

**Incorporating considerations of socio-economic health
inequalities in evidence synthesis**

‘Thesis submitted in accordance with the requirements of the
University of Liverpool for the degree of Doctor of Philosophy
by Michelle Maden’

December 2018

Declaration

This thesis is entirely my own work and has not been offered previously for any other degree or diploma

Signed:

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This thesis contains material from a publication subject to an embargo period:

Chapter 5: Toward a theory-led meta-framework for considering socio-economic health inequalities within systematic reviews (study 3)

Publication: Maden M, McMahon N, Booth A, Dickson R, Paisley S, Gabbay M. Toward a theory-led meta-framework for considering socio-economic health inequalities within systematic reviews. *Journal of Clinical Epidemiology*. 2018;104:84-94.

Date embargo begins: December 2018

Date embargo ends: December 2019

Table of Contents

Tables, figures and boxes	6
Acknowledgements	8
Abstract	9
Chapter 1: Introduction	10
1.1 Thesis rationale.....	10
1.1.1 What do we mean by ‘health inequalities’, ‘socio-economic health inequalities’, and why are they important?	10
1.1.2 The importance of addressing socio-economic health inequalities in research ..	13
1.1.3 Approaches to tackling health inequalities in research.....	16
1.1.4 Role of the NIHR CLAHRC NWC in reducing health inequalities.....	18
1.1.5 Evidence synthesis collaboration in NIHR CLAHRC NWC.....	18
1.2 The role of systematic reviews	20
1.2.1 What is a systematic review?.....	20
1.2.2 The importance of systematic reviews in informing policy and practice	21
1.2.3 Why should we consider health inequalities in systematic reviews?.....	22
1.2.4 Extent to which health inequalities are considered in systematic reviews.....	23
1.3 Challenges involved in considering health inequalities in systematic reviews	25
1.3.1 Challenges relating to the nature of the evidence base.....	25
1.3.2 Challenges relating to the review process.....	26
1.3.3 Challenges relating to the reviewer.....	28
1.3.4 Toward the improving of health inequality considerations in systematic reviews	29
1.4 Summary.....	30
1.5 Research aim and questions.....	31
1.5.1 Research aim.....	31
1.5.2 Research Questions (RQs).....	31
1.6 Target audience	31
1.7 Motivation for the thesis	32
1.8 Positionality	33
1.9 Thesis structure.....	35
Chapter 2: Methods	36
2.1 Choice of methodological approach.....	36
2.1.1 Realist epistemology and ontology.....	36
2.1.2 Rationale for a ‘realist informed’ epistemology	40
2.2 Informing the research aim, research questions and methods.....	41

2.2.1 Development of research question 1 and study 1 methods	41
2.2.2 Development of research question 2 and study 2 methods	42
2.2.3 Development of research question 3 and study 3 methods	44
2.2.4 Development of research question 4 and study 4 methods	48
2.3 Coherence of work.....	49
2.4 Ethics.....	51
2.5 Summary	51
Chapter 3: Consideration of health inequalities in systematic reviews: a mapping review of guidance (study 1)	53
3.1. Publication and acknowledgement of contributions to study 1.....	53
3.2 Background	53
3.3 Aim and objectives.....	54
3.4 Methods.....	55
3.4.1 Search strategy.....	55
3.4.2 Inclusion criteria.....	56
3.4.3 Data extraction.....	56
3.4.4 Data synthesis	56
3.5 Results.....	57
3.5.1 Focus, scope and purpose of guidance	58
3.5.2 Guidance definitions	58
3.5.3 Development of guidance	60
3.5.4 Operationalisation of guidance.....	60
3.5.5 Evaluation of guidance.....	63
3.6 Discussion	63
3.7 Strengths and limitations of the review	68
3.8 Conclusions	68
Chapter 4: Use of programme theory to understand the differential effects of interventions across socio-economic groups in systematic reviews – a systematic methodology review (study 2)	70
4.1 Publication and acknowledgement of contributions to study 2.....	70
4.2 Background	70
4.2.1 Defining programme theory	71
4.2.2 Limitations of the systematic review guidance in helping reviews to operationalise a programme theory.....	73
4.2.3 Perceived value of programme theory use in systematic reviews	73
4.2.4 Operationalising programme theory in systematic reviews.....	74
4.2.5 Using programme theory to guide action on health inequalities.....	74

4.3 Aim	76
4.4 Methods.....	76
4.4.1 Inclusion criteria.....	76
4.4.2 Search strategy.....	77
4.4.3 Data collection and analysis.....	78
4.5 Results.....	79
4.5.1 Search results.....	79
4.5.2 Included study characteristics	81
4.5.3 Quality assessment	81
4.5.4 How reviewers rationalise an understanding of if, what and how/why interventions have differential effects in or across socio-economic populations.....	91
4.5.5 Legitimisation of programme theory in systematic reviews	92
4.5.6 Extent of use of programme theory to inform the review process	95
4.6 Discussion	98
4.7 Strengths and limitations of the methodological review	102
4.8 Conclusions	103
Chapter 5: Toward a theory-led meta-framework for considering socio-economic health inequalities within systematic reviews (study 3)	104
5.1 Publication and acknowledgement of contributions to study 3.....	104
5.2 Background	104
5.3 Methods.....	108
5.4 Results.....	109
5.4.1 ‘What’ factors may be associated with differential effects of healthcare interventions across socio-economic groups.....	111
5.4.2 ‘How’ factors may be associated with differential effects of healthcare interventions across socio-economic groups?.....	112
5.4.3 ‘Why’ factors may be associated with differential effects of healthcare interventions across socio-economic groups.....	115
5.5 Discussion	118
5.6 Conclusions	120
Chapter 6: Methodological challenges when developing meta-frameworks in evidence synthesis: a worked example of a socio-economic health inequalities meta-framework (study 4)	121
6.1 Acknowledgement of contributions to study 4	121
6.2 Background	121
6.3 Methods.....	124
6.4 Results.....	125
6.4.1 Development of a meta-framework	125

6.4.2 Operationalising the framework.....	136
6.4.3 Evaluating the framework.....	140
6.5 Discussion	140
6.5.1 Challenges in identifying theories to inform a meta-framework	140
6.5.2 Challenges in selecting theories to inform a meta-framework	143
6.5.3 Challenges in operationalising theory to inform a meta-framework	143
6.5.4 Challenges in evaluating theory to inform a meta-framework.....	145
6.6 Strengths and limitations.....	146
6.7 Conclusions	147
Chapter 7: Discussion	148
7.1 Introduction	148
7.2 Extent to which review guidance assists systematic reviewers to incorporate socio-economic health inequalities (research question 1)	154
7.3 Whether, and how, reviewers operationalise guidance on conducting systematic reviews that consider health inequalities to develop an understanding of whether their review findings may have differential effects across different socio-economic groups (research question 2).....	156
7.4 How can we enable reviewers to consider what, why and how interventions may result in differential effects across different socio-economic groups? (research question 3).....	157
7.5 What methodological challenges arise in developing a theory-led meta-framework to inform socio-economic health inequality considerations in evidence synthesis? (research question 4)	159
7.6 Contribution to knowledge.....	162
7.6.1 Builds on review guidance to inform health inequality considerations in systematic reviews.....	162
7.6.2 Provides a theory-led practical approach to operationalising review guidance on conducting systematic reviews that consider health inequalities.....	162
7.6.3 Advances systematic review methodologies	163
7.6.4 Advances information retrieval techniques in identifying theory	163
7.6.5 Demonstrates the role of theory in informing systematic review guidance development.....	164
7.6.6 Advances the role of theory in informing the conduct of systematic reviews ...	164
7.6.7 May improve usefulness of systematic reviews in informing practice and policy	165
7.7 Strengths and limitations.....	165
7.7.1 Strengths and limitations relating to the topic area – socio-economic health inequalities.....	168
7.7.2 Strengths and limitations relating to the methods.....	168

7.8 Dissemination of knowledge	170
7.9 Implications for practice	171
7.9.1 Raising awareness of the meta-framework	171
7.9.2 Use/misuse of the meta-framework to inform socio-economic health inequalities in evidence synthesis	172
7.9.3 Wider implications for information retrieval practice	178
7.9.4 Wider implications for research practice	179
7.10 Recommendations for research	179
7.10.1 Further research on developing a meta-framework to inform socio-economic health inequality considerations in evidence synthesis	179
7.10.2 Further research on evaluating a meta-framework to inform socio-economic health inequality considerations in evidence synthesis	180
7.10.3 Informing wider research on developing frameworks to inform evidence synthesis.....	181
7.10.4 Wider development of systematic review guidance	181
7.11 Impact of my research	181
7.11.1 Impact on my own knowledge, understanding and practice	181
7.11.2 Impact on the wider community	183
Chapter 8: Conclusion	185
Acknowledgement of funding	187
Disclaimer	187
References	188
Appendices	201

Tables, figures and boxes

Tables

- 1.1 Targeting, gap and gradient approaches to tackling health inequalities
- 1.2 Evidence Synthesis Theme recommendations for funding review applications
- 1.3 Comparing 'positivist' and realist approaches to evidence synthesis
- 2.1 Thesis research aim
- 3.1 Characteristics of included studies
- 3.2 Overlap of guidance items on anticipating differential effects across SES in relation to population characteristics
- 4.1 Defining programme theory
- 4.2 Perceived value of programme theory to inform systematic reviews
- 4.3 Typology of actions to reduce health inequalities with underlying programme theory
- 4.4 Inclusion and exclusion criteria
- 4.5 Quality assessment criteria based on the PRISMA Equity Extension checklist reporting on programme theory
- 4.6 Included study characteristics
- 4.7 Quality assessment
- 4.8 Referenced theoretical literature in systematic reviews exploring the effectiveness of interventions in SES populations.
- 4.9 Use of programme theory in systematic reviews of effectiveness of interventions in SES populations
- 5.1 Guidance on conducting systematic reviews incorporating health inequalities.
- 5.2 Defining access
- 5.3 Defining mechanisms associated with differential effectiveness across SES groups
- 6.1 Guidance for developing a 'best fit' framework
- 6.2 'Best fit' framework variants
- 6.3 The BeHEMoTh Framework
- 6.4 Reasons for non-retrieval of health inequality intervention theories indexed in MEDLINE
- 6.5 Stage 1 – Generating the 'intervention' theme and subthemes for the meta-framework
- 6.6 Factors omitted from meta-framework because of non-retrieval of theories in MEDLINE due to theory terms in the BeHEMoTh approach
- 6.7 Factors omitted from meta-framework because of non-retrieval of theories in MEDLINE due to health inequality terms
- 6.8 Stage 2 - Applying an 'equity lens' to the meta-framework
- 6.9 Generating mechanism themes for the meta-framework
- 6.10 'Reciprocal translation' of definitions across theories informing the meta-framework
- 7.1 Research aim and research questions
- 7.2 Overview of Study 1
- 7.3 Overview of Study 2
- 7.4 Overview of Study 3
- 7.5 Overview of Study 4
- 7.6 Defining 'context' for the meta-framework
- 7.7 Extending Booth et al's conceptual grid for reciprocal translation
- 7.8 Summary of strengths and limitations reported through this research
- 7.9 Potential use of the meta-framework to inform the review process

- 7.10 Using the meta-framework to inform SES considerations in a systematic review of interventions to increase uptake of mass cancer screening programmes
- 7.11 Summary of factors associated with differential effects across SES groups in a systematic review on interventions to increase uptake of mass cancer screening programmes

Figures

- 1.1 Main determinants of health
- 1.2 Male life expectancy at birth in England 2014-2016
- 1.3 Female life expectancy at birth in England 2014-2016
- 1.4 Health inequalities continuum
- 1.5 The systematic review process
- 2.1 Epistemology and analytical approach
- 2.2 Context-Mechanism-Outcome configuration
- 2.3 Aligning review epistemologies and methods
- 2.4 Development of research question 1 and study 1 methods
- 2.5 Development of research question 2 and study 2 methods
- 2.6 Development of research question 3 and study 3 methods
- 2.7 Overview of the 'best fit' framework synthesis method
- 2.8 Development of research question 4 and study 4 methods
- 2.9 Coherence of work
- 3.1 Flow of search results study 1
- 4.1 Flow of search results study 2
- 5.1 Potential impact of healthcare interventions on health inequalities
- 5.2 Meta-framework for incorporating socio-economic health inequalities in evidence synthesis

Acknowledgements

After 4 years, it's all done! I am indebted to my children Phoebe and Isla and my husband Chris who have supported me through every step (evenings, weekends, and holidays) of my thesis. This thesis is dedicated to them. I am grateful also for the support and encouragement of my parents, family and friends (and yes, this is the last degree I am ever undertaking!).

This thesis would never have been completed without the support and encouragement of my supervisor Professor Rumona Dickson. In particular, I would like to thank Rumona for putting her faith in me to undertake and complete this piece of work, for the opportunity to get involved with other Liverpool Reviews and Implementation Group (LRIG) activities, encouraging me to travel to conferences all over the world and her continued support post-doc. I am grateful to my other supervisors, Professor Mark Gabbay and Dr Suzy Paisley, for their valuable comments and words of encouragement. I am also truly grateful to Dr Andrew Booth who freely offered his expertise and feedback on my work and who expected little in return, thank you.

I am also very grateful to Naoimh McMahon for her time and effort in checking the accuracy of my data extraction and analysis. Thanks also must go to Alex Cunliffe and Gina Carey for their help and support.

Special thanks to go also to my colleagues in the LRIG for welcoming me into the group. In particular, special thanks to Eleanor Kotas for reviewing the search strategy, Jan Atkinson for helping me with all my admin needs, Gareth Jones and Lesley Harper.

I would also like to thank the funders of this research, the Collaboration for Leadership in Applied Health Research and Care North West Coast for providing me with the opportunity to undertake a funded PhD.

Abstract

Incorporating considerations of socio-economic health inequalities in evidence synthesis

Michelle Maden

Interventions shown to be effective in improving the health of a population may actually widen the health inequalities gap while others reduce it. Therefore, it is imperative that all systematic reviewers consider the potential for their findings to reduce or increase health inequalities. However, challenges arising when incorporating health inequality considerations in systematic reviews relate to the nature of the evidence base, the nature of the review process, the reviewer and lack of guidance available to reviewers.

The aim addressed here is how we can enable systematic reviewers to consider *a priori* whether, and how, an individual's socio-economic status (i.e. their income, educational or occupational status) may moderate the effectiveness of healthcare interventions, in order to predict the likely impact on socio-economic health inequalities. Methods used to examine this aim included a mapping review of the review guidance on the conduct of systematic reviews considering health inequalities; a methodology study on the use of programme theory to inform considerations of socio-economic health inequalities in systematic reviews; a 'best fit' framework synthesis approach in developing a meta-framework and a worked example of meta-framework development.

The mapping review found 20 review guidance documents to inform health inequality considerations in systematic reviews. The underlying assumption in the guidance was that reviewers would understand the ways in which an individual's socio-economic status moderates intervention effectiveness. The guidance advocates the use of theory to inform health inequality considerations in systematic reviews, but offer little practical advice. The methodology study found that the use of theory in socio-economic focused systematic reviews was fragmented and ad-hoc, with little use of formal theory.

A meta-framework approach combined two theoretical perspectives (socio-economic health inequalities and complex interventions) into a single framework to inform socio-economic health inequality considerations in systematic reviews. The meta-framework identified factors relating to the type of intervention, implementation, context, participant response, and mechanisms associated with differential effects across socio-economic groups. Methodological challenges in developing a meta-framework to inform evidence synthesis identified include; i) identification of theory, ii) selection of theory, iii) operationalisation of theory and iv) evaluation of theory.

The meta-framework can inform socio-economic health inequality considerations at different stages in the review process. In particular, during question formulation, literature searching, data extraction, analyses and synthesis, and assessments of applicability. In the event of a lack of evidence of the impact of socio-economic status on differential effectiveness of health interventions, the theory-led meta-framework can ensure that reviewers base assessments of the applicability of the findings to disadvantaged populations on *a posteriori* reasoning rather than *post-hoc* assumptions. In this way, the meta-framework aims to increase the usefulness of systematic reviews in informing healthcare practice and policy.

Chapter 1: Introduction

The research process that informed this thesis explored how we can enable systematic reviewers to consider whether, and how, an individual's socio-economic status (i.e. their income, educational or occupational status) (SES) may moderate the effectiveness of healthcare interventions. In this introductory chapter, I set the context for the research by providing the rationale with reference to the literature on health inequalities and systematic reviews, and the work of the Evidence Synthesis Theme within the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care North West Coast (NIHR CLAHRC NWC). This chapter concludes with an outline of the research aims and research questions explored in this work and an overview of the structure of this thesis.

1.1 Thesis rationale

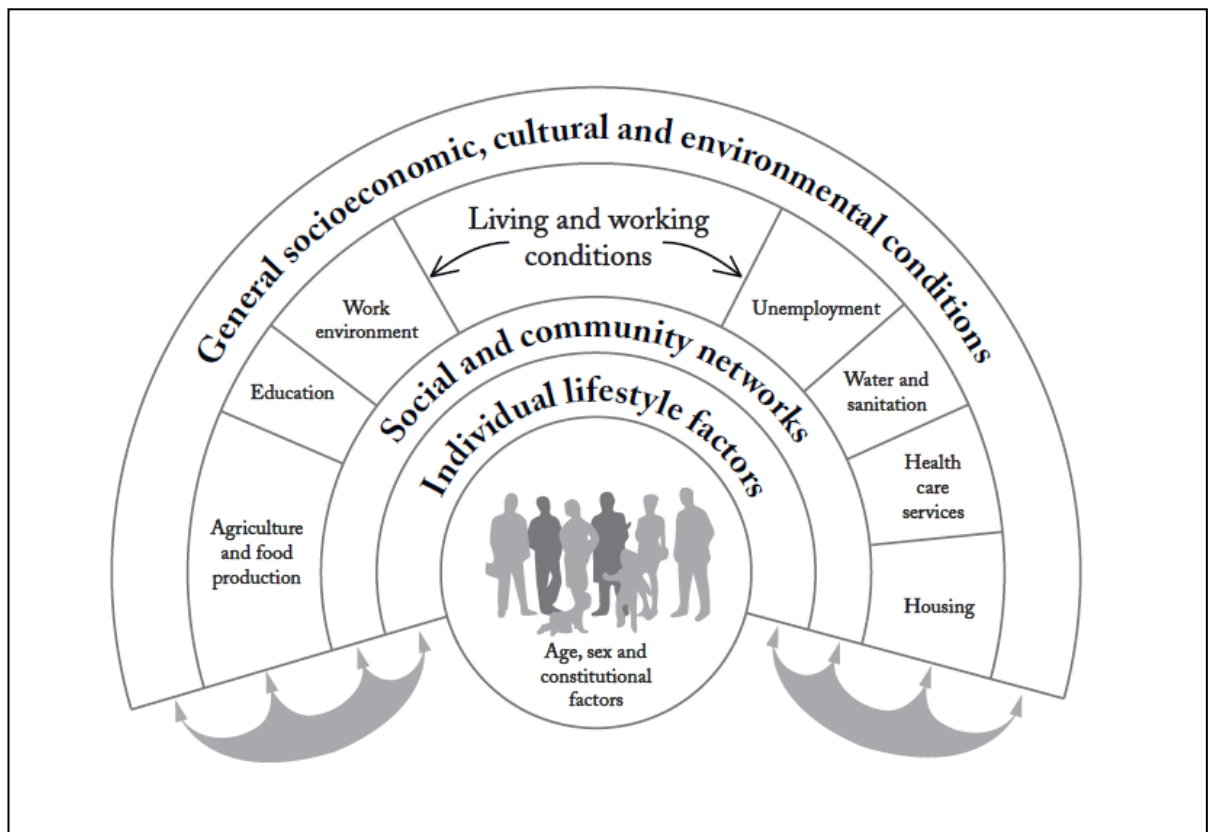
In establishing the rationale for this thesis, I begin by providing a brief overview of the wider context of health inequalities and the need for research in general to consider socio-economic health inequalities. In introducing the role of the NIHR CLAHRC NWC in reducing socio-economic health inequalities, and specifically the role of the Evidence Synthesis Theme, I provide the local context for this thesis. I then define 'systematic review' and highlight their importance in informing policy and practice. In this way, I demonstrate why it is important that systematic reviews consider health inequalities in evidence synthesis. In discussing methodological work on the extent to which systematic reviews incorporate health inequalities, the challenges facing reviewers when incorporating health inequalities in evidence synthesis and the work of The Cochrane and Campbell Equity Methods Group (1), I go on to highlight the need for further research in this area. This section continues with reference to my motivation for undertaking this thesis and my positionality as a researcher. I then conclude with an overview of the thesis structure.

1.1.1 What do we mean by 'health inequalities', 'socio-economic health inequalities', and why are they important?

Dahlgren and Whitehead's (2, p.473) widely known 'rainbow model' (see figure 1.1) depicts the range of factors that influence population health. This model illustrates the influence of various factors on health with personal characteristics (e.g. age, sex and ethnicity) at the core. Such characteristics are largely unavoidable, but surrounding these are influences that

are potentially modifiable (2). These influences include lifestyle factors such as smoking, social and community influences, living and working conditions and the wider socio-economic, cultural and environmental influences. Figure 1.1 depicts the relationship between the layers, with factors in the outer layers exerting a greater effect on health status than the inner layers. Factors which may influence health status in either a positive or negative way are referred to as the determinants of health (2).

Figure 1.1: Main determinants of health (2, p.20)



Factors which influence individual or population health in a negative way may result in health inequalities, i.e. ‘measurable differences in health experience and health outcomes between different population groups—according to socio-economic status, geographical area, age, disability, gender or ethnic group.’ (3). Furthermore, when such differences in health are “not only unnecessary and avoidable, but, in addition, are considered unfair and unjust” (4, p.5),

then they can be considered inequitable. It must be noted that the terms 'social inequalities' and 'social inequities' and 'health inequalities' and 'health inequities' are often used interchangeably both across and amongst authors (2). The term 'inequalities' is referred to throughout this thesis but is taken to have the same meaning as that of 'inequities', i.e. that 'differences in health which are not only unnecessary and avoidable, but, in addition are considered unfair and unjust'. For example, some health differences due to biological variation, free choice and transient health advantage, may be inevitable and unavoidable. Whilst others, such as limited or restricted lifestyle choices, exposure to unhealthy working and living conditions, poor access to essential health services or differential consequences of ill health, are unnecessary, avoidable and considered unjust or unfair (3). Such factors tend to be influenced by political, commercial and individual decisions and are referred to as the determinants of social inequalities in health, or socio-economic health inequalities, i.e. "systematic differences in health status between socio-economic groups, as measured by income, education and occupation" (2, p.5).

Health inequalities are important as they influence the ability of individuals to lead healthy lifestyles, and can affect the quality of life and ultimately, mortality. The existence of socio-economic disparities in health across the world is widely accepted (5, 6). Furthermore, an uneven distribution of health across populations is seen, in which a social gradient in health exists. Individuals from the most socio-economically disadvantaged populations have worse health and die earlier than the most socio-economically advantaged populations (7). For example, across a number of countries researchers have observed differences in cancer incidence and mortality across different socio-economic groups with significantly better survival and better quality of life seen amongst those in higher socio-economic groups (8-10). There is also growing evidence that socio-economic inequalities in outcomes arise across the cancer care continuum. Studies have shown evidence of different treatments being provided to cancer patients according to their SES (11). A systematic review by Forrest et al. (12) found that lower socio-economic lung cancer patients were less likely to receive any type of treatment, surgery and chemotherapy.

Despite an improvement in population health in England over the last century, socio-economic inequalities in health across regional areas persist (13, 14). The Marmot Report (14) commissioned by the UK Government demonstrated evidence of the existence of a social gradient in health across the UK. The report found that those most disadvantaged in terms of SES have poorer health than the most advantaged. Within England the extent of a widening of the health divide between the North and the rest of country is highlighted in the

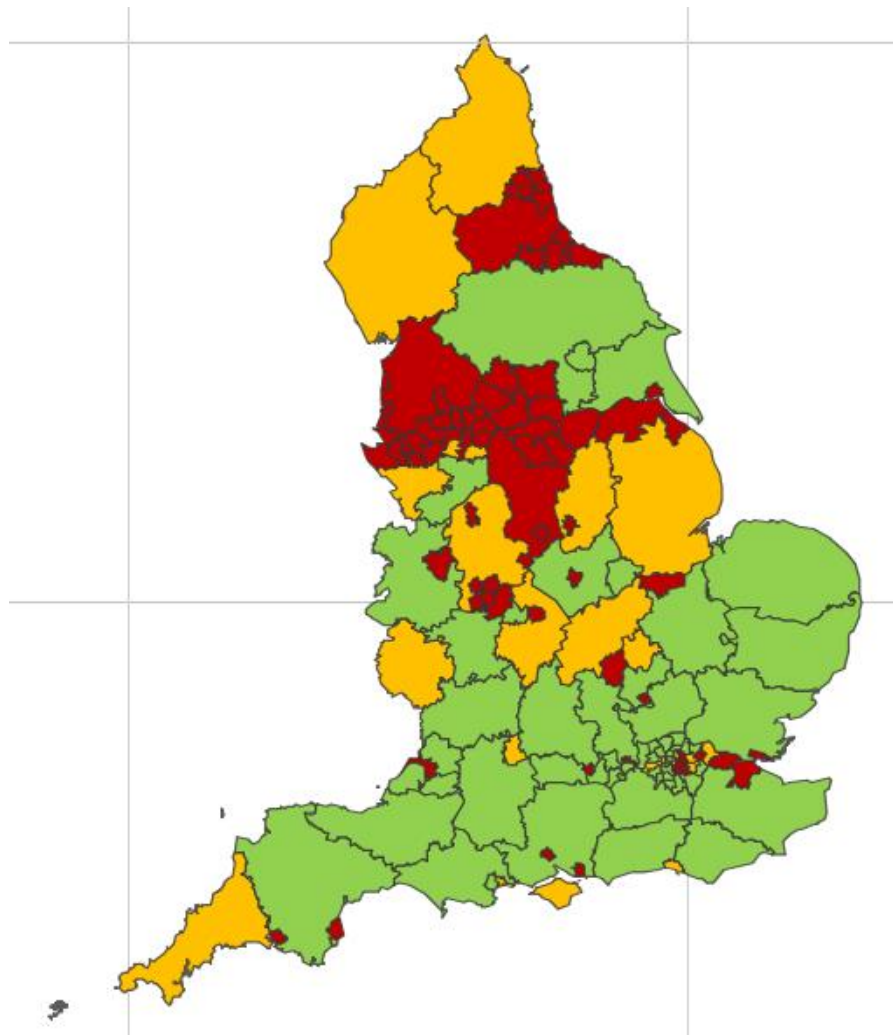
Due North report (15). The report published the findings of an independent inquiry by Public Health England documenting three facts highlighting the scale of the health gap between the most and least disadvantaged populations: 1) Despite the fact that only 30% of the population actually live in the North, it includes 50% of the poorest neighbourhoods, 2) poor neighbourhoods in the North have worse health than similar neighbourhoods elsewhere in England and 3) the social gradient is health in steeper in the North than other parts of England, with a lower life expectancy in the north for both male and females (15).

In 2017, the average life expectancy for males and females was 79.6 years and 83.1 years respectively (16). Data from Public Health England (16) shows that for the period 2015-2017, the majority of boroughs in North West England have below average life expectancy for both males and females (see figures 1.2 and 1.3). Furthermore, Barr et al., (17) have shown that between 2012 and 2014 the gap in male and female life expectancy between the most deprived areas in England and the rest of the country increased at a rate of 0.68 months each year (95% CI -0.20-1.56 months) for males and 0.31 months (95% CI -0.26-0.88) for females. One of the main upstream drivers of health inequalities in the North West are the socio-economic conditions within which people live and work (15, 18).

