were most likely to use SSSs given routine data collection by services had provided statistics on this for several years.(1) This Discussion chapter builds on the literature review in Chapter 2 to place my systematic review findings from Chapter 3 within the context of what is already known about sociodemographic differences in SSS uptake.

7.1.2 Objective B: "Is e-cigarette use associated with SSS use?"

My quantitative workstream collected cross-sectional survey data from over 2,000 smokers through new questions added into UCL's existing Smoking Toolkit Study (STS). This addressed Objective B by assessing associations between e-cigarette use and past or planned uptake of SSSs. Sociodemographic differences were furthermore examined by including interaction terms as part of this work.

7.1.3 Objective C: "What factors influence e-cigarette or SSS use?"

The STS data also provided evidence towards Objective C, since several of my survey questions collected information about knowledge and beliefs - including in relation to e-cigarettes - that could be influencing smokers' SSS attendance. My qualitative workstream then involved 46 interviews with current and ex-smokers, as well as SSS professionals, at three research sites in order to further address Objective C. Interviews with the current and ex-smokers provided rich qualitative insights into influences on their decision-making regarding these quit routes, such as the central importance of perspectives about the potential harms from vaping. Interviews with professionals, meanwhile, highlighted how both their services' formal policies and their own views on e-cigarettes could be influencing the attendance of different potential client groups.

In this discussion, I first provide a summary of the findings relating to each objective, drawing out additional insights and examining how the quantitative and qualitative results relate to each other. Findings are situated in the context of previous studies, while research, policy and service implications are also considered. Finally, the chapter provides a conclusion to the thesis as a whole.

7.2 Summary of findings and comparison with existing literature

7.2.1 Objective A: "How is e-cigarette use patterned across society compared to SSS use?"

Sociodemographic differences in e-cigarette use

My systematic review (Chapter 3) marked an important contribution to understanding in this area, since it essentially constituted the first comprehensive review and synthesis of the global literature on which sociodemographic groups were using e-cigarettes more than others. Across the 58 studies that met the inclusion criteria, there was variability in social patterning of the outcomes within and between countries, but some clear findings emerged. Across all outcomes, e-cigarettes appeared to achieve greater reach among older adolescents and younger adults, males and people of white ethnicity. For awareness and ever use, this was also the case for subpopulations with relatively higher educational attainment. The only previous review in this area also identified higher rates of e-cigarette use amongst young adults but found no clear patterning by race/ethnicity or education levels.(2) This earlier review included far fewer studies, however, due to less comprehensive searches, and also did not incorporate any critical appraisal within its methods. My paper was therefore the first rigorous systematic review to tackle this question.

In terms of research published subsequent to my review, a 2018 Australian online survey (n=1,116) has echoed my findings in concluding that young males are particularly likely to be regular vapers, while similarly observing no associations with socioeconomic status (SES, which the authors calculated from participant's postcodes using the Australian 'Socio-Economic Indexes for Areas [SEIFA] classification').(3) Recent US studies in this area have also indicated that the association I found between ever e-cigarette use and higher education may now be extending to current use. Friedman and Horn, for instance, found in a 2018 analysis of 50,000 25 to 54 year olds that more educated smokers were more likely to have switched to exclusive e-cigarette use than less educated ones.(4) Similarly, Glover et al. found current use of e-cigarettes to be greatest in respondents with college-level educational attainment in 2018,

compared to lower educated groups.(5) As the Discussion section of my systematic review suggests, early adopters of technologies are known to be generally more likely to come from younger age-groups and to have higher education levels and SES.(6) It could therefore be expected that such groups would also be likely to be the first in society to move from ever use to current use.

In terms of the specific picture for the UK, at the time of my review there were only limited data on e-cigarette use by sociodemographic groups. Studies included in the review that had solely UK samples were all graded by the critical appraisal process as being in the lowest quality group, barring one high quality study of 1,601 children from Wales, which found no significant differences in ever use of e-cigarettes by gender or SES.(7) The low quality studies generally found no significant differences between sociodemographic groups for the outcomes they considered, with the exception of: a small study of 256 SSS attendees in Liverpool that observed greater current use of e-cigarettes in females; a large British study (n=12,432) that found greater ever use in younger adults than older ones; and a separate study of British adult smokers (n=4,117) that identified greater ever use amongst higher socioeconomic groups.(8–10) The last of these findings was supported at the time of my review by longitudinal English data showing a clear socioeconomic gradient of higher e-cigarette use amongst more affluent groups.(11) This same dataset from UCL showed no clear associations with age but suggested marginally higher rates in women than men.

As outlined in Chapter 2, more recent English data was brought together in Public Health England's (PHE's) 'Vaping in England' report.(12) This concurs with the overall findings of my systematic review in showing that, across all four of the surveys it included, e-cigarette use was higher in men and amongst 25-34 year olds. The other sociodemographic variable explored in the PHE report is SES. Here, the four surveys - despite using different measures - broadly align in showing vaping rates to be greater amongst lower socioeconomic groups, with the biggest users being the 'lower supervisory and technical occupation' category. Interestingly, this clear association with SES was not apparent across the overall literature included within my systematic review and is in contrast to the two British studies identified in my trawls, which suggested either no associations with SES or that ever use was greater amongst higher

socioeconomic groups.(7,9) It is also in contrast to the more recent American studies outlined above.(4,5) Two explanations seem plausible. Firstly, the triangulation of four datasets within the PHE report may have more closely approached the 'underlying reality' in England than the limited sources available at the time of my review, particularly since the latter were of variable quality according to the review's grading system. Yet it also possible that the PHE findings reflect the development of the vaping market in the intervening years (which has clearly become more saturated now that e-cigarette uptake has plateaued in the UK),(11) as well as the characteristic 'diffusion of innovation' process - mentioned above - that one expects from a new technology like e-cigarettes. So while the early innovators in this case may have tended to be from higher SES or higher educational backgrounds, as time has gone on, later adopters from lower SES or lower educational backgrounds may have begun to dominate the market. Given the high proportion of vapers who are also still using tobacco,(11) it would thus be unsurprising that vaping prevalence now reflects the established inverse relationship between smoking and socioeconomics.(13) The US, however, may well be 'lagging behind' the UK on the innovation diffusion curve, given the much more conservative regulatory approach being taken there and the strong warnings about e-cigarettes that have been voiced by some of their most prominent public officials, including the Surgeon General.(14,15)

Sociodemographic differences in SSS use

In terms of how these data correspond with sociodemographic uptake of behavioural support, the picture is a complex one. International literature is limited, but one 2008 US study found that uptake of behavioural support was more likely amongst smokers with higher SES and education levels.(16) UK research does not echo this, however. A 2009 study of STS data did not find a significant socioeconomic gradient in the use of SSSs, with the authors hypothesising that this may have been in part due to the subsidisation of pharmacotherapies in the UK, which is not mirrored in the US.(17) A rigorous evaluation of the first ten years of SSSs' work meanwhile found that they had been "successful in reaching economically disadvantaged smokers, with more than half of those treated being eligible for free prescriptions" (SSSs also improved their balance between male and female smokers during this time and attracted an increasing proportion of smokers from ethnic minority groups).(18) A previous systematic review

highlighted two observational studies which similarly showed that SSSs were used by a greater proportion of smokers from lower SES areas than higher ones.(19–21) Meanwhile, STS data analysis has historically shown no difference in quit attempts by SES but has found a significant social gradient in the success of quit attempts, with much higher quit rates being observed for smokers from higher social grades in 2012 (20.4% vs 11.4% for lower social grades).(13) Part of the explanation may be, as Hiscock et al. posit, that the features of behavioural support (the most effective quit route a smoker can take) may favour high SES groups, for instance through referral processes or the timing and design of treatment programmes.(13,22) Lower SES smokers have also been shown to be less likely to complete courses of smoking cessation pharmacotherapies and programs of behavioural support, so adherence to treatment will surely be another factor in these observed socioeconomic differences.(22–24)

In terms of the current picture in England, as outlined in Chapter 2, NHS Digital's most recent data (2017/18) show that the 'routine and manual' group of smokers are comfortably the most likely socioeconomic group to record a quit *attempt* with SSSs, while 45-59 year old smokers are the most likely age group to make an attempt (followed by 18-34 year olds).(25) Women are more likely to attempt quitting than men and - as would be expected given the UK's overall population demographics - white smokers are by far the biggest users of SSS support. Yet there are striking gender differences within ethnic groups, as around 80% of the Asian or Asian British group who attempt to quit are male, compared to only around 40% of white service users. In terms of rates of *successful* quits, the picture is very different. Men outnumber women on this measure, for instance, while Asian or Asian British smokers are the ethnic group most likely to succeed in quitting. Quit rates furthermore increase with increasing years, with the over 60s thus being the most successful group. With regards to socioeconomics, retirees are the most likely smokers to quit, with the 'never worked or long term unemployed' group being the least successful, despite recording the second highest number of attempts.(25)

Comparing the sociodemographics of e-cigarette use and SSS use

Table 1 presents a broad summary of the most recent English data available regarding which sociodemographic groups are currently the main users of e-cigarettes and SSSs

respectively.(12,25,26) This sets the most recent data compiled in the 2019 PHE 'Vaping in England' report alongside the latest NHS Digital SSS monitoring data (2017/18) and the findings of my systematic review in Chapter 3. These data sources are presented together for ease of reference, but it is important to point out that my own review findings were based on a synthesis of global literature (and showed that minimal studies with English samples had been published at that point in time), whereas the data shown from the other two sources in the table has a specifically English scope.

Table 1: Summary of latest data on sociodemographic subgroups reporting highest current use of e-cigarettes and stop smoking services

Sociodemographic factor	E-cigarettes		Stop smoking services
	Hartwell et al. 2016 review	*PHE 2019 report*	*NHS Digital 2018 data*
Age	Young adult	25-34 years	45-59 years
Gender	Male	Male	Female
Socioeconomic status	Insufficient data	Lower SES	Lower SES
Ethnicity	White	Insufficient data	White

Data sources: Hartwell et al. 2016 review;(26) PHE 'Vaping in England' report;(12) and NHS Digital statistics.(25)

Taken together, these sources suggest some important differences in the appeal that e-cigarettes and SSSs may be holding for various groups of smokers. With respect to gender, men are more likely to be current smokers than women (16.4% vs 12.6%),(27) and the PHE report's most recent English data from 2018 support the findings from my systematic review that e-cigarettes appeal to men more than to women, but the opposite appears to be true for SSSs within the NHS Digital 2017/18 data.(12,25) E-cigarettes also seem to have a greater appeal to younger adults (25-34 year olds), which may reflect this being the age group with the highest smoking rates overall, whereas SSSs' main client base is the 45-59 year old age group. There appear to be broader similarities between the two quit routes in terms of the ethnicities and socioeconomic statuses of their users, however. While UK-specific data regarding ethnicity were extremely limited within my systematic review (the single small, low quality study included found no significant differences in e-cigarette current use between different ethnicities),(8) the review as a whole showed higher prevalence of ever and current use amongst people of white ethnicity, which is also the ethnicity that makes up the

substantial majority of SSS users; most current smokers in England are, after all, of white ethnicity, which in turn reflects the overall population structure of a country which was approximately 81% 'White British' at the last census.(27,28) In terms of socioeconomics, lower income groups appear to now be the most likely to use both SSSs and e-cigarettes respectively, as of 2018. These associations are of course probably driven in large part by the inverse social gradient seen in smoking prevalence, since 'routine and manual' is also the socioeconomic group whose members are most likely to be current smokers.(13,27) Importantly though, these lower socioeconomic groups are not necessarily the ones having the most success with breaking their addictions in either case. As shown above, despite the high attendance rates seen at SSSs in 2017/18 from lower income smokers, it is the 'never worked or long term unemployed' group that fares worst in terms of successfully quitting, a relationship observed in STS analyses as well as NHS Digital's routine data.(13,25) For e-cigarettes, as stated in Chapter 2, the 'Vaping in England' PHE report suggests that:

> *"The social gradient of vaping in long-term ex-smokers may suggest that those from higher social groups are using EC [e-cigarettes] to quit smoking and then stop use while those from more disadvantaged groups continue use"*.(12)

As the authors point out, this will need to be monitored closely in the future as it has the potential to either narrow or exacerbate health inequalities depending on whether e-cigarettes prove in the long-run to be protective (or not) against smoking relapse.

7.2.2 Objective B: "Is e-cigarette use associated with SSS use?"

Associations between e-cigarette use and SSS uptake

The manuscript for my first quantitative paper (Chapter 4) shows how this objective was addressed through the analysis of data from new questions added into the existing STS survey for the purposes of this PhD. Notably, the paper represents the first national survey to examine concerns that the availability of e-cigarettes could undermine future uptake of behavioural support, the most effective route to quitting tobacco.(12,29-30) In summary, the 'dual users' of tobacco and e-cigarettes were in fact significantly more likely than other smokers to report both having accessed SSSs in the past and intending

to take up these services in the future. The same was true of 'dual users' of tobacco and nicotine replacement therapy (NRT).