1.1.2 The importance of addressing socio-economic health inequalities in research

Aside from the moral and ethical obligations to ensure interventions help improve the health of the most disadvantaged (19, 20), empirical evidence suggests that interventions which are shown to be effective in improving the health of a population, may actually improve the health of those who are least disadvantaged (i.e. higher socio-economic groups) at a faster rate than those who are most disadvantaged (i.e. lower socio-economic groups) (21-23). White et al., (24) label these as 'intervention-generated inequalities'. In other words, interventions may have differential effects across different populations, thus leading to a potential widening of health inequalities between richer and poorer populations in terms of health outcomes. Furthermore, lower socio-economic groups may have a greater burden of disease and risk of exposures to harmful environments (2). It is imperative therefore that researchers examining the effectiveness of interventions consider the role of health inequalities in moderating effectiveness.

Figure 1.2: Male life expectancy at birth in England 2015-2017 (16)



Life expectancy - Years 2015 - 17

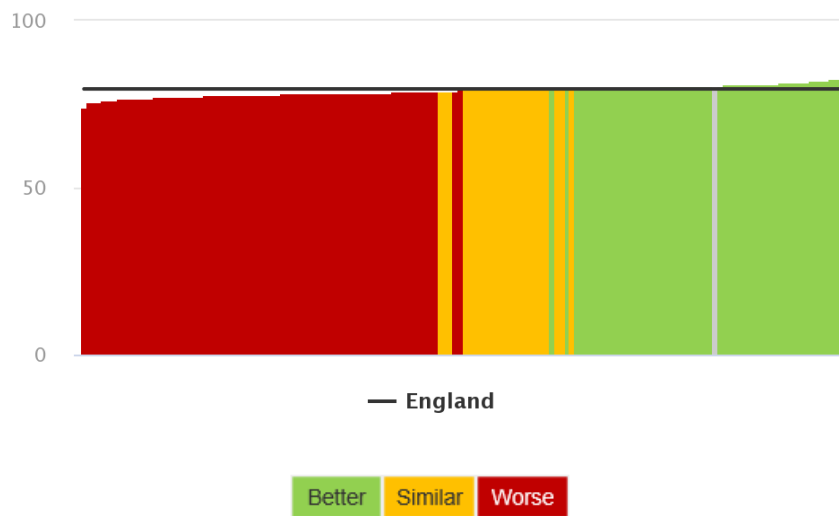
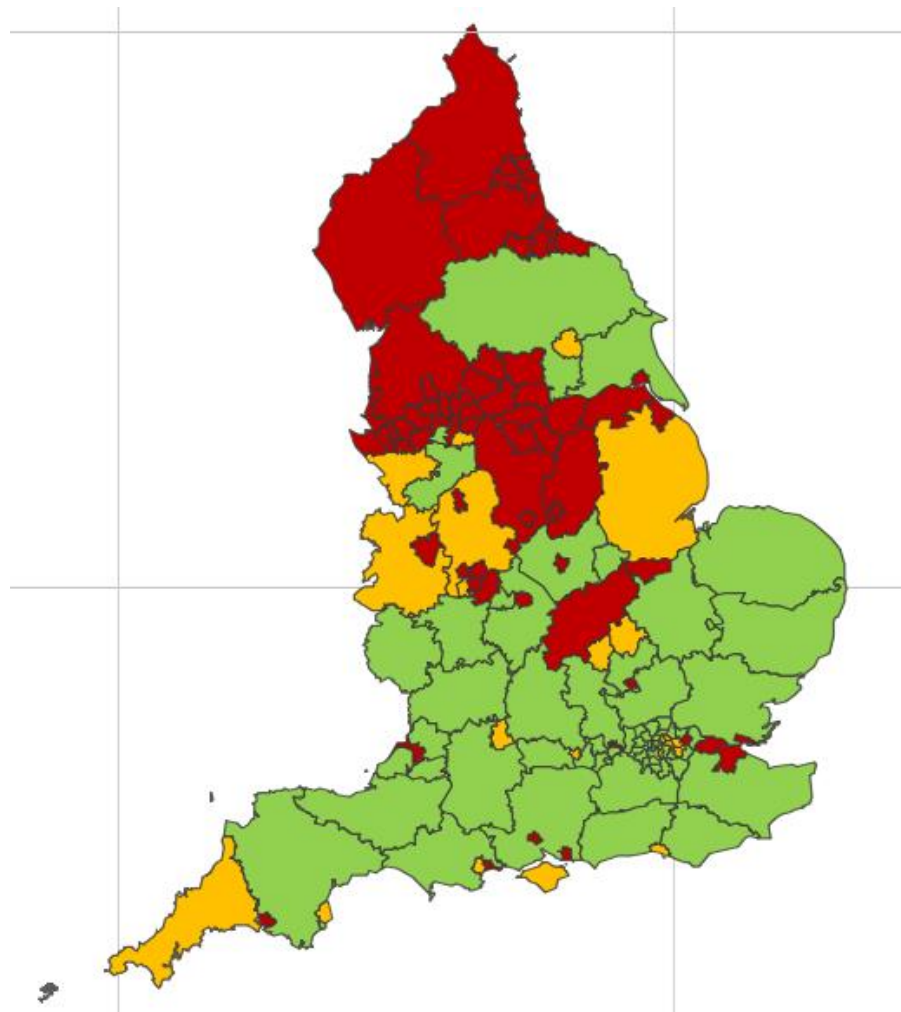


Figure 1.3: Female life expectancy at birth in England 2015-2017 (16)



Life expectancy - Years 2015 - 17



1.1.3 Approaches to tackling health inequalities in research

Work done by Graham (13) and Graham & Kelly (25) in outlining approaches to measuring and tackling health inequalities has been influential in directing policy to reduce health inequalities (26). Three main approaches are proposed; targeting health disadvantage, the health gap and the health gradient (25) (see table 1.1).

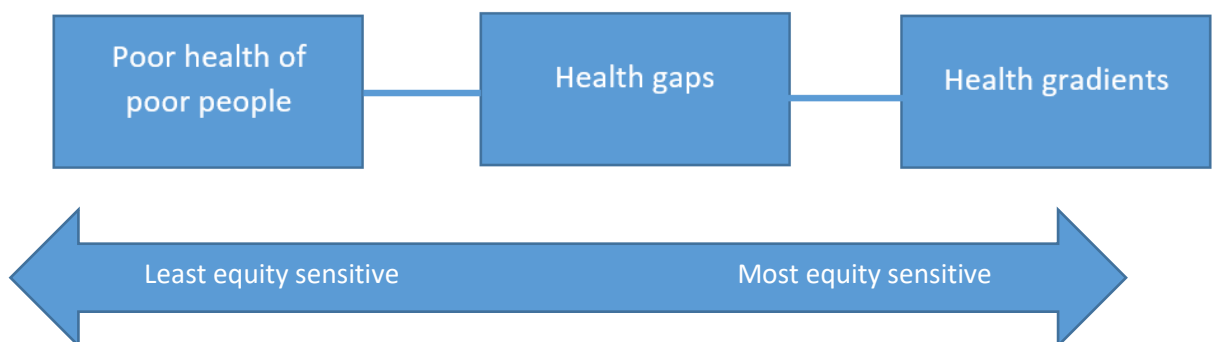
Table 1.1: Targeting, gap and gradient approaches to tackling health inequalities

Approach	Explanation	Examples
Targeting health disadvantage	Targets the most disadvantaged populations (individuals or groups) aiming to improve their absolute position, regardless of whether there are improvements in the health across the whole population or in the highest socio-economic groups.	A randomized controlled trial of a community-based nutrition education program for low-income parents (27). Health promotion intervention in low socio-economic kindergarten children (28).
Health gap	Aims to reduce the relative health difference gap between the most disadvantaged and least disadvantaged.	A randomized trial of the effects of reducing television viewing and computer use on body mass index in young children (29). The effectiveness of school-based smoking prevention interventions among low- and high-SES European teenagers. Health (30).
Health gradient	Aims to reduce health inequalities across all social groups. It recognises that social inequalities in health increase with declining socio-economic status. It seeks to achieve equity in health by improving the health of the population disproportionately with those of lower socio-economic status receiving greater benefit.	Reducing the Social Gradient in Uptake of the NHS Colorectal Cancer Screening Programme Using a Narrative-Based Information Leaflet: A Cluster-Randomised Trial (31).

Actions to address health inequalities can therefore, either be targeted (aimed at disadvantaged individuals or groups) or universal (aimed at the whole population). Targeted interventions have been focused predominantly on deprived groups only, and have not involved wider sections of the population (32). Achieving equity in health requires all areas of the population to be on a level playing field, therefore actions to tackle health inequalities should aim to reduce the social gradients in health (14). It would be unethical to suggest that the health of the wealthiest should be brought down to the same level of health as the poorest, therefore a 'levelling-up' approach is required whereby an improvement in health is proportional to the level of disadvantage (33). In this way, the aim is to improve the health of lower socio-economic groups at a faster rate than those who are in the middle, whilst the health of those in the middle improve at a faster rate than those of higher SES.

Therefore, the three approaches to reducing health inequalities outlined in figure 1.4 can be placed on a continuum "according to the degree to which they focus on the absolute levels of health in the poorest groups and communities" (25, p.7). In this way, the different approaches to tackling health inequalities increase in 'equity sensitivity' as you move from an approach that targets disadvantaged populations to one that aims to close the gap between the most and least disadvantaged to the most equity sensitive approach of reducing social gradients in health.

Figure 1.4: Health inequalities continuum (adapted from Graham & Kelly (25))



Researchers need to consider that in order to reduce the social gradient, actions are required that aim to improve the health of the more disadvantaged at a faster rate than those of higher socio-economic status but which is proportionate to the level of disadvantage (14). Therefore, it is important that researchers aim to assess relative effects, not just absolute effects, of interventions.

1.1.4 Role of the NIHR CLAHRC NWC in reducing health inequalities

The need for research to address socio-economic health inequalities in the North West of England informed the establishment in 2014 of the NIHR CLAHRC NWC. The NIHR CLAHRC NWC is one of 13 NIHR CLARHCs across England that bring together universities, academic networks, local NHS service providers, NHS commissioners and other local organisations to research public health and chronic disease interventions (34). The remit of the NIHR CLAHRC NWC is to ensure that all of the research it produces has socio-economic related health inequalities as is core focus. Working collaboratively with partner organisations and the public, the NIHR CLAHRC NWC aims to “co-produce and conduct high-quality, leadership enhancing, applied research designed to decrease health inequalities and improve the health of the population of the NW Coast.” (35). The two overarching themes of the NIHR CLAHRC NWC are Evidence Synthesis and Knowledge Exchange, Engagement and Effective Implementation. In addition, there are four programme themes; Delivering Personalised Health Care, Improving Mental Health, Improving Public Health, Managing Complex Needs.

1.1.5 Evidence synthesis collaboration in NIHR CLAHRC NWC

The aim of the NIHR CLAHRC NWC Evidence Synthesis Themes is “to encourage, facilitate and support specific requests for evidence synthesis from CLAHRC stakeholders, partners and themes to inform policy and/or develop future research projects.” (36). The term ‘evidence synthesis’ is used here to describe approaches to the review of literature to create a more powerful overview of nature of the evidence base. Under the umbrella term ‘evidence syntheses’ sit many different review types, including systematic review, realist review, and qualitative evidence synthesis. These types of review differ in the type of question(s) a review aims to answer, the type of evidence it aims to synthesise and the extent to which the methods can be described as ‘systematic’ (37). The Evidence Synthesis theme supports syntheses through training and advice, delivering specific CLAHRC focused syntheses and seeking external funding for synthesis.

A position paper (see appendix 1, (38)) written to guide the NIHR CLAHRC NWC Research Selection Sub-committee and the Steering Committee in making decisions on whether to fund evidence synthesis proposals put forward three recommendations (see Table 1.2).

Table 1.2: Evidence Synthesis Theme recommendations for funding review applications

1. Priority be given to proposals that assess the effects of interventions in disadvantaged populations or that assess the effects of interventions aimed at reducing social gradients across populations.
2. At a minimum, evidence synthesis proposals must consider the impact of their review findings on health inequalities and their differential impact across social groups to identify whether their recommendations could have a positive or negative effect on the health inequality gap.
3. All evidence synthesis proposals must include recommendations for future research on the type of data that needs to be collected to address actual or potential health inequality issues.

However, the experience of the Evidence Synthesis Theme of applications for funds to conduct evidence synthesis research was that the potential collaborators were not starting from a perspective of health inequalities in the formulation of their review question(s). Given that we know that interventions shown to be effective in improving the health of a population, may actually widen the health inequalities gap while others reduce it (21-23), it is imperative that *all reviewers* consider the potential for their findings to reduce or increase health inequalities.

Ensuring that the primary research funded by the NIHR CLAHRC NWC focuses on health inequalities is relatively straightforward and although the methods for carrying out such research and the appropriate measurement of outcomes is often complex, they are known and there are examples of good practice that can be followed. However, methodological work to examine how to incorporate considerations of health inequalities into evidence synthesis is a relatively new and emerging area of research (39, 40). Methods of taking a

health inequality focus when synthesising existing evidence are less clear and the methods to do so are in the early stages of development. Given the lack of consideration of health inequalities within the proposals submitted to the Evidence Synthesis theme, this thesis set out to explore how we can help reviewers to consider the impact of socio-economic health inequalities on their review findings.

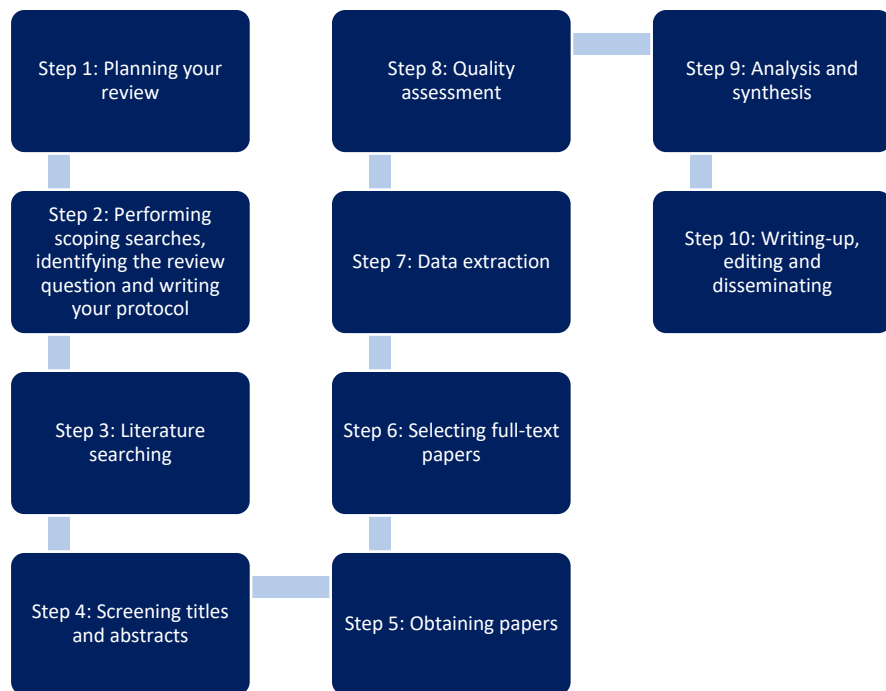
1.2 The role of systematic reviews

This research focuses specifically on systematic reviews that ‘assess the effects of interventions’. Therefore, in the following sections I define what I mean by systematic review and highlight the importance of the systematic review in research. I put forward an argument for the need to incorporate health inequalities in systematic reviews, explore the extent to which systematic reviews consider health inequalities, and the challenges facing reviewers wishing to incorporate such considerations. In this way, I justify the need for this research.

1.2.1 What is a systematic review?

A systematic review has been defined as “a review of existing research using explicit, accountable rigorous research methods.” (41, p.2). Booth et al., (37, p.25) expand on this definition of a systematic review as one which “combines the strength of critical review with comprehensive search process. Addresses broad questions to produce ‘best evidence synthesis’”. The systematic review process involves transparent and replicable methods in searching, selecting, appraising, and synthesising the available research in order to minimise the effect of bias arising from both the review methods and the studies included in the review (see figure 1.5). Approaches to minimising bias during the systematic review process include searching for both published and unpublished research and having more than one reviewer independently screen studies for inclusion in the review, undertake data extraction and quality assessment of the included studies. Applying these approaches aims to increase the internal validity and reliability of the review findings, thereby strengthening the validity and credibility of the review conclusions (41, 42).

Figure 1.5: The systematic review process (based on Boland et al., (42, p.9))



1.2.2 The importance of systematic reviews in informing policy and practice

Due to their explicit design and rigorous approach in reviewing the evidence base, systematic reviews are considered the highest levels of evidence (43). The robustness and transparency of systematic reviews in collating all the evidence on a particular topic, assessing the quality of it and synthesising it to come to a conclusion based on multiple studies, make them more attractive to policy makers than the results of single studies (44, 45). For example, in the UK the findings of systematic reviews inform National Institute for Health and Care Excellence (NICE) guidance wherever possible.

Lavis et al., (46, 47) and Sheldon (48) outline several advantages that systematic reviews offer to non-research audiences (e.g. policy-makers and health practitioners). Firstly, the likelihood of being mis-led by a systematic review is lower than with a single study. For example, smaller single studies may not reach statistical power, and offer a single biased perspective on an intervention. Secondly, systematic reviews can save policy makers and healthcare professionals time in not having to search for, and appraise all the evidence on a particular topic. Thirdly, systematic reviews remove the debate on why one single study was

chosen over another to inform decision-making. Fourthly, the findings of a systematic review of multiple studies can instil greater confidence in what can be expected of an intervention. For example, it allows for the consideration of multiple contexts within which an intervention may be delivered and how intervention effectiveness may be modified according to the context within which it is implemented. Finally, systematic reviews offer the opportunity to identify not only, what types of interventions work, but also the factors and mechanisms involved. Sheldon (48) argues that it is unlikely that a single study would cover all of these issues. These last two advantages, i.e. the need to consider the wider context and the move towards systematic reviews that explore not only what works, but for whom and under what circumstance have particular resonance in the argument for considering health inequalities in systematic reviews and therefore require further discussion.

1.2.3 Why should we consider health inequalities in systematic reviews?

Two factors support the argument for systematic reviews to incorporate health inequality considerations; firstly, the nature of the evidence base that informs systematic reviews and secondly, the needs of policy-makers and practitioners. Empirical evidence clearly highlights the potential for interventions to have differential effectiveness across different population sub-groups (21-23). Therefore, it is imperative that those conducting systematic reviews consider the potential for the implementation of their findings to reduce or increase health inequalities. Indeed, two of the leading systematic review collaborations, The Cochrane and Campbell Collaborations (see Chapter 1.3.4), call for systematic review authors to consider the effects of interventions on health inequalities (39, 49).

Parallel to this is the need to improve the applicability and usefulness of systematic reviews in informing policy and practice (48, 50). In the past, the emphasis of systematic reviews was to focus on the effectiveness of interventions and the testing of hypotheses about whether or not interventions work (47, 51). Arguably, practitioners and policy makers need to know what types of interventions work and don't work. However, systematic reviews have been criticised for focusing only on 'what works' across *average* populations, when we know that interventions may have differential effectiveness across *different* population sub-groups (51). This may inadvertently lead to policy and practitioners implementing evidence from systematic reviews that may actually increase health inequalities (19).

In generating reviews that are more *useful* to policy-makers and practitioners, sufficient information is also required to determine whether the findings of the review are likely to be

applicable not only to different populations but also, to different contexts and environments (47, 50-52). For example, the methods manual for the production of NICE public health guidance (53) (which are often informed by systematic reviews) calls for evidence about ‘what works generally, why it works, and what might work (and how) in specific circumstances’.

Furthermore, Petticrew (51, ‘Do systematic reviews really need a focused question?’) argues that,

“evaluating complex social interventions purely in terms of whether they ‘work’ or ‘do not work’ can be simplistic and misleading. Instead, systematic reviews in these circumstances probably should not aim to make such an overarching, blanket statement, with the implication that the intervention works in all circumstances, but instead should aim to assemble a range of examples of what happened when that intervention was implemented in different contexts.”

Variability within different health systems means that interventions that work in one context, may not necessarily work in another (47, 54). For example, interventions to promote insecticide treated bed-nets as a way of controlling malaria may have differential effects across different contexts. If bed-nets are not free, then they are likely to have less coverage in poorer areas than more affluent areas and therefore are likely to be less effective amongst the most disadvantaged populations (49, 54). The lack of evidence on health inequalities in systematic reviews has been highlighted as a major barrier to the use of systematic reviews in supporting policy (52).

By incorporating health inequality considerations in systematic reviews therefore, reviewers can begin to address some of the limitations of systematic reviews in relation to informing policy and practice (20). By moving away from simply assessing ‘what works’ to considering how review findings may have differential effects by SES, reviewers can provide more useful decision-relevant information to policy-makers and healthcare practitioners. In this way, reviewers can help improve the applicability, and therefore impact, of systematic reviews (47, 55).

1.2.4 Extent to which health inequalities are considered in systematic reviews

Although there is a strong argument for incorporating health inequalities, methodological research highlights an absence of evidence about the extent to which systematic reviews take into account issues of health inequalities when analysing and making recommendations

for further research and practice (20, 22, 56, 57). For instance, Welch et al (19) examined the extent to which a sample of systematic reviews of effectiveness (indexed in Medline in November 2004) assessed the effects of an intervention on health outcomes across health inequality indicators (such as SES, gender/sex, religion and age. Of 224 systematic reviews sampled, only 29 (13%) assessed the effects of interventions across health inequality indicators). Fifteen undertook subgroup analysis of vulnerable populations, while 14 performed targeted analysis. They found no reviews assessing a gradient approach. Twenty-four of the 29 reviews found evidence of differences of effects on interventions across health inequality indicators. Only 18 reviews went on to provide implications for policy, practice or research, of which only two reviews based their implications on differential effects. The authors conclude by calling for a “fundamental need to find a way to systematically consider impacts on equity in health status in a way that is currently missing from systematic review processes” (19, ‘Conclusions’).

Blaxter (22) also confirms the lack of information provided on social inequalities in systematic reviews. In a study examining the extent to which reviews of behaviour change interventions incorporate considerations of health inequalities, Blaxter (22, p.16) reports that “data relevant to social inequalities in health is lacking in systematic reviews.” In an examination of 40 reviews in a meta-review on ‘Prevention of tobacco use, smoking cessation and reduction’ (58) and 20 reviews in a meta-review on ‘Healthy eating and weight control in adulthood’ (59), no analyses by social variables was mentioned. However, the author undertook analysis of the individual reviews only ‘at least at the level of abstracts’. It is unclear therefore, whether the same results would hold true if the full-text of all the individual reviews had been examined. Furthermore, Welch et al., (20, ‘Types of studies’) point out, “individual systematic reviews might introduce bias because they are less likely to report health inequalities analyses when no substantive differences are found.”.

In attempting to overcome the limitations of individual systematic reviews, a Cochrane methodological review (20) examined empirical studies of cohorts of systematic reviews that assessed methods for measuring effects on health inequalities. They found that of the 34 studies included, 22 used a targeted approach, 12 used a gap approach and one used a gradient approach (one study used both a targeted and gap approach). None of the systematic reviews described whether differences were due to relative or absolute effects. In addition, no studies identified factors associated with differential effects within or across disadvantaged populations, which could “be used to inform *a priori* decisions to assess effects on health equity in systematic reviews and primary studies.” Welch et al., (20) make

several recommendations for further research, including methodological research on what factors are associated with differences in absolute and relative effects and how to improve judgements about applicability.

1.3 Challenges involved in considering health inequalities in systematic reviews

The literature (e.g. 22, 52, 60, 61) cite several reasons for the lack of consideration given to health inequalities in systematic reviews relating to; the nature of the evidence base, the nature of the review process, the reviewer and lack of guidance available to reviewers.

1.3.1 Challenges relating to the nature of the evidence base

Above all, one of the most cited challenges is the availability, or rather lack of availability of data on health inequalities analysed in the primary literature (19, 32, 61, 62). It may be, as Runnells et al., (61) observe that questions asked by reviewers are often driven by the availability of data. If the data on health inequalities is not in the primary literature, then reviewers may be less likely address them in systematic reviews. Although a recent extension to the international CONSORT guidelines for the conduct and reporting of randomised controlled trials (63) calls for consideration of health inequalities, implementation of this guidance will take time. Even then, evidence suggests that journal editors may not actually enforce researchers to comply with the guidance (64).

Despite this Snilstveit (50, p.391) points out that, "Policy-makers often have to make a decision, even if the evidence base is limited. If systematic reviews only provide evidence on effects and conclude the evidence is lacking, or inconclusive, this is not very useful in informing decision-making.". Assessing the applicability of evidence to disadvantaged populations is one way of addressing the lack of evidence. However, there is evidence to suggest that reviewers are not consistent in making applicability judgements of evidence to disadvantaged populations and settings. In a sample of 34 systematic reviews that assessed methods for measuring effects on health inequalities, only 11 assessed the applicability of the evidence (20). Welch et al., (20) also report that reviewers had difficulty in making judgments about the applicability of interventions in different settings because of variability in context and setting or limited evidence on effectiveness across disadvantaged populations. The challenge here therefore, is how can reviewers draw conclusions of the impact of their

review findings on health inequalities, if there is an absence of evidence in the primary literature or a high degree of variability in the context and settings within which interventions are delivered?

Acknowledging the lack of evidence on differential effects across disadvantaged populations, Whitehead (32), among others (e.g. 50), calls for a theory-based approach to guide actions on reducing health inequalities. However, in adopting a theoretical stance in incorporating health inequalities in systematic reviews new challenges for reviewers emerge, particularly for those new to health inequalities or new to the use of theory to inform reviews. For example, what theories should be considered?, and how can theory inform systematic reviews and assessments of applicability?

1.3.2 Challenges relating to the review process

Blaxter (22) suggest that another reason why health inequalities are rarely considered in systematic reviews is due to an artefact of the reviewing process. In other words, systematic reviews often seek out the 'best available evidence'. One of the disadvantages of the evidence hierarchy (43) is that it biases guidelines to certain paradigms, questions and topics. Few randomised controlled trials (RCTs) and syntheses focus on work within vulnerable and disadvantaged groups, so we end up with resources being focused on areas where this type of evidence supports practice, and away from other groups.

In focusing on the higher levels of evidence, systematic reviews often exclude studies that are more likely to provide relevant data on health inequalities. To highlight this, Blaxter (22) investigated what types of studies were more likely to include relevant information on health inequalities. In a review of studies examining behaviour change and inequalities, Blaxter (22) found that studies of associations, surveys or modelling studies rather than intervention studies were more likely to contain relevant information and were more likely therefore to be excluded from systematic reviews on the grounds of 'poor quality'.

Interestingly, there is evidence to suggest that reviewers are collecting health inequality data in systematic reviews (19, 56). Welch et al., (19, 56) found that in a sample of 224 systematic reviews, 158 (68%) did report collecting data on health inequality indicators. However, they also note a significant difference in the types of health inequality indicators that were being collected with gender (49%), age (47%) and place of residence (22%) most frequently reported, followed by race/ethnicity (4%), SES (3%), occupation (1%) and education (1%). The emphasis on gender and age may be another artefact of the review process whereby

reviewers collect this type of simply to describe demographic details on the population of interest, rather than a desire to examine inequalities. Furthermore, few reviews examined by Welch et al., (19) collected data on socio-economic characteristics. This seems to support the criticism earlier that systematic reviews tended to focus on *average* population effects, rather than differential effects across disadvantaged populations.