In particular, the examination of *future* intentions to access SSSs makes my paper unique. The limited research in this area to date has generally focused on past use of SSS,(31,32) yet future attendance intentions are also crucial to understand given their relevance for the long-term viability of these struggling services. Reported intention does not necessarily translate into future action, of course, but it is the best available proxy and can provide valuable insights for efforts to change behaviour and improve health outcomes. In Fishbein's words, "the single best predictor of whether or not a person will engage in a particular behaviour is his intention with respect to that behaviour".(33) Indeed, meta-analytic evidence has subsequently demonstrated the partial but direct link between changes in intentions and changes in behaviours.(34)

As outlined in Chapter 4, two previous studies, one from the UK (2016) and one from the US (2018), although inconclusive, have not identified associations between e-cigarette use and past uptake of behavioural support.(31,32) The one exception was dual users of tobacco and e-cigarettes aged 65+ years in the US study who were more likely than non e-cigarette users to have accessed such support.(32) My findings suggest a broader positive association between dual tobacco/e-cigarette use and past SSS uptake than these studies. They also indicate that e-cigarettes are similar to NRT in this respect, with both being markers of a greater likelihood of having accessed SSSs in the past and planning to do so in future. As described in my results paper, there are a number of possible explanations for these associations. They may reflect, for instance: a broader willingness amongst these 'dual users' to try different quit methods; an educative or motivational effect from previous encounters with SSSs; a positive influence from e-cigarette experiences on quit intentions; or similar financial considerations influencing both e-cigarette and SSS uptake. The divergence from the findings of the two previous studies could meanwhile reflect the different study designs, settings (in the case of the US study) or the fact that my data collection was two years more recent than theirs, a sizeable timeframe in the context of an ever-shifting technology. Perceptions of e-cigarettes amongst both smokers and the general public are, after all, far from stable and our more recent data may potentially reflect a slowing

in public enthusiasm towards e-cigarettes. STS data shows, for instance, that e-cigarette use for quitting peaked in 2016 (a year after these previous studies' data collections ended), and that declining amounts of smokers believe that vaping is safer than smoking.(11) UK smokers may still use e-cigarettes more than other quit aids,(11) but the initial explosion in demand certainly seems to have waned, and claims that the country is still "hopelessly smitten" with e-cigarettes do not seem credible.(35)

Given this apparent 'cooling off' towards e-cigarettes shown by STS data, our findings may therefore reflect an increasing inclination amongst dual users to buttress their vaping with other smoking cessation options. There may also be a socioeconomic dimension within this too. Smokers from lower socioeconomic groups are the most likely to access SSSs,(25) while - as outlined above - it has also been posited that vapers from such backgrounds are the ones most likely to struggle to quit ongoing e-cigarette use.(12) The apparently increasing levels of scepticism towards e-cigarettes may therefore be partly driven by those smokers from lower socioeconomic groups who have found it harder to quit vaping and also have fewer ex-vapers in their social circles. The increased odds of SSS uptake for dual e-cigarette/tobacco users may therefore reflect lower socioeconomic groups' increased likelihood of accessing SSS, as well as their potentially increased likelihood of disenchantment with e-cigarettes. My interaction analyses did not record a significant difference in this area, however, so this may be too speculative.

Sociodemographic differences in associations

Interaction analyses in fact suggested there were no major differences between sociodemographic groups for these outcomes with the single exception of gender when examining the association between dual use of tobacco/NRT with future SSS uptake. Among females, such dual tobacco/NRT use increased their odds of intending to access a SSS in future (AOR 3.40, 95% CI = 2.19 to 5.28), whereas this was not evident in males (AOR 1.45, 95% CI = 0.90 to 2.35). It is not obvious how to interpret this. One plausible explanation relates to the facts that: a) female smokers are more likely to access SSSs overall than males ones; and b) NRT can be obtained either from a SSS or elsewhere (e.g. via a GP or over-the-counter).(25) The interaction observed could therefore simply reflect the fact that female smokers in any given sample are slightly more likely than

male users: a) to be in the midst of SSS behavioural support programs (such smokers would probably have reported a future intention to access SSS use since we did not include a specific question for current/ongoing SSS use); and b) to have obtained any NRT from a SSS rather than elsewhere. Whatever the explanation may be though, it is a finding that does not appear to have particularly evident research or policy implications.

7.2.3 Objective C: "What factors influence e-cigarette or SSS use?"

For my qualitative workstream, I conducted semi-structured interviews with current and ex-smokers, as well as SSS professionals in the same geographic areas. Analysis was based on the principles of framework analysis.(36) Framework analysis is a type of thematic analysis which has already been shown to be fruitful for previous studies into influences on smoking cessation, including those comparing professional and patient/client perspectives.(37–39) It has the advantage over grounded theory of giving researchers opportunity to examine concepts that are already of particular interest, based on previous relevant literature, while still allowing scope for themes to emerge inductively from transcripts.(36,40) It is often linked to quantitative work and is particularly suited to 'policy relevant' research such as my own where objectives need to be set in advance to obtain funding.(41) Perhaps most importantly though, its pragmatic, matrix-based techniques are ideal for projects like mine, in which qualitative data from different groups of interviewees need to be compared and contrasted (for instance, my comparisons of the perspectives of smokers and SSS professionals, or of SSS professionals in different geographical areas).(36)

I situated my findings within the widely-recognised COM-B framework of behavioural change. This thesis was focused on both past behaviour in relation to tobacco quit routes and future intended/envisaged behaviour in this same area, and there are clearly a complex range of factors that influence such behaviour. While these can be conceptualised or categorised in different ways, COM-B was identified at the outset of my programme of research as the most persuasive and robust model of behaviour change in this field. Yet COM-B proved much more fruitful in relation to this PhD's qualitative workstream than its quantitative one.

While COM-B informed the development of the survey questions asked through the quantitative work, these were primarily influenced by close reading of the relevant scientific literature in this area, followed by input from subject matter experts and my PhD supervisors. While all my final questions arrived at could arguably be fitted into the COM-B model, this felt like it would be rather forcing the data, as questions often seemed to straddle more than one of the capability, opportunity and motivation categories. To take an example, the question about 'knowing people who use e-cigarettes' could be relevant to motivation (since hearing about peers' positive or negative experiences with e-cigarettes could make someone more or less interested in trying vaping themselves), but it could also relate to a person's capability (since seeing other people using e-cigarettes will confer some knowledge about how to use these devices and which ones to opt for). Similarly, it even has implications for opportunities to vape (since people who have peers that use e-cigarettes will get more opportunities to 'have a try' on someone else's device than people without vaping peers). Attempting to categorise the questions in this way therefore seemed to be a rather subjective process and one which did not add any obvious utility for my quantitative analysis or the presentation of those findings. Rather, I found that it was sufficient and more logical for the purposes of my quantitative work to simply split my analysis into factors that could potentially influence smokers' use of e-cigarettes and those that could potentially influence their use of SSSs; given this workstream's tight focus on a small number of survey questions, attempting to break down the limited number of factors further by capability, opportunity or motivation could have made the presentation of the results more bitty and confusing for readers.

On the other hand, the COM-B model proved of clear value for my qualitative workstream where, by employing it to structure my findings, I was able to categorise logically the diverse array of influences on their decision-making that were reported by smokers. It also provided a coherent conceptual framework for analysing the SSS professional interviews alongside the smoker ones. While there were still a few occasions where it was not possible to fit a concept neatly into just one of the three capability, opportunity or motivation categories (as highlighted explicitly at points in Chapter 6's paper), this process did prove feasible and helpful in a way that it simply did

not with the quantitative work. It was far easier, for instance, to ascertain from direct quotations and their context within a broader interview which category a concept truly belonged in, given this workstream was dealing with richly nuanced interview data as opposed to fixed survey question responses. COM-B was thus employed specifically during the mapping and interpretation phase of my qualitative analysis as a means of categorising my findings. I wanted to integrate COM-B only towards the end of the analytical process in this way, since this approach avoided the risk of my analysis being constrained or directed too much by a pre-existing model, plus my paper was not designed to be an interrogation of the COM-B model itself.

In summary, both smoker and SSS interviewees showed a range of individual views on the potential risks of long-term vaping. On the smoker side, these appeared to motivate people's decisions about taking up vaping, while for staff they appeared to influence the advice and support individual services provided in relation to e-cigarettes. As I outline in the paper, the study thus provides some rich qualitative insights into previous quantitative findings about harm perceptions which have highlighted a lack of evidence on e-cigarettes as a leading concern for smokers, particularly among those who have never vaped (like most interviewees in the 'sceptical' group of my typology).(42) This workstream also directly addresses a recommendation for further research from the US study by Salloum et al. mentioned above, namely that:

> *"More investigation is needed, including qualitative studies, of perceptions about evidence-based pharmacological and behavioral cessation therapies, as well as investigation into patient-provider interactions related to e-cigarette use".*(32)

My second quantitative paper (Chapter 5) used data from the same STS participants as in Chapter 4 to generate hypotheses about the knowledge and beliefs - including in relation to e-cigarettes - that appear to be influencing smokers' uptake of SSSs. To my knowledge, it is unique as a quantitative study in examining these particular issues. Overall, holding beliefs about e-cigarette effectiveness and reporting familiarity with vaping were associated with decisions to access SSSs. On the service side, reporting familiarity with SSSs and holding various beliefs about them were also associated with uptake. The two clearest interaction results related to SES, which seems logical given

the entrenched, long-documented correlation between smoking rates and this particular sociodemographic variable.(13) The first of these findings showed that the odds of having accessed SSSs in the past were significantly increased for smokers in higher SES grades when they reported knowing people who had used e-cigarettes (OR 2.80, 95% CI = 1.70 to 4.60), whereas this was not the case for those in lower SES grades (OR 1.40, 95% CI = 0.99 to 1.98). This apparent influence that social contacts can have echoes another recent quantitative study which showed that having vaping acquaintances appeared to have positive impacts on smokers' inclination and attempts to quit.(43) The second interaction result showed that the odds of planned SSS uptake were significantly decreased for lower SES smokers when they believed e-cigarettes to be more effective than SSSs, but that this was not the case for higher SES smokers.

Taken together, this may suggest that lower SES smokers view cessation options in more mutually exclusive terms, while higher SES smokers may be more willing to experiment with a quit route even if they do not necessarily think it is the most effective available. A mechanism for these various findings might potentially be found in the PHE report's aforementioned suggestion about the social gradient of vaping in long-term ex-smokers.(12) That suggests that amongst smokers with acquaintances who have used e-cigarettes, those from higher social grades might plausibly be more likely to have seen such 'dual users' successfully quit their vaping as well as their smoking. In the same way, lower SES smokers might be more likely to have seen vaping acquaintances struggle to shake an ongoing nicotine addiction, which could understandably make them more cynical about other smoking cessation options.

Mixed methods: convergence

Taken together, my qualitative and quantitative findings provide further important insights relating to Objective C, both in terms of where the results from different methods align with each other and where they diverge. Firstly, there were a number of areas where the quantitative and qualitative results clearly complemented each other. The STS data showed, for instance, that respondents generally felt confident about accessing SSSs, with 75.3% agreeing with the statement "I know how to access NHS stop smoking services if I want to". This was echoed in the qualitative workstream where many smokers conveyed a self-assurance that they could identify local SSSs to attend if

they desired. The power of smartphones and the internet were frequently cited by these qualitative interviewees, for instance, in the sense that people felt there was nothing stopping anyone from simply searching online for SSSs if they wanted to know more. Indeed, there was sometimes even a sense of being 'inundated' by adverts and posters for the services.

Previous qualitative research has indicated the impact that logistical and organisational barriers can have on service attendance.(44,45) In my interviews, as in previous studies into smoking cessation services,(46,47) time commitments emerged as a particularly important barrier for smokers. This was evident both in terms of the short-term waiting time that could be required 'hanging on the telephone' to book appointments and the longer-term waiting time that might be required before the first appointments were available. The quantitative results similarly indicated that 'believing SSS attendance required lots of time' was inversely associated with intention to access services (AOR 0.61, 95% CI = 0.47 to 0.79). Conversely, distance to travel to services was not a concern for any interviewees. I hypothesise in Chapter 6 that this could be due to the predominantly urban catchment areas of my three research sites. However, it is notable that, in my quantitative analysis (Chapter 5), the statement 'I think I would have to travel far to use SSSs' was not significantly associated with either past or planned SSS uptake, suggesting this was again not a barrier in this much larger, nationally representative sample. Also evident from my quantitative results was the far greater popularity of e-cigarettes over SSSs, which has been shown previously in broader analyses of STS data.(11) Out of my sample, 76.6% of respondents reported knowing people who used e-cigarettes, while only 32.8% had acquaintances that had used SSSs. Again, this echoed findings in my qualitative interviews where smokers rarely reported knowing anyone who had used SSSs, but having some friends or family members who vaped was very common.

Perceptions of how receptive SSSs are to smokers who are trying to quit using e-cigarettes is a further area where both workstreams aligned. The second quantitative paper shows that, strikingly, 62.1% of current smokers disagreed with the question "Do you think NHS stop smoking services currently offer their support to smokers who are using e-cigarettes to try to quit smoking, or not?", suggesting a widespread perception

that e-cigarette users are not welcome at services. This adds weight to the qualitative paper's finding that SSSs, despite being widely encouraged to be 'e-cigarette friendly',(48–50) do not appear to be communicating their policies on e-cigarettes particularly clearly to SSS users. Previous research has indicated the importance of services being perceived to be non-judgmental.(19,44) Taken together, the possible implication is that this disconnect or misunderstanding could be depressing SSS uptake; respondents who thought SSSs *did* offer support to smokers using e-cigarettes were, after all, more likely to intend to access SSSs (AOR 1.32, 95% CI = 1.06 to 1.63). The concept of candidacy, mentioned in Chapter 2 is particularly relevant here, since it describes "the ways in which people's eligibility for medical attention and intervention is jointly negotiated between individuals and health services".(51) This may be particularly relevant in this context where the widespread badging of SSSs as 'e-cigarette friendly' has clearly not been sufficient to convince many smokers that 'dual users' are indeed eligible. This may in part be due to the 'e-cigarette friendly' message not being able to be promulgated adequately by SSSs. For instance, interviewees at one service in my study reported having constraints put on their e-cigarette messaging due to anxious comms colleagues. This therefore particularly reflects the 'operating conditions' element of Dixon-Woods et al.'s framework which describes how candidacy can be impacted by the local or organisational context within which services operate and the associated availability of resources.(51)

Mixed methods: divergence

In other areas, the quantitative and qualitative data show interesting divergences. The quantitative results, for instance, suggest a confidence among smokers that barriers to e-cigarette use are low: only 10.4% of people felt that "learning how to use e-cigarettes takes up a lot of time", while 70.1% agreed with the statement "I know how to use e-cigarettes if I want to". This marks a clear area of difference from my qualitative interviews where current and ex-smokers who vaped often talked about the importance of patience and the need to try various models or liquid strengths in order to find something that was personally suitable:

> *"I think it takes a bit of learning, what to do and how"*
> (S19: Current smoker, current vaper, non-SSS user, female)

"Get a starter kit, see how you get on. But persevere, I didn't last year, but you really need to. Give it two or three days"
(S24: Ex-smoker, vaper, non-SSS user, female)

"They're absolutely for, in my experience, 100% effective. When you find the right one. I think there's a danger in giving it, throwing it away, thinking oh that didn't work for me, vaping doesn't work for me. But I would always say to somebody and I have advised people who I've tried to encourage, try different vapes, try different settings, go in a shop and get some advice, have a go on something, don't just think that the disposable one that's actually rubbish is all there is"
(S27: Ex-smoker, vaper, non-SSS user, female)

It is important to note though that this theme emerged in interviews with the vaping interviewees, some of whom were ex-smokers, whereas the quantitative sample consisted solely of current smokers, of whom only 18.2% were currently vaping. This discrepancy may therefore suggest that amongst current smokers as a whole, there is a somewhat over-confident attitude towards e-cigarettes which does not mirror the experience of those smokers who actually do take up vaping. Furthermore, in the qualitative interviews, amongst those participants who had accessed SSSs in the past, there were almost unanimous reports of positive experiences, with only one person expressing predominantly negative views about their contact with their local service. The quantitative data suggest a slightly less homogenous picture, with 63.3% of the 472 respondents who had accessed SSSs reporting that they had found their experiences 'very helpful' or 'fairly helpful', while 36.7% therefore reported their encounters with the services had been 'not very helpful' or 'not at all helpful'.

Comparison of smoker/professional perspectives and uniqueness of research

The inclusion of SSS staff and stakeholder interviews within my qualitative research was a particular strength of this PhD, since it allowed for the investigation of areas where misunderstandings or misaligned perceptions between SSSs and their potential clients could be affecting service uptake. Previous qualitative research in this area has

tended to focus on either service users or service staff in isolation from each other.(52,53) Only one other previous study, by Tamimi in 2018, has combined interviews with both SSS staff and smokers.(54) My own study therefore sought to build on this existing research to provide stronger evidence in this area. Not only did I employ more consistent data collection (solely using face-to-face interviews rather than some phone interviews), but my research sites had a broad geographical spread across Northern, Central and Southern England, rather than being situated in a single region like these three previous studies. In addition to Tamimi's focus on e-cigarette use, my work also explored at length influences on attendance at SSSs, thus providing insights into how decisions on the two options related to each other. Finally, by recruiting almost twice as many participants as Tamimi, I was able to capture a much broader range of smokers with varied experiences of quitting smoking, using e-cigarettes and accessing SSSs (as shown by my recruitment matrix in Appendix C), as well as a wider range of voices on the SSS side, which included service managers and key stakeholders, rather than solely practitioners. In terms of smokers, for instance, Tamimi's study only included current vapers, whereas my own research also incorporated smokers who were not vaping to obtain a broader sense of the barriers that might impede e-cigarette use, as well as the facilitators that can prompt it. In terms of SSS professionals, as outlined in Chapter 6, my findings in this respect support previous studies in observing ongoing nervousness amongst many staff towards e-cigarettes.(53,55–57)

My study aligned with Tamimi's, however, in identifying heterogeneity in vapers' attitudes towards e-cigarettes and, in particular, towards their absolute health risks, while finding more unified attitudes towards their risks relative to smoking. The previous study reported, for instance, that "all participants believed e-cigarettes to be less harmful than smoking",(54) while my own findings similarly showed that vapers across my sample felt long-term vaping was a safer choice relative to smoking. Indeed, my study was able to show an important further nuance that, although vapers aligned in believing e-cigarettes to be the less harmful choice, some still felt sufficiently uncomfortable with their nicotine addition to want to give it up (the 'finite' vapers), whilst others lacked any intention to do so (the 'forever' ones). My study similarly expanded on this previous research by setting these views alongside those of non-vaping smokers, revealing that the 'sceptical' group of these non-vapers held far more

mixed views, with many believing that vaping could be even more harmful than smoking. Furthermore, by placing findings within the COM-B framework, I was able to highlight differences in smokers' perceived capabilities to make informed judgments. Brose et al. concluded in a 2015 study into harm perceptions of vaping that "clear and balanced information on the relative harm of e-cigarettes and cigarettes is needed".(58) Sadly, four years on, this recommendation remains as valid as ever.

7.3 Limitations

To avoid duplication, limitations already outlined in Chapters 3 to 6 are not repeated in full here, but a summary is provided below for reference.

The systematic review (Chapter 3):

- may have been affected by publication bias, in which studies with non-significant findings in relation to awareness and use were less likely to be published;
- identified no eligible low-income or middle-income country studies with its trawls, and there was no clear way of assessing the degree to which this reflected a bias in the body of research that had been conducted versus any bias in the databases searched;
- focused on general population samples so did not explore e-cigarette use within specific clinical populations and also did not include smoking of conventional cigarettes as a variable for analysis;
- employed quality assessment based on an established tool for prevalence studies, but this tool was tailored to the review's requirements and adaptations were not validated;
- was limited, like all reviews, by the evidence available and its reporting.

The quantitative workstream (Chapters 4 and 5):

- relied, in part, on data gathered using novel questions for which there were no relevant established questionnaire tools;

- may have been affected by recall bias (in data regarding past behaviour) and social desirability bias (in data regarding future actions or knowledge/belief statements);
- may have been affected by residual confounding in relation to the concept of 'intention to quit' or other variables;
- was unable, like all cross-sectional research, to establish causal relationships.

The qualitative workstream (Chapter 6):

- collected data from only three research sites, all within the UK and - as such - findings were not necessarily generalisable to other settings;
- faced challenges with some issues that could not be neatly categorised within the COM-B framework as 'capability', 'motivation' or 'opportunity', but rather involved multiple concepts;
- was unable to explore how individual smokers' behavioural support uptake and vaping interrelated over time, which repeat/longitudinal interviews could have shown more definitively.

The following additional points are also worth noting. A potential limitation of my quantitative workstream is the fact that the smokers who were removed from the sample due to having incomplete data on our key variables - age, gender and heaviness of smoking (HSI) - were significantly more likely to be male and of non-white ethnicities. This seems unlikely to have markedly affected findings though; the percentage of such smokers removed from the sample was only 5.5% (5.0% due to incomplete HSI data, 0.4% due to age data and 0.1% due to gender data), which is a small and fairly standard proportion for such exclusions.

Across both my workstreams, but particularly my quantitative one, the precise badging of the services was an area that risked inaccuracy and potential confusion. In my STS data collection, questions referred to "NHS stop smoking services" rather than 'local stop smoking services' or simply 'stop smoking services'. This decision was taken based on advice received from senior academics and subject matter experts at UCL and NCSCT that these services were often still referred to (and thought of by the public) as 'NHS

stop smoking services'. This was confirmed during face validity testing of my questions, where respondents were asked whether they felt references to "NHS stop smoking services" or "local stop smoking services" would be clearer. There was a clear view across these testers that the former was a more readily understandable term for the services in question.

Finally, the generalisability of this work beyond the UK needs careful consideration depending on the context of individual countries concerned. The regulation of e-cigarettes is, after all, an area where there are wide differences internationally, as is the provision of behavioural support akin to that provided by England's SSSs.(59)

7.4 Implications and recommendations

As outlined in Chapter 1, this thesis aimed to investigate whether, amongst English smokers, the use of e-cigarettes could be influencing their use of SSSs and, if so, how this was occurring. Chapter 3 thus details how the use of e-cigarettes varies across different sociodemographic groups, before Chapter 4 shows that e-cigarette use amongst smokers is indeed associated with their use of SSSs. Finally Chapters 5 and 6 delineate, using both quantitative and qualitative data, the varied factors that influence smokers' decisions to use e-cigarettes or SSSs. As well as addressing my original aim, these findings suggest a number of implications and recommendations for policy, practice and research alike.

My systematic review (Chapter 3) outlines a number of implications for researchers in particular. I describe the findings, for instance, as "an essential first step towards monitoring the population and health inequality impacts of e-cigarettes with more clarity and granularity", while also suggesting that future studies should consider "more precise measures of current use to capture this concept more accurately" as well as "more precision around the specific types of e-cigarettes being used". On this note, I would recommend researchers now consider the comprehensive set of proposals that have subsequently been outlined by Pearson et al. for assessing e-cigarette ever use, frequency of use, device type and related items.(60)

I believe the findings from my main quantitative paper (Chapter 4) have clear relevance for decision-makers across England. As the introduction to that chapter outlines, it has been suggested that widespread e-cigarette use may be reducing the need for SSSs, an argument that has formed part of the rationale for cutting services in a number of local authorities.(61–64) Our findings, however, cast doubt on the credibility of this position, showing that - rather than wanting to 'go it alone' - smokers are keen to receive additional support from these services even when they are already using e-cigarettes to try to quit. My paper in fact echoes the conclusions of the RCT into e-cigarettes and behavioural support recently published in the *New England Journal of Medicine* (*NEJM*), which found that "among dual users who want to stop smoking, there seems to be a high level of interest in smoking-cessation treatments."(65) This follows other recent studies which have indicated that smokers themselves do not seem to view e-cigarettes as being in isolation from, or in competition with SSSs;(31,32) indeed, both dual users and ex-smoking vapers have now been shown to have ongoing interest in accessing other forms of treatment including behavioural support.(66,67)

This therefore ought to give pause for thought to any local authorities planning to make similar decommissioning decisions, as well as to national policy-makers who provide guidance to local government. In this respect, my findings also lend weight to recommendations in a *Lancet* comment that "Government authorities should resist any cost-cutting suggestions to decrease support for the SSS on the basis of the obvious and well documented benefits achieved when smokers are enrolled in these services."(68) In particular, given SSSs' strong cost-effectiveness has been well established for years, ongoing cuts in this area will inevitably be a false economy leading to greater burdens on the NHS from smoking-related conditions in the future.(69) Finally, these findings should also be of considerable interest to wider international audiences. Uptake of SSSs has, after all, declined across the EU as a whole in recent years,(30) while countries everywhere are each having to grapple with how to regulate e-cigarettes appropriately alongside other routes to quitting smoking.(59)

My qualitative workstream is unique in its examination of smokers' decision-making regarding the most effective quit route available (behavioural support with pharmacotherapy) and the most popular (e-cigarettes). As part of this, it investigates

the potential influence of SSSs themselves on such decisions by smokers. By unpacking exactly how various views on risk influence e-cigarette uptake, my study provides researchers with a qualitative complement to recent quantitative data showing the central role played by harm perceptions in this area.(42) These findings have implications for decision-makers, commissioners and practitioners alike. SSSs, for instance, in the context of six years of declining service uptake,(25) could use these findings to inform their efforts to attract more 'dual users' of tobacco and e-cigarettes through their doors. Similarly, national and local policy-makers may wish to reflect on our study's implication that ex-smoking vapers - who are often uncomfortable with their ongoing nicotine addiction - may be being forgotten in parts of the country where SSS policies do not provide them with access or where SSSs have been completely discontinued. Finally, the insights about difficulties smokers report in making informed choices about e-cigarettes reinforce the need for clearer information provision about the likely relative risks of switching from tobacco to vaping.(58) Any such messaging should also incorporate recent research about communicating scientific uncertainty in relation to e-cigarettes.(70)

More broadly, my findings again have relevance for audiences internationally. At a conceptual level, the COM-B framework that underpins my paper is internationally recognised, informing research and practice in many other countries. From a policy perspective, very recent research shows significant proportions of European long-term vapers think that health professionals could help them stop their e-cigarette use and would be interested in using cessation services,(66) yet the variable provision of such behavioural support for vapers is a key finding of our paper. Meanwhile, another recent study has demonstrated that - in Australia, Canada, England and the United States - discussions between smokers and health professionals about vaping products appear to be infrequent.(71) My paper provides some rich qualitative insights into these discussions, outlining disconnects between the perspectives of practitioners and smokers on several fundamental issues. In particular, it appears that there is scope for SSSs to be clearer to prospective clients about what level of support they will be able to offer them - after they quit tobacco - to then help them taper off any quit aid products used, including NRT or e-cigarettes. I would therefore fully echo the broader point made by Wells et al. that "there is an evident need for services, supported by policy-makers, to

better convey to the public…what can be offered and how this will work".(37) Several of my interviewees had doubts about SSSs, for instance, since they felt people simply remained addicted to nicotine patches afterwards. The typology developed in my qualitative paper may assist practitioners with this by allowing them to quickly assess what an individual smoker's specific views are in relation to continuing using nicotine after quitting tobacco. A previous typology has been proposed in this area,(72) as discussed in Chapter 6, and mine aligns with it to a large extent but has the advantage of expanding beyond vapers to incorporate all smokers, thus giving it wider applicability to the work of SSSs.

The most similar previous study to mine concluded that "stop smoking services need to recognise the potential benefits gained by using e-cigarettes as a harm reduction tool and focus on stopping smoking rather than stopping nicotine".(54) I would argue, however, that a more nuanced approach is required. As outlined in my qualitative paper, national policy-makers may wish to reflect on my study's implication that ex-smoking vapers – who are sometimes uncomfortable with their ongoing nicotine addiction – may be 'falling through the cracks' in parts of the country, with no access to any specialist support. It is, of course, understandable that some SSSs may be unwilling to take these people on as clients; services are, after all, frequently needing to absorb deep budget cuts that require them to prioritise their resources carefully. Furthermore, SSS interviewees frequently cited the importance of PHE's figure of an estimated 95% lesser risk of vaping compared to smoking,(73) so they are therefore likely to often take the view that they should spend their limited resources tackling the much graver health threats of smoking. In addition, SSS outcomes are judged primarily by a 'four week quit rate' measure that requires 85% of reported quits to be validated via clients' readings on carbon monoxide meters. Ex-smoking vapers do not therefore fit comfortably into this monitoring regime. As one SSS interviewee explained, the bottom line was that supporting someone to quit vaping:

> *"wouldn't be something that we would count as a quit if you like, if we did contract monitoring based on the service specification"*
> (P12, Council-employed public health commissioner, Site B).