Moving reviewers away from assessing *average* population effects towards considering what works, for disadvantaged populations *and* under what circumstance aims to improve the usefulness of systematic reviews in informing policy and practice (48, 50). However, encouraging reviewers to move away from simply asking questions about ‘what works’ to ‘what works, for whom, and under what circumstance’ will require a paradigm shift in the conduct of systematic reviews from a more ‘positivist’ way of thinking about evidence synthesis, towards more of a ‘realist’ way of thinking (48, 51). Table 1.4 compares the two approaches (see Chapter 2).

Table 1.3: Comparing ‘positivist’ and realist approaches to evidence synthesis (41)

‘What works’ reviews	‘What works, for whom and under what circumstance
Positivist approach to evidence synthesis	Realist approach to evidence synthesis
Aims to understand whether an intervention has a certain effect and can assess the size of the effect.	Aims to understand not only whether an intervention works, but also explain the circumstances under which an intervention may work
Uses empirical data to test causal hypotheses on what interventions work (which may be theory-driven)	Theory-driven approach to test and refine hypotheses on how and why interventions work using CMO configurations – i.e. it aims to uncover hidden mechanisms (M) that lead interventions to specific outcomes (O) under particular contexts (C).
Deductive approach	Inductive/deductive approach
Linear review process	Iterative review process
Sensitive search strategy based around intervention	Purposive and theoretically driven search strategy based around mechanisms

However, realist reviews present a number of challenges, not least that the approach is not one recommended for novice reviewers (42, 65), is time-consuming (48, 66) and potentially expensive. As Sheldon (48, ‘Theory-based (realist) synthesis’) observes, “while it [*realist*

synthesis] provides a methodological template for implementing the recommendation to involve policymakers, the extent to which it will be feasible for researchers or policy-makers is not clear.”. The challenge here is how we can assist reviewers to consider ‘what works, for disadvantaged populations, under what circumstance’ without increasing the burden on them.

1.3.3 Challenges relating to the reviewer

A failure on the part of review authors to *consider* health inequalities (in particular differential impacts by socio-economic status), may also contribute to a lack of consideration of health inequalities in systematic reviews. Reviewers are less likely to include health inequality considerations if they do not understand the ways in which health inequalities may affect the intervention process. The fact that some data on health inequality indicators is being *collected* may suggest that reviewers are indeed aware of the impact of inequalities on their review findings (19). However, the limited number of reviews (29/224, 13%) seeking to *analyse* health inequality data to assess effectiveness on or across disadvantaged populations seems to contradict this point of view (19).

Few empirical studies have focused specifically on the challenges facing reviewers when looking to incorporate health inequalities in systematic reviews. Runnels et al., (61) in a qualitative study examining the challenges of including sex/gender analysis in systematic reviews found that reviewers struggled with the concepts and definitions associated with sex/gender. In addition, the authors report the findings of one respondent who stated, "The biggest challenges are much more fundamental and have to do with the way that we arrive at decisions as to what is important for us to study, why it is important for us to study, and how we determine the way to study and ultimately produce evidence" (61, ‘Conceptual challenges’). In other words, reviewers need to be able to recognise if and how health inequalities may matter in order to inform decisions on; firstly, whether or not to incorporate health inequality considerations in systematic reviews; secondly, the type of data they may need to collect; and thirdly, in the event of a lack of relevant data, how to assess the likely impact of their review findings on health inequalities. This is of particular importance for reviewers who are unfamiliar with health inequalities. Recent experiences of the NIHR CLAHRC NWC Evidence Synthesis Theme (see Chapter 1.1.5) seem to suggest that despite reviewers being made aware of guidance to support the inclusion of health inequalities, such issues were not being considered in systematic review proposals submitted to the Theme.

Following on from this, Runnels et al., (61) suggest that a lack of review guidance, tools or practical aids on the conduct of health inequality reviews may also have contributed to a lack of consideration of health inequalities in systematic reviews. Over the last ten years however, significant advances have been made in the production of guidance and tools to help reviewers to conduct health inequality focused systematic reviews driven largely by The Campbell and Cochrane Equity Methods Group (1).

1.3.4 Toward the improving of health inequality considerations in systematic reviews

The Campbell and Cochrane Equity Methods (CCEM) Group was established in 2005 with the aim of encouraging Campbell and Cochrane reviews “to include explicit descriptions of the effect of the interventions not only on the whole population but to describe their effect upon the disadvantaged and/or their ability to reduce socio-economic inequalities in health and to promote their use to the wider community.” (1). The CCEM group are leading the field in exploring and advancing methodological research and guidance around health inequalities and systematic reviews. This includes not only the publication of guidance on the conduct and reporting reviews that consider health inequalities, most notably, the PRISMA Equity Extension (67, 68), but also, checklists (69), frameworks (70), methodological studies exploring the extent to which, and how, systematic reviews incorporate health inequality considerations (19, 20), and exemplar systematic reviews with a focus on health inequalities (71). In addition, other organisations have begun to develop guidance to help reviewers conduct systematic reviews that consider health inequalities, including the NIHR CLAHRC NWC (18).

During the process of conducting research for this thesis, I did not identify any critique to date that assesses the strengths and limitations of the guidance in helping reviewers to conduct systematic reviews that consider health inequalities, nor any studies that examine whether and how reviewers are adhering to the guidance in the conduct of their reviews. Given the challenges outlined above therefore, an exploration of the guidance is needed in order to understand how reviewers can incorporate health inequality considerations in systematic reviews. More importantly, it may also help to explain why, in spite of the available guidance, reviewers are still struggling to incorporate health inequalities in systematic reviews.

1.4 Summary

In summary, the above presents my argument for the need for reviewers to consider socio-economic health inequalities in systematic reviews. This argument is supported firstly by the evidence base, which demonstrates quite clearly that health interventions may have differential effectiveness amongst different socio-economic groups (21-23). This is particularly important in instances when ‘intervention-generated inequalities’ are created (24). The argument for incorporating health inequality considerations is further strengthened by the role systematic reviews play in informing policy and practice and the limitations surrounding their applicability (i.e. “the extent to which an intervention *process* could be implemented in another setting.” (54, ‘Introduction’)) and usefulness in providing decision-relevant information.

Based on the above review of the published literature and on my own experience of my involvement with the NIHR CLAHRC NWC Evidence Synthesis Theme, the research that is part of this thesis addresses calls for further research in overcoming some of the challenges in helping reviewers to incorporate socio-economic health inequalities in systematic reviews. The reason for focusing on socio-economic health inequalities as opposed to broader health inequalities is to align with the aims of the CLAHRC NWC in focusing on socio-economic health inequalities. In doing so, this thesis also aims to address the broader issue of how we can improve the usefulness of systematic reviews for policy-makers and practitioners by incorporating socio-economic health considerations given; firstly, the lack of available data in primary research; secondly; reviewer unfamiliarity with socio-economic health inequalities and finally, the need for such considerations to avoid becoming an extra burden on reviewers.

1.5 Research aim and questions

1.5.1 Research aim

The aim of this research was to explore how we can enable systematic reviewers to consider *a priori* whether, and how, an individual's SES (i.e. their income, educational or occupational status) may moderate the effectiveness of healthcare interventions, in order to predict the likely impact on socio-economic health inequalities.

1.5.2 Research Questions (RQs)

RQ 1. To what extent does guidance on conducting systematic reviews that consider health inequalities assist reviewers in making *a priori* decisions as to whether, and how, an individual's socio-economic status (i.e. their income, educational or occupational status) may moderate the effectiveness of healthcare interventions?

RQ 2. Whether, and how, reviewers operationalise guidance on conducting systematic reviews that consider health inequalities to develop an understanding of whether their review findings may have differential effects across different socio-economic groups?

RQ 3. How can we enable reviewers to consider what, why and how interventions may result in differential effects across different socio-economic groups?

RQ 4. What methodological challenges arise in developing a theory-led meta-framework to inform socio-economic health inequality considerations in evidence synthesis?

1.6 Target audience

The target audience for this thesis are systematic reviewers who are looking to examine the effectiveness of health interventions and who may be unfamiliar with health inequalities, policy and decision makers and those funding reviews. The aim is to help them to understand the ways in which an individuals' SES may moderate intervention effectiveness to assess the likelihood that an intervention could lead to a narrowing or widening of socio-economic health inequalities. In this way, the thesis aims to generate discussions amongst reviewers at the point at which they are formulating systematic review questions on the need to incorporate socio-economic health inequality considerations in systematic reviews of

intervention effectiveness. However, the findings may also be useful in informing socio-economic health inequality considerations in primary research designs, such as randomised controlled trials. Furthermore, this thesis may also be of interest to systematic review methodologists looking to develop meta-frameworks to inform evidence synthesis.

1.7 Motivation for the thesis

The motivation for this thesis was borne out of my own professional interest in, and experiences of systematic review methodologies and a desire to help improve the quality and applicability of systematic reviews, by helping reviewers to understand the importance and impact of considering health inequalities. I feel it is important to document my journey in order to understand how my position has helped to shape my research (see Chapter 1.8).

I graduated in 1997 with a Masters in Mathematics and Medieval History. Following this in 1999 I gained my professional qualification in Library and Information Management (LIM). Whilst these three subjects may not appear to sit naturally together, I feel that the logical skills I developed from studying Mathematics, the critical thinking and questioning skills I developed from my historical background and the searching skills developed in my LIM degree, have complimented each other very well in my career going forwards within health research methods. For example, in my first professional post as a research assistant and information officer within a busy urban accident and emergency unit in Manchester I helped to organise a weekly journal club in which clinicians would critically appraise published research. I found that my background in Maths helped me to understand and interpret study results, whilst my critical thinking and questioning skills honed during my historical studies helped me to appreciate the need to appraise the methods that lead to those results. During this time, my experience as a research assistant on a diagnostic chest pain study made me appreciate the practical difficulties of actually 'doing research' and ensuring that the research methods are robust.

My role also involved supporting departmental clinicians in the production of shortcut reviews (Best Evidence Topics (BETs)). My background as an information specialist meant that I was in a unique position to check the quality of the search strategies used within the shortcut reviews. Any flaws in the search strategy could result in relevant studies omitted from the BET, therefore affecting the validity of the BET conclusions. My interest in, and experiences of being involved in, the production of shortcut reviews and knowledge of critical appraisal skills then helped me to secure a Clinical Information Specialist role at Edge Hill

University (EHU). In this role, I supported NHS staff, students and Faculty of Health and Social Care staff undertaking systematic reviews. In 2010 I was offered an Associate Tutor post at EHU with responsibility for teaching and supervising students undertaking systematic reviews. Since then I have co-authored several published systematic reviews, both in my own field (information science) and in health.

Although my expertise in systematic reviews initially developed as a result of my information retrieval background in locating studies for the reviews, my interest in systematic review methodologies has broadened to include approaches to quality assessment and ultimately, to the work of this thesis on the use of theory to inform considerations of socio-economic health inequalities in systematic reviews.

1.8 Positionality

An understanding of one's positionality, that is, an awareness of one's own personal attributes and how this may shape the approach to research, is an important issue to address. Researchers with different positionalities may conduct research in different ways, resulting in conflicting results or interpretations of the research findings. I am aware that my background (see Chapter 1.7) has shaped my approach to this research in the following way:

- I consider myself to be both an expert and novice systematic review methodologist. My expertise in systematic reviews lies very much in the designing and conducting of search strategies to inform different types of systematic reviews, in understanding the structure of a systematic review and in the processes required to minimise bias in the production of systematic reviews. Yet I also consider myself to be a novice systematic reviewer.
- I consider myself a novice in the subject matter of socio-economic health inequalities. In this way, I believe I am working as a researcher who can offer an insight from the perspective of the target audience, i.e. systematic reviewers who do not necessarily have an expert understanding of the impact of socio-economic status on the effectiveness of healthcare interventions.
- I appreciate that systematic review methodology has largely been dominated by positivist or constructivist way of thinking in attempting to understand whether

something works or not and that new methodological approaches to evidence synthesis have emerged in response to addressing questions surrounding 'what works, for whom, under what circumstance' and in particular realist reviews. However, I am also acutely aware of the practicalities and challenges facing systematic reviewers when considering issues of complexity and health inequalities and believe that there is a middle ground for incorporating considerations of socio-economic health inequalities.

- I consider myself open-minded in the value of different methodological approaches to evidence synthesis and appreciate the value that both quantitative and qualitative approaches have to offer. This stems from my background of a degree for which I studied both quantitative (Mathematics) and qualitative (History) elements.
- I also consider it important that I disseminate my work to a wider audience. This is of particular importance given the increase in ongoing methodological research in this field. Therefore, I published and presented my work throughout the undertaking of this thesis.

In summary, I entered this research exploring the integration of socio-economic health inequalities in systematic reviews with a position and an agenda. I consider my position to be one of pragmatism. Pragmatism implies that "knowing begins with uncertainty and is inevitably based on and framed by prior knowledge. The starting point is therefore practical, not wholly theoretical." (72, p.230). Whilst pragmatism supports a mixed-methods approach to research (72), I appreciate that systematic review methodology has largely been dominated by positivist or constructivist way of thinking in attempting to understand whether something works or not and how. I am also aware of the emergence of new methodological approaches to evidence synthesis in response to addressing questions surrounding 'what works, for whom, under what circumstance' and in particular realist reviews. However, I am acutely aware of the practicalities and challenges facing systematic reviewers when considering issues of complexity and health inequalities and believe that there is a middle ground for incorporating considerations of socio-economic health inequalities. My agenda was to advance methods to enhance the guidance for incorporating considerations of socio-economic health inequalities in systematic reviews. In particular, the

focus was to help reviewers, particularly those new to health inequalities to understand better the ways in which an individual's socio-economic status may moderate intervention effectiveness.

1.9 Thesis structure

The following chapter (Chapter 2) outlines the overall methodological approach (i.e. the underlying epistemology and methods) that informed the research for this thesis and provides the rationale for the selection of methods. Chapter 3 presents a mapping review of health inequality systematic review guidance. Chapter 4 presents the findings of a methodology study on the use of programme theory to inform socio-economic health inequality focused systematic reviews. Chapter 5 describes the development of a theory-led meta-framework to help inform *a priori* considerations of how an individual's socio-economic status may moderate intervention effectiveness. Chapter 6 discusses the methodological challenges involved in developing a meta-framework and how they were overcome. Chapter 7 presents a discussion of the findings, outlines the strengths and weaknesses of the research, implications for practice and further research and outlines the contribution to knowledge and impact of this research to date. The final chapter (Chapter 8) pulls together the findings and conclusions on enabling systematic reviewers to consider socio-economic health inequalities in systematic reviews. The exact way the chapter's link into each other is described in the section titled 'Coherence of work' (see Chapter 2.3).

Chapter 2: Methods

This chapter details the overall methodological approach (i.e. the underlying epistemology and methods) that informed the research for this thesis. Firstly, I discuss the rationale for the overall methodological approach. Following this, I discuss the development of the four research questions that addressed the research aim along with a brief overview of the methods adopted to answer the research questions. I provide more information on the methods that informed each study in forthcoming chapters (see Chapters 3-6). This chapter concludes with a discussion about how each of the four studies presented in this thesis link together to form a coherent whole in addressing the overall research aim.

2.1 Choice of methodological approach

The choice of overall methodological approach was informed by four perspectives; the research aim, the target audience for this research, the findings of the background literature and my own positionality as a researcher. The research aim, to enable reviewers to gain an understanding of what works, for disadvantaged populations and under what circumstance (see table 2.1), naturally seems to align with a realist epistemological position.

Table 2.1: Thesis research aim

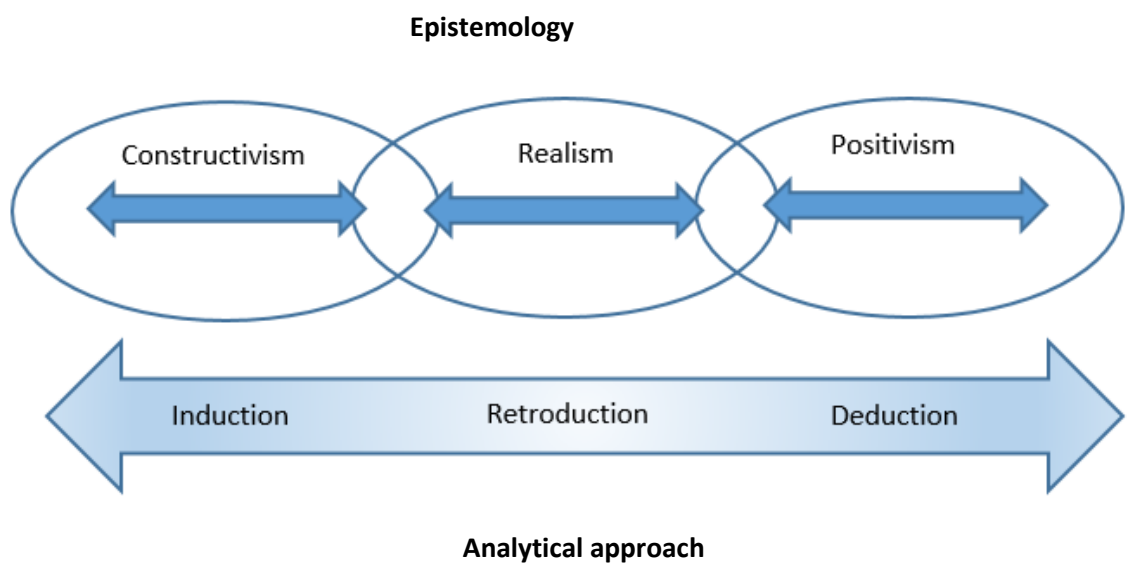
<p>‘To explore how we can enable systematic reviewers to consider <i>a priori</i> whether, and how, an individual’s socio-economic status (i.e. their income, educational or occupational status) may moderate the effectiveness of healthcare interventions, to help predict the likely impact on socio-economic health inequalities.’</p>
--

2.1.1 Realist epistemology and ontology

With its origins rooted in philosophical traditions, realism posits that a limitation of positivism is that causal explanations need to be linked to observable evidence (73). On the other hand, realism also recognises the limitations of constructivism in not pursuing an objective assessment of the evidence that is required to truly understand causality (73). Realism inhabits the middle ground between positivism and constructivism borrowing from the

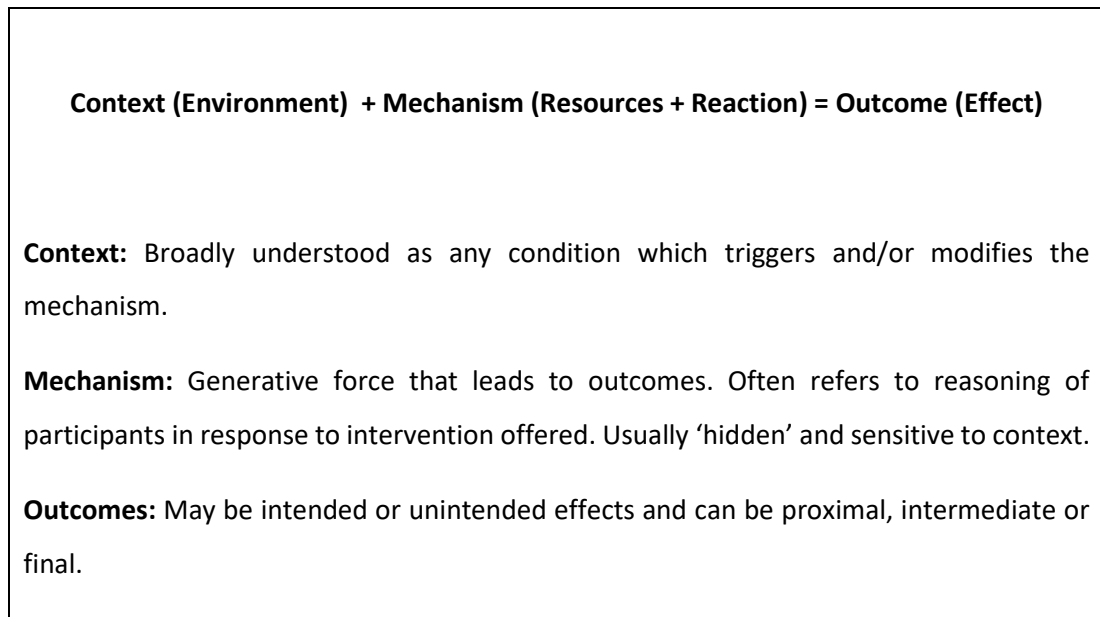
principles of both using both deduction (i.e. applies data to test theory) and induction (i.e. uses data to build theory) approaches, known as retrodution i.e. a “constant shuttling between theory and empirical data, using both inductive and deductive reasoning.” (74, p.374) in order to offer causal explanation. As an epistemology therefore, realism sits between positivism and constructivism (see figure 2.1).

Figure 2.1: Epistemology and analytical approach (adapted from Jagosh (75))



Realism recognises that in order to understand how outcomes (O) are generated, the underlying mechanisms (M) and the context (C) within which this occurs needs to be understood (65) (see figure 2.2). The realist paradigm seeks to “unpack the mechanism of how complex programmes work (or why they fail) in particular contexts and settings” (65, p.21). Sheldon (48, p.15) highlight the importance of understanding ‘how and why’ interventions may work or fail in assessing the applicability of research, “the emphasis on an explanatory approach is inherently attractive to both researchers and policymakers who want to take an approach from one country or setting and apply it to another”.

Figure 2.2: Context-Mechanism-Outcome configuration (75, 76, 77, 'table 1')

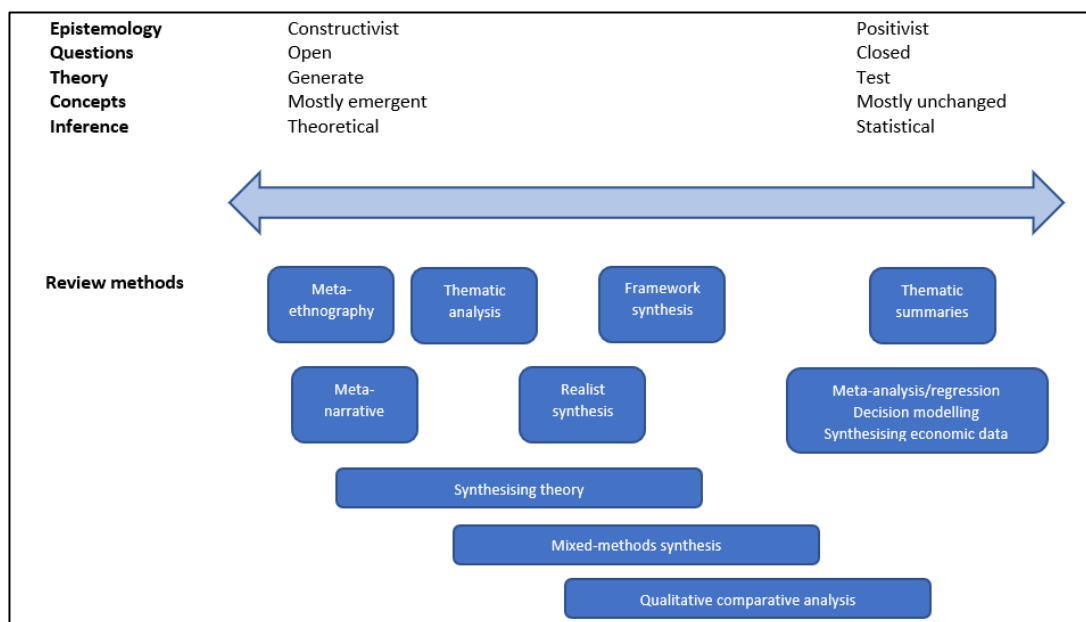


Realist principles propose that interventions do not create change, people do (75). In this way, programme theories (i.e. an understanding of how an intervention is expected to work/not work) are developed using context-mechanism-outcome (CMO) configurations. The realist approach follows an iterative process in which CMOs are generated, tested and refined to bring about a greater understanding of the conditions under which mechanisms are triggered to produce outcomes. As Rycroft-Malone et al., (66) point out, the realist approach is largely concerned with providing explanations, theory development and refinement.

Furthermore this research adopts a critical realist ontology, which has been described as one which “recognises that a mechanism may exist but not be activated, be activated but not observed, or be activated but affected by other mechanisms and hence have an unpredictable result.” (72, p.230). I adopted this ontological position because in understanding what and how *any* interventions work for disadvantaged populations, we need to consider the broader perspective. Therefore, it is likely that mechanisms may exist that may, or may not, be triggered depending on the specific context. This ontological position is compatible with my positionality as a pragmatist which recognises that “all inquiry is purposeful and situated” (72, p.320).

Systematic review methods that align more with the positivist paradigm aim to test an existing *a priori theory*. The types of review questions that ask ‘what works’ and ‘how effective’ are best answered by these methods. Review questions that seek to explain ‘why things work’ are best answered by review methodologies within the constructivist paradigm. Review questions that seek to answer, ‘what works, by whom and under what circumstance’, therefore, sit between these two approaches. Figure 2.3 aligns the underlying epistemology with systematic review question types and potential review methods.

Figure 2.3: Aligning review epistemologies and methods (Based on Gough et al., (41, p.185))



Therefore, in addressing the research aim of gaining ‘an understanding of what works, for disadvantaged populations and under what circumstance’, a realist perspective would seem appropriate. However, several factors relating to the long-standing feature of systematic reviews to examine ‘what works’ as opposed to ‘what works, for whom and under what circumstance’ (51) and the need to improve the applicability and usefulness of systematic reviews in informing policy and practice (48), and my own positionality as a researcher (see Chapter 1.8) have led me to propose that the underlying epistemology for this research lies

somewhere between positivism and realism. I shall refer to this position as one of 'realist-informed'.

2.1.2 Rationale for a 'realist informed' epistemology

Firstly, within healthcare, systematic reviews have a long-standing tradition to examine 'what works' (51) and therefore naturally lean more towards a positivist stance. This may have largely been influenced by early review guidance which focused specifically on reviews of effectiveness. There is no question that establishing 'what works' in relation to healthcare interventions is still an important concern. However, in increasing the usefulness of systematic reviews, there is *also* a need to recognise that the same intervention may have differential effects depending upon the context within which it is implemented and the way in which it is implemented (51). Therefore, there is a need to go beyond simply establishing the direction and size of an intervention effect. In recognition of this, Tugwell et al., (78, 'Conclusions, para. 2') suggests that for reviewers to consider what works for disadvantaged populations, how and under what circumstances, "a paradigm shift in the generation and synthesis of evidence" is required. The question is therefore, how far should reviewers go in this 'paradigm shift'?

Whilst I acknowledge that a realist position can help to improve the applicability of systematic reviews, I would argue that a realist perspective is very much driven by contexts and mechanisms specific to a *particular* set of circumstances and intervention(s). The purpose of this thesis however, is to consider how we can help *all* reviewers to consider whether it is likely that *any* intervention(s) under review would have differential effects across different socio-economic populations. This requires a broader level approach, and a recognition that any mechanisms identified, may only be at the broadest level and further investigation may be required to uncover more specific mechanisms and influences related to a particular intervention(s).

In addition, undertaking realist reviews to answer questions relating to 'what works for disadvantaged populations and under what circumstance', demand skills in theoretical sensitivity in developing, testing and refining programme theories and can be time-consuming (66). This may be particularly challenging for novice reviewers (65), or for those who are unfamiliar with health inequalities, i.e. the target audience of this research. Furthermore, my own positionality reflects on the practicalities and challenges facing systematic reviewers when considering the impact of review findings on health inequalities

and I believe that there is a middle ground for incorporating considerations of socio-economic health inequalities. Therefore, the paradigm shift suggested by Tugwell et al., (78) that I propose for this research, is one which pulls reviewers away from a purely positivist stance *towards* a realist informed stance.

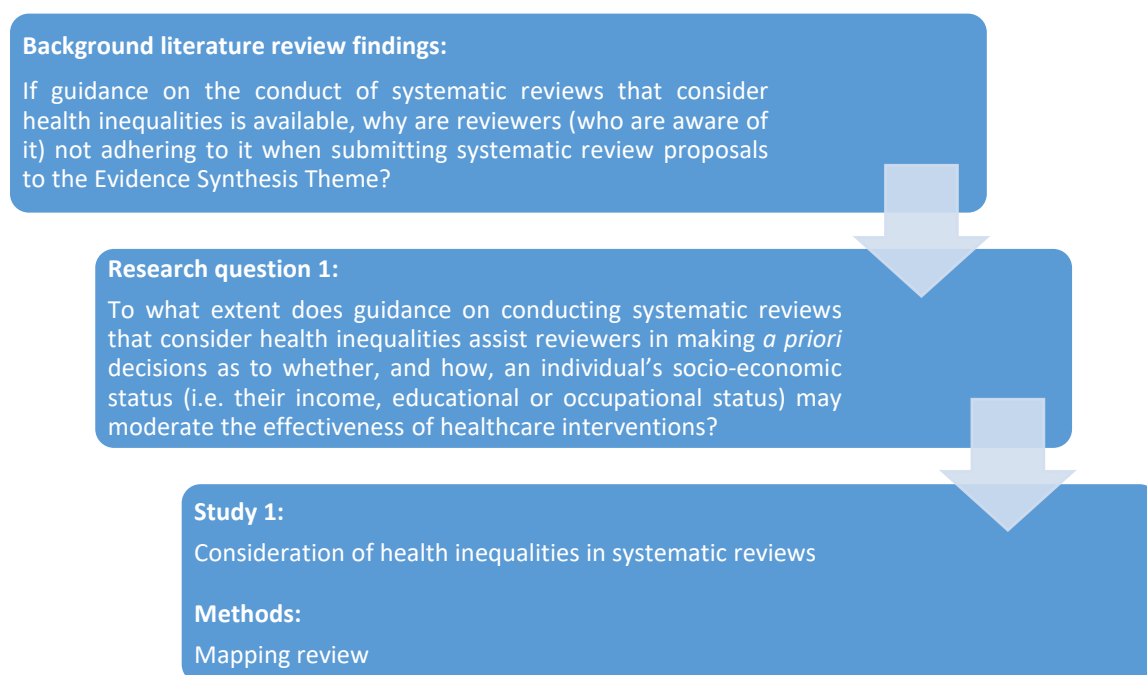
2.2 Informing the research aim, research questions and methods

The overall research aim (see table 2.1) was specified *a priori* and was informed by the experiences of the Evidence Synthesis Theme in receiving systematic review proposals that lacked consideration of socio-economic health inequalities. From my own perspective, as someone new to socio-economic health inequalities, it was difficult to set out all research questions and methods at the start to address the aim of the research without a clear understanding of what the problems were and how they could be addressed. The research questions developed as my knowledge and understanding of the problem and potential solutions grew as the research progressed. In this way, rather than a single research study, this thesis consists of a series of linked studies. In seeking to answer fully the research aim therefore, the research questions and methods developed iteratively with each research question seeking to build on the findings of the previous one. Four research questions addressed the overall aim of the thesis. I will now discuss the development of each of the four research questions and the methods used to address each of them.

2.2.1 Development of research question 1 and study 1 methods

The background literature review highlighted the existence of multiple review guidance on the conduct of systematic reviews that consider health inequalities (see Chapter 1.3.4). My initial thought was, if guidance already exists to assist reviewers when incorporating considerations of health inequalities (and reviewers are aware of the guidance), then why were reviewers not operationalising it to inform their systematic review proposals? I identified a gap in the background literature that reviewed *what* systematic review guidance was available and *how* it helped reviewers to incorporate health inequality considerations. This informed the development of the first research question and the methods subsequently adopted (see figure 2.4).

Figure 2.4: Development of research question 1 and study 1 methods



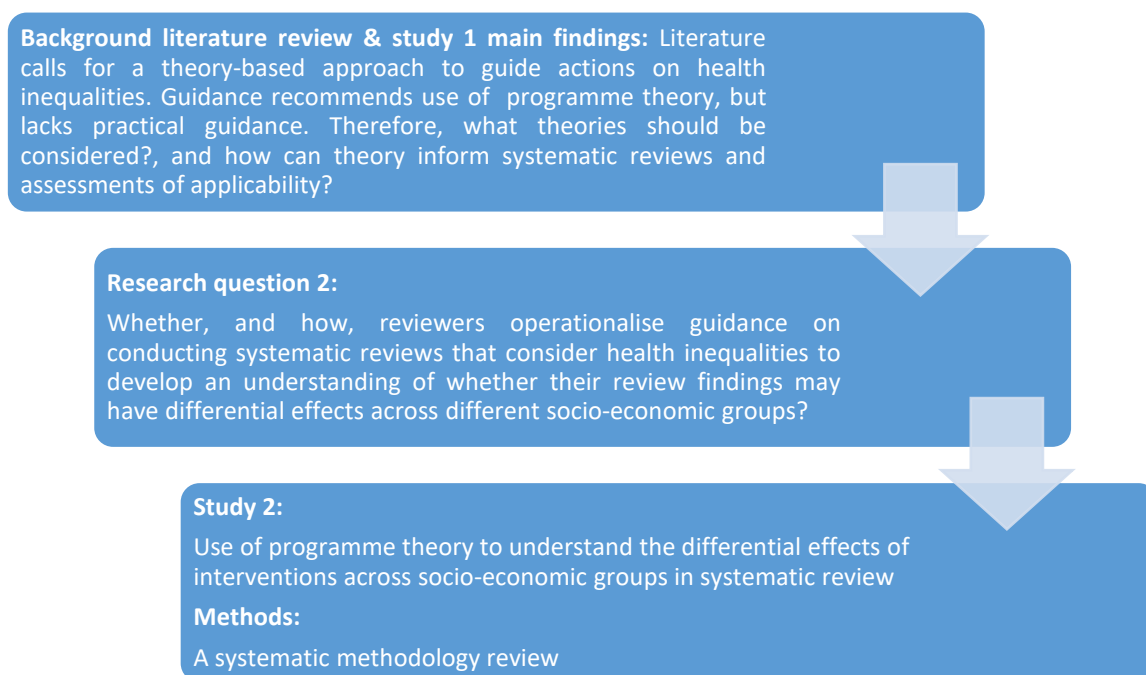
A mapping review was undertaken to identify and map the guidance available to systematic reviewers on whether and how to incorporate health inequality considerations (see Chapter 3). A mapping review aims to map out and categorise the literature, according to key features, and identify gaps in the evidence base (37). I chose this approach to allow for the categorisation of the literature by its focus, purpose and scope, and to identify the level of detail included therein to help reviewers' to operationalise the guidance. The mapping review therefore aimed to identify what guidance was available to help reviewers incorporate considerations of socio-economic health inequalities and the extent to which it helped reviewers to consider the ways in which an individuals' socio-economic status may moderate intervention effectiveness.

2.2.2 Development of research question 2 and study 2 methods

The mapping review of guidance on the conduct systematic reviews that consider health inequalities calls for reviewers to use programme theory or logic models to inform *a priori* decisions on whether and how health inequalities may impact on review findings (see

Chapter 3.5.4). This also supported the findings of the background literature review that highlighted a lack of evidence on differential effectiveness of health interventions across different socio-economic groups (Chapter 1.3.1). In the absence of such evidence, Whitehead (32) among others (50), call for the use of theory to inform actions on health inequalities. One of the main findings of the mapping review however, was a lack of practical help for reviewers looking to use theory to inform systematic reviews that consider health inequalities. These findings informed the development of the second research question (see figure 2.5).

Figure 2.5: Development of research question 2 and study 2 methods



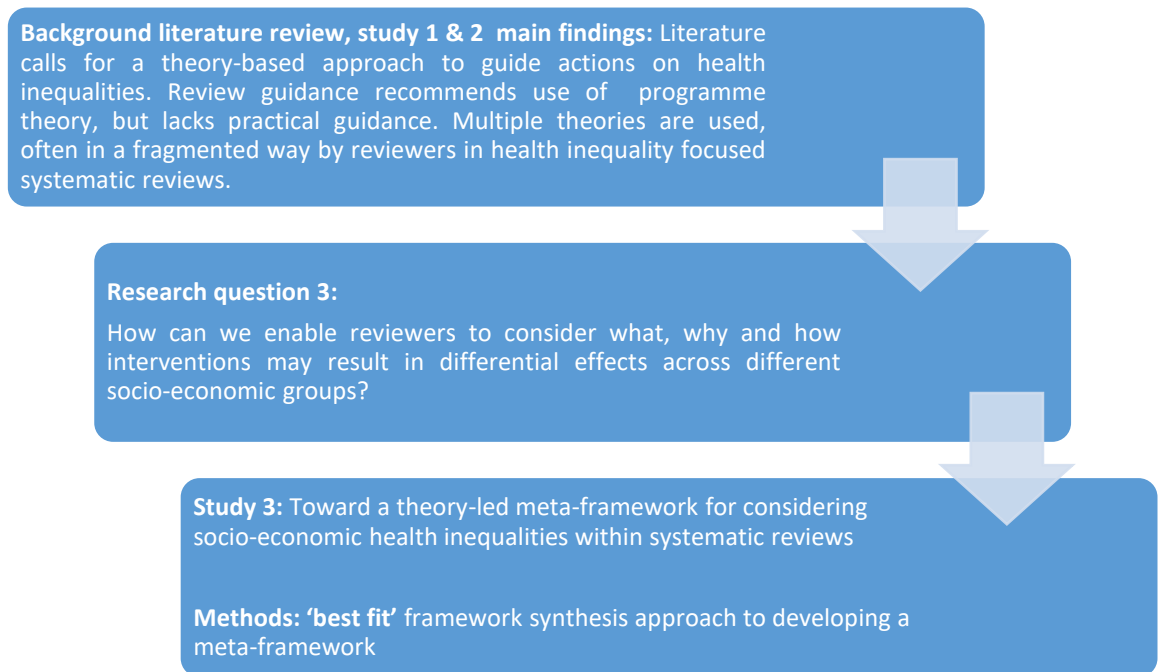
The lack of practical guidance on the use of theory to inform the conduct of systematic reviews that consider health inequalities therefore led me to question whether and how systematic reviews use theory to inform their reviews. Through an analysis of published systematic reviews that incorporated health inequalities I hoped to identify the extent to which reviewers were using theory, what theories were used and how theory was currently used to inform health inequality focused systematic reviews (see Chapter 4). I envisaged that

the findings of this study would help to inform the development of practical guidance to help reviewers use theory to inform considerations of socio-economic health inequalities in systematic reviews. The Cochrane Methodology Group (79) defines a systematic methodology review as ‘examining the evidence on methodological aspects of systematic reviews, randomised trials and other evaluations of health and social care’. A systematic methodology review was therefore, deemed an appropriate method for answering the second research question.

2.2.3 Development of research question 3 and study 3 methods

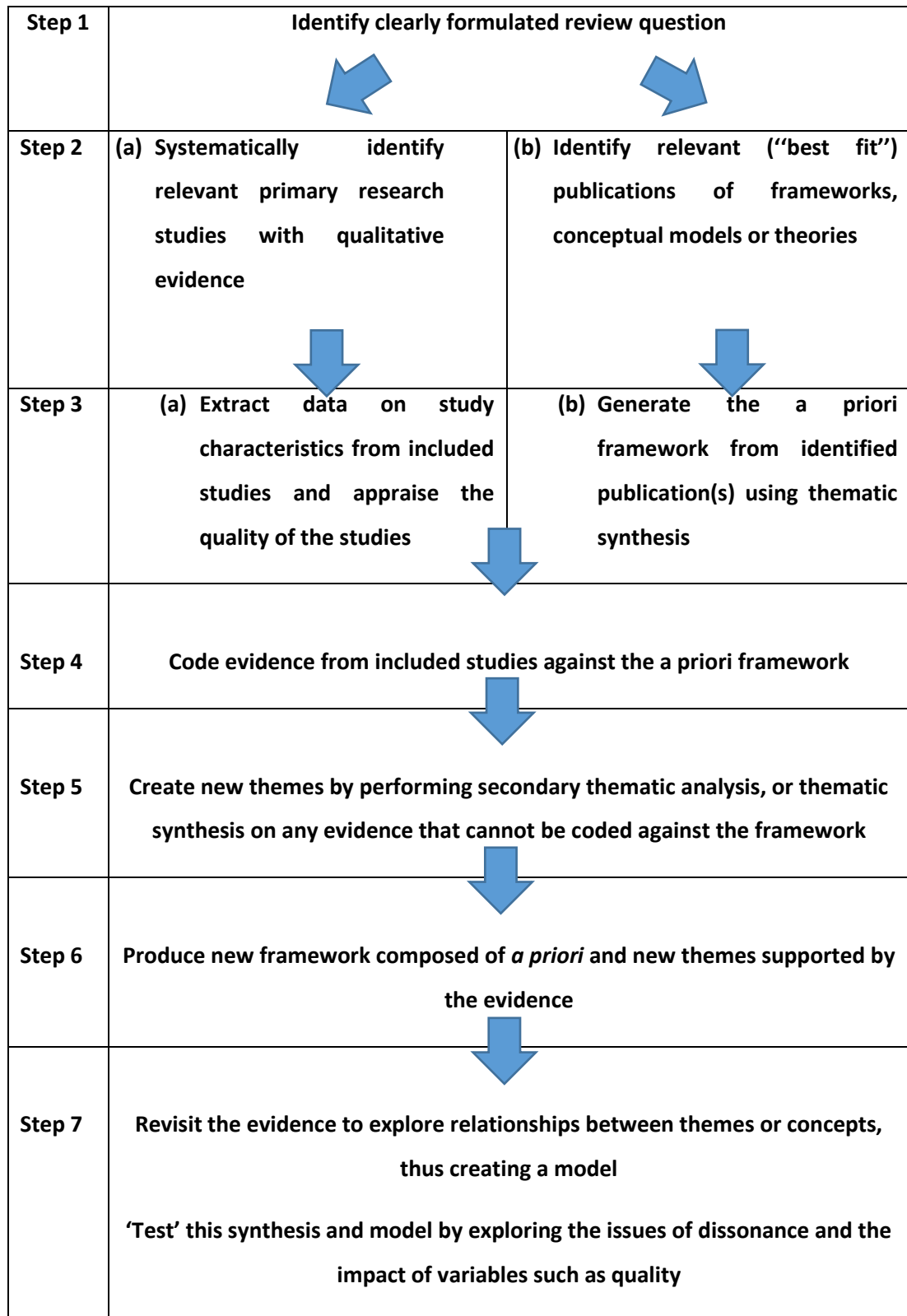
Study 2 found that while multiple theories informed socio-economic health inequality systematic reviews, the use of theory was fragmented and not widely adopted (see Chapter 4.6). Reviewers were more likely to use theory in an ad-hoc way *a priori* and/or at the end using supplementary evidence to explain their findings, rather than use theory to underpin the review analysis and synthesis through a testing and refining process. These results, along with those of the mapping review (which highlighted calls for the use of programme theory to inform considerations of health inequalities in systematic reviews), led me to consider how I could enable reviewers to use theory to inform considerations of socio-economic health inequalities in systematic reviews. By ‘enabling reviewers’, I mean offer practical guidance in incorporating theory in the review process. Additionally, it also led me to consider how I could encourage reviewers to use theory *throughout* the analysis and synthesis processes to increase the validity and applicability of their review findings (see figure 2.6). Such guidance also had to align with my own positionality of offering a ‘pragmatic’ approach to reviewers who may be new to the field of health inequalities and therefore unfamiliar with how an individual’s socio-economic status may moderate intervention effectiveness (see Chapter 1.8).

Figure 2.6: Development of research question 3 and study 3 methods



The 'best fit framework synthesis (BFFS) method is one approach that encourages reviewers to incorporate theory in systematic reviews (80-82). Developed by Carroll et al., (80, 81), the BFFS approach, outlined in figure 2.7 is a variant of the 'framework synthesis' method. It involves the identification of a relevant theory, framework or conceptual model, which then forms the themes for an *a priori* framework. In a similar way to 'framework synthesis', the framework is then used to code data from included studies in the review using a deductive process. However, unlike the 'framework synthesis' approach, the BFFS method recognises that the framework need not be a 'perfect fit', but rather a 'best fit'. This means that in circumstances in which data does not map to themes, the framework is flexible enough to allow new themes to be generated using an inductive approach.

Figure 2.7: Overview of the ‘best fit’ framework synthesis method (Booth and Carroll, 2015, ‘figure 1’)



I selected the BFFS method as my approach for developing practical guidance on incorporating considerations of socio-economic health inequalities in systematic reviews for the following reasons:

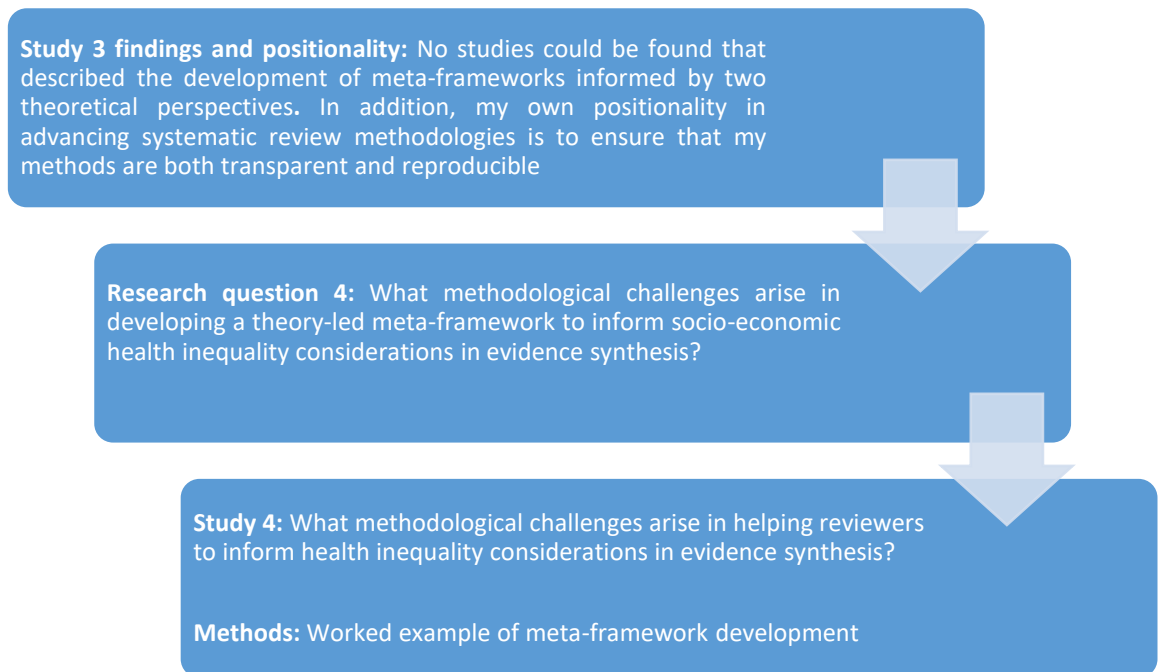
- Above all, the BFFS method aims to promote the use of theory to help reviewers understand ‘what works, for whom and under what circumstance’ (82). This aligns with the aim of this research in helping reviewers to understand what and how interventions work/don’t work for different socio-economic groups.
- Similar to realist synthesis, the starting point for ‘best fit’ framework synthesis is theoretical (81). This fitted well with the findings from the background literature calling for the use of theory to inform action on health inequalities (32, 50) (see Chapter 1.3.1) and the findings of study 1, the mapping review of review guidance calling for reviewers to use programme theory to inform considerations of health inequalities in systematic reviews (see Chapter 3.5.4).
- The use of a framework approach to incorporate considerations of health inequalities in systematic reviews encourages reviewers to use theory to inform the *whole* review process, thus aiming to increase the validity and applicability of the review by basing findings on *post-hoc reasoning* rather than *post-hoc assumptions*.
- An external theoretical framework allows for engagement with a wider body of more generalisable theory (82). This was an essential requirement since the framework had to work at the broadest level, that is, for any intervention (see Chapter 2.1.2). Consequently, the framework also had to be adaptable to cope with new themes that may emerge when used to examine individual interventions. I also considered a framework synthesis approach; however, this approach does not allow for adaptations for data that cannot be accommodated within an *a priori* framework.
- Furthermore, the results of study 2 found that reviewers used multiple theories to inform socio-economic health inequality systematic reviews (see Chapter 4.5.5). In comparison with a framework synthesis approach, the BFF approach allows for more than one theory to inform framework development (a meta-framework) (82).

- The developers of the BFFS method describe it as a pragmatic methodology for research synthesis (81). For example, in highlighting the rapid and transparent approach to data analysis when using a framework to code data from a review's included studies (81) this approach aligns with my own positionality as one of 'pragmatism' (see Chapter 1.8).
- Finally, as can be seen in figure 2.3 the BFFS as a variant of framework synthesis sits between realist review and positivist review methods. This is because the BFFS uses both deductive and inductive approaches during data synthesis. This method also aligned therefore with my epistemological position as one of 'realist informed'. In other words, it is an approach to reviewing that aims to pull reviewers away from a purely positivist position in answering simply, 'what works', to one which encourages consideration of 'what works, for whom, and under what circumstance' (see Chapter 2.1.2).

2.2.4 Development of research question 4 and study 4 methods

Several methodological challenges arose during the development of the meta-framework (see Chapter 5.5) that I had not necessarily anticipated. Whilst the developers of the 'best fit' framework approach have published two worked examples of their 'best fit' framework method (80, 81), I could find no further worked examples. Although there is an example of a best-fit framework informed by two theoretical perspectives(83), the authors do not provide any detail on how the two theoretical perspectives were merged to generate the framework. This may be largely because the development of 'best fit' frameworks is often reported within a wider 'best fit' framework synthesis and authors may therefore be limited due to journal word count. Furthermore, I could find no studies that documented the challenges facing reviewers when developing meta-frameworks. In advancing methodologies for the incorporation of socio-economic health inequality considerations in systematic reviews, I felt it was important therefore to document the challenges (see figure 2.8). Just as important was the need to document how I overcame the challenges to help others who may wish to develop meta-frameworks in a similar way. This aligned with my positionality in producing research that is both transparent and reproducible (see Chapter 1.8).

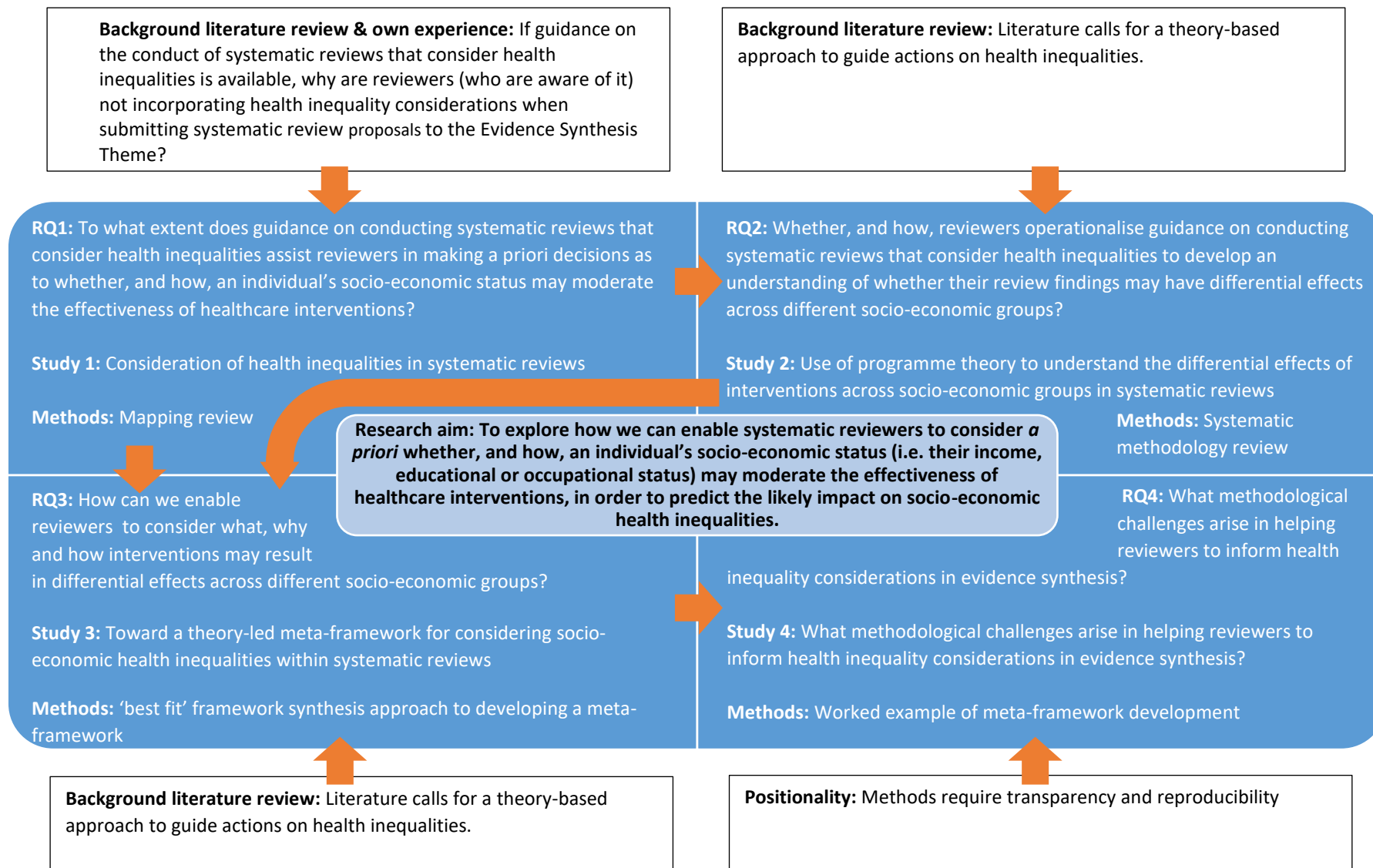
Figure 2.8: Development of research question 4 and study 4 methods



2.3 Coherence of work

Each of the four research questions developed iteratively as the research progressed. Each research question emerged from a combination of one or more of the following; the background literature review, previous study findings, or my own positionality. Figure 2.9 depicts how each of the four research questions and studies link together to form a coherent whole in addressing the overall aim of the research.

Figure 2.9: Coherence of work



2.4 Ethics

It is important to consider the requirement for ethical approval when conducting research. The above studies involved secondary analysis of publically available research papers and reports. As such, this research did not involve human (or animal) participants, their tissue or their data. Therefore, in accordance with the University of Liverpool's policy on research ethics (84), ethical approval was not required.