Yet this does beg the policy question: whose responsibility are these vapers? At the moment, this appears to be a 'grey area' of policy, or a 'limbo land' as one SSS interviewee put it memorably:

> *"It's one of those real grey areas because we're the only people who, we're the best people to deal with it, but it's not something that we're there for, particularly. Which does leave people stuck in a limbo land where they've gone from smoking just to nicotine and now they can't get off that... so it's a real tricky one because it's like, yeah you need to go back and start smoking before we can see you, which is the wrong idea".*
> (P1: SSS Manager, Site B)

The view from smokers themselves on this question was clear within my research. Interviewees across all groups of my typology felt that such people ought to be eligible for SSS support to help quit vaping, with people often pointing to the fact that NHS support was available for other addictions, that vaping still carried some harms or that any addiction was painful to break:

> *"It's still very much an addiction… Rehab, you get rehab for alcoholics, gamblers, drug addicts, but you don't get a rehab for smokers and you get the smoking clinics, which really help so why can't they help the people that want to come off the vaping."*
> (S14: Ex-smoker, non-vaper, SSS user, female)

> *"It's still nicotine, it's still causing you harm. So, yeah, I think they should… I think there should be support afterwards, when you want to stop them. Because any drug, any addiction is, it's torture to come off".*
> (S29: Smoker, non-vaper, non SSS user, male)

Despite these arguments, support to current tobacco smokers should surely remain the top priority, given the overwhelming weight of current evidence suggesting smoking carries substantially greater risks than vaping.(73)

This issue of vaping in ex-smokers also has important wider implications, not least since rates of ongoing, long-term use are very high for e-cigarettes. Among participants in the 2019 *NEJM* RCT, for instance, 80% of smokers who quit tobacco using e-cigarettes were still vaping one year later, compared to only 9% of NRT users who were still using NRT at this one year mark.(65) Taken together with the recent PHE report's suggestion that it may be most likely to be ex-smokers from lower socioeconomic groups who struggle to quit their vaping long-term,(12) this must surely be an area where further research focus is needed, given the potential for social inequity of impacts. In this context, further studies are also needed into whether ongoing vaping in ex-smokers has a protective effect against relapse back to tobacco or is in fact a risk factor for this, as has recently been warned.(74) If the latter scenario does prove to be the case, the need to provide further cessation support to ex-smoking vapers should become an even more urgent priority. As my own systematic review concludes, it is imperative that future studies help maintain vigilance to ensure that the opportunities offered by e-cigarettes "are distributed fairly across society" and "do not widen existing health inequalities".(26)

In summary, the implications of my thesis for various audiences are as follows.

PRACTICE

SSSs should consider:

- Using the findings from Chapters 5 and 6 about factors that influence smokers' decision-making to inform their efforts to attract more 'dual users' of tobacco and e-cigarettes through their doors.
- Providing clearer information about the likely relative risks of switching from tobacco to vaping, given the confusion in this area highlighted in Chapter 6.
- Giving greater clarity to prospective clients (in light of Chapter 6's findings) about what level of support they will be able to offer them – after they quit tobacco – to then help them taper off any quit aid products used, including NRT or e-cigarettes.
- Using the typology outlined in Chapter 6 to help them quickly assess what an

individual smoker's specific views are in relation to continuing using nicotine after quitting tobacco.

Local authorities should consider:

- Giving their support to SSSs to help them address the first three recommendations above around recruitment and information provision.
- Reviewing any SSS cuts for which e-cigarette prevalence has formed part of the rationale, given the findings outlined in Chapter 4 that – rather than wanting to 'go it alone' – smokers are keen to receive additional support from these services even when they are already using e-cigarettes to try to quit.

POLICY

National organisations (DHSC and PHE) should consider:

- Giving more explicit, vocal support (in light of Chapter 4's findings) to SSSs in the face of such service reductions and, resisting – as also recommended by the *Lancet* – "any cost-cutting suggestions to decrease support for the SSS on the basis of the obvious and well documented benefits achieved when smokers are enrolled in these services".(68)
- Clarifying the policy 'grey area' around support for the proportion of ex-smoking vapers who may be uncomfortable with their ongoing nicotine addiction. Specifically, the differing approaches being taken on this issue by SSSs documented in Chapter 6 suggest national guidance from PHE would be valuable on what assistance these people may require and whose responsibility it is to deliver this. In financial terms, however, support to current tobacco smokers should unequivocally remain the top priority; i.e. no funds should be diverted from local SSSs' core work, given current evidence suggests smoking carries far greater risks than e-cigarettes. Rather, any efforts in this area should be supported by new funds and only if such monies cannot be better invested in tackling tobacco smoking.

RESEARCH

Researchers should consider:

- Designing studies to specifically examine the sociodemographic profile of ex-smokers who continue vaping long-term.
- Conducting further studies into whether ongoing vaping in ex-smokers has a protective effect against relapse back to tobacco or is in fact a risk factor for it, given the centrality of this issue to policy decisions around e-cigarettes.

7.5 Conclusion

This thesis has examined a hitherto largely neglected research gap: whether e-cigarettes might be impacting attendance rates at SSSs and, if so, how this is occurring. Amidst a number of important findings, one stands out as particularly urgent. My research suggests that local authorities making partial or complete cuts to their SSSs on the basis that e-cigarettes are now such a popular, widely-available quit aid should rethink. This thesis in fact adds to a growing evidence base that smokers using e-cigarettes remain keen to access the most effective route to quitting available: behavioural support from SSSs. Given the clear social gradients observed in smoking and vaping rates,(12,13) removing opportunities to access such support services can also be expected to have direct, retrograde health impacts for some of the most vulnerable in society.

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APPENDICES

APPENDIX A – Systematic review: example of full electronic search strategy (MEDLINE)

Search terms used	Limits
electronic cigarette or **electronic cigarettes** or **e-cigarette** or **e-cigarettes** or **e cigarette** or **e cigarettes** or **ecigarette** or **ecigarettes** or **electronic nicotine delivery** or **vape** or **vaper** or **vapers** or **vaping** or **vaporiser** or **vaporizer** or **vapouriser** or **vapourizer** or **smokeless cigarette** or **smokeless cigarettes** or **vapor cigarette** or **vapor cigarettes** or **vapour cigarette** or **vapour cigarettes** or **digi-cigarette** or **digi-cigarettes** or **digi cigarette** or **digi cigarettes** or **digital-cigarette** or **digital-cigarettes** or **digital cigarette** or **digital cigarettes** or **vaporette** or **vaporettes** or **vapourette** or **vapourettes**	2006 onwards Research on humans

Search dates were from 01/01/06 (reflecting the nascence of viable e-cigarette markets around the world) to 27/10/14 (the cut-off date when our final searches were run).

APPENDIX B – Systematic review: effect direction plot

Ordered by PROGRESS Plus sub-group criteria, and then grouped by evidence quality

Key: ● = outcome reported, statistically significant difference found; ○ = outcome reported, no statistically significant difference found; ⁘ = outcome reported, no indication of any test for statistical significance; [blank box] = outcome not studied

Lead Author	Country	Quality of Evidence	Sample	Aware	Ever use	Current Use	Key findings
PLACE OF RESIDENCE							
Pepper 2013 (1)	USA	H	421 male adolescents	○			
Adkison 2013 (2)	UK, USA, Canada, Australia	M	5,939 adult smokers	●	●	○	USA & UK > Australia & Canada (awareness); USA & UK > Canada (ever use); USA > Australia (ever use)
Gallus 2014 (3)	Italy	M	3,000 adults	●	○	●	Northern Italy & Central Italy > Southern Italy (awareness); Southern Italy > Central Italy (current use)
Giovenco 2014 (4)	USA	M	2,136 current/recent smokers		○	○	
Goniewicz 2012 (5)	Poland	M	20,240 high school/uni students		●	●	Urban > rural
King 2014 (6)	USA	M	14,758 adults	○	○	○	
Lee 2014 (7)	South Korea	M	75,643 high school students			●	City & metropolitan city > province
Tan 2014 (8)	USA	M	9,080 adults	○			
Vardavas 2014 (9)	EU member states	M	26,566 adults	●	●		Individual countries: various international differences (awareness & ever use); Large towns > rural (ever use); North & East Europe > West Europe (ever use)
Agaku 2014 (10)	EU member states	L	Adults in 25 countries			●	Individual countries: various international differences [a]
Agaku 2014 (11)	USA	L	60,192 adults			○	
Douptcheva 2013 (12)	Switzerland	L	5,081 men		●		German region > French region [b]
McMillen 2012 (13)	USA	L	3,240 adults		○		
Pepper 2014 (14)	USA	L	17,522 adults	○			
Popova 2013 (15)	USA	L	7,776 adult current/recent smokers		○		
Regan 2013 (16)	USA	L	41,240 adults	○	○	○	
RACE / ETHNICITY							
Kasza 2013 (17)	USA	H	6,110 adult smokers		○		
Pearson 2012 (18)	USA	H	19,026 adult smokers	●	●		White > African American
Pepper 2013 (1)	USA	H	421 male adolescents	●			Other races > Hispanic
Adkison 2013 (2)	UK, USA, Canada, Australia	M	5,939 adult smokers	●	○	○	White/English > Non-white/Non-English [c]

Lead Author	Country	Quality of Evidence	Sample	Aware	Ever use	Current Use	Key findings
Amrock 2014 (19)	USA	M	24,658 high school students	●	●	●	White, Mixed/Multiple race > Black (awareness); Hispanic > Asian (ever & current use) [d]
Emery 2014 (20)	USA	M	17,522 adults	●			White > Hispanic, Other
Giovenco 2014 (4)	USA	M	2,136 adult current/recent smokers		●	○	White > Other races (ever use) [e]
King 2014 (6)	USA	M	14,758 adults	●	○	●	White > Black (awareness); White > Hispanic (current use) [f]
Lippert 2014 (21)	USA	M	15,264 adolescents		●		Other races > Black, Mexican-American
Richardson 2014 (22)	USA	M	1,487 adult current/former smokers		●		White > Hispanic
Tan 2014 (8)	USA	M	9,080 adults	●			White > Hispanic
Agaku 2014 (11)	USA	L	60,192 adults			●	'Other, Non-Hispanic', White > Other races [d,g]
Camenga 2014 (23)	Connecticut & NY, USA	L	3,102 high school students			◌	
Camenga 2014 (24)	Connecticut & NY, USA	L	4,766 high school students			●	Mixed results
Choi 2013 (25)	Minnesota, USA	L	2,624 adults	○	○		
Czoli 2014 (26)	Canada	L	1,188 young adults		○	○	
Grana 2014 (27)	USA	L	1,549 adult smokers			○	
Hayes 2014 (28)	USA	L	2,376 adult smokers			○	
Hyland 2013 (29)	New York, USA	L	2 schools		○	○	
Li 2013 (30) [h]	New Zealand	L	840 adult current/recent smokers		○		
McMillen 2012 (13)	USA	L	3,240 adults		○		
Pokhrel 2014 (31)	Hawaii, USA	L	307 undergrad students		●	●	Filipino > White
Pokhrel 2013 (32)	Hawaii, USA	L	1,685 adult smokers		●		White > Native Hawaiian
Popova 2013 (15)	USA	L	7,776 adult current/recent smokers		●		Asian > White
Regan 2013 (16)	USA	L	41,240 adults	●	○	○	White > African, Hispanic
Sherratt 2014 (33)	Liverpool, England	L	256 adult smokers			○	
Sutfin 2013 (34)	North Carolina, USA	L	4,857 undergrad students		●		Hispanic, Other > White
Vickerman 2013 (35)	USA	L	7,966 adult smokers		●		White > Other races
OCCUPATION							
EU 2012 (36)	27 EU member states	L	26,751 adults	◌			
GENDER							
CHETS 2014 (37)	Wales	H	1,601 children		○		
Kasza 2013 (17)	USA	H	6,110 adult smokers		○		
Pearson 2012 (18)	USA	H	19,026 adult smokers	●			Men > Women
Pepper 2013 (1)	USA	H	421 male adolescents	○			
Adkison 2013 (2)	UK, USA, Canada, Australia	M	5,939 adult smokers	●	○	○	Men > Women [c]
Amrock 2014 (19)	USA	M	24,658 high school students	○	●	●	Men > Women [d]
Emery 2014 (20)	USA	M	17,522 adults	●			Men > Women
Gallus 2014 (3)	Italy	M	3,000 adults	●	○	○	Men > Women

Lead Author	Country	Quality of Evidence	Sample	Aware	Ever use	Current Use	Key findings
Giovenco 2014 (4)	USA	M	2,136 adult current/recent smokers		○	○	
Goniewicz 2012 (5)	Poland	M	20,240 high school/uni students		●	●	Males > Females
King 2014 (6)	USA	M	14,758 adults	○	●	●	Women > Men [f]
Lee 2014 (7)	South Korea	M	79,202 high school students			●	Males > Females
Lippert 2014 (21)	USA	M	15,264 adolescents		●		Men > Women
Richardson 2014 (22)	USA	M	1,487 adult current/former smokers		●		Men > Women
Tan 2014 (8)	USA	M	9,080 adults	○			
Vardavas 2014 (9)	EU member states	M	26,566 adults		○		
Agaku 2014 (11)	USA	L	60,192 adults			●	Men > Women [d,g]
Agaku 2014 (10)	Multiple countries	L	Adults in 25 countries			●	Mixed results in different countries [a]
ASH Wales 2014 (38)	Wales	L	740 adolescents	○	○	○	
Biener 2013 (39)	USA	L	5,150 adults		○	○	
Brown 2014 (40)	UK	L	4,117 adult smokers		○		
Camenga 2014 (23)	USA	L	3,102 high school students			◌	
Cho 2011 (41)	Seoul, South Korea	L	4,341 middle/high school students		●		Males > Females
Choi 2013 (25)	Minnesota, USA	L	2,624 adults	●	●		Men > Women
Czoli 2014 (26)	Canada	L	1,188 young adults		○	○	
Dautzenberg 2013 (42)	Paris, France	L	3,409 high school students		○		
Dockrell 2013 (43)	UK	L	12,432 adults		○	○	
EU 2012 (36)	27 EU member states	L	26,751 adults	◌			
Grana 2014 (27)	USA	L	1,549 current/recent smokers			●	Women > Men [i]
Hyland 2013 (29)	New York, USA	L	2 schools		○	○	
Kinnunen 2013 (44)	Finland	L	3,535 adolescents	◌	◌		
Kralikova 2013 (45)	Czech Republic	L	1,738 smokers		●	●	Men > Women
Krishnan-Sarin 2014 (46)	Connecticut, USA	L	4,780 middle/high school students		●		Males > Females
Kvaavik 2014 (47)	Norway	L	629 adult current/former smokers			●	Men > Women [j]
Li 2013 (30) [h]	New Zealand	L	840 adult current/recent smokers		○		
Martinez-Sanchez 2014 (48)	Barcelona, Spain	L	1,291 adults		○	○	
McMillen 2012 (13)	USA	L	3,240 adults		○		
Pearson 2011 (49)	USA	L	3,638 adults	●	●		Men > Women
Pokhrel 2014 (31)	Hawaii, USA	L	307 undergrad students		○		
Pokhrel 2013 (32)	Hawaii, USA	L	1,685 adult smokers		○		
Popova 2014 (15)	USA	L	7,776 adult current/recent smokers		●		Women > Men
Regan 2013 (16)	USA	L	41,240 adults	●	●	○	Men > Women (aware); Women > Men (ever use)
Sherratt 2014 (33)	Liverpool, England	L	256 adult smokers			●	Females > Men
Sochor 2014 (50)	Brno city, Czech Rep	L	966 adults			●	Men > Women
Stillman 2014 (51)	USA	L	723 flight attendants			●	Men > Women [k]

Lead Author	Country	Quality of Evidence	Sample	Aware	Ever use	Current Use	Key findings
Sutfin 2013 (34)	North Carolina, USA	L	4,857 undergrad students		●		Men > Women
Vickerman 2013 (35)	6 states, USA	L	7,966 adult smokers		◌		
WHO 2013 (52)	Qatar	L	8,398 adults	◌	◌	◌	
EDUCATION LEVEL							
Kasza 2013 (17)	USA	H	6,110 adult smokers		●		Intermediate > lower education
Pearson 2012 (18)	USA	H	19,026 adult smokers		●		Higher > lower education
Pepper 2013 (1)	USA	H	421 male adolescents	○			
Gallus 2014 (3)	Italy	M	3,000 adults	●	●	○	Higher > lower education (aware); Intermediate > lower education (ever use)
Adkison 2013 (2)	UK, USA, Canada, Australia	M	5,939 adult smokers	●	○	●	Higher > lower education [c]
Emery 2014 (20)	USA	M	17,522 adults	●			Higher > lower education
Giovenco 2014 (4)	USA	M	2,136 adult current/recent smokers		○	○	
King 2014 (6)	USA	M	14,758 adults	○	○	●	Less than high school > High school [f]
Richardson 2014 (22)	USA	M	1487 adult current/former smokers		○		
Tan 2014 (8)	USA	M	9,080 adults	●			Higher > lower education
Agaku 2014 (11)	USA	L	60,192 adults			●	Lower > higher education [d,g]
Choi 2013 (25)	Minnesota, USA	L	2,624 adults	●	○		Higher > lower education
Czoli 2014 (26)	Canada	L	1,188 young adults		●	●	Lower > higher education (ever use); Higher > lower education (current use)
Douptcheva 2013 (12)	Switzerland	L	5,081 men		●		Secondary > tertiary or primary [b]
Grana 2014 (27)	USA	L	1,549 smokers			●	Lower > higher education
Li 2013 (30) [h]	New Zealand	L	840 adult current/recent smokers		○		
Martinez-Sanchez 2014 (48)	Barcelona, Spain	L	1,291 adults		○	○	
McMillen 2012 (13)	USA	L	3,240 adults		●		Intermediate > lower education
Pearson 2011 (49)	USA	L	3,638 adults	●	●		Higher > lower education
Pokhrel 2013 (32)	Hawaii, USA	L	1,685 adult smokers		○		
Popova 2013 (15)	USA	L	7,776 adult current/recent smokers		○	●	Intermediate > higher education
Regan 2013 (16)	USA	L	41,240 adults	●	●	●	Higher > lower education (aware); Lower > higher education (ever & current use)
Sherratt 2014 (33)	Liverpool, England	L	256 adult smokers			○	
Sochor 2014 (50)	Brno city, Czech Republic	L	966 adults			◌	
Stillman 2014 (51)	USA	L	723 flight attendants			○	
Vickerman 2013 (35)	USA	L	7,966 adult smokers		●		Higher > lower education
SOCIOECONOMIC STATUS							
CHETS 2014 (37)	Wales	H	1,601 children		○		
Kasza 2013 (17)	USA	H	6,110 adult smokers		○		
Adkison 2013 (2)	UK, USA, Canada, Australia	M	5,939 adult smokers	●	●	○	Higher > lower income [c]
Emery 2014 (20)	USA	M	17,522 adults	○			
Lippert 2014 (21)	USA	M	15,264 adolescents		○		
Lee 2014 (7)	South Korea	M	79,202 high school students			●	Higher > lower weekly allowance

Lead Author	Country	Quality of Evidence	Sample	Aware	Ever use	Current Use	Key findings
Richardson 2014 (22)	USA	M	1,487 adult current/former smokers		○		
Tan 2014 (8)	USA	M	9,080 adults	○			
Vardavas 2014 (9)	EU member states	M	26,566 adults		○		
Agaku 2014 (11)	USA	L	60,192 adults			●	Lower > higher income [d,g]
Brown 2014 (40)	UK	L	4,117 adult smokers		●		Higher > lower SES [i]
Dockrell 2013 (43)	UK	L	12,432 adults		○	○	
Douptcheva 2013 (12) [b]	Switzerland	L	5,081 men		○		
King 2013 (53)	USA	L	10,739 adults	○	○		
Kinnunen 2013 (44)	Finland	L	3,535 adolescents		●		Mixed results
Li 2013 (30)	New Zealand	L	840 adult current/recent smokers		●		Higher > lower income [h]
Pokhrel 2014 (31)	Hawaii, USA	L	307 adult current/former/never smokers		○		
Pokhrel 2013 (32)	Hawaii, USA	L	1,685 adult smokers		○		
Popova 2013 (15)	USA	L	7,776 adult current/recent smokers		○	●	Lower > higher income
Regan 2013 (16)	USA	L	41,240 adults	○	●	○	Mixed results
Sochor 2014 (50)	Brno city, Czech Republic	L	966 adults			○	
Sutfin 2013 (34)	North Carolina, USA	L	4,857 undergrad students		○		
Vickerman 2013 (35)	USA	L	7,966 adult smokers		●		Mixed results
DISABILITY OR HEALTH STATUS							
Pearson 2012 (18)	USA	H	19,026 adult smokers		●		Better > worse self-reported health status
Richardson 2014 (22)	USA	M	1,487 adult current/former smokers		○		
Tan 2014 (8)	USA	M	9,080 adults	○			
Hayes 2014 (28)	USA	L	2,376 adult smokers			●	Medical illnesses, depressed mood, alcohol use > absence of these
SEXUAL ORIENTATION							
Emery 2014 (20)	USA	M	17,522 adults	○			
Agaku 2014 (11)	USA	L	60,192 adults			●	Lesbian, gay or bisexual > heterosexual & unspecified [d,g]
AGE							
Kasza 2013 (17)	USA	H	6,110 adult smokers		●		18-24yo > 40yo+
Pearson 2012 (18)	USA	H	19,026 adult smokers	●	●		Younger > Older adults
Pepper 2013 (1)	USA	H	421 male adolescents	●			Older > Younger children
Adkison 2013 (2)	UK, USA, Canada, Australia	M	5,939 adult smokers	●	●	○	Younger > Older adults [c]
Amrock 2014 (19)	USA	M	24,658 high school students	●	●	●	Older > Younger children [d]
King 2014 (6)	USA	M	14,758 adults	○	●	○	Younger > Older adults [f]
Gallus 2014 (3)	Italy	M	3,000 adults	●	●	●	Younger > Older adults
Giovenco 2014 (4)	USA	M	2,136 adult current/recent smokers		●	○	Younger > Older adults
Goniewicz 2012 (5)	Poland	M	20,240 high school/uni students		●	●	High school students > Uni students
Lee 2014 (7)	Korea	M	79,202 high school students		◌	●	Older > Younger children

Lead Author	Country	Quality of Evidence	Sample	Aware	Ever use	Current Use	Key findings
Lippert 2014 (21)	USA	M	15,264 adolescents		○		
Richardson 2014 (22)	USA	M	1,487 adult current/former smokers		●		Younger > Older adults
Tan 2014 (8)	USA	M	9,080 adults	●			Younger > Older adults
Vardavas 2014 (9)	EU member states	M	26,566 adults		●		Younger > Older adults
Agaku 2014 (11)	USA	L	60,192 adults			●	Younger > Older adults [d,g]
ASH 2014 (54)	Great Britain	L	53,719 adults & children	◌	◌	◌	
ASH Wales 2014 (38)	Wales	L	740 adolescents	◌	◌	◌	
Baeza-Loya 2014 (55)	USA	L	184 adults		◌		
Biener 2014 (39)	USA	L	5,150 adults			◌	
Brown 2014 (40)	UK	L	4,117 adult smokers		○		
Cho 2011 (41)	Seoul & province in Korea	L	4,341 middle/high school students		○		
Choi 2013 (25)	Minnesota, USA	L	2,624 adults	○	●		20-24 year olds > 25-28 year olds
Czoli 2014 (26)	Canada	L	1,188 young adults		◌	◌	
Dautzenberg 2013 (42)	Paris, France	L	3,409 high school students		◌		
Dockrell 2013 (56)	UK	L	12,171 adolescents	◌	◌	◌	
Dockrell 2013 (43)	UK	L	12,432 adults		●		Younger > Older adults
Douptcheva 2013 (12) [b]	Switzerland	L	5,081 men		◌		
EU 2012 (36)	27 EU member states	L	26,751 adults	◌			
Grana 2014 (27)	USA	L	1,549 adult smokers			●	Younger > Older adults
Johns 2014 (57)	USA	L	504 adolescents		●		Older > Younger children
King 2013 (53)	USA	L	10,739 adults	●	○		Younger > Older adults
Kinnunen 2013 (44)	Finland	L	3,535 adolescents	◌	◌		
Kralikova 2013 (45)	Czech Republic	L	1,738 smokers		●	●	Younger > Older adults (ever use); Older > Younger adults (current use)
Krishnan-Sarin 2014 (46)	USA	L	4,780 middle/high school students	◌	◌	◌	
Li 2013 (30)	New Zealand	L	840 adult current/recent smokers		●		Younger > Older adults [h]
Martinez-Sanchez 2014 (48)	Barcelona, Spain	L	1,291 adults		●	○	Younger > Older adults
McMillen 2012 (13)	USA	L	3,240 adults		○		
Pepper 2014 (14)	USA	L	17,522 adults	●			Younger > Older adults
Pokhrel 2014 (31)	Hawaii, USA	L	307 undergrad students		●	●	Younger > Older adults
Pokhrel 2013 (32)	Hawaii, USA	L	1,685 adult smokers		●		Younger > Older adults
Popova 2013 (15)	USA	L	7,776 adult current/recent smokers		●		Younger > Older adults
Regan 2013 (16)	USA	L	41,240 adults	●	○	○	Younger > Older adults
Sherratt 2014 (33)	Liverpool, England	L	256 adult smokers			○	
Sochor 2014 (50)	Brno city, Czech Republic	L	966 adults			●	Older > Younger adults
Stillman 2014 (51)	USA	L	723 flight attendants			○	
Sutfin 2013 (34)	North Carolina, USA	L	4,857 undergrad students		○		

Lead Author	Country	Quality of Evidence	Sample	Aware	Ever use	Current Use	Key findings
Vickerman 2013 (35)	6 states, USA	L	7,966 adult smokers		○		
Yong 2014 (58)	Australia	L	~13,500 current/former smokers [l]	○	○		

[a] Current use defined as self-reported use 'regularly' or 'occasionally'.

[b] Among smokers only. Ever use defined as any use in last 12 months.

[c] Plot shows results for all 4 countries combined.

[d] Statistical significance inferred by review authors from non-overlapping confidence intervals

[e] Rates also higher among whites for 'established use' (used an e-cigarette at least once in the past 30 days and more than 50 times in their lifetime).

[f] Study reports multiple years of data; for reporting purposes, plot reflects data from most recent year.

[g] Current use defined as reporting smoking electronic cigarettes at least once during their lifetime and now smoking them 'every day' or 'some days'.

[h] Ever purchase of an e-cigarette taken as proxy for ever use.

[i] Among smokers only.

[j] Among both current and former smokers respectively.

[k] Current use defined as 'do you use e-cigarettes?' (i.e. no 30-day timeframe given).

[l] Estimated by review team due to sample size not being reported directly by authors.