Despite the fact that ethical approval was not required, ethical issues underpinned my whole approach to research conduct. For example, I believe that there was an ethical requirement to justify the need for this research (85). In addition, I aimed to design my research in such a way as to ensure its integrity and transparency (85). For example, in examining the use of programme theory in socio-economic systematic reviews, I had a second reviewer check my selection of studies, data extraction and quality assessment (see Chapter 4.4.3). This also aligned with my own positionality in ensuring that all my research is robust, thus aiming to minimise research bias and improve the validity of my results (See Chapter 1.8). Whilst it was not necessary to encrypt my data, I spent some time working with data at home. This required the transfer of data, temporary storage of data on a personal computer and restoration of data onto the University networked server. This required careful consideration of version control and backing-up of data on a weekly basis. I also believe that it would be unethical not to disseminate my research findings. This partly influenced my decision to publish my work as I went along and present my findings at international, national and local conferences, both as oral and poster presentations (see appendix 1).

Furthermore, I firmly believe that ethics is more than a set of principles that guide research actions (e.g. gaining ethical approval to undertake research). I believe in adopting moral principles to ensure that all research adopts an ethical approach. I believe that there is a right way to behave and I have respect for others involved in my research. Whilst I did not look to recruit participants into a primary study, I took appropriate steps not to overburden academic colleagues, including two fellow PhD students, who supported elements of this research.

2.5 Summary

My methodological approach, underpinned by a realist informed epistemology, was informed by four perspectives; the research aim, the target audience for this research, the

findings of the background literature and my own positionality as a researcher. I addressed the research aim by four linked research questions and studies:

- Study 1 (see Chapter 3): Consideration of health inequalities in systematic reviews: a mapping review of guidance (86).
- Study 2 (see Chapter 4): Use of programme theory to understand the differential effects of interventions across socio-economic groups in systematic reviews – a systematic methodology review (87).
- Study 3 (see Chapter 5): Towards a theory-led meta-framework for considering socio-economic health inequalities within systematic reviews (88).
- Study 4 (see Chapter 6): Methodological challenges when developing meta-frameworks in evidence synthesis: a worked example of a socio-economic health inequalities meta-framework.

An iterative process informed the development of a meta-framework to inform socio-economic health inequalities in systematic reviews, in which the findings of each study informed the development of subsequent research questions and studies. Thus, the four studies presented in the following chapter's link together to form a coherent whole in answering the overall research aim (see figure 2.9).

Chapter 3: Consideration of health inequalities in systematic reviews: a mapping review of guidance (study 1)

3.1. Publication and acknowledgement of contributions to study 1

Citation: Maden M. Consideration of health inequalities in systematic reviews: a mapping review of guidance. *Systematic Reviews* 5:202 DOI 10.1186/s13643-016-0379-1. (see appendix 1).

I contributed to this study in its entirety, developing the idea for the mapping review, searching for the literature, screening the studies for inclusion, extracting and analysing data and wrote the first and subsequent versions of this paper. Professor Rumona Dickson, Dr Suzy Paisley and Professor Mark Gabbay provided comments on earlier drafts of this paper.

3.2 Background

Health inequalities are avoidable and unjust differences in health between individuals or populations (32). Given that we know that interventions shown to be effective in improving the health of a population may actually widen the health inequalities gap while others reduce it, it is imperative that all systematic reviewers consider how the findings of their reviews may impact (reduce or increase) the health inequality gap (21-23). Furthermore, the existence of social inequalities, defined as “systematic differences in health between different socio-economic groups within a society” (32, p.473, 89), increases the argument for *all reviewers*, not just those with a focus on health inequalities, consider the *potential* for their findings to reduce or increase health inequalities. This is echoed by Cochrane and Campbell Collaborations who have called for the effects of interventions on health inequalities to be considered by systematic review authors (39, 90).

Incorporating considerations of how review findings impact on health inequalities also aims to overcome one of the major barriers in using systematic reviews to inform decision-making, policy-making and practice (52). Moving away from simply assessing what works to considering how review findings impact on disadvantaged populations, by assessing for example differential effects by subgroup populations can improve the applicability of the review findings to the local population (47, 55) thus increasing their ‘fit for purpose’ in supporting decision-making and practice. Going beyond simply ‘does it work’ to examine under what circumstances it works for whom and why (91) holds even more resonance when

considering the impact on health inequalities. As O'Neill et al., (70, p.57) point out, “the intervention has to be accessible, acceptable, effective in, and used by the most disadvantaged group within that population to be truly effective at reducing inequities in health” (whilst health inequalities are defined as avoidable differences in health outcomes across individuals or between populations, the narrower but related term health equity is often referred to in the literature as health inequalities which are also considered ‘unfair and unjust’ (3)).

Methodological research has highlighted an absence of evidence with regards to the extent systematic reviews take into account issues of health inequalities when analysing and making recommendations for further research and practice (22, 56, 57). Furthermore, recent methodological studies of systematic reviews demonstrated that very few (<5%) addressed differential impacts across socio-economic groups (19, 92). The extent to which systematic reviewers in the past have failed to consider how their review findings impact on health inequalities is due in part to the focus of reviewers placed on the ‘effectiveness’ of interventions but also by the lack of relevant data reported in the primary literature to assess such differential effects (62) (see Chapters 1.3.1-1.3.2). In addition, the lack of guidance, or awareness of the existence of such guidance in this area may also have worsened the situation. More importantly, it is also due to a failure on the part of review authors to even consider differential impacts in reviews where health inequalities are not the focus (19, 52, 60).

This study aims to review existing guidance on incorporating considerations of health inequalities in systematic reviews to examine the extent to which they can help reviewers incorporate such considerations in systematic reviews.

3.3 Aim and objectives

The aim of this study was to undertake a mapping review of existing guidance documents currently provided to assist reviewers when determining whether and how to incorporate considerations of health inequalities (see Chapter 2.2.1). A mapping review aims to map out and categorise the literature according to key features (e.g. study design) on a particular topic and to identify gaps in the research literature (37).

The objectives were;

- i) to provide an overview on the types of guidance, in particular the focus, scope and purpose of the guidance;
- ii) to explore how the guidance is defined by authors;
- iii) to describe the methods used to develop the guidance;
- iv) to examine the comprehensiveness, overlap and operationalisation of the guidance.

3.4 Methods

3.4.1 Search strategy

A systematic approach to identifying the literature was undertaken in a two-tiered approach. Firstly, more generic guidelines to evidence synthesis were located and searched to identify specific guidance relating to the incorporation of health inequalities. A search of review guidance manuals prepared by international organisations, known to the author, engaged in undertaking evidence synthesis was undertaken (see appendix 2, A2.1). Publications listed on the Campbell and Cochrane Equity Group website were also scanned.

In addition to this a search was undertaken in Medline, CINAHL and The Cochrane Methodology Register. Key terms searched on included thesaurus and textwords terms comprising of synonyms for health inequalities, evidence synthesis and methodology/guidance/tools (see appendix 2, A2.2). A pre-published search strategy designed to capture health inequalities studies was reviewed and utilised (20). A practical approach to developing a search strategy to identify different types of evidence synthesis was adopted. This approach was informed by published systematic review filters and related evidence synthesis terms (e.g. realist review, realist synthesis, integrative, etc.). Searches were undertaken in September 2015 and search alerts were set up to capture relevant articles added into the databases after this date. No restrictions by year were applied, but publications were limited to English language only studies.

Requests for guidance were made via relevant email discussion lists and contacting experts in the Campbell and Cochrane Equity Group. For guidance that had been updated, the most recent update was included. Where multiple publications discuss the same guidance they were considered together.

3.4.2 Inclusion criteria

Any type of study was included if it provided an overview or discussed the development and testing of a conceptual or practical framework, tool, model or guidance (advice or formal recommendations) for dealing with the incorporation of considerations of health inequalities in evidence synthesis. For the purpose of this review, health inequalities are defined according to Whitehead's (32, p.473) definition in which "inequalities" in the British context—and increasingly also across Europe—carries the same connotations of unfairness and injustice as the term "inequities". Both generic guidance (e.g. guidelines published by evidence synthesis organisations or collaborations) that incorporated considerations of health inequalities and health inequalities specific guidance (e.g. scholarly methodological studies presenting specific guidance for incorporating considerations of health inequalities in systematic reviews) were included. Studies that primarily offer a theoretical discussion or comments on if and why health inequalities should be included in evidence synthesis, or frameworks and guidance for the incorporation of health inequalities for purposes other than evidence synthesis were excluded. For practical reasons, studies were limited to English language publications. Screening of studies was undertaken by the author.

3.4.3 Data extraction

Data were extracted by the author on targeted audience (e.g. for reviewers, users of evidence synthesis), purpose (e.g. tools are to be used for planning, conducting, reporting, disseminating or using systematic reviews), scope (e.g. to inform systematic reviews, other research), how the tool was developed, operationalisation of the tool (how reviewers are instructed to apply the guidance) and whether and how they define 'health inequalities'. Included studies were also categorised as to their focus, i.e. whether they were health inequalities, or had a generic focus but which accounted for health inequalities.

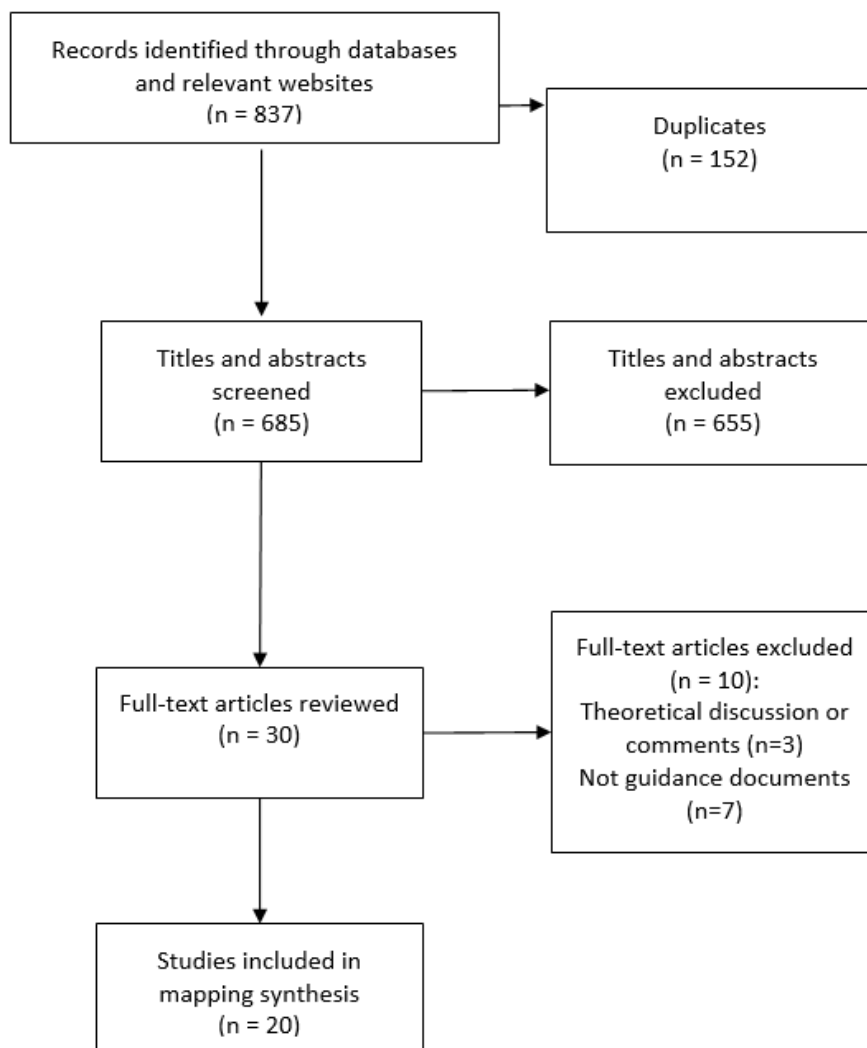
3.4.4 Data synthesis

Results are summarised in narrative and tabular forms. Strengths and weaknesses of the guidance in assisting systematic reviewers were assessed based on methods of development including evaluation, accessibility and transparency in operationalisation.

3.5 Results

The results of the search are summarised in figure 3.1. Eight hundred and thirty-six references were identified of which 20 were included in the review. All guidance documents (40, 67-70, 78, 93-106) incorporating considerations of health inequalities in systematic reviews were published between 2009 and 2016. Table 3.1 outlines the characteristics of the included studies. Doull et al., (93) report on three guidance documents within the same study (94-96). Tugwell et al., (78) and Ueffing et al., (69) both discuss the Cochrane Equity Checklist, whilst Welch et al., (67, 68) and Burford et al., (101) report on the PRISMA-Equity 2012 Extension. The majority of the guidance has been produced with the involvement of members of The Campbell and Cochrane Equity Methods Group.

Figure 3.1: Flow of search results



3.5.1 Focus, scope and purpose of guidance

Table 3.1 outlines the focus, scope and purpose of the guidance. The majority of the guidance documents have an health inequalities focus; three focus on sex and gender (94-96), one on SES (97) and one on both sex and SES analysis in systematic reviews (102). All four generic guidance documents in which health inequalities were considered, signposted reviewers onto health inequalities focused guidance produced by The Campbell and Cochrane Equity Group or the PROGRESS framework (70). All guidance was produced for informing the production of systematic reviews with two guidance documents also applicable to other types of research (70, 97). Guidance has been produced to inform considerations of health inequalities at different stages of the systematic review process with the most guidance produced to support the conduct of systematic reviews.

3.5.2 Guidance definitions

The documents defined their guidance in different ways, for example, as briefing notes (93-96) equity lens (69, 70, 78, 97, 98), recommendations (40, 69, 78), plausibility algorithm (102), tool (99) framework (100, 105), guidance (103, 104, 106) and guidelines (67, 68, 101).

All but three guidance documents (100, 105, 106) define what is meant by health inequalities, equity or inequity. Where definitions are recorded, they differed across the studies. Whitehead's (3) definition of health equity and health inequalities were the most commonly reported within the guidance documents, although a number of different authors were cited for health inequalities (3, 52, 107, 108), health inequity (3, 107, 109) and health equity (3, 6, 110-113). Four of the five guidance documents with a sex and gender health inequalities focus all define what it meant by 'sex' and 'gender' in the same way (93-96). Neither of the two guidance documents with a socio-economic focus define 'socio-economic status' (97, 102).

Table 3.1: Characteristics of included studies

Guidance	Focus		Purpose			Scope					Place of publication			Open access	HI defined
	Equity	Generic	Systematic Review	Intervention studies	Other	Planning	Conduct	Reporting	Applicability	Knowledge Translation	Article	Book Chapter	Online only		
Armstrong et al., (103) ¹		✓	✓				✓					✓		✓	✓
Armstrong et al., (104) ¹		✓	✓				✓					✓		✓	✓
Chambers & Wilson (105)		✓	✓						✓			✓		✓	
CRD (106)		✓	✓				✓					✓		✓	
Doull et al. (93) ²	✓ ⁵		✓			✓	✓				✓			✓	✓
Doull, et al., (96) ²	✓ ⁵		✓			✓	✓						✓	✓	✓
Puil, et al., (95) ²	✓ ⁵		✓			✓	✓						✓	✓	✓
Welch, et al., (94) ²	✓ ⁵		✓			✓	✓				✓			✓	✓
NIHR CLAHRC North West Coast, (97)	✓ ⁶		✓	✓	✓ ⁷	✓							✓	✓	✓
Nasser et al. (98)	✓		✓			✓					✓				✓
O'Neill et al. (70)	✓		✓	✓		✓		✓			✓				✓
Oxman et al. (99)	✓		✓						✓		✓			✓	✓
Tugwell et al. (78) ³	✓		✓				✓	✓			✓			✓	✓
Ueffing, et al., (69) ³	✓		✓			✓	✓						✓	✓	✓
Tugwell et al. (100)	✓		✓							✓	✓			✓	
Welch et al. (67) ⁴	✓		✓				✓	✓			✓			✓	✓
Welch et al. (68) ⁴	✓		✓				✓	✓			✓			✓	✓
Burford et al., (101) ⁴	✓		✓				✓	✓			✓			✓	✓
Welch et al. (102)	✓ ^{5,6}		✓			✓					✓			✓	✓ ⁸
Welch et al. (40)	✓		✓				✓			✓	✓			✓	✓

¹Guidance from The Cochrane Collaboration ²Doull et al., (93) report on three guidance documents (94-96) within the same study, ³Report on the Cochrane Equity Checklist (78), ⁴Report on the PRISMA-Equity 2012 Extension (67), ⁵Sex and gender focus ⁶Socio-economic focus ⁷Applied research, evidence synthesis, capacity building and knowledge exchange and implementation, ⁸Health inequalities defined, SES/Sex and gender not defined.

3.5.3 Development of guidance

Appendix 2, A2.3 outlines the guidance development process of the included studies. The majority of the guidance documents were transparent in outlining how the guidance had been produced. Of those reporting methods of guidance development, all were informed by a literature review.

The guidance development process for most involved seeking feedback and revision from people with a wide range of expertise (including researchers, health inequalities experts, review methodologists, decision-makers, clinical epidemiologists, practitioners and journal editors) and systematic review experience the majority of whom were either members of the Cochrane Collaboration or were attending Cochrane Workshops. Burford et al., (101) and Doull et al., (93) specifically report involving novice reviewers in the development of their guidance. The PRISMA-E 2012 reporting guidelines (67, 68) were also informed by consensus methods. Whilst all of the guidance documents were produced from a health inequalities perspective, only five had theoretical underpinnings or followed established methods in developing their guidance (67, 68, 93, 98, 102).

3.5.4 Operationalisation of guidance

As a means of demonstrating *what* reviewers should consider in the application of the items most of the guidance provide examples from published systematic reviews. For example, when asking reviewers to consider whether there are known or possible differences by sex/gender Welch et al., (94) use the following example, “In a systematic review on quality of life after total hip and total knee arthroplasty, men appeared to benefit more from the intervention in the few studies that addressed this issue.”.

Despite the different purposes and audiences, there is considerable overlap in what users of the guidance are asked to consider at different stages of the review process. Table 3.2 highlights this using the example of whether to expect differential effects across SES across population characteristics.

Table 3.2: Overlap of guidance items on anticipating differential effects across SES in relation to population characteristics.

Guidance	Purpose	Item (i.e. what reviewers are asked to consider)
<i>Can we expect differential effects across socio-economic status in relation to population characteristics?</i>		
Welch et al., (40, p.2)	Conduct Knowledge translation	<i>Define conceptual approach to health equity</i> “whether social gradients exist in the burden of disease and whether relative or absolute effects of interventions are likely to differ for disadvantaged populations” <i>Frame the health equity question</i> “This requires consideration of both relative risk and absolute effects, as well as baseline risk of the health outcome of interest across social gradients.”
Welch et al., (102)	Planning	“Are there differences in patient/community/population characteristics (e.g. underlying pathophysiology, comorbidities, patient attitudes, etc.) that are likely to create important differences in the magnitude of relative effect of the intervention versus the control for the outcome of interest?”
Oxman et al., (99)	Applicability	“Which groups or settings are likely to be disadvantaged in relation to the option being considered?” “Are there plausible reasons for anticipating differences in the relative effectiveness of the option for disadvantaged groups or settings?” “Are there likely to be different baseline conditions across groups or settings such that that the absolute effectiveness of the option would be different, and the problem more or less important, for disadvantaged groups or settings?”
NIHR CLAHRC North West Coast (97)	Planning	“What evidence is there that this problem is unequally distributed across socio-economic groups?” “What aspects of socio-economic inequalities can be expected to impact on this problem?”
Welch et al., (94)	Planning Conduct	<i>Question formulation:</i> “Consider whether there are known or possible differences by sex/gender across: baseline risk, prevalence, vulnerability, implementation or response to intervention, and plan objectives and methods accordingly.”

The rationale for *why* health inequalities should be considered was also provided in some guidance. For example, Oxman et al., (99, “Questions to consider”, no.3), ask “are there likely to be different baseline conditions across groups or settings such that the absolute effectiveness of the option would be different, and the problem more or less important, for disadvantaged groups or settings?” They then outline the rationale, “Typically, baseline risks are larger in disadvantaged populations and a larger absolute effect could therefore be expected.” (99, “Questions to consider”, no.3).

When addressing *how* reviewers can operationalise the items, the comprehensiveness and application with which this is detailed differs across the guidance. For example, the number of items reviewers are asked to consider in the guidance documents ranges from 3 up to 26. Many guidance documents recommend using a theory-based approach, using programme theory or logic models to understand the assumptions behind how and why the intervention may work differently across disadvantaged populations and the influence of context on the outcome (40, 67-69, 78, 93-97, 102). However, there is a lack of detail on how this could be implemented in practice. Tugwell et al. (78, 2. “Defining disadvantage”, para. 2) for example state that “implications on inequities are dependent on context, so authors of health inequality orientated reviews must strive to understand and explore the mediating effect of context”, yet they do not define what is meant by ‘context’ and what data could be collected to explore this. Welch et al. (67) suggest that one limitation of the guidance is the use of terminology such as ‘logic model’, ‘analytic framework’, ‘context’, and ‘process evaluation’, terms that ‘are not widely accepted’. A lack of consistency was noted in applying such terms across the guidance with some referring instead to ‘causal pathway analysis’, ‘program theory’ and ‘mechanisms of action’.

Few guidance documents discuss who should be involved in making decisions on if and how health inequalities matter in systematic reviews. Tugwell et al. (78) suggest that ‘relevant stakeholders’ should be involved in defining the review question, whilst HIAT (97) recommend involving members of the public (e.g. service users, carers, people living in disadvantaged neighbourhoods) in the planning stages. Only Welch et al., (102) started to explore *how* people came to their decisions of whether to expect differential effects across sex/SES and found that these decisions were made based on theory, personal experience, empirical data and guesses, but called for further research to investigate how these are used to make judgements.

3.5.5 Evaluation of guidance

Formal methods of evaluation were reported in three studies (93, 101, 102) for 6 of the guidance documents (68, 94-96, 101, 102). Burford et al., (101) surveyed 151 systematic review authors on the perceived utility of the PRISMA-E 2012 (67, 68). Reported advantages of using PRISMA-E 2012 include improved awareness of health inequality considerations in systematic reviews and improved consistency of reporting of health inequalities in systematic reviews. Barriers reported include time required to apply guidance, length of guidance, increase length and complexity of reviews and lack of data in primary studies to operationalise some of the guidance.

Doull et al. (93) undertook a workshop evaluation involving 19 participants including potential users (researchers, practitioners and policy-makers) with little or some knowledge of the concepts of sex/gender to evaluate the content, readability and comprehensiveness of their briefing notes (94-96). Although respondents reported that the briefing notes “provided clear methodological guidance to address sex/gender in reviews” (93, “Results”, para. 2) and rated all aspects highly, responses were mixed on the level of complexity within the methods section.

Finally, in Welch et al., (102) four clinical methodologists evaluated the face and construct validity of a plausibility algorithm in predicting the likelihood of differential effects across sex and SES. Thirty-five review users, methodologists and clinicians also assessed the inter-rater reliability of the algorithm against 10 pre-selected systematic reviews. The results found a low to no agreement beyond chance between raters for each of the three questions across sex and socio-economic considerations. The authors suggest several reasons for the poor agreement relating to the design of the algorithm (use of ‘multi-component questions covering several factors’, omission of a ‘don’t know’ category for responses), individual characteristics of respondents and poor choice of proxy or gold standard set of reviews to test the algorithm against. Whether any of the guidance has resulted in an uptake of considerations of health inequalities in systematic reviews is still to be determined (93, 94).

3.6 Discussion

This review identified 20 guidance documents for incorporating considerations of equity in systematic reviews spanning the whole spectrum of the review process, from planning, conduct and reporting through to considerations of applicability to disadvantaged populations and knowledge translation when using reviews to inform decision-making and

policy. Many of the documents have been published in the last three years, highlighting the fact that methodological research in this field is an important, emerging and evolving area of interest. The majority of the guidance is published in open access format in the journal literature. Whilst this increases the accessibility of the guidance, omission from standard review guidance handbooks places a greater emphasis on guidance authors to raise awareness of the existence of such tools to encourage greater uptake. For example, Welch et al., (67, 68) recognise the importance of widespread dissemination amongst journal editors, funding bodies and ethics committees in order to encourage the adoption of the PRISMA-Equity Extension reporting guideline.

A citation analysis was undertaken on 12 of the review guidance documents included in this study for which citation data was available to see whether reviewers were using it. The citation analysis found that not all guidance is cited in systematic reviews. The PRISMA-E (67) guidance was the most frequently cited, followed by PROGRESS-Plus (70) and the PRISMA-E Extension (68) (see Appendix A2.4). Encouragingly, the results also suggest that the guidance is being used to inform both systematic reviews generally, and health inequalities reviews specifically.

Increasing awareness of such guidance is even more important when reviewers are faced with the different terminology used by authors to describe it. Use of multiple terms such as algorithm, equity lens, tool etc., may make them harder to locate within the journal literature. The Campbell and Cochrane Equity Methods Group have started to collate guidance on health inequality considerations for review authors (1), yet the list does not cover all guidance identified in this review and focuses to a greater extent on the guidance developed to support Cochrane Review authors.

Whitehead's (3) definition of health inequalities as "Inequality in health is a term commonly used in some countries to indicate systematic, avoidable and important differences" and health inequity as "refers to differences in health which are not only unnecessary and avoidable but, in addition, are considered unfair and unjust" were most commonly applied in the guidance. However, rather than demonstrate an acceptance of a common definition for health inequality or health equity, most of the guidance citing Whitehead (3) were produced by the same group (The Campbell and Cochrane Equity Methods Group). The different definitions of health inequality and health equity used by the guidance documents supports the view by Tugwell et al., (78) that these terms are used in different ways by different authors and that there is no agreed definition of health equity or health inequality

This stresses the importance therefore for HI guidance to define health equity and/or health inequality to help reviewers to operationalise the guidance.

This is particularly true for guidance incorporating considerations of SES in systematic reviews. Neither of the two guidance documents with a focus on SES (97, 102) defined the term. Several of the guidance documents refer reviewers to the PROGRESS framework (70) when asking reviewers to consider disadvantage. PROGRESS although doesn't explicitly define SES, relates it to income, while considering education and occupation separately. Yet SES has been defined more broadly as "a composite measure that typically incorporates economic status, measured by income, social status, measured by education; and work status measured by occupation" (13, 114, p. 30, 115). The classification of individuals by SES has implications for reviewers in relation to types of SES indicators to collect in and therefore, the definition and classification of health inequality terms such as SES needs to be operationalised within the guidance. This is further supported by the findings of Runnels et al., (61) who in a survey examining the challenges of including sex/gender analysis in systematic reviews found that one of the significant challenges was clarifying the concepts of 'sex' and 'gender'.

Much of the guidance is written from the perspective of health inequalities having already being identified as the focus of the review and from a whole health inequality perspective rather than specifically focusing on a specific health inequality dimension. More recently however, guidance is being tailored more towards specific health inequality domains, in particular, sex/gender (94-96, 102) and SES (97, 102). This may reflect the interests of the groups involved in producing the guidance. For example, HIAT (97) was developed by the NIHR CLAHRC NWC whose remit is to ensure that all of the research it produces has socio-economic related health inequalities as is core focus (35). Guidance on incorporating sex/gender analysis in systematic reviews was produced by the Cochrane Sex/Gender Methods Group (a sub-group of the Campbell and Cochrane Equity Methods Group). The development of more health inequality specific guidance may also suggest that once reviewers have identified which health inequality domain(s) to consider, they may have difficulty operationalising the more generic health inequality focused tools and require more tailored guidance, however, there is no empirical evidence to suggest this is the case. Or it may be that given that it would be impossible for reviewers to incorporate considerations across all health inequality dimensions, that there is a debate developing that certain health inequality domains may be considered more important than others to incorporate in systematic reviews. Indeed, in the application of the PROGRESS framework to systematic

reviews, O'Neill et al., (70, p. 62) state that the framework is “not intended to encourage data dredging but to identify the most important factors that drive inequities in health”.

The Campbell and Cochrane Equity group have been instrumental in driving forward methodological advances in evidence synthesis for the incorporation of health inequalities in systematic reviews and although not specifically stated, most of the guidance produced appears most relevant to reviewers undertaking systematic reviews measuring the effectiveness of interventions or at users assessing the applicability of reviews of effectiveness. This is no doubt partly due to the focus of The Cochrane Collaboration on reviews of effectiveness, yet how well this guidance translates to other types of health inequality systematic reviews (e.g. qualitative) therefore is unclear and further research investigating the usefulness of the guidance for other types of reviews is required.

One potential challenge facing reviewers in operationalising the guidance is that methodological approaches to incorporating considerations of health inequalities are still in development and even the guidance authors themselves recognise that one of the limitations of the guidance may relate to the terminology used, such as logic model, process evaluation, mechanisms of action, terms which may not be accepted (68) or understood (116). Encouraging reviewers to consider what works for disadvantaged populations, why, how and under what circumstances not only requires as Tugwell et al., (78, “Conclusions”, para. 2) suggest “a paradigm shift in the generation and synthesis of evidence”, but also an acceptance of the terminology along with an understanding of *how* these methods can be applied in practice. Part of the problem is that current review methods cannot necessarily be transferred across to consider more complex issues and health inequalities (22, 91) and methods to incorporate such complexity in systematic reviews are only just emerging (50, 55, 91, 117-121). Given the potential complexity of the process therefore, further research examining the challenges and barriers in incorporating considerations of health inequalities in systematic reviews is required to better support reviewers in undertaking health inequality focused reviews.

There is also perhaps, a greater need to understand *how* guidance items can be operationalised. Most of the guidance is operationalised by means of descriptive examples from published systematic reviews and there is evidence to indicate that reviewers find them useful. For example, Doull et al., (93) in testing their guidance on incorporating issues of sex/gender analysis in systematic reviews found that reviewers wanted even more examples.

Much of the guidance is written with an underlying assumption that reviewers will recognise if and how equity matters. Empirical evidence however suggests otherwise (61, 102). A recent survey by Runnels et al., (61) conducted on the challenges of including sex/gender analysis in systematic reviews seems to support this view. They found that concerns were raised over the construction of knowledge and cites one respondent as saying “the biggest challenges are much more fundamental and have to do with the way that we arrive at decisions as to what is important for us to study, why it is important for us to study, and how we determine the way to study” (13, “Conceptual challenges”, para. 3).

Welch et al., (102) in developing their equity plausibility algorithm start to explore the rationale behind reviewers’ decisions and found that empirical data, theory or personal experience were often used to explain their reasons but call for further research to enhance understanding of how this was used and the contribution of individual characteristics to the process. In order to help reviewers to operationalise the guidance therefore, it may be useful to explore the rationale behind how reviewers are making decisions when applying the guidance and the contribution made to those decisions by different individuals (e.g. stakeholders).

Furthermore, Welch et al., (102, “Discussion”, para. 1) suggest, reviewers “need to have a deep understanding of the content area” to make judgements about likely differential effects, then single examples drawn from topic- specific reviews may not be the best way to demonstrate guidance application. Without a comprehensive understanding of the different ways in which HI issues may contribute towards differential effects in health outcomes it may be difficult for some reviewers, particularly those new to health inequalities, to recognise the need to incorporate or operationalise such issues in systematic reviews.

Strengths of the guidance evaluation methods include the involvement of a wide range of expertise (e.g. reviewers, methodologists, decision-makers, health inequalities experts), consensus methods and piloting of the guidance. However, the use of self-selecting samples may not necessarily be representative of the wider population expected to utilise the guidance. Assessment of face validity alone, i.e. a subjective assessment of the relevance of the questions (122) rather than evaluating how well the guidance works when applied prospectively may not identify problems operationalising items. Burford et al., (101) used a prospective design to assess the utility of the reporting guidelines but, largely due to the type of guidance, did not ask reviewers to discuss how they had operationalised the checklist items. In addition, evaluation of the guidance appears to be undertaken by individuals rather than reflecting the collaborative approach that a systematic review encourages. This may be

a further reason why the Welch et al., (102) plausibility algorithm had poor inter-rater reliability. Evaluating guidance using a case study approach, may better capture how well the guidance is interpreted or operationalised by those it is designed to assist. Involving novice reviewers in the guidance evaluation may also identify challenges in interpreting and operationalising the guidance that may not necessarily be considered when piloting is undertaken by the guidance developers or expert reviewers alone.

3.7 Strengths and limitations of the review

This study is the first to summarise the range of guidance available on the incorporation of health inequalities in systematic reviews. One of the strengths of this study is in detailing what guidance is available for considering health inequalities at various stages of the systematic review process. There is no validated search filter for health inequalities, however, terms were based on those used in a Cochrane methodological review exploring how effects on health inequalities are assessed in systematic reviews (20). The review did not seek to critique the individual items/questions in the guidance or recommend one guidance over another, but rather offer an overview of guidance available to reviewers when incorporating considerations of health inequalities at different stages of the review process.

A potential limitation of this review is that only one person was involved in the selection of studies, data extraction and synthesis. One limitation of this review is the focus on English Language literature when it is acknowledged that other languages, such as Spanish, may offer extensive coverage of literature regarding inequalities. As this is not a systematic review the search was restricted to a small number of key databases in health, further databases outside of health could have been searched. Instead a targeted approach to the search was adopted using a number of different search approaches, including scanning of relevant systematic review organisational websites, reference checking and contacting known experts in the field. Given the diverse nature of the guidance documents included in this review no formal quality appraisal was undertaken instead each guidance document was assessed as to whether or not it formally evaluated.

3.8 Conclusions

Given the recent growing interest in the incorporation of health inequalities in systematic reviews, it is not surprising that methodological guidance exploring how considerations of

health inequalities can be incorporated into evidence synthesis is a relatively new and emerging area of research (39, 123). Above all, the strength of all the guidance documents reviewed in this study is in highlighting the importance of incorporating considerations of health inequalities in systematic reviews. The citation analysis demonstrates awareness of the review guidance and use of it in systematic reviews, including reviews of health inequalities, but the nature and fidelity of its use requires greater analysis. It is clear however, that operationalising the guidance will require more work for the reviewer but aside from the Runnels et al., (61) survey there is limited evidence on the challenges facing reviewers when incorporating considerations of health inequalities. Furthermore, understanding how reviewers can operationalise the guidance and the challenges in doing so have implications not only for understanding the usefulness and burden of the guidance (101), but also has implications for the uptake of guidance and its ultimate goal of improving health inequality considerations in systematic reviews. There is currently a gap in the evidence examining how reviewers can operationalise the guidance and the barriers and facilitators involved. The results of this review will be used to inform the development of a framework to help reviewers rationalise whether or not to incorporate considerations of health inequalities in systematic reviews (see Chapters 4-6).

Chapter 4: Use of programme theory to understand the differential effects of interventions across socio-economic groups in systematic reviews – a systematic methodology review (study 2).

4.1 Publication and acknowledgement of contributions to study 2

Citation: Maden M, Cunliffe A, McMahon N, Booth A, Carey G,M, Paisley S, Dickson R, Gabbay M. Use of programme theory to understand the differential effects of interventions across socio-economic groups in systematic reviews – a systematic methodology review. *Systematic Reviews* 6:266 DOI 10.1186/s13643-017-0638-9. (see Appendix 1).

I (MM) was responsible for the overall design of the study, designed and conducted the search, designed data collection and quality assessment forms, extracted data, undertook quality assessment, synthesised data in tables and wrote the first draft and final draft of this paper. Alex Cunliffe (AC) independently extracted data and undertook quality assessment. Naiomh McMahon (NM) independently screened the titles/abstracts and full text of studies. GC independently screened titles/abstracts. Dr Andrew Booth, Professor Rumona Dickson, Professor Mark Gabbay and Dr Suzy Paisley AB, RD, MG and SP provided comments and feedback on the methodology and final draft of the study.

4.2 Background

A key challenge facing systematic reviewers when complying with recent guidance (67-69, 78, 97, 102) on incorporating considerations of socio-economic health inequalities, is to determine not only *if*, but also *how* the interventions being reviewed may work differently across socio-economic status (SES) groups. An understanding of how socio-economic health inequalities may impact on intervention effectiveness can help reviewers to decide whether interventions are likely to have either a positive, or negative effect on the health inequality gap (38) (see Chapter 1.1.5). This may then influence their decision on whether or not to include considerations of socio-economic health inequalities in the review.

Guidance on incorporating considerations of health inequalities in systematic reviews recognises the limitations of using traditional approaches to formulate review questions (68). While the traditional 'PICO' (population, intervention, comparison and outcome) framework, and subsequent derivatives (124), can help reviewers to clarify the specific components under review, they are not designed to help to identify explanatory relationships for *if* and

how interventions may have differential effects on health across different SES groups (118). For example, when defining the 'P' in PICO (i.e. population group), the emphasis is on describing what population characteristics are under review (e.g. condition, age), rather than the way different people experience the health care system within which an intervention is delivered.

As a consequence, equity review guidance recommends using additional methods such as programme theory, logic models or theories of change to understand the assumptions behind *if* and *how* the intervention may work differently across SES groups (67, 68). When considering the need to incorporate health inequalities in systematic reviews, therefore, reviewers need to know *if*, *what* and *how* interventions designed to improve the health of a population may have differential effects across different SES groups. Little is known, however, on if and how reviewers operationalise the equity review guidance when deciding whether or not to incorporate considerations of socio-economic health inequalities in systematic reviews.

4.2.1 Defining programme theory

Programme theory is the overarching theory or model of how an intervention is expected to work (125). There is, however, a lack of consistency in the way in which the terms relating to programme theory are applied in the literature, with some authors using them synonymously. Others note that while an overlap between the terms exists, a distinction can nevertheless be made between them (126, 127) (see table 4.1).

Table 4.1 Defining programme theory

<p>Programme theory A programme theory is the overarching theory or model of how an intervention is expected to work. The ‘theory’ in a programme theory “can be an articulation of practice wisdom or of tacit assumptions – that is, not only a formal, research-based theory” (126, p.33). A programme theory is made up of two components, a theory of change and a theory of action.</p> <p>Theory of change A theory of change explains the causal processes or hypothesised mechanisms that lead from activities to outcomes (127).</p> <p>Theory of action A theory of action details what the programme or intervention will do in order to activate the change theory (126).</p> <p>Logic model A logic model is a graphical representation of a programme theory, which maps out the links between the intervention and anticipated outcomes.</p>
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The use of programme theory in guiding the conduct of systematic reviews is not new (128-130). New theory-informed approaches to systematic reviews (e.g. realist reviews, ‘best fit’ framework synthesis) have increased awareness of the use of theory within the systematic review process (131). More recently, programme theory has been advocated as a tool to help reviewers of complex interventions to better understand ‘what works, for whom and under what circumstance’ (51, 118). The Cochrane Collaboration have recently published guidance on the choice and use of theory in complex intervention reviews (131).

While current equity guidance clearly presents the rationale for incorporating considerations of health inequalities in systematic reviews, it offers little practical guidance on how to operationalise a programme theory to inform an understanding of *if, what* and *how* interventions work for different SES groups (see Chapter 3.6, (86)).

A study of systematic review guidance for incorporating health inequalities (see Chapter 3.6, (86)) found that of 20 guidance documents, only one (102) looked at how reviewers were operationalising such decisions. Although data were collected on whether reviewers operationalised their decisions by using theory, empirical evidence or personal experience, no information was sought on which theories or evidence was used, or how these were used to inform the review process.

4.2.2 Limitations of the systematic review guidance in helping reviews to operationalise a programme theory

Much of the guidance on incorporating considerations of health inequalities in systematic reviews is written either from the perspective that health inequalities have already been identified as the focus of the review, or written with an underlying assumption that reviewers already have a good understanding of health inequalities and how they *could* impact on their review findings (86) (see Chapter 3.6). Furthermore, the use of terms such as ‘programme theory’, ‘logic model’ etc., may neither be widely accepted nor understood by reviewers (67, 132). These challenges make operationalising the guidance difficult for both expert and novice reviewers who either do not have a health inequalities background, or are unfamiliar with the use of programme theory to inform systematic reviews.

4.2.3 Perceived value of programme theory use in systematic reviews

The perceived value of using programme theory to inform systematic reviews is well documented in the literature (see table 4.2). From an implementation perspective, programme theory may help to identify the elements of an intervention that may be more effective for given populations, therefore increasing the applicability and usefulness in translating the review findings into practice.

Table 4.2: Perceived value of programme theory to inform systematic reviews (116, 118, 127, 131, 133-135)

- | |
|---|
| <ul style="list-style-type: none">• Provide a theoretical basis for the review• Aid reviewers in thinking conceptually to gain an initial understanding of the way in which the intervention is likely to work• Assist in refining the review question and defining the scope of the review• Identify points of uncertainty, and provide the rationale for data collection and approach to synthesis• Increase the transparency of the review process |
|---|

This is particularly important for considerations of health inequalities. Given the diverse nature of health problems and the necessary interactions required between what are often complex interventions and individuals, it is likely that the underlying mechanisms supporting or undermining the effectiveness of interventions will vary and be context dependent(135). In the event of a deficiency or absence of evidence from review findings, programme theory can help reviewers to make assumptions about whether and how the intervention *may* indirectly result in differential effectiveness, which can then better inform the direction of future health inequalities research (133).

4.2.4 Operationalising programme theory in systematic reviews

Few empirical papers examine how reviewers utilise programme theory. A recent study by Kneale et al. (127) on the use of programme theory found that only five Cochrane Reviews published between September 2013 and September 2014, and 13 reviews published in the 3ie (International Initiative for Impact Evaluation) database of systematic reviews in 2013, mentioned use of either a logic model or theory of change. All of the reviews included in the Kneale et al., (127) study used programme theory to describe how the intervention might work *a priori*, but relatively few used it to inform other elements of the review process such as guiding selection criteria or to structure the synthesis. The study authors identified a need to develop good practice on how to use programme theory, logic models and theory of change in systematic reviews to avoid their use becoming merely a ‘tick-box exercise’. The conclusions of their study also support calls made elsewhere for researchers to develop a better understanding of the use and value of theory within the systematic review process (131).

However, the Kneale et al. review (127) offers only limited assistance to reviewers who seek to operationalise the use of programme theory, being based upon a relatively small sample of Cochrane and 3ie reviews, and relying upon the included reviews explicitly articulating the terms ‘logic model’ or ‘theory of change’. Programme theory may be invoked either explicitly or implicitly without the use of such terms (125).

4.2.5 Using programme theory to guide action on health inequalities

One example of how programme theory can be operationalised to guide research on health inequalities is the typology of actions to tackle social inequalities in health (32, p.474-475).

Acknowledging the lack of evidence in primary research on the differential effects of interventions on health across SES groups, Whitehead (32) calls for it to be “absolutely imperative” that a theory-based approach is adopted to guide actions on reducing health inequalities.

In particular, Whitehead (32, p.476) calls for best use of “intervention programme theories, to come up with plausible mechanisms for bringing about the desired change”. Using programme theory to understand how interventions may work to bring about an improvement in health across disadvantaged populations, Whitehead (32) suggests four levels of action in tackling the underlying causes of health inequalities (see table 4.3).

Table 4.3: Typology of actions to reduce health inequalities with underlying programme theory (32, p.474-475)

Level of action*	Underlying cause of health inequality	Underlying programme theory
1) Strengthening individuals (using person- based strategies to improve the health of the most disadvantaged)	A perceived personal deficit, e.g. lack of knowledge, skills, beliefs, self-esteem	Actions that acknowledge positive strengths (i.e. assets and capabilities disadvantaged individuals possess) and remove barriers to achieving them will allow individuals to act in ways that improve their health
2) Strengthening communities (building social cohesion and mutual support to improve the health of disadvantaged communities)	Greater social exclusion, isolation or powerlessness in disadvantaged communities	Fostering social interactions between members of the same community (horizontal interventions) could influence their local environment leading to healthier neighbourhoods. Improving social interactions across society (vertical interventions) produces a less divided society, builds inclusiveness and increases equitable access to resources for health
3) Improving living and working conditions (improving infrastructure and access to services)	Greater exposure to health-damaging living and working environments with declining social position and poorer access to essential goods and services	Improving the physical environment and addressing psychosocial health hazards have the potential to improve the health of the whole population but especially that of people living in the poorest conditions, thereby reducing the gradient in health
4) Promoting healthy macro policies (making structural alterations to economic, cultural and environmental conditions to influence the standard of living of the whole population)	The standard of living, income, unemployment, and job security, etc., are linked to wider macro-economic, cultural and environment conditions	Universal actions that aim to alter the macro-environment or cultural environment to reduce poverty span several sectors and work across the whole population. These actions are potentially more efficient in reducing poverty and tackling the socio-economic gradient

*The levels of action are based on the widely cited Dahlgren and Whitehead (136) conceptual model of the social determinants of health

Even though health inequalities research includes examples of the use of programme theory, there has been no exploration, to date, of its use in informing considerations of socio-economic inequalities in health in systematic reviews.

4.3 Aim

The purpose of this study was to assess *if, how* and the *extent* to which systematic reviewers use programme theory to inform considerations of socio-economic inequalities in health.

The objectives were:

- i) to identify the extent to which reviewers use programme theory when articulating considerations of whether and how differences in intervention effectiveness on health may be expected across SES groups;
- ii) to identify how reviewers rationalise an understanding of what and how interventions have differential effects in or across SES populations (e.g. use of programme theory terminology and tools, authority for their decision based on theory, empirical evidence, personal experience);
- iii) to identify the extent to which reviewers are using programme theory to inform the review process (e.g. to predict or explain a change in health status, to inform the approach to the methods).

4.4 Methods

A systematic methodology review was undertaken (see Chapter 2.2.2). A methodology review is defined by the Cochrane Methodology Reviews Group (79) as “examining the evidence on methodological aspects of systematic reviews, randomised trials and other evaluations of health and social care”. The PRISMA guidance for the conduct and reporting of systematic reviews was adhered to during the review process (137).

4.4.1 Inclusion criteria

Table 4.4 outlines the inclusion and exclusion criteria.

Table 4.4: Inclusion and exclusion criteria

Inclusion criteria	Further explanation
Published systematic reviews	With or without meta-analysis
Assessed the effects of a non-pharmacological intervention on health behaviour or health outcome as primary outcome	Health behaviour is defined broadly as “any behaviour that may affect an individual’s physical health or any behaviour that an individual believes may affect their physical health” (138, p.94)
Measured or collected data on the effects of SES on the intervention	SES is defined as incorporating a measure of one or more of the following: income, education or occupation
Reported either differential effects relating to SES (universal) or targeted low SES populations (targeted)	
Published between January 2013 and May 2016	The date period is selected to acknowledge the publication in 2012 of the Reporting Guidelines for Systematic Reviews with a Focus on Health Equity (67)
Exclusion criteria	Further explanation
Included a primary outcome relating to a context other than health or health behaviour	
Did not separate SES data from other equity considerations	For example, if it was not possible to separate data on ethnicity, age, or SES
Did not examine the effectiveness of an intervention	
Measured the effectiveness of pharmacological interventions	
Protocols or primary study designs	
Published in a language other than English	
Full-text was not available at the time of data collection and analysis	

4.4.2 Search strategy

A systematic methodology review requires a different approach to the identification of the literature compared with conventional systematic reviews of empirical research (139). Methods for undertaking methodological reviews are undefined, but the focus of the search should aim for a systematic rather than exhaustive approach (140). Databases and websites searched were selected for their potential relevance in indexing records that were relevant to the review aims and objectives (see appendix 3, A3.1).

The search strategy was developed by one author (MM) with expertise in information retrieval in Ovid MEDLINE and adapted for other electronic databases. A second information scientist reviewed the search strategy. Full-text searches were undertaken in Google Scholar (see appendix 3, A3.2).

4.4.3 Data collection and analysis

Study selection

A two-stage process to filter studies was undertaken. Stage one involved an initial screening of titles and abstracts against the inclusion criteria. Studies were then categorised into: 1) 'probable' studies that appeared to meet the inclusion criteria; 2) 'possible' studies that may be eligible but further information was required; 3) excluded studies. Studies in the first two categories were taken forward to stage two where the full text of the study was retrieved and assessed for eligibility. Any studies not meeting the inclusion criteria after stage two were excluded with reasons noted. At least two reviewers (MM, NM, GC) independently screened all studies. Disagreements were resolved by discussion. Covidence.org was used to screen the studies. Multiple publications were analysed as one study.

Quality assessment

The approach to quality assessment was guided by the aims of the review and follows the advice of Snilstveit (50) that "authors should systematically assess the quality of all studies included in their review, adopting criteria that are sensible for the question it is being used to answer". No formal criteria exist to assess the use of programme theory in systematic reviews, therefore all included studies were assessed against PRISMA Equity Extension criteria (67, 68) for reporting use of programme theory (see table 4.5).

Table 4.5 Quality assessment criteria based on the PRISMA Equity Extension checklist reporting on programme theory (67, 68).

1. PRISMA Rationale (Item 3): Describe assumptions about mechanism(s) by which the intervention is assumed to have an impact on health equity. The review should describe *a priori* how and why interventions are expected to work and the influence of factors such as setting and participant and programme characteristics
2. Rationale (Item 3A): Provide the logic model/analytical framework, if done, to show the pathways through which the intervention is assumed to affect health equity and how it was developed
3. Discussion/Conclusions (Item 26): Present extent and limits of applicability (what does/does not work) to disadvantaged populations of interest, and describe the evidence and logic (how/why) underlying those judgements

Data extraction and synthesis

Two review authors (MM, AC) extracted data independently from the included studies using pre-determined criteria. The data extraction form was piloted. Disagreements were resolved by discussion. Study characteristics extracted included: author, year of publication, review topic, type of synthesis, types of studies included in the reviews, whether the study had an SES focus (where the primary aim related to effects within or across SES groups), or SES was accounted for (e.g. SES data were collected, subgroup analysis was undertaken on SES characteristics), intervention type, population, outcomes (relevant to SES), programme theory terminology used in the review, and use of programme theory to inform the review process. A template, adapted from that of Kneale et al., (127), was used to extract data on the use of programme theory. As this study is an exploration of the use of programme theory, a narrative approach to synthesis was undertaken.

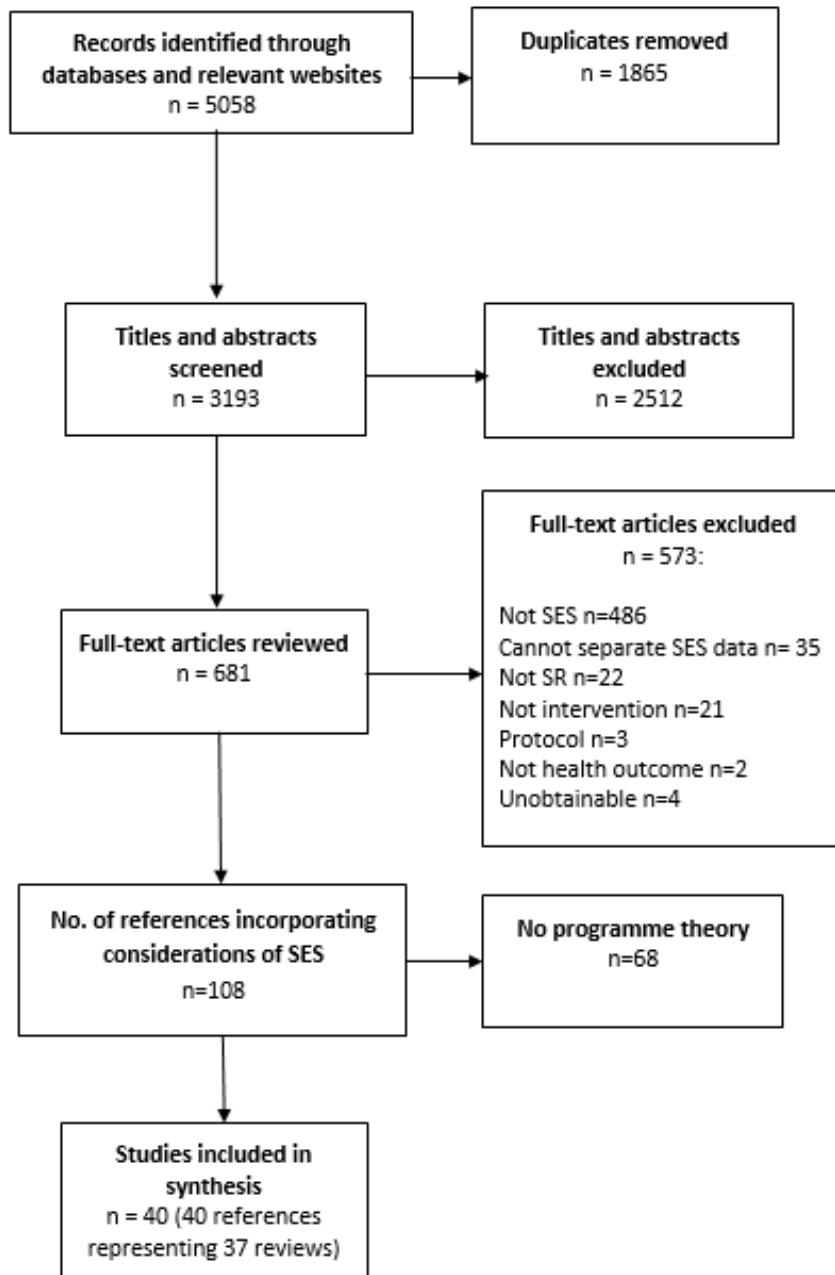
4.5 Results

4.5.1 Search results

A total of 5058 references were identified from the literature search (see figure 4.1). One hundred and eight references incorporated considerations of SES, either by collecting data relating to SES variables or by undertaking data analysis on SES variables. Forty references (135, 141-179) reporting on 37 studies (40%) articulated considerations of *if*, *what* or *how*

interventions designed to improve the health of a population may have differential effects across different SES groups in systematic reviews and were included in this study.

Figure 4.1: Flowchart of search results study 2



4.5.2 Included study characteristics

Table 4.6 highlights the characteristics of the included studies. The most reviewed topics were obesity and diet-related issues. Twenty-eight reviews had an SES focus, whereby the aim or an objective of the review related to assessing either differential effectiveness of interventions across SES populations, or the effectiveness of interventions within a targeted group of socio-economically disadvantaged populations. Nine reviews accounted for effectiveness targeted at, or across, socio-economically disadvantaged populations (e.g. using subgroup analysis) but did not report it as being a specific aim or objective of the review.

Moving beyond simply aiming to measure the effectiveness of an intervention, 18 studies specifically aimed to examine *which* characteristics relating to the intervention may have different effects in and across SES populations. Eighteen reviews undertook a narrative synthesis with the number of studies included in the reviews ranging from 5 to 463.