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APPENDIX C – Qualitative workstream: supplementary recruitment information

Participant recruitment summary

		Site A	Site B	Site C	TOTALS	
CURRENT AND EX-SMOKERS	**SSS users** *Vapers*	1: Fri 8th Dec 2: Mon 18th Dec 3: Fri 25th May -	1: Mon 4th Dec 2: Mon 4th Dec 3: Weds 6th Dec 4: Tues 22nd May	1: Weds 7th March 2: Mon 12th March 3: Weds 21st March -	*10*	**17**
	SSS users *Non-vapers*	1: Fri 8th Dec 2: Weds 17th Jan 3: Tues 6th Feb	1: Fri 15th Dec 2: Tues 6th March -	1: Weds 7th March 2: Weds 21st March -	*7*	
	Non SSS users *Vapers*	1: Fri 4th May 2: Mon 25th June	1: Fri 8th June -	1: Weds 30th May 2: Fri 24th Aug	*5*	**12**
	Non SSS users *Non-vapers*	1: Fri 13th April 2: Fri 4th May 3: Fri 25th May	1: Tues 17th April 2: Fri 11th May 3: Tues 15th May	1: Fri 24th Aug - -	*7*	
STOP SMOKING SERVICE (SSS) PROFESSIONALS	**Staff**	1: Tue 31st Oct 2: Wed 1st Nov 3: Fri 3rd Nov 4: Fri 3rd Nov	1: Mon 30th Oct 2: Tues 21st Nov 3: Tues 21st Nov 4: Mon 27th Nov	1: Thurs 14th Dec 2: Thurs 14th Dec 3: Thurs 11th Jan 4: Thurs 11th Jan	*12*	**17**
	Stakeholders	1: Tue 31st Oct 2: Weds 1st Nov	1: Mon 19th Feb 2: Tues 13th March	1: Mon 12th March -	*5*	
TOTALS		**17**	**16**	**13**	**46**	

Within the SSS professionals group of interviewees (n=17), 'staff' (n=12) included SSS managers (n=3) and practitioners (n=9), while 'stakeholders' (n=5) included local council-employed public health consultants (n=3), a local Trust-employed public health consultant (n=1) and a local council-employed public health commissioner (n=1).

Site recruitment

- Site A was recruited after being identified as a strong candidate for the study in light of their public statements regarding e-cigarettes. The lead researcher then met with the SSS manager on several occasions to discuss the proposed research with them.
- Site B was recruited following the lead researcher consulting public health registrar colleagues for SSS contacts in suitable local authorities, which led to a discussion with the local authority public health consultant responsible for Site B, followed by meetings with the SSS manager.
- Site C was recruited through the lead researcher consulting two national and regional smoking subject matter experts about suitable sites, followed again by discussions with the SSS manager.
- For each of the three sites, the lead researcher was also invited to meetings with wider SSS team members where the plans for the study were presented, discussed and refined.

Thumbnail sketches of sites

Site A was an urban SSS with a staff of 15 people (including the manager), which covered the whole city where the service was based. Clinics were provided out of GP surgeries, community centres, council offices and other voluntary organisations (e.g. Age UK). There was then a further network of "associate providers" in the form of community pharmacists and practice nurses who also delivered smoking cessation support on behalf of the SSS, though these had been reduced in number by about two thirds in recent years, as the best quit rates were observed with the core team of smoking cessation advisors.

Site B was an urban SSS covering one of many local authority areas within a major city. It employed 7 people in total (including the manager), and the provider was the local hospital trust. Unlike the other two sites, it no longer provided services through pharmacists and nurses; the SSS was now mainly delivered by the core team of specialists operating half or full-day clinics out of GP surgeries (particularly large practices or those in the most deprived areas). A further key focus of work was the development of an online stop smoking programme to allow self-referral for local smokers, text message support and automated provision of prescriptions to GP practices.

Site C was a SSS covering a large county, which was primarily rural but included several towns. It employed 8 people (including the manager) within the core team, but these specialists then trained a wide network of "intermediate advisors" in the form of pharmacists, GPs, practice nurses and healthcare assistants. The provider of the SSS was the local hospital trust.

APPENDIX D – Qualitative workstream: recruitment flyer

Would you like to tell me what you think about:

E-CIGARETTES?

I'm doing a research study into e-cigarette use and how the NHS responds to it. I would love to hear your views, whether you vape, smoke or both!

For more information, with no obligation to take part, please get in touch with me, **Greg Hartwell**, by:

Phone or text: 07854 233 655
Email: gregory.hartwell@lshtm.ac.uk

All participants will receive a £20 shopping voucher as a thank you.

APPENDIX E – Qualitative workstream: participant information sheets

[Current and ex-smokers version]

Participant Information: LSHTM study into stop smoking services & e-cigarettes

This is an information sheet for a research study (IRAS 223311) about what influences smokers who also vape when they are deciding whether or not to access NHS stop smoking services. Please note though that we seeking to recruit both smokers who use e-cigarettes, and smokers who *do not* use them. This is because we are interested in differences between these two groups.

You are being invited to take part in this study. Before you decide, please read through this sheet which provides further information on why the study is taking place and what it will involve. Please take as long as you need to decide whether you would like to take part, and feel free to ask us any questions you like about the study (contact details below).

1. What is the purpose of this study?

We want to understand more about people who use e-cigarettes to try to stop smoking, and whether e-cigarette use influences their decisions to attend (or not to attend) NHS stop smoking services. Ultimately, the aim is to provide better informed and more effective services for smokers who want to quit.

2. Why have I been asked?

As someone who either currently uses or has previously used, e-cigarettes or conventional (i.e. tobacco) cigarettes, your views on issues around e-cigarettes, smoking and quitting are highly relevant for this study. As outlined above, we are interested in recruiting both smokers who use e-cigarettes, and those who *do not* use them.

3. Do I have to take part?

Not at all – we would love to hear your views on these issues but participation is entirely voluntary. Furthermore, declining to take part in the study will have no impact whatsoever on the care you receive from your stop smoking service.

4. What does taking part involve?

If, after reviewing this information sheet, you are willing to take part, please just let our research team know (contact details are below if required). We will arrange a one-to-one interview lasting approximately 30-45 minutes at whatever time and place is most convenient to you. We are particularly interested in your views and experiences of NHS stop smoking services (even if you have never used these services before, we will still be interested to hear your views on them). The kinds of topics we will be keen to discuss with you will therefore include: your history of smoking and e-cigarette use; your experiences (if any) of your local NHS

stop smoking services; your perceptions of these services and of other methods of quitting, including e-cigarette use; and your views on broader social factors that can influence smoking and e-cigarette use (such as their social acceptability). You will be free to decline to answer any specific questions within the interview that you wish to.

5. What are the possible disadvantages and risks of taking part?

The only disadvantage is giving up 30-45 minutes of your time. Even if you have decided to take part and signed the consent form, you can still change your mind and withdraw from the study at any point (i.e. before, during or after the interviews), without having to give any reason. Again, should you do so, this will have no impact whatsoever on the care you receive from your stop smoking service.

6. What are the possible benefits of taking part?

While there are no direct benefits to you in taking part, people often enjoy the experience of being able to give their views on such an interesting and topical area. In addition, you will be contributing to research of national importance that could ultimately help provide better support to smokers who wish to quit smoking. We can also share the overall results of the study with you directly by email, if you would like to receive these.

7. Will my taking part in the study be kept confidential?

You will be asked before the interview if you are happy for it to be recorded so that it can be transcribed afterwards in order for us to analyse it along with the other interviews. We use third party transcribers (i.e. external to our university) for this, but they are bound under a confidentiality agreement, and all the information you provide in the interview will be fully anonymised during this transcription process. You will therefore not be identifiable in any report or publication. Similarly, data about/from your interview may be shared via a public data repository or by sharing directly with other researchers, but you will not be identifiable from this information since it will all be anonymised. The only person we would want to make aware of your participation in the study, as a courtesy, is your stop smoking service advisor (if you have one). This will be entirely up to you though, so you will be able to let us know if you would rather we did not inform them.

If you provide your contact details to us, these will be used to arrange the interview with you and will then be immediately deleted. The only exception would be if you wish to receive a copy of the research's final findings (which again would be entirely up to you) – if so, we would need to keep an email address for you in order to be able to circulate this to you when it is ready, after which we would immediately delete it.

8. What if I am unhappy with the process?

If you have any concerns at any point, you can discuss these with Greg Hartwell from our research team, whose contact details are below. If for any reason you are still unhappy, you can also contact the lead supervisor Mark Petticrew at mark.petticrew@lshtm.ac.uk or on 020 7976 2009.

9. Who is organising and funding the study?

We are researchers from the London School of Hygiene and Tropical Medicine, a University of London medical school (www.lshtm.ac.uk). Our study is funded by Health Education England and the National Institute for Health Research, and forms part of a PhD being undertaken by Greg Hartwell.

10. Who has reviewed the study?

This study has been granted ethical approval by the London School of Hygiene and Tropical Medicine's ethical committee (ref 11672), the NHS Health Research Authority (IRAS ref 223311) and the National Research Ethics Service (REC ref 17/LO/0414). Local R&D approval in *[name of research site added here]* has also been obtained *[local R&D reference added here]*.

11. What do I do if I am interested in taking part?

If you are interested in taking part or would like to ask any questions to help you make your mind up, please contact:

Greg Hartwell
School of Public Health Research
London School of Hygiene and Tropical Medicine
Tel: 07854 233 655
Email: gregory.hartwell@lshtm.ac.uk

All participants will receive a £20 shopping voucher as a thank you.

Thank you for considering this study

[Stop smoking service staff version]

Participant Information: LSHTM study into stop smoking services & e-cigarettes

This is an information sheet for a research study (IRAS 223311) about what influences smokers who also vape when they are deciding whether or not to access NHS stop smoking services.

You are being invited to take part in this study. Before you decide, please read through this sheet which provides further information on why the study is taking place and what it will involve. Please take as long as you need to decide whether you would like to take part, and feel free to ask us any questions you like about the study (contact details below).

1. What is the purpose of this study?

We want to understand more about people who use e-cigarettes to try to stop smoking, and whether e-cigarette use influences their decisions to attend (or not to attend) NHS stop smoking services. Ultimately, the aim is to provide better informed and more effective services for smokers who want to quit.

2. Why have I been asked?

You have been asked to take part as someone who works in one of the NHS stop smoking services being researched as part of this study. We are particularly interested in your views and experiences of smokers using e-cigarettes and their attendance at NHS stop smoking services.

3. Do I have to take part?

Not at all – we would love to hear your views on these issues but participation is entirely voluntary.

4. What does taking part involve?

If, after reviewing this information sheet, you are willing to take part, please just let our research team know (contact details are below if required). We will arrange a one-to-one interview lasting approximately 30-45 minutes at whatever time and place is most convenient to you. The kinds of topics we will be keen to discuss your views on will include: factors influencing your service's policy on e-cigarettes; the accessibility of your services to smokers using e-cigarettes; your service's methods of recruiting clients; and advice offered to clients regarding e-cigarettes. You are not expected to know the answers to all of these – we are simply interested in exploring the areas with you. You will also be free to decline to answer any specific questions within the interview that you wish to.

5. What are the possible disadvantages and risks of taking part?

The only disadvantage is giving up 30-45 minutes of your time. Even if you have decided to take part and signed the consent form, you can still change your mind and withdraw from the study at any point (i.e. before, during or after the interviews), without having to give any reason.

6. What are the possible benefits of taking part?

While there are no direct benefits to you in taking part, people often enjoy the experience of being able to give their views on such an interesting and topical area. In addition, you will be contributing to research of national importance that could ultimately help provide better support to smokers who wish to quit smoking, both across England and within your own borough. We can also share the overall results of the study with you directly by email, if you would like to receive these.

7. Will my taking part in the study be kept confidential?

You will be asked before the interview if you are happy for it to be recorded so that it can be transcribed afterwards in order for us to analyse it along with other interviews. We use third party transcribers (i.e. external to our university) for this, but they are bound under a confidentiality agreement, and all the information you provide in the interview will be fully anonymised during this transcription process. You will therefore not be identifiable in any report or publication. Similarly, data about/from your interview may be shared via a public data repository or by sharing directly with other researchers, but you will not be identifiable from this information since it will all be anonymised.

If you provide your contact details to us, these will be used to arrange the interview with you and will then be immediately deleted. The only exception would be if you wish to receive a copy of the research's final findings (which again would be entirely up to you) – if so, we would need to keep an email address for you in order to be able to circulate this to you when it is ready, after which we would immediately delete it.

8. What if I am unhappy with the process?

If you have any concerns at any point, you can discuss these with Greg Hartwell from our research team, whose contact details are below. If for any reason you are still unhappy, you can also contact the lead supervisor Mark Petticrew at mark.petticrew@lshtm.ac.uk or on 020 7976 2009.

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All participants will receive a £20 shopping voucher as a thank you.

Thank you for considering our study

[Stop smoking service stakeholders version]

Participant Information: LSHTM study into stop smoking services & e-cigarettes

This is an information sheet for a research study (IRAS 223311) about what influences smokers who also vape when they are deciding whether or not to access NHS stop smoking services.

You are being invited to take part in this study. Before you decide, please read through this sheet which provides further information on why the study is taking place and what it will involve. Please take as long as you need to decide whether you would like to take part, and feel free to ask us any questions you like about the study (contact details below).

1. What is the purpose of this study?

We want to understand more about people who use e-cigarettes to try to stop smoking, and whether e-cigarette use influences their decisions to attend (or not to attend) NHS stop smoking services. Ultimately, the aim is to provide better informed and more effective services for smokers who want to quit.

2. Why have I been asked?

You have been asked to take part as someone who is an important stakeholder of one of the NHS stop smoking services being researched as part of this study. We are particularly interested in your views on smokers using e-cigarettes and their attendance at NHS stop smoking services.

3. Do I have to take part?

Not at all – we would love to hear your views on these issues but participation is entirely voluntary.