Despite articulating a programme theory on how they expected the intervention to work differently for SES populations, three reviews (169, 170, 172) reported only that data were collected on SES characteristics and did not offer any analysis of data by SES. Five reviews (147, 156, 175-177) reported either a lack of data on differential effects by SES within the included studies in the review, or a lack of availability of studies for inclusion in the review.

4.5.3 Quality assessment

Table 4.7 presents the results of the quality assessment. Only six reviews met all three quality criteria. One review (148) reported using a logic model but did not include it in the review. Of the eight reviews that reported adhering to the PRISMA Equity Extension guidance (67), only one (168) met all three criteria.

Table 4.6: Included study characteristics

Author, date	Intervention	Population/Setting	Outcomes (relevant to SES)	Type of synthesis	Type of studies included	No of studies included in review	Did review aim to consider 'what works, for SES'?
SES Focus							
Backholer et al., (141)	Sugar-sweetened beverage tax	High income countries	Differential effects on beverage purchases and consumption, weight, amount paid in SSB taxes	Narrative	Any study design	11	-
Bambra, et al., (142)¹; Hillier-Brown et al.,(178)	Individual, community and societal level interventions aimed at reducing inequalities in obesity	Children (0-18yrs) in any setting in any country	Targeted/differential effects effects on proxy for body fat (weight and height, BMI, waist measurement/ waist-to-hip proportion, percentage body fat content, skinfold thickness, ponderal index in relation to childhood obesity)	Meta-analysis/ narrative	RCT, nRCT, prospective/ retrospective cohort studies, prospective repeat cross-sectional studies	76 (25 measured differential effects by SES)	✓ (descriptive analysis, sensitivity analysis)
Bambra, et al., (142)¹; Cairns et al., (144), Hillier-Brown et al., (143)	Individual, community and societal level interventions aimed at reducing inequalities in obesity	Adults (≥18yrs) in any setting in any country	Targeted/differential effects effects on proxy for body fat (weight and height, BMI, waist measurement/ waist-to-hip proportion, percentage body fat content, skinfold thickness, ponderal index in relation to childhood obesity)	Meta-analysis/ narrative	RCT, nRCT, prospective/ retrospective cohort studies, prospective repeat cross-sectional studies	103 (36 measured differential effects by SES)	✓ (descriptive analysis, sensitivity analysis)
Beauchamp, et al., (179)	Public health obesity prevention	Interventions addressed everyone across the social gradient	Differential effects on change in anthropometric outcomes	Narrative	Any study design	14	✓ (descriptive analysis)

Author, date	Intervention	Population/Setting	Outcomes (relevant to SES)	Type of synthesis	Type of studies included	No of studies included in review	Did review aim to consider 'what works, for SES'?
Boelsen-Robinson, et al., (145)	Whole of community obesity prevention	Interventions across different socio-economic strata	Differential effects on behavioural change, energy balance, anthropometric outcomes	Narrative	Any study design	13	✓ (descriptive analysis)
Brown et al., (147)^{2,3}; Brown et al., (146)	Community Pharmacy delivered interventions focused on alcohol misuse, smoking cessation, and weight management	People of any age in any country	Targeted/differential effects on behavioural outcome (e.g. quit rate, change in alcohol intake), weight loss interventions had to report anthropometric outcome	Meta-analysis/narrative	RCTs, nRCTs, CBAs, ITS and repeated measure studies	24	✓ (descriptive analysis)
Brown, et al., (148)	Population-level tobacco control	Adults (≥18yrs) or studies which measured children's reports of parental smoking in a country at stage 4 of the tobacco epidemic or in the WHO European Region	Differential effects on smoking related outcomes: Social norms/attitudes, exposure to second-hand smoke, policy reach, use of quitting services, quit attempts, smoking prevalence, morbidity	Narrative	All primary study designs, including: RCT, non-RCT, cohort studies, cross-sectional, qualitative	117	-
Brown, et al., (149)	Individual-level smoking cessation interventions undertaken in Europe since 1995	Adults (≥18yrs) based in a WHO European Region country	Differential effects on smoking cessation	Narrative	All primary research designs, including: RCT, non-RCT, cohort studies, cross-sectional, qualitative	29	-
Brown, et al., (150)	Population level interventions/policies and individual level cessation support	Participants (birth-25yrs) in a country in the WHO European Region or non-European country at	Differential effects on smoking related outcomes: Intentions/attitudes/perceptions, exposure to second-hand smoke, smoking behaviour,	Narrative	All primary research designs, including: RCT, non-RCT, cohort studies, cross-sectional, qualitative	38	-

Author, date	Intervention	Population/Setting	Outcomes (relevant to SES)	Type of synthesis	Type of studies included	No of studies included in review	Did review aim to consider 'what works, for SES'?
		stage 4 of the tobacco epidemic	sensitivity to price, initiation, relapse, cessation rates, smoking prevalence, morbidity				
Bull, et al., (151)	Interventions targeting a change in smoking, eating and/or physical activity behaviours	Adults (≥ 18 yrs) of low income and from the general population	Behavioural outcomes relevant to smoking cessation, healthy eating and physical activity	Meta-analysis	RCTs and cluster RCTs	35	-
Cleland, et al., (152)	Any intervention focused on increasing physical activity	Community-dwelling socio-economically disadvantaged women (19-64 yrs)	Physical activity outcome, or closely related (e.g. cardiorespiratory fitness)	Meta-analysis	RCTs, nRCTs	19	✓ (subgroup-analysis, meta-regression)
Everson-Hock, et al., (153)	Community-based physical activity and dietary	Adults (18-74 yrs) from a low SES group within the UK	Effectiveness, acceptability	Narrative (mixed-methods)	Quantitative intervention studies, qualitative evaluations of interventions, qualitative studies assessing beliefs and perceptions of physical activity	35	-
Gardner, et al., (154)	Interventions that aimed to increase mammography use	Asymptomatic low-income women	Uptake of mammography	Meta-analysis	RCT	21	✓ (subgroup and meta-regression)
Hill, et al., (155)	Tobacco control	Adults (≥ 18 yrs) in countries at an advanced stage of the tobacco epidemic	Targeted/differential effects on smoking related outcomes	Narrative	Reviews and primary research	84	-

Author, date	Intervention	Population/Setting	Outcomes (relevant to SES)	Type of synthesis	Type of studies included	No of studies included in review	Did review aim to consider 'what works, for SES'?
Hollands et al., (156)³	Portion, package or tableware size	Adults and children directly engaged with manipulated products	Differential effects on behavioural outcomes (consumption or selection of food, alcohol, or tobacco products)	Meta-analysis/narrative	RCTs	70	✓ (meta-regression)
Kader, et al., (157)	Universal parental support targeting children's health behaviours	At least one parent/caregiver of a child 2-18yrs with or without their child	Targeted/differential effects on children's dietary habits, physical activity, sedentary behaviour, weight status	Narrative	Prospective studies assessing effectiveness of a controlled intervention	35 (6 with SES focus)	-
Kendrick, et al., (158)	Home safety interventions	Children and young people (≤19yrs) and their families	Differential effects on self-reported or medically attended injury in children/young people	Meta-analysis (IPD)/narrative	RCTs, nRCTs, CBA	98	-
Kristjansson, et al., (159)	Supplementary feeding	Children (3mths-5yrs) from socio-economically disadvantaged groups or all socio-economic groups with results stratified by SES	Targeted/differential effects on physical (growth), psychosocial health in children	Meta-analysis/narrative	RCTs, c-RCTs, CCT, CBA, ITS	32	✓ (sub-group analysis and process evaluation)
Laba, et al., (160)	Strategies to increase patient adherence to cardiovascular medications	Socio-economically disadvantaged adults with prescribed medications for prevention/treatment of cardiovascular disease	Targeted/differential effects on patient adherence	Narrative	RCTs, quasi-RCTs	14	✓ (descriptive analysis)
Laws, et al, (161)	Obesity prevention	Healthy children (0-5 yrs from) socio-	Targeted/differential effects on anthropometric measures,	Narrative	Any study design	32	✓ (descriptive analysis)

Author, date	Intervention	Population/Setting	Outcomes (relevant to SES)	Type of synthesis	Type of studies included	No of studies included in review	Did review aim to consider 'what works, for SES'?
		economically disadvantaged or Indigenous families	child/family diet, parental feeding practices related to obesity, physical activity, sedentary behaviours				
Magnee, et al., (162)	Obesity prevention	Participants included within studies identified from a systematic inventory (1990-2007) of Dutch obesity prevention interventions	Differential effects on anthropometric measures, obesity-related behavioural outcomes (e.g. diet, physical activity)	Narrative	Studies selected from a systematic inventory (1990-2007) of Dutch obesity prevention interventions	26	-
McGill, et al., (163)	Promotion of healthy eating	Healthy populations (any age/gender)	Differential effects on dietary intake	Narrative	Any study design measuring effects of intervention	36	✓ (descriptive analysis)
McLean et al., (135)⁴	Reminder systems for scheduled health service encounters	Examined differential effectiveness across particular subgroups of the population (age, gender, ethnic group, SES, etc.)	Differential effects on improving uptake	Thematic/ Narrative	Effectiveness review: RCTs, SRs Realist informed review: studies examining effectiveness of outpatient appointment reminders, qualitative/quantitative designs on appointment attendance behaviour, studies of adherence to	Effectiveness review: 42 Realist informed review: 463	✓ (descriptive analysis, realist informed review)

Author, date	Intervention	Population/Setting	Outcomes (relevant to SES)	Type of synthesis	Type of studies included	No of studies included in review	Did review aim to consider 'what works, for SES'?
					treatment, theories/ models/frameworks relating to appointment attendance		
Mizdrak, et al, (164)	Food/beverage price change	NR	Differential response in purchase of targeted foods	Narrative	Controlled experimental study	8	✓ (descriptive analysis)
Moore, et al., (165)	Universal school-based health behaviour	School children (4-18yrs)	Differential effects on diet, physical activity, smoking, alcohol	Narrative	RCTs, quasi-experimental studies	20	✓ (content analysis)
Moredich, et al, (166)	Physical activity and weight-loss	Low income adult women	Change in weight	Integrative	Intervention studies	7	✓ (descriptive analysis)
Rojas-Garcia, et al., (167)	Healthcare interventions to treat depressive disorders	Socially disadvantaged patients with depressive disorders	Reduction of depressive symptoms	Meta-analysis/ narrative	Controlled trials including RCTs & quasi-experimental studies	15	✓ (meta-regression)
Sarink, et al., (168)	Menu-labelling	Adolescents or adults of a low SEP population or analysis stratified by a measure of SEP	Targeted/differential effects on awareness of exposure, understanding, food or energy purchased or consumed, body mass index	Narrative	Quantitative and qualitative	18	-
SES Accounted for							
Ciciriello, et al., (169)⁵	Multimedia-based patient education about prescribed or over the counter medications	People of all ages prescribed a particular medication or medication regimen or who had obtained an over-the-counter medication	Patient or carer knowledge about the medication, any measure of skill acquisition related to the medication	Meta-analysis/ narrative	RCTs, quasi-RCTs	24	-

Author, date	Intervention	Population/Setting	Outcomes (relevant to SES)	Type of synthesis	Type of studies included	No of studies included in review	Did review aim to consider 'what works, for SES'?
Ejemot-Nwadiaro et al., (170)⁵	Hand-washing promotion	Adults and children in day care centres or schools, patients in hospitals, communities or households	Episodes of diarrhoea	Meta-analysis/narrative	RCTs, cluster RCTs	22	-
Gittelsohn, et al., (171)	Community-based prepared food sources	NR	Access to and consumption of healthful foods (psychosocial factors (awareness, knowledge, acceptability), behaviour, frequency of use, frequency of purchase, increase in healthful food sales)	Narrative	Some form of written documentation that included a description of the intervention and evaluation	19	-
Guroi-Urganci, et al., (172)⁵	Mobile phone messaging reminders	All study participants, regardless of age, gender, ethnicity	Rate of attendance at healthcare appointments	Meta-analysis	RCTs	8	-
Hartmann-Boyce, et al., (173)	Self-help	Adults (≥18yrs) with body mass index ≥25kg/m ²	Targeted/differential effects on change in weight	Meta-analysis/narrative	RCTs	23	✓ (meta-regression)
Kroon, et al., (174)	Structured self-management education programmes for osteoarthritis (OA)	People diagnosed with OA	Self-management of OA, participant's positive and active engagement in life, pain, global OA scores, self-reported function, quality of life, withdrawals	Meta-analysis	RCTs, quasi-RCTs	29	-
Lutge et al., (175)³	Any material inducement to return for TB test results, or adhere to or complete anti-TB	People receiving curative treatment for active TB, People receiving preventive therapy for latent TB	Cure or completion of treatment, cases of active TB; completion of prophylactic treatment, number returning to collect test results within the	Meta-analysis/narrative	RCTs	12	-

Author, date	Intervention	Population/Setting	Outcomes (relevant to SES)	Type of synthesis	Type of studies included	No of studies included in review	Did review aim to consider 'what works, for SES'?
	preventive or curative treatment	or People suspected of TB undergoing, and collecting results of, diagnostic tests	appropriate time frame for that test.				
Pega, et al., (176)³	In-work tax credits	Working age adults (18-64yrs)	Self-rated general health, mental health or physical distress, mental illness, overweight and obesity, alcohol use, tobacco use	Narrative	CBA, ITS	5	-
Polec et al., (177)³	Interventions that aimed to increase the ownership and appropriate use of insecticide-treated bednets (ITN)	Children and adults with permanent residence in malarial areas	ITN ownership, appropriate ITN use	Meta-analysis/narrative	RCTs, cluster RCTs, non-RCTs, CBA, ITS	10	-

¹Two studies reported across four publications, ²One study reported in two publications, ³Subgroup analysis planned by SES but not undertaken, ⁴One study undertook 2 systematic reviews relating to effectiveness and 'what works, for whom, under what circumstance in relation to SES populations, ⁵Data collected on SES variables, but no analysis undertaken. Abbreviations: SEP= Socio-economic position, SES= Socio-economic status, RCT=Randomised Controlled Trial, nRCT= non-Randomised Controlled Trial, quasi-RCT=quasi Randomised Controlled Trial, cluster RCT= Cluster Randomised Controlled Trial, SR= Systematic Review, CBA=Controlled Before-and After Study, ITS= Interrupted Time Series, NR = not reported

Table 4.7: Quality assessment

Author, [ref]	PRISMA Rationale (Item 3): Describe assumptions about mechanism(s) by which the intervention is assumed to have an impact on health equity. The review should describe <i>a priori</i> how and why interventions are expected to work and the influence of factors such as setting and participant and programme characteristics	PRISMA Rationale (Item 3A): Provide the logic model/analytical framework, if done, to show the pathways through which the intervention is assumed to affect health equity and how it was developed	Discussion/Conclusions (Item 26): Present extent and limits of applicability (what does/does not work) to disadvantaged populations of interest, and describe the evidence and logic (how/why) underlying those judgements
Backholer, et al., (141) ¹	✓		✓
Bambra, et al., (142) ^{2,4}	✓	✓	✓
Bambra, et al., (142) ^{3,4}	✓	✓	✓
Beauchamp, et al., (179)	✓		✓
Boelsen-Robinson, et al., (145) ¹	✓		✓
Brown, et al., (147) ^{4,5}	✓		✓
Brown, et al., (148) ^{1,4}			✓
Brown, et al., (149) ¹			✓
Brown, et al., (150) ¹			✓
Bull, et al., (151)	✓		✓
Ciciriello, et al., (169)	✓		✓
Cleland, et al., (152)			✓
Ejemot-Nwadiaro et al., (170)	✓		
Everson-Hock, et al., (153)	✓		✓
Gardner, et al., (154)			✓
Gittelsohn, et al., (171)	✓		✓
Guroi-Urganci, et al., (172)	✓		
Hartmann-Boyce, et al., (173)	✓		✓
Hill, et al., (155)			✓
Hollands et al., (156) ^{1,4}	✓	✓	
Kader, et al., (157)			✓
Kendrick, et al., (158)	✓		
Kristjansson, et al., (159)	✓	✓	✓
Kroon, et al., (174)			✓
Laba, et al., (160) ⁴	✓		✓
Laws, et al., (161)	✓		✓
Lutge, et al., (175)	✓		✓
Magnee, et al., (162)	✓		✓
McGill, et al., (163) ¹	✓		✓
McLean, et al., (135) ⁴	✓	✓	✓
Mizdrak, et al., (164)	✓		
Moore, et al., (165)	✓		✓
Moredich, et al., (166)			✓
Pega, et al., (176) ⁴	✓	✓	
Polec et al., (177)	✓	✓	✓
Rojas-Garcia, et al., (167)	✓		✓
Sarink, et al., (168) ¹	✓	✓	✓
TOTAL	28	8	31

¹ Study reports use of PRISMA Equity Extension (67), ² Study 1 review in child population (142, 178), ³ Study 2 review in adult population (142-144), ⁴ Refer to conceptual/casual modelling/behavioural frameworks rather than analytical framework/logic models, ⁵ Two studies report on same review (146, 147)

4.5.4 How reviewers rationalise an understanding of if, what and how/why interventions have differential effects in or across socio-economic populations

Defining programme theory terminology

Ten studies were explicit in the use of terminology for 'programme theory'; however, not a single review mentioned the term 'programme theory'. Two reviews (148, 177) referred to a 'logic model', three describe a conceptual model (156, 159, 176), while others referred to a logic pathway (168), conceptual framework (135), casual modelling framework (147) or, simply, framework (142, child and adult reviews). The remaining studies were implicit, rather than explicit in their use of programme theory, describing their assumptions about *what* and *how* interventions may work differently for different SES populations without labelling it as 'programme theory'.

'If' interventions work/don't work for different socio-economic groups

With the exception of three studies (164, 169, 174), all studies considered whether it was likely that interventions may have differential effects in health within or across SES populations *a priori* in the Introduction section. Such a verdict was largely made on the basis of the burden of disease in different SES groups. For example, the risk or prevalence of the disease was greater for lower SES populations compared with higher SES populations (141). Others described the burden in terms of higher rates of unhealthy behaviours, such as cigarette consumption (150), or lower rates of healthy behaviours, such as adherence to medications, among lower SES groups (160).

'What' interventions work/don't work for different socio-economic groups

All included studies considered *what* types of interventions are likely to work or not work for different SES groups. For example, Bambra et al.,(142) suggest that tailored weight-loss interventions worked equally well, or better in children in low SES groups. In a review of interventions to improve medication adherence, Laba et al., (160) found that physician- and patient-targeted interventions were most effective in socio-economically disadvantaged populations. This was in contrast to a previous systematic review (180) which found larger improvements in medication adherence amongst the general population in physician only-targeted interventions.

Three of these studies (156, 170, 172) incorporated these considerations to inform only their *a priori* assumptions of what works for different SES groups, and five studies (148, 150, 157, 166, 174) incorporated these considerations only to explain what interventions work based on their review findings. The remaining 29 studies considered what types of interventions work or do not work both in their *a priori* assumptions and in explaining their review findings. Studies used programme theory to inform considerations of *what works*, as well as *what does not work*.

'How' interventions work/do not work for different socio-economic groups

All included studies also considered *how* interventions may or may not work for different SES groups. Of these, six reviews (156, 158, 164, 170, 172, 176) incorporated such considerations only *a priori*, and nine (148-150, 152, 154, 155, 157, 166, 174) discussed *how* interventions may have differential effects only to explain their review findings.

Twenty-two studies considered *how* interventions work or do not work both in their *a priori* assumptions and in their explanations of the review findings. For example, Laba et al., (160) suggest that differences in adherence behaviour between social groups can help explain why interventions which target both patient and physician are more effective for lower SES groups. Whereas in a systematic review of obesity-related lifestyle interventions, Magnee et al., (162), suggest that greater effects may be seen in higher SES groups because lower SES groups participate less. They go on to say that lower participation rates in lower SES groups may be due to either, intervention design (e.g. recruitment strategies not reaching lower SES groups) or participant response (e.g. lower SES groups may not prioritise participating in interventions if they are experiencing other material and psychosocial problems). Overall, 22 studies incorporated considerations of both *what* and *how* interventions work or do not work in and across SES groups to both predict and explain their review findings.

4.5.5 Legitimation of programme theory in systematic reviews

Thirteen studies (see Table 4.8) referenced the theoretical literature to inform an understanding of what or, how/why interventions may lead to differential effectiveness within or across SES groups. One study mentioned the Oxford Food and Activity Behaviours taxonomy but did not provide a reference (173). The theoretical literature was used to inform both *a priori* assumptions (n=10) (135, 141, 142, (child and adult reviews), 147, 151, 160, 163,

165, 173) and explanations of review findings (n=7) (141, 151, 155, 162, 163, 165, 166). In four studies (141, 151, 163, 165), the theoretical literature informed both *a priori* assumptions and explanations of review findings.

Table 4.8: Referenced theoretical literature in systematic reviews exploring the effectiveness of interventions in SES populations.

No. of studies	Theoretical literature
5 (142, child and adult reviews, 151, 162, 163)	White M, Adams J, Heywood P. How and why do interventions that increase health overall widen inequalities within populations? In: Barbones S, editor. Health, inequality and public health. Volume 65. Bristol: Policy Press; 2009.
5 (142, child and adult reviews, 163, 165, 179)	Whitehead M. A typology of actions to tackle social inequalities in health. J Epidemiol Community Health. 2007;61:473–8. http://dx.doi.org/10.1136/jech.2005.037242
4 (142, child and adult reviews, 165, 179)	McLaren L, McIntyre L, Kirkpatrick S. Rose’s population strategy of prevention need not increase social inequalities in health. Int J Epidemiol. 2010;39:372–7.
2 (142, child and adult reviews)	Graham H, Kelly M. Health inequalities: concepts, frameworks and policy. London: Health Development Agency; 2004.
2 (142, child and adult reviews)	European strategies for tackling social inequities in health: levelling up part 2. Available at: http://www.who.int/social_determinants/resources/leveling_up_part2.pdf
2 (142, child and adult reviews)	Whitehead M, Dahlgren G. Concepts and principles for tackling social inequities in health: levelling up Part 1. Copenhagen: WHO Regional Office for Europe; 2006.
1 (155)	Graham H. Unequal lives: health and socio-economic inequalities. Maidenhead: McGraw-Hill Open University Press; 2007.
1 (173)	Mackenbach JP. The persistence of health inequalities in modern welfare states: the explanation of a paradox. Soc Sci Med. 2012;75(4):761–9.
1(165)	Phelan JC, Link BG, Tehranifar P. Social conditions as fundamental causes of health inequalities theory, evidence, and policy implications. J Health Soc Behav. 2010;51(1 suppl):S28–40.
1 (163)	Frieden TR. A framework for public health action: the health impact pyramid. Am J Public Health. 2010;100:590–5.
1 (166)	Bandura A. Self-efficacy: toward a unifying theory of behavioural change. Psychol Rev. 1977;84:191–225.
1 (160)	Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci. 2011;6:42.
1 (151)	Michie S, Richardson M, Johnston M, Abraham C, Francis J, Hardeman W, et al. The behaviour change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. Ann Behav Med. 2013;46:81–95.
1 (163)	Grier S, Bryant CA. Social marketing in public health. Annu Rev Public Health. 2005;26:319–39
1 (147)	Hardeman W, Sutton S, Griffin S, Johnston M, White A, Wareham NJ, et al. A causal modelling approach to the development of theory-based behaviour change programmes for trial evaluation. Health Educ Res. 2005;20:676–87. http://dx.doi.org/10.1093/her/cyh022

No. of studies	Theoretical literature
1 (135)	Coomes CM, Lewis MA, Uhrig JD, Furberg RD, Harris JL, Bann CM. Beyond reminders: a conceptual framework for using short message service to promote prevention and improve healthcare quality and clinical outcomes for people living with HIV. <i>AIDS Care</i> . 2012;24:348–57.
1 (135)	Ajzen I. From intentions to actions: a theory of planned behavior. In: Kuhl J, Beckmann J, editors. <i>Action-control: from cognition to behavior</i> . Heidelberg: Springer; 1985. pp. 11–39.
1 (135)	Prochaska JO, Norcross JC, DiClemente CC. <i>Changing for good: the revolutionary program that explains the six stages of change and teaches you how to free yourself from bad habits</i> . New York, NY: W. Morrow; 1994.
1 (135)	Deci EL, Ryan RM. An overview of self-determination theory. In: Ryan RM, editor. <i>The Oxford handbook of human motivation</i> . Oxford: Oxford University Press; 2012. pp. 85–107.
1 (135)	Phillips KA, Morrison KR, Andersen R, Aday LA. Understanding the context of healthcare utilization: assessing environmental and provider-related variables in the behavioral model of utilization. <i>Health Serv Res</i> . 1998;33:571–96.
1 (135)	Rogers RW. A protection motivation theory of fear appeals and attitude change. <i>J Psychol</i> . 1975;91:93–4. http://dx.doi.org/10.1080/00223980.1975.9915803
1 (135)	Glasser W. <i>Choice theory: a new psychology of personal freedom</i> . London: Harper Collins; 2009.
1 (135)	Cooper HC, Geyer R. What can complexity do for diabetes management? Linking theory to practice. <i>J Eval Clin Pract</i> . 2009;15:761–5. http://dx.doi.org/10.1111/j.1365-2753.2009.01229.x
1 (147)	Nuffield Intervention Ladder. In: <i>Policy process and practice</i> . Public Health: Ethical Issues. London: Nuffield Council on Bioethics; 2009.

¹Two studies reported across four publications (144-146, 179)

Collectively, the included studies acknowledged 24 unique theoretical references to support *a priori* assumptions and explanations of the review findings of what or how/why interventions may have different effects within and across SES groups (see Table 4.8). The most referenced were intervention theories: ‘How and why do interventions that increase health overall widen inequalities within populations?’ (24), and ‘A typology of actions to tackle social inequalities in health’ (32).

The majority of the included studies (n=36) used supplementary evidence to support their considerations of differential effectiveness. Supplementary evidence included empirical (qualitative or quantitative), descriptive, or policy-related evidence. Of note here is the use of supplementary evidence to examine intervention-generated inequalities (e.g. (21, 23)). In 32 of the included studies, the authors’ review findings were used to inform explanations of the review findings of differential effectiveness. Only two studies (135, 177) mentioned the involvement of other stakeholders in developing their logic models or programme theory. In

some studies, only partial support for the programme theory was derived either from the literature or from the review findings.

4.5.6 Extent of use of programme theory to inform the review process

Table 4.9 outlines the extent to which programme theory is used to inform the review process within the included studies. The majority of authors outlined a programme theory in the Introduction and Discussion sections of the review to inform their assumptions (n=32) or to provide explanations (n=34) of what or how interventions may result in differential effects within or across SES groups. Despite not always being explicit in their use of programme theory, 29 review teams used this approach to inform both their *a priori* assumptions and explanations of review findings.

Twenty-one studies (see Table 4.9) tested their *a priori* programme theory of how they expected interventions to have different effects on health within or across SES populations *and* revisited or revised their programme theory to explain their review findings.