4. What does taking part involve?

If, after reviewing this information sheet, you are willing to take part, please just let our research team know (contact details are below if required). We will arrange a one-to-one interview lasting approximately 30-45 minutes at whatever time and place is most convenient to you. The kinds of topics we will be keen to discuss your views on will include: factors influencing your local service's policy on e-cigarettes; the accessibility of your local services to smokers using e-cigarettes; your local service's methods of recruiting clients; and advice offered to clients regarding e-cigarettes. You are not expected to know the answers to all of these – we are simply interested in exploring the areas with you. You will also be free to decline to answer any specific questions within the interview that you wish to.

5. What are the possible disadvantages and risks of taking part?

The only disadvantage is giving up 30-45 minutes of your time. Even if you have decided to take part and signed the consent form, you can still change your mind and withdraw from the study at any point (i.e. before, during or after the interviews), without having to give any reason.

6. What are the possible benefits of taking part?

While there are no direct benefits to you in taking part, people often enjoy the experience of being able to give their views on such an interesting and topical area. In addition, you will be contributing to research of national importance that could ultimately help provide better support to smokers who wish to quit smoking, both across England and within your own borough. We can also share the overall results of the study with you directly by email, if you would like to receive these.

7. Will my taking part in the study be kept confidential?

You will be asked before the interview if you are happy for it to be recorded so that it can be transcribed afterwards in order for us to analyse it along with other interviews. We use third party transcribers (i.e. external to our university) for this, but they are bound under a confidentiality agreement, and all the information you provide in the interview will be fully anonymised during this transcription process. You will therefore not be identifiable in any report or publication. Similarly, data about/from your interview may be shared via a public data repository or by sharing directly with other researchers, but you will not be identifiable from this information since it will all be anonymised.

If you provide your contact details to us, these will be used to arrange the interview with you and will then be immediately deleted. The only exception would be if you wish to receive a copy of the research's final findings (which again would be entirely up to you) – if so, we would need to keep an email address for you in order to be able to circulate this to you when it is ready, after which we would immediately delete it.

8. What if I am unhappy with the process?

If you have any concerns at any point, you can discuss these with Greg Hartwell from our research team, whose contact details are below. If for any reason you are still unhappy, you can also contact the lead supervisor Mark Petticrew at mark.petticrew@lshtm.ac.uk or on 020 7976 2009.

9. Who is organising and funding the study?

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11. What do I do if I am interested in taking part?

If you are interested in taking part or would like to ask any questions to help you make your mind up, please contact:

Greg Hartwell
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Tel: 07854 233 655
Email: gregory.hartwell@lshtm.ac.uk

All participants will receive a £20 shopping voucher as a thank you.

Thank you for considering our study

APPENDIX F – Qualitative workstream: consent form

INFORMED CONSENT FORM: LSHTM study into stop smoking services & e-cigarettes

(Research Study IRAS 223311)

Please read the following statements, initial those you agree with in the boxes on the right, and sign your name at the end if you are happy to take part in the study:

		(Initials)
1.	I confirm that I have read the participant information sheet dated …… (version ……) for this study and have had the opportunity to consider the information within it.	
2	I confirm that I have had the opportunity to ask questions about the study and to have these answered fully.	
3.	I agree to take part in an interview for this study.	
4.	I agree to the interview being audio recorded.	
5.	I understand that my participation is voluntary and that I am free to stop the interview at any point without having to give any reason.	
6.	I understand that the interview is part of a research study being conducted for the purposes of a PhD degree.	
7.	I understand that all information I give during the interview will be strictly confidential and that the results of the study will be anonymised (i.e. no one will be able to trace anything I say during the interview back to me).	
8.	I understand that data about/from me may be shared via a public data repository or by sharing directly with other researchers, and that I will not be identifiable from this information.	
9.	I agree that anonymised, unidentifiable direct quotations may be used in the reporting of this study.	

_____ _____ _____

Name of participant (PRINTED) | Signature of participant | Date

_____ _____ _____

Principal investigator (PI) (PRINTED) | Signature of PI | Date

1 copy to be retained by the participant; 1 copy to be retained by the Principal Investigator

If you would like more information, please contact:

Greg Hartwell
London School of Hygiene & Tropical Medicine
15-17 Tavistock Place
London WC1H 9SH
Tel: 07854 233 655
Email: gregory.hartwell@lshtm.ac.uk

APPENDIX G – Qualitative workstream: topic guides

[Current and ex-smokers version]

NB: Interviewees included people with varying histories of quitting tobacco (i.e. current and recent ex-smokers), using e-cigarettes (i.e. current, ex and never vapers) and accessing stop smoking services (i.e. ever users and never users). Questions included/omitted and specific wording of questions asked therefore inevitably flexed depending on the individual respondent.

Key area of investigation	Themes	Example questions
Smoking/ vaping: initially and now	1) Frequency & duration of tobacco and/or e-cigarette use 2) Reasons for tobacco and/or e-cigarette use	• Can you tell me about when you first started smoking / can you remember your first cigarette? • And what were the kinds of reasons why you first started smoking? • And during the period you smoked, how much were you smoking on average? (e.g. cigarettes per day) And as a maximum? • So when did you quit? • When did you first start using e-cigs? • Could you tell me a bit about how often you usually use e-cigs at present? (e.g. periods of vaping per day, for how long) • How has that amount changed (if at all) over time since you first started? • And what were the kinds of reasons why you first started using e-cigs? • And to what extent are the reasons why you use e-cigs today still the same as that or have they shifted at all?
Quit attempts	1) Previous quit attempts and success or failure 2) Periods of abstinence	• When you quit for good, how did you go about it? (e.g. what kind of quit aids, if any, did you use?) • How often (if at all) had you tried quitting smoking before you quit for good? • And how did you go about quitting each time? (e.g. what kind of quit aids did you use?)

Key area of investigation	Themes	Example questions
		• How helpful did you find those? • How long did any quit periods last? • What were the kinds of reasons why you started smoking again?
E-cigs: Perceptions and influence on use	1) General views on e-cigs 2) Plans to continue or curtail vaping 3) E-cigarettes safety & efficacy as quitting aids 4) Influence of family/friends 5) Cultural acceptability 6) Sense of identity & belonging	• How do you feel about vaping generally? • Who else do you know, if anyone, that uses e-cigs or has used them? • If you/they wanted to quit vaping, how do you think you/they would go about it? • What are your thoughts on the safety or harms of e-cigs compared to smoking? • What are your thoughts on e-cigs as a tool for quitting smoking / how effective, if at all, do you think they are at helping people to quit smoking? • How do you think e-cigs are viewed by the general public nowadays? • How do you think this compares to how smoking is viewed? • How far (if at all) do you think anything you've read/seen in the media has influenced your views on e-cigs and decisions about using them? • How much (if at all) do you feel vaping is an important part of your identity and how does this compare to how you feel/felt about your smoking? • What kind of responses have you had from friends, family, work colleagues etc to your vaping? • Have you had any positive or negative comments/feedback on your vaping? • To what extent (if at all) do you think any of these responses have had any influence on your own views or decisions around vaping?
SSS: past experiences and future intentions	1) Previous use of services 2) Awareness of services 3) Peer precedents 4) Positive or negative experiences 5) Potential future use of SSS & rationale	• How often have you accessed a SSS in the past? • How did you hear about your SSS (each time)? • What kind of people (if any) do you know personally who have accessed SSSs? (*prompt if required:* e.g. family, friends, work colleagues, general acquaintances etc) • Could you tell me about your experiences with the SSS? • How helpful or unhelpful would you say the SSS was in your efforts to quit? • How likely or unlikely would you say you are to ever use SSSs in the future to try to quit smoking / quit vaping? How likely would you be to recommend them to other people? • Why is that?

Key area of investigation	Themes	Example questions
SSS: Perceptions and influences on use	1) General influences on use 2) Influence of family & friends 3) Influence of logistical hurdles 4) Perceptions of SSS effectiveness 5) SSS advice on e-cigs 6) Perceptions of SSS e-cigarette policies	• What would you say were the main reasons why you decided to use the SSS? • What do you think were the reasons that stopped you using it before then? • How far, if at all, do you feel any logistical challenges affected your decisions about attending SSSs? (*prompt if required:* e.g. distance to travel, opening hours, time required to attend etc) • To what extent, if at all, do you think your family or friends had any influence on your decisions about whether or not to attend SSSs? • How effective or not do you think SSSs are at helping people to quit smoking? • How about compared to e-cigarettes? • To what extent (if at all) do you feel budget cuts / cost constraints might have had any impact on your local SSS? • What advice did the SSS give you about e-cigs? • How did you feel the SSS viewed e-cigs compared to other ways to quit smoking? • How do you think your SSS would respond to you /other people who are trying to quit smoking using e-cigs? i.e. how willing or not would you expect them to be to help such smokers? • How do you think your SSS would respond to you /other people who are trying to quit e-cigs having already quit smoking? i.e. how willing or not would you expect them to be to help such people?
CLOSING		• Is there anything else you'd like the chance to speak about not covered already?

[Stop smoking service professionals version]

NB: Interviewees included both managers and practitioners of stop smoking services, as well as a small number of their key stakeholders. Questions included/omitted and specific wording of questions asked therefore inevitably flexed depending on the individual respondent.

Key area of investigation	Themes	Example questions
Respondent characteristics	1) Career history 2) Motivation 3) Role & tenure in team	• Could you tell me how you ended up in the field of smoking? • What was your background before this job? (i.e. kinds of other roles you have had) • What was it about the field of smoking in particular that attracted or inspired you? • Could you tell me about your role with the service here and what it encompasses? • How long have you been with the team?
General context: service set-up, recruitment and dual user attendance	1) General service structure 2) Recruitment of smokers, including proactive work on dual users 3) Systematic differences between dual users & other smokers	• Could you describe the challenges the borough faces in relation to smoking, i.e. any that are particularly key or pressing for your area specifically as a result of its demographics, for instance? • Could you very briefly describe the current set-up of the service here, i.e. how support is provided within the borough? To what extent has this shifted at all in recent years due to any changes in commissioning arrangements, budget cuts or reconfigurations? • Could you describe the current broad approaches taken to recruiting smokers? How far, if at all, has any of your recruitment work focused on e-cigs? • What kind of data do you collect at present relating to e-cigs? • To what extent have there been any obvious broad differences between smokers using e-cigarettes to try to quit smoking and the other smokers you see? • How likely do you feel dual users (of e-cigs and tobacco) are to use the service compared to other smokers? Why do you think that is?
Service position on e-cigs	1) Nature of service's policy & where captured 2) Policy in practice	• How would you describe the philosophy/approach towards e-cigs that the service has? • To what extent would you say this is written down formally anywhere? To what extent would you say the service here has historically had any kind of formal policy on e-cigs?

Key area of investigation	Themes	Example questions
	3) Staff understanding & adherence 4) Frequency of review 5) Similarity to other areas	• If someone presented to your service wanting to quit smoking solely through the use of e-cigs rather than any other aids, what advice/support would they receive? • Similarly, if they presented having already quit smoking but now wanting to quit e-cigs too, what advice or support would be given to them? • How far do you feel staff have a shared awareness & understanding of this position/policy? • How consistent across staff would you say advice given to people about e-cigs is? • How regularly (if at all) do you think the position/policy is discussed and updated? • How do you think your service's policy/position on e-cigs probably compares to those of other services around the country?
Influences on services' policy	1) History of e-cig policy's development 2) Discussions across borough 3) Local influences 4) National influences 5) Influence of other boroughs 6) Overall balance between internal & external control/ influences 7) Budget cuts & reconfigurations	• How do you think the service's position on e-cigs developed to what it is today? • So what do you feel were the most particularly important influences on your service's policy/approach, i.e. from which groups or organisations? • How much discussion has there been specifically on e-cigs amongst stakeholders across the borough? Do you think local stakeholders had a particular influence on the position/policy? e.g. what role (if any) did your local authority public health or commissioning team have in determining the current position/policy? • And how do you think local smokers have influenced it (if at all)? • What other particularly important influences on your service's position/policy have there been from any other groups or organisations? (*prompts if required:* e.g. national organisations/guidelines, local or national media, research and new studies) • To what extent would you say you've been influenced by services in other areas? • Overall, how far would you say staff across the service shaped the position/policy from within, compared to these external influences and pressures? • What kind of influences (if any) do you think any changes to commissioning arrangements, budget cuts or reconfigurations have had on the service's present policy/position on e-cigs?
Individual views on e-cigs	1) Views on e-cigs 2) Future for e-cigs	• How would you say your own views on e-cigs have developed over time, if at all? • How do you think e-cigs will be viewed ten, twenty years from now?
CLOSING		• Is there anything else you'd like the chance to speak about not covered already?

APPENDIX H – Ethical clearances

The following pages contain scanned copies of:

1) LSHTM REC approval (09/09/16, REC Reference 11672)

2) National Research Ethics Service (NRES) approval (18/04/17, REC Reference 17/LO/0414, IRAS ID 223311)

3) Health Research Authority (HRA) approval (19/04/17, REC Reference 17/LO/0414, IRAS ID 223311)

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Observational / Interventions Research Ethics Committee

Mr Greg Hartwell
LSHTM

9 September 2016

Dear Greg

Study Title: Understanding the facilitators and barriers that impact on the attendance of electronic cigarette users at NHS stop smoking services: a mixed methods investigation

LSHTM Ethics Ref: 11672

Thank you for responding to the Observational Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Conditions of the favourable opinion

Approval is dependent on local ethical approval having been received, where relevant.

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document Type	File Name	Date	Version
Information Sheet	2016.06.06 Consent form DRAFT	06/06/2016	1
Investigator CV	2016.06.20 Greg Hartwell CV - LSHTM ethics	20/06/2016	1
Information Sheet	2016.06.30 Ipsos MORI Information Sheet FINAL	30/06/2016	1
Information Sheet	2016.08.30 Participant Information Sheet (Smokers & E-cig users) DRAFT v2	30/08/2016	2
Information Sheet	2016.08.30 Participant Information Sheet (Service staff) DRAFT v2	30/08/2016	2
Advertisements	2016.08.30 Recruitment poster DRAFT v2	30/08/2016	2
Protocol / Proposal	2016.08.30 Protocol FINAL (LEO) v2	30/08/2016	2
Covering Letter	2016.08.30 Letter to Chair (with UCL letter appended) FINAL	30/08/2016	1

After ethical review

The Chief Investigator (CI) or delegate is responsible for informing the ethics committee of any subsequent changes to the application. These must be submitted to the Committee for review using an Amendment form. Amendments must not be initiated before receipt of written favourable opinion from the committee.

The CI or delegate is also required to notify the ethics committee of any protocol violations and/or Suspected Unexpected Serious Adverse Reactions (SUSARs) which occur during the project by submitting a Serious Adverse Event form.

At the end of the study, the CI or delegate must notify the committee using an End of Study form.

All aforementioned forms are available on the ethics online applications website and can only be submitted to the committee via the website at: http://leo.lshtm.ac.uk

Additional information is available at: www.lshtm.ac.uk/ethics

[redacted]

Professor John DH Porter
Chair

ethics@lshtm.ac.uk
http://www.lshtm.ac.uk/ethics/

London - Camberwell St Giles Research Ethics Committee
Level 3, Block B
Whitefriars
Lewins Mead
Bristol
BS1 2NT

Telephone: 02071048044

Please note: This is an acknowledgement letter from the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval

18 April 2017

Mr Gregory J Hartwell
NIHR Clinical Doctoral Research Fellow
London School of Hygiene and Tropical Medicine (LSHTM)
Room 145, 15-17 Tavistock Place
London
WC1H 9SH

Dear Mr Hartwell

Study title:	**Understanding influences on the attendance of 'dual users' of tobacco and e-cigarettes at NHS stop smoking services**
REC reference:	**17/LO/0414**
Protocol number:	**N/A**
IRAS project ID:	**223311**

Thank you for your response received 10th April 2017. I can confirm the REC has received the documents listed below and that these comply with the approval conditions detailed in our letter dated 29 March 2017

Documents received

The documents received were as follows:

Document	*Version*	*Date*
IRAS Checklist XML [Checklist_10042017]		10 April 2017
Participant consent form [Consent form (track changes)]	2	10 April 2017
Participant consent form [Consent form (no track changes)]	2	10 April 2017
Participant information sheet (PIS) [Service staff version (track changes)]	2	10 April 2017
Participant information sheet (PIS) [Service staff version (no track changes)]	2	10 April 2017
Participant information sheet (PIS) [Smokers/vapers version (track changes)]	2	10 April 2017
Participant information sheet (PIS) [Smokers/vapers version (no track changes)]	2	10 April 2017
Participant information sheet (PIS) [Stakeholders version (track changes)]	2	10 April 2017
Participant information sheet (PIS) [Stakeholders version (no track changes)]	2	10 April 2017

Approved documents

The final list of approved documentation for the study is therefore as follows:

Document	*Version*	*Date*
Contract/Study Agreement [Schedule of Events]	1	15 February 2017
Copies of advertisement materials for research participants [Poster]	1	15 February 2017
Copies of advertisement materials for research participants [Flyer-type initial info sheet]	1	15 February 2017
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [LSHTM sponsor letter]	1	15 February 2017
GP/consultant information sheets or letters [Practitioner Letter]	1	15 February 2017
Interview schedules or topic guides for participants [Dual users/smokers version]	1	15 February 2017
Interview schedules or topic guides for participants [Service staff version]	1	15 February 2017
Interview schedules or topic guides for participants [Stakeholders version]	1	15 February 2017
IRAS Application Form [IRAS_Form_15022017]		15 February 2017
IRAS Application Form XML file [IRAS_Form_15022017]		15 February 2017
IRAS Checklist XML [Checklist_15022017]		15 February 2017
IRAS Checklist XML [Checklist_10042017]		10 April 2017
Letter from funder [Funding Letter]		
Participant consent form [Consent form (track changes)]	2	10 April 2017
Participant consent form [Consent form (no track changes)]	2	10 April 2017
Participant information sheet (PIS) [Service staff version (track changes)]	2	10 April 2017
Participant information sheet (PIS) [Service staff version (no track changes)]	2	10 April 2017
Participant information sheet (PIS) [Smokers/vapers version (track changes)]	2	10 April 2017

Participant information sheet (PIS) [Smokers/vapers version (no track changes)]	2	10 April 2017
Participant information sheet (PIS) [Stakeholders version (track changes)]	2	10 April 2017
Participant information sheet (PIS) [Stakeholders version (no track changes)]	2	10 April 2017
Referee's report or other scientific critique report [Upgrading report]	1	15 February 2017
Research protocol or project proposal [Research protocol]	1	15 February 2017
Summary CV for Chief Investigator (CI) [CI summary CV]		15 February 2017
Summary CV for supervisor (student research) [Supervisor CV]	1	15 February 2017

You should ensure that the sponsor has a copy of the final documentation for the study. It is the sponsor's responsibility to ensure that the documentation is made available to R&D offices at all participating sites.

17/LO/0414 **Please quote this number on all correspondence**

Yours sincerely

[redacted]

Tina Cavaliere
REC Manager

E-mail: nrescommittee.london-camberwellstgiles@nhs.net

Copy to: *Ms Patricia Henley*

Health Research Authority

Mr Gregory J Hartwell
NIHR Clinical Doctoral Research Fellow
London School of Hygiene and Tropical Medicine (LSHTM)
Room 145, 15-17 Tavistock Place
London
WC1H 9SH

Email: hra.approval@nhs.net

19 April 2017

Dear Mr Hartwell

Letter of HRA Approval

Study title:	**Understanding influences on the attendance of 'dual users' of tobacco and e-cigarettes at NHS stop smoking services**
IRAS project ID:	**223311**
Protocol number:	**N/A**
REC reference:	**17/LO/0414**
Sponsor	**London School of Hygiene and Tropical Medicine**

I am pleased to confirm that **HRA Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications noted in this letter.

Participation of NHS Organisations in England

The sponsor should now provide a copy of this letter to all participating NHS organisations in England.

Appendix B provides important information for sponsors and participating NHS organisations in England for arranging and confirming capacity and capability. **Please read *Appendix B* carefully**, in particular the following sections:

- *Participating NHS organisations in England* – this clarifies the types of participating organisations in the study and whether or not all organisations will be undertaking the same activities
- *Confirmation of capacity and capability* - this confirms whether or not each type of participating NHS organisation in England is expected to give formal confirmation of capacity and capability. Where formal confirmation is not expected, the section also provides details on the time limit given to participating organisations to opt out of the study, or request additional time, before their participation is assumed.
- *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* - this provides detail on the form of agreement to be used in the study to confirm capacity and capability, where applicable.

Further information on funding, HR processes, and compliance with HRA criteria and standards is also provided.

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

Appendices

The HRA Approval letter contains the following appendices:

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

After HRA Approval

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

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

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

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

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

Scope

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

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

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

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website: http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/.

HRA Training

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

Your IRAS project ID is **223311**. Please quote this on all correspondence.

Yours sincerely

Joanna Ho

Assessor

Email: hra.approval@nhs.net

Copy to: *Ms Patricia Henley, Sponsor Representative, London School of Hygiene and Tropical Medicine*

Professor Mark Petticrew, Academic Supervisor, London School of Hygiene and Tropical Medicine

Appendix A - List of Documents

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

Document	*Version*	*Date*
Contract/Study Agreement [Statement of Activities]	1	15 February 2017
Contract/Study Agreement [Schedule of Events]	1	15 February 2017
Copies of advertisement materials for research participants [Poster]	1	15 February 2017
Copies of advertisement materials for research participants [Flyer-type initial info sheet]	1	15 February 2017
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [LSHTM sponsor letter]	1	15 February 2017
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Participant information sheet (PIS) [Smokers/vapers version (track changes)]	2	10 April 2017
Participant information sheet (PIS) [Smokers/vapers version (no track changes)]	2	10 April 2017
Participant information sheet (PIS) [Stakeholders version (track changes)]	2	10 April 2017
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Research protocol or project proposal [Research protocol]	1	15 February 2017
Summary CV for Chief Investigator (CI) [CI summary CV]		15 February 2017
Summary CV for supervisor (student research) [Supervisor CV]	1	15 February 2017

Appendix B - Summary of HRA Assessment

This appendix provides assurance to you, the sponsor and the NHS in England that the study, as reviewed for HRA Approval, is compliant with relevant standards. It also provides information and clarification, where appropriate, to participating NHS organisations in England to assist in assessing and arranging capacity and capability.

For information on how the sponsor should be working with participating NHS organisations in England, please refer to the, *participating NHS organisations*, *capacity and capability* and *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* sections in this appendix.

The following person is the sponsor contact for the purpose of addressing participating organisation questions relating to the study:

Name: Mr Greg Hartwell
Tel: 0207 927 7915
Email: gregory.hartwell@lshtm.ac.uk

HRA assessment criteria

Section	HRA Assessment Criteria	Compliant with Standards	Comments
1.1	IRAS application completed correctly	Yes	No comments
2.1	Participant information/consent documents and consent process	Yes	No comments
3.1	Protocol assessment	Yes	No comments
4.1	Allocation of responsibilities and rights are agreed and documented	Yes	Sponsor will use the Statement of Activities to act as agreement of an NHS organisation to participate. No other site agreement is expected.
4.2	Insurance/indemnity arrangements assessed	Yes	Sponsor indemnity is in place for the management, design and conduct of the study. Where applicable, independent contractors (e.g. General Practitioners)

Section	HRA Assessment Criteria	Compliant with Standards	Comments
			should ensure that the professional indemnity provided by their medical defence organisation covers the activities expected of them for this research study
4.3	Financial arrangements assessed	Yes	No funding will be provided to the participating NHS organisations as indicated in the Statement of Activities.
5.1	Compliance with the Data Protection Act and data security issues assessed	Yes	No comments
5.2	CTIMPS – Arrangements for compliance with the Clinical Trials Regulations assessed	Not Applicable	No comments
5.3	Compliance with any applicable laws or regulations	Yes	No comments
6.1	NHS Research Ethics Committee favourable opinion received for applicable studies	Yes	REC Favourable Opinion with Conditions issued 29 March 2017; REC acknowledgment of Conditions Met issued 18 April 2017
6.2	CTIMPS – Clinical Trials Authorisation (CTA) letter received	Not Applicable	No comments
6.3	Devices – MHRA notice of no objection received	Not Applicable	No comments
6.4	Other regulatory approvals and authorisations received	Not Applicable	No comments

Participating NHS Organisations in England

This provides detail on the types of participating NHS organisations in the study and a statement as to whether the activities at all organisations are the same or different.
This is a non-commercial single centre study. All participating NHS organisations will be acting as a Participant Identification Centre only undertaking the same activities to identify participants for the main research site, there is therefore, only one site-type for this study. If this study is subsequently extended to other NHS organisation(s) in England to become a research site, an amendment should be submitted to the HRA, with a Statement of Activities and Schedule of Events for the newly participating NHS organisation(s) in England. The Chief Investigator or sponsor should share relevant study documents with participating NHS organisations in England in order to put arrangements in place to deliver the study. The documents should be sent to both the local study team, where applicable, and the office providing the research management function at the participating organisation. For NIHR CRN Portfolio studies, the Local LCRN contact should also be copied into this correspondence. For further guidance on working with participating NHS organisations please see the HRA website. If chief investigators, sponsors or principal investigators are asked to complete site level forms for participating NHS organisations in England which are not provided in IRAS or on the HRA website, the chief investigator, sponsor or principal investigator should notify the HRA immediately at hra.approval@nhs.net. The HRA will work with these organisations to achieve a consistent approach to information provision.

Confirmation of Capacity and Capability

This describes whether formal confirmation of capacity and capability is expected from participating NHS organisations in England.
Participating NHS organisations in England **will be expected to formally confirm their capacity and capability to host this research**. • Following issue of this letter, participating NHS organisations in England may now confirm to the sponsor their capacity and capability to host this research, when ready to do so. How capacity and capacity will be confirmed is detailed in the *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* section of this appendix. • The Assessing, Arranging, and Confirming document on the HRA website provides further information for the sponsor and NHS organisations on assessing, arranging and confirming capacity and capability.

Principal Investigator Suitability

This confirms whether the sponsor position on whether a PI, LC or neither should be in place is correct for each type of participating NHS organisation in England and the minimum expectations for education, training and experience that PIs should meet (where applicable).
A Local Collaborator is expected at participating NHS organisations acting as a Participant Identification Centre only. These have already been identified as listed in Part C of the IRAS form.

GCP training is not a generic training expectation, in line with the HRA statement on training expectations.

HR Good Practice Resource Pack Expectations

This confirms the HR Good Practice Resource Pack expectations for the study and the pre-engagement checks that should and should not be undertaken

As a non-commercial study undertaken by local staff substantively employed by the participating NHS organisation, it is unlikely that letters of access or honorary research contracts will be applicable, except where local network staff employed by another Trust (or University) are involved (and then it is likely that arrangements are already in place).

Where arrangements are not already in place, network staff (or similar) undertaking any of the research activities listed in A18 or A19 of the IRAS form (except for administration of questionnaires or surveys), would be expected to obtain an honorary research contract from one NHS organisation (if university employed), followed by Letters of Access for subsequent organisations. This would be on the basis of a Research Passport (if university employed) or an NHS to NHS confirmation of pre-engagement checks letter (if NHS employed). These should confirm enhanced DBS checks, including appropriate barred list checks, and occupational health clearance. For research team members only administering questionnaires or surveys, a Letter of Access based on standard DBS checks and occupational health clearance would be appropriate.

Other Information to Aid Study Set-up

This details any other information that may be helpful to sponsors and participating NHS organisations in England to aid study set-up.

The applicant has indicated that they intend to apply for inclusion on the NIHR CRN Portfolio.