Table 4.9: Use of programme theory in systematic reviews of effectiveness of interventions in SES populations

	Review Initiation: Indicate whether reported that PT is used to communicate aims of review in engaging with stakeholder or involving/recruiting different team members or obtaining funding	Review Question/Methodology: Indicate whether reported that PT is based on, or adapted from, existing tools/theories	Review Question/Background: Indicate assumptions on what intervention(s) may be likely to work/not work for SES populations? (<i>a priori</i> PT)	Review Question/Background: Indicate assumptions on how/why intervention(s) may be likely to work/not work for SES populations? (<i>a priori</i> PT)	Search strategy (selection criteria): Indicate whether reported that PT is used to make decisions on the inclusion criteria for studies in the review	Description of study characteristics: Indicate whether reported that PT is used to make decisions on coding information on study characteristics (data extraction)	Quality and relevance assessment: Indicate whether reported that PT is used as reference point in choosing quality assessment tools	Used to guide analyses: State that they specifically used their PT of how the intervention may work to guide the analysis	Synthesis: Present their synthesis based on their PT	Discussion/Conclusion: Use programme theory to explain what intervention(s) may be likely to work/not work for SES populations at the end of the review to explain their findings? (<i>a posteriori</i> PT)	Discussion/Conclusion: Revise or revisit or state their programme theory of how the intervention is likely to work' at the end of the review to explain their findings? (<i>a posteriori</i> PT)	Additional considerations: Indicate whether reported that tool is based on shared consensus across the team or across stakeholders	Additional considerations: Was PT tested?
Backholer, et al., (141)			✓	✓						✓	✓		✓
Bambra, et al., (142) ¹	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓
Bambra, et al., (142) ²	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓
Beauchamp, et al., (179)	✓		✓	✓				✓	✓	✓	✓		✓
Boelsen-Robinson, et al., (145)			✓	✓				✓	✓	✓	✓		✓
Brown, et al., (146) ³	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓
Brown, et al., (148)	✓							✓		✓	✓		✓
Brown, et al., (149)			✓							✓	✓		
Brown, et al., (150)										✓	✓		
Bull, et al., (151)	✓		✓	✓						✓	✓		✓
Ciciriello, et al., (169)			✓	✓			✓			✓	✓		✓
Cleland, et al., (152)			✓							✓	✓		✓
Ejemot-Nwadiaro, et al.,(170)			✓	✓		✓							
Everson-Hock, et al.,(153)			✓	✓				✓	✓	✓	✓		✓
Gardner, et al., (154)			✓							✓	✓		✓
Gittelsohn, et al., (171)			✓	✓						✓	✓		
Gurol-Urganci, et al., (172)			✓	✓									

	Review Initiation: Indicate whether reported that PT is used to communicate aims of review in engaging with stakeholder or involving/recruiting different team members or obtaining funding	Review Question/Methodology: Indicate whether reported that PT is based on, or adapted from, existing tools/theories	Review Question/Background: Indicate assumptions on what intervention(s) may be likely to work/not work for SES populations? (<i>a priori</i> PT)	Review Question/Background: Indicate assumptions on how/why intervention(s) may be likely to work/not work for SES populations? (<i>a priori</i> PT)	Search strategy (selection criteria): Indicate whether reported that PT is used to make decisions on the inclusion criteria for studies in the review	Description of study characteristics: Indicate whether reported that PT is used to make decisions on coding information on study characteristics (data extraction)	Quality and relevance assessment: Indicate whether reported that PT is used as reference point in choosing quality assessment tools	Used to guide analyses: State that they specifically used their PT of how the intervention may work to guide the analysis	Synthesis: Present their synthesis based on their PT	Discussion/Conclusion: Use programme theory to explain what intervention(s) may be likely to work/not work for SES populations at the end of the review to explain their findings? (<i>a posteriori</i> PT)	Discussion/Conclusion: Revise or revisit or state their programme theory of how the intervention is likely to work' at the end of the review to explain their findings? (<i>a posteriori</i> PT)	Additional considerations: Indicate whether reported that tool is based on shared consensus across the team or across stakeholders	Additional considerations: Was PT tested?
Hartmann-Boyce, et al., (173)	✓	✓	✓						✓	✓	✓		✓
Hill, et al., (155)	✓	✓	✓							✓	✓		
Hollands, et al., (156)		✓	✓	✓	✓	✓		✓	✓				
Kader, et al., (157)				✓						✓	✓		
Kendrick, et al., (158)			✓	✓						✓			
Kristjansson, et al., (159)		✓	✓	✓		✓		✓	✓	✓	✓		✓
Kroon, et al., (174)				✓						✓	✓		
Laba, et al., (160)	✓	✓	✓	✓				✓	✓	✓	✓		✓
Laws, et al., (161)		✓	✓	✓						✓	✓		✓
Lutge, et al., (175)		✓	✓	✓						✓	✓		
Magnee, et al., (162)	✓	✓	✓	✓						✓	✓		✓
McGill, et al., (163)	✓	✓	✓	✓				✓	✓	✓	✓		✓
McLean, et al., (135)	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Mizdrak, et al., (164)		✓	✓	✓						✓	✓		
Moore, et al., (165)		✓	✓	✓				✓	✓	✓	✓		✓
Moredich, et al., (166)		✓		✓						✓	✓		
Pega, et al., (176)			✓	✓						✓			
Polec, et al., (177)	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Rojas-Garcia, et al., (167)			✓	✓	✓					✓	✓		✓
Sarink, et al., (168)			✓	✓	✓	✓		✓	✓	✓	✓		✓
Total	2	15	32	28	8	9	1	15	15	34	31	2	21

*Programme theory also includes reference to logic models/frameworks/causal pathway analysis. ¹Study 1 review in child population (142, 178), ²Study 2 review in adult population (142-144), ³One study reported in two publications (149, 150). PT programme theory

4.6 Discussion

Interest in the use of programme theory to inform systematic reviews is increasing. In an attempt to enhance the applicability of review findings, reviewers are being encouraged to extend consideration beyond whether an intervention is effective or not, towards examining ‘what interventions work, for whom, and how’ (39).

While the relatively small proportion of systematic reviews (n=108) incorporating considerations of socio-economic inequalities in health is in line with that reported elsewhere (19), it is clear that the push to move systematic reviews away from only considering *if* an intervention works towards a better understanding of *what* works and *how*, is slowly starting to emerge in the literature (see table 4.9).

The lack of reference to the equity guidance within systematic reviews incorporating considerations of socio-economic inequalities in health may reflect the short interval between the publication of the guidance and the systematic reviews included in this study. However, given that eight studies in this sample did reference the PRISMA Equity guidance between 2013 and 2016, it may also suggest a lack of awareness of the guidance, or consideration of its relevance and importance, not only among systematic reviewers, but also among journal editors and peer reviewers. Therefore, to deliver better evidence on equity within research syntheses and systematic reviews, not only does the health research community need to increase awareness of equity guidance, but journal editors and peer reviewers also need to be proactive in encouraging reviewers to adopt the equity guidance when undertaking and reporting such reviews (67).

Alternatively, a lack of reference to the equity guidance in the reviews may indicate that reviewers are unsure about how to operationalise the guidance with respect to how the intervention may be expected to work within or across SES populations. No empirical research has been undertaken on reviewers’ understanding of how to operationalise equity guidance for systematic reviews.

In studies that do use programme theory terminology (e.g. logic model, conceptual framework), the findings here agree with commentators who note that these terms are often inconsistently applied in the literature (86, 131). No studies explicitly applied the term ‘programme theory’ to describe their assumptions. This supports assertions made elsewhere (131) that the use of theory to inform systematic reviews may not be explicitly articulated.

While it may not necessarily matter whether or not reviewers explicitly label a ‘programme theory’ to describe their understanding of how interventions may or may not work, *not*

explicitly labelling it makes it harder to ascertain the extent to which reviewers are either consciously, or unconsciously *using* programme theory to inform systematic reviews. The majority of the reviews included in this study described their programme theory in the narrative of the review without explicitly labelling it as a theory or using more graphical representations such as logic models or analytical frameworks. If reviewers are either considering this detail irrelevant to the methods section of their reports, or unconsciously using programme theory, then there is a need for greater clarity on operationalising the use of theory in systematic reviews.

In most of the included studies, programme theory was informed by low-level theory (i.e. assumptions based on supplementary evidence, e.g. empirical or descriptive research, or policy). This is consistent with the findings of a previous study on the use of theory in systematic reviews (131). The lack of reference to more formal theory (e.g. intervention theories such as Whitehead's (32) typology of policies and interventions, and behaviour change theories such as the Theory of Planned Behavior (181)) to inform reviewers' assumptions or explanations of whether and how interventions may have differential effects may suggest that reviewers are using programme theory unconsciously. Among the included reviews that used formal theory, the most popular were intervention theories based on the target of the intervention (e.g. individual, community, societal).

While this study neither set out to examine the quality or richness of the programme theory used in systematic reviews, nor to establish the fidelity or utility of use of theory, analysing interventions based only on the target of the intervention (i.e. universal versus individual) may not offer sufficient explanation of which *components* of the intervention process may work better for different SES groups and why.

Using only supplementary evidence to *explain* how interventions may work differently across SES populations may weaken the applicability of the review, especially given that it was often unclear as to how the supplementary evidence was identified. This is not limited to systematic reviews with a socio-economic health inequality focus. MacLure (182) observes that there is a strict inclusion and exclusion process set up for the main body of the review, only for other evidence to be brought into play in the discussion in an unsystematic way to interpret the findings.

While Anderson et al. (118, '3. Broadening the scope of inquiry') warn that, "conclusions drawn about intervention effects based simply on ad hoc criteria, rather than a theoretical understanding of the putative mechanisms of action of the intervention, can sometimes

obscure aspects of the intervention that contribute to its effect.” Using programme theory in an *ad hoc* and supplementary way to explain review findings may, therefore, result in conclusions based on poor-quality studies that may have little direct relevance to the topic under review.

The results of this study demonstrate that the use of programme theory to inform socio-economic health inequality considerations in the systematic review process remains in its infancy, is used implicitly, is often fragmented and is not implemented in a systematic way. The PRISMA Equity Extension explanation and elaboration document (68, ‘Item 3: rationale’) highlights that the explicit reporting of programme theory can guide the reviewer in the choice of methods and synthesis. However, the findings of this study agree with Kneale et al. (127), in suggesting that programme theory is not yet seen as a tool that is integral to the whole review process.

Instead, reviewers are more likely to use programme theory in an *ad hoc* way at the start (*a priori*) and end of the review using supplementary evidence (e.g. empirical (qualitative or quantitative), descriptive, or policy-related evidence) rather than to use formal theory or to test their assumptions or explanations of how interventions may or may not work for different SES groups. This may be due to the fact that many reviewers are using programme theory implicitly and therefore are unaware of its potential value in guiding the whole review process.

Using programme theory to inform only an *a priori* understanding of how reviewers expect the intervention to work across SES populations allows reviewers to ‘tick a box’ in the PRISMA Equity Extension guidance (67). However, integration of programme theory within the whole review process would provide a more systematic ‘uncovering’ of possible explanations that emerge *a posteriori* from the review findings for *how* interventions may work differently for different populations.

Establishing review intentions *a priori* has always been the approach in clinical effectiveness reviews in order to minimise bias (183). However, *a priori* assumptions of *how* an intervention may work may not necessarily be supported by the review findings. This may lead to an uninformed interpretation of the problem being imposed at the outset of the review. Furthermore, reviewers may not necessarily identify all the issues relating to *how* an intervention is expected to work *a priori* and therefore a revision of the programme theory may be required (134).

In avoiding the use of programme theory simply becoming what Kneale et al., (127) have described as a 'tick-box' exercise in demonstrating compliance with the PRISMA Equity Extension criteria, reviewers need to understand how programme theory can help in moving beyond simply basing their systematic reviews on theory towards securing a theoretical underpinning of the review analysis and synthesis.

The value of a programme theory approach lies in its ability to allow an acceptable, systematic, tested and refined *a posteriori reasoning* rather than *post hoc assumption* of how interventions may work. Twenty-one reviews in this study tested their programme theories; in doing so they present review findings that are *tested* interpretations or explanations, rather than unbiased observations, thus strengthening the validity and applicability of the review findings.

Using programme theory to articulate considerations of *if, what* and *how* interventions work for different populations will require reviewers to include more diverse forms of evidence beyond randomised controlled trials. Only 12 reviews in this study included evidence other than quantitative research to support their programme theory, largely using a narrative synthesis approach.

If reviewers of effectiveness studies are to be encouraged to consider health inequalities in systematic reviews, this will require a paradigm shift: they will need to move from a positivist stance in considering only 'if and what works' towards a more realist informed way of thinking to consider 'what works, for whom, and under what circumstance' (see Chapter 2.1.2). It requires a different approach to analysis moving away from a purely observational approach (i.e. how often, how much) to one that incorporates a more interpretive approach. This shift is hugely challenging, requiring skills in understanding theoretical sensitivity and in being able to generate, test and refine possible explanations.

While there is a greater need to understand the advantages and disadvantages of different synthesis approaches, the decision on what synthesis approach to undertake and whether to conduct separate parallel reviews has to be balanced with considerations of time, resources, and the skills and expertise within the review team (118). Given that it is unrealistic to expect all reviewers to accompany each systematic review with a parallel realist review, the challenge is how reviewers of effectiveness studies can incorporate realist principles within reviews of effectiveness to inform considerations of *what* and *how* interventions may work differently across SES populations within a single review.

Establishing an *a priori* programme theory of *if, what* and *how* an intervention is expected to work across different SES groups, testing and refining it based on the review findings may offer reviewers a way forward.

4.7 Strengths and limitations of the methodological review

A key strength of this study was the inclusion of full-text searches rather than simply undertaking title and abstract searches alone. Full-text searching took place in order to overcome the limitations associated with the fact that SES analysis may have been undertaken but not reported in journal abstracts. In addition, during the screening phase, if no mention was made in the title or abstract of SES, the full-text of the paper was examined.

A further strength was to include studies that were either explicit *or* implicit in their consideration of what and how interventions may have different effects within and across SES populations. This extends a previous study on the use of programme theory (127), and recognises that the articulation of what works, for whom, and under what circumstance may not necessarily be recognised as ‘programme theory’ or labelled as a ‘logic model’ or ‘conceptual framework’. Indeed, as this study demonstrates, reviewers rarely identify with these labels even when outlining a programme theory. The involvement of two reviewers to independently extract the data on programme theory aimed to reduce the chances of missing relevant information.

Only systematic reviews published since the introduction of the PRISMA Equity Guidance (67) were included in this study. The short interval between the publication of the guidance and the systematic reviews included in this study may result in a more modest indication of the extent to which reviewers are operationalising the PRISMA guidance in exploring how interventions may result in differential effectiveness within or across SES populations. Studies in which it was not possible to separate out the analysis for SES were excluded; therefore, it may be that other theories relating to what works, and how/why they work may have been missed.

Unless explicitly stated in the included studies, this study was unable to assess the way in which different members of the review team or stakeholders contributed to the programme theory. Furthermore, this study only assessed the extent of use of programme theory if reviewers were explicit in reporting their use of it to inform their review processes.

This study did not set out to examine the fidelity, utility or richness of the programme theory. For example, Magnee et al. (162, e62) described why they assume that differential effectiveness across SES populations may arise, because “more highly educated people may be better equipped to benefit from interventions”, yet they failed to explain in what way or why highly educated people are ‘better equipped’. In another example, Mizdrak et al., (164, Introduction) stated that they expected differential effectiveness to occur because “low income purchasers may react differently to changes in food price than high income purchasers” but it is not clear in what way or why low income purchasers ‘may react differently’. Therefore, the use of the PRISMA Equity Extension criteria (67) in the quality assessment only allows for an assessment of the quality of the *reporting* of programme theory.

4.8 Conclusions

Given the lack of evidence in primary research on the differential effects of interventions on health across SES groups, Whitehead (32) considers it “absolutely imperative” that a theory-based approach is adopted to guide actions on reducing health inequalities. Despite the PRISMA Equity Extension guidance recommending the use of programme theory, this study demonstrates that use of the guidance to inform considerations of *if*, *what* and *how* interventions lead to differential effects on health within and across SES groups in the systematic review process is not yet widely adopted, and is fragmented.

Encouraging reviewers of effectiveness studies to consider health inequalities in systematic reviews requires a paradigm shift in thinking, from a positivist (i.e. ‘if, and what works’), towards a realist informed way of thinking (i.e. ‘what works, for whom, and under what circumstance’) (see Chapter 2.1.2). The fact that reviewers are more likely to use programme theory implicitly, in an ad hoc descriptive way, and use supplementary evidence to support their assumptions of how interventions work rather than use more ‘formal’ theories, suggests that reviewers are unconsciously using programme theory and are not fully exploiting its potential in informing the review process.

Chapter 5: Toward a theory-led meta-framework for considering socio-economic health inequalities within systematic reviews (study 3).

5.1 Publication and acknowledgement of contributions to study 3

Citation: Maden, M., McMahon, N., Booth, A., Paisley, S., Dickson, R., Gabbay, M. Toward a theory-led meta-framework for considering socio-economic health inequalities within systematic reviews. *Journal of Clinical Epidemiology* 104:84-94. DOI 10.1016/j.jclinepi.2018.08.008. (see Appendix 1)

I (MM) was responsible for the overall design of the study, designed and conducted the search, designed data collection, extracted data, undertook thematic analysis, constructed the framework and wrote the first draft and final draft of this paper. Naoimh McMahon (NM) independently checked the data extraction, thematic analysis and construction of the framework. Dr Andrew Booth advised on the design and commented on drafts of the study. Professor Rumona Dickson, Professor Mark Gabbay and Dr Suzy Paisley supplemented the methodological and theoretical aspects of the study and provided feedback on drafts of the study.

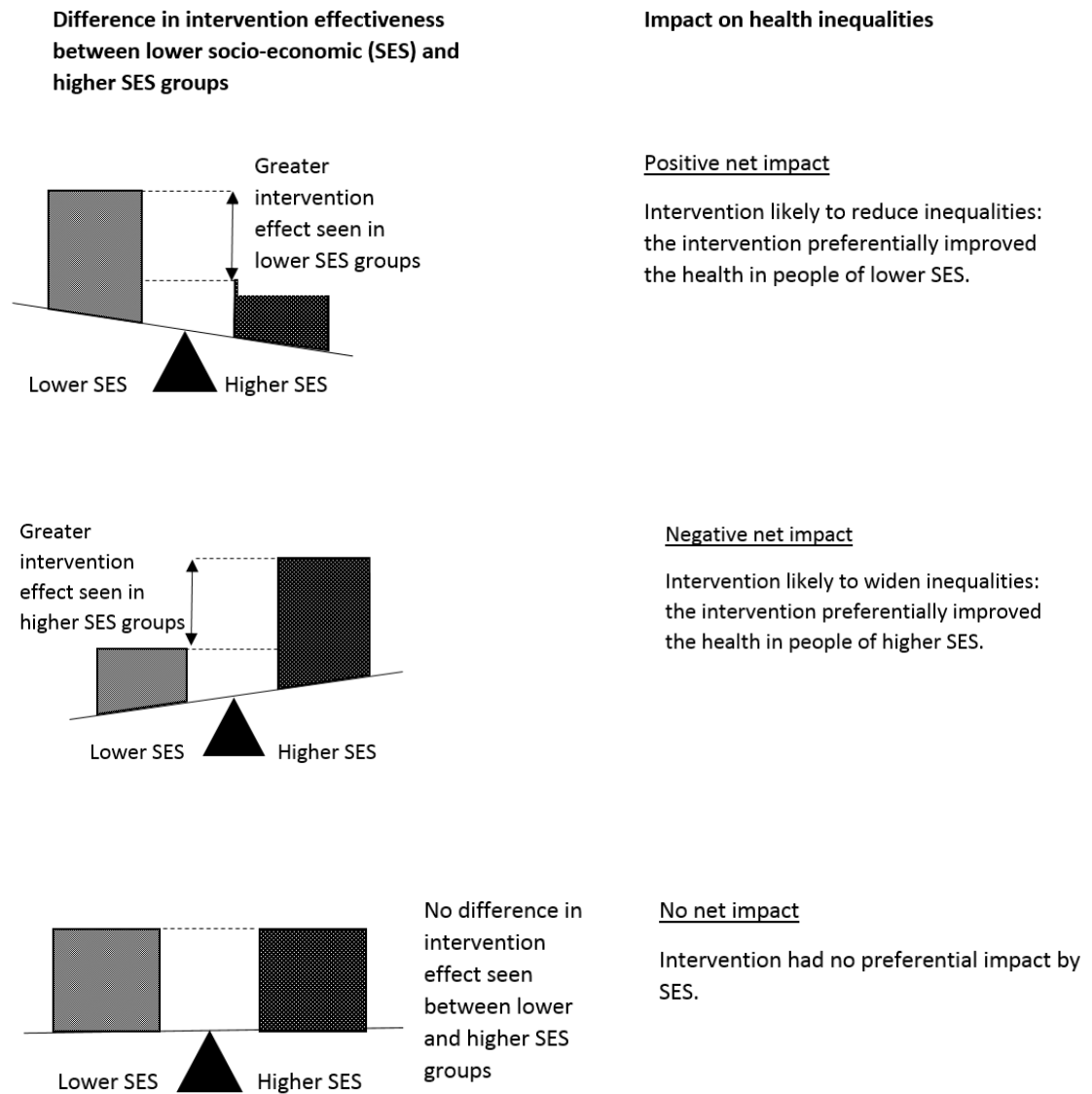
5.2 Background

Interventions which may be effective in improving the overall health of a population, may inadvertently increase health inequalities (23, 24, 49, 70) (i.e. differences in health status between individuals or populations which are avoidable and unjust (32)). White et al., (24, p.68) label these as ‘intervention generated inequalities’ (IGIs) i.e., “all processes in the planning and delivery of an intervention have the potential to widen inequalities within the target population, distinguished by a range of factors, such as gender, age, ethnicity or SEP [socio-economic position]”. Such IGIs occur for example, when an intervention improves the health of higher socio-economic status (SES) groups at a faster rate than in lower SES groups (i.e. higher SES groups will benefit first, then lower SES groups will catch up) (23, 24).

All healthcare interventions have the potential to impact on health inequalities. The net impact of an intervention may be positive, negative, or have no discernible impact (see figure 5.1). Such an impact may be the result of either intended, or unintended effects (24). It is

imperative therefore, that all reviews consider whether it is likely that their review findings have the potential to impact on health inequalities (24, 44, 49).

Figure 5.1 Potential impact of healthcare interventions on health inequalities



Guidance on conducting systematic reviews that consider health inequalities encourages reviewers to develop an understanding, or ‘programme theory’/logic model, from the outset of their review, of what works, for disadvantaged populations, under what circumstance (18, 67, 68, 78). However, much of the guidance assumes that reviewers can recognise *a priori*,

what, how and why interventions may result in differential effects across different SES populations (87) (see Chapter 3.6). Consequently, within the review guidance there is a lack of detail on the specific factors and mechanisms (i.e. responses and changes in an individuals' reasoning and actions) associated with the intervention pathway that may result in differential effects across SES groups (see table 5.1).

Table 5.1: Guidance on conducting systematic reviews incorporating health inequalities.

Guidance	Guidance item
PRISMA-Equity 2012 Extension(67)	Rationale 3: "Describe assumptions about mechanism(s) by which the intervention is assumed to have an impact on health equity."
PRISMA-Equity 2012 Extension(67)	Rationale 3A: "Provide the logic model/analytical framework, if done, to show the pathways through which the intervention is assumed to affect health equity and how it was developed."
Health equity plausibility algorithm (102, 'Table 1')	"Are there differences in patient/community/ population characteristics (e.g. underlying pathophysiology, comorbidities, patient attitudes, etc.) that are likely to create important differences in the magnitude of relative effect of the intervention versus the control for the outcome of interest?"
Health Inequalities Assessment Toolkit (HIAT) (18)	"How could the socio-economic circumstances in which your target group live and work limit their ability to benefit from, or take part in, your activities? Are there any risks that your work may unintentionally increase inequalities in health? How would you reduce these risks?"

Furthermore, in explaining the low reliability of a plausibility algorithm designed to predict relative differences in effectiveness of interventions across SES populations, Welch et al., (102, 'Discussion') suggest that it "may be due to multi-component questions covering several factors, and potential confusion of access to health care, prognostic factors and treatment-covariate interactions.". This suggests that reviewers need to recognise firstly, *what* factors relating to an intervention pathway (e.g. the intervention, participant characteristics and access) may moderate intervention effectiveness and secondly, *if, how* and *why* these factors may result in differential effects across different SES groups.

Empirical evidence however, suggests that reviewers struggle to understand how interventions under review may impact on health inequalities (38, 61, 86, 102). If reviewers are not able to recognise such issues, then they may be less likely to incorporate health

inequality considerations in systematic reviews (see Chapter 4.6, (87)). Thus, a framework that offers the potential to facilitate the identification of factors and mechanisms associated with what, how and why interventions may work across different SES groups, may help reviewers to operationalise the guidance on conducting systematic reviews that consider health inequalities.

Such a framework also has the potential to help reviewers identify the types of data to extract, inform *a priori* analysis of which factors are associated with differential effects and identify possible explanatory factors (i.e. mechanisms) for why some interventions may widen, narrow or have no impact on the health inequality gap. Furthermore, when evidence is lacking from primary research of an impact on socio-economic health inequalities, the framework could provide a structure within which to hypothesise both the likely applicability of review findings and the potential for an intervention to indirectly widen or narrow socio-economic health inequalities.

Given the lack of evaluation of differential effects of interventions across disadvantaged populations, Whitehead (32, p.477) states that it is “imperative to adopt a theory based approach to guide the development and implementation of actions aimed at tackling social inequalities in health.”. Several theories and frameworks exist to help reviewers hypothesise how interventions may or may not work across socio-economic groups, but few distinguish between the factors associated with the intervention pathway that may result in differential effectiveness. However, theories relating to complexity in systematic reviews of complex interventions can help reviewers to identify such factors. For example Rohwer et al., (134) highlight factors relating to participants, intervention design, context and implementation that reviewers should consider when hypothesising how an intervention may or may not work.

Therefore, in considering two theoretical perspectives i.e. health inequality interventions and complexity in systematic reviews of complex interventions within a single framework, we aimed to map out the factors and mechanisms associated with the intervention pathway that may lead to differential effects across socio-economic groups. In combining multiple theories into a single framework, we adopted a meta-framework approach. This approach identifies both common and unique elements from across multiple theories to inform a single meta-framework (81, 82).

The objectives were to;

- i) identify existing theories, guidance and frameworks that consider what, how and why healthcare interventions may lead to differential effects across socio-economic groups;
- ii) consider the strengths and limitations of these theories;
- iii) identify key factors and mechanisms within the theoretical literature associated with what, why and how interventions may result in differential effects across SES groups;
- iv) develop a theory-led meta-framework to inform reviewers' understanding of what, how and why healthcare interventions may lead to differential effects across socio-economic groups inform considerations of socio-economic health inequalities in systematic reviews.

5.3 Methods

We adhered to the 'best fit' framework synthesis guidance on developing a meta-framework (81, 82) (see Chapter 2.2.3). This guidance was selected as it offers a theory-led, systematic approach to meta-framework development to help reviewers generate programme theories and test them in systematic reviews. A meta-framework is generated by firstly identifying relevant theories from the published literature. Common and unique themes contributed by each theory are identified and 'deconstituted' into a single meta-framework (82).

We sought theories (the term theory is used here to collectively refer to published theories, frameworks, models and guidance documents) relating to complexity in systematic reviews of complex interventions and health inequality intervention theories about how socio-economic status may influence the effectiveness of an intervention. Systematic searches were undertaken in eight resources following guidance on searching for theory (82) (see appendix 4, A4.1, A4.2). Theories were also identified opportunistically from within relevant theoretical papers, an earlier published work on the use of programme theory in SES focused systematic reviews (see Chapter 4, (87)) and informal discussions with health inequality experts. We excluded theories on the causes and determinants of inequalities since they do not focus on interventions.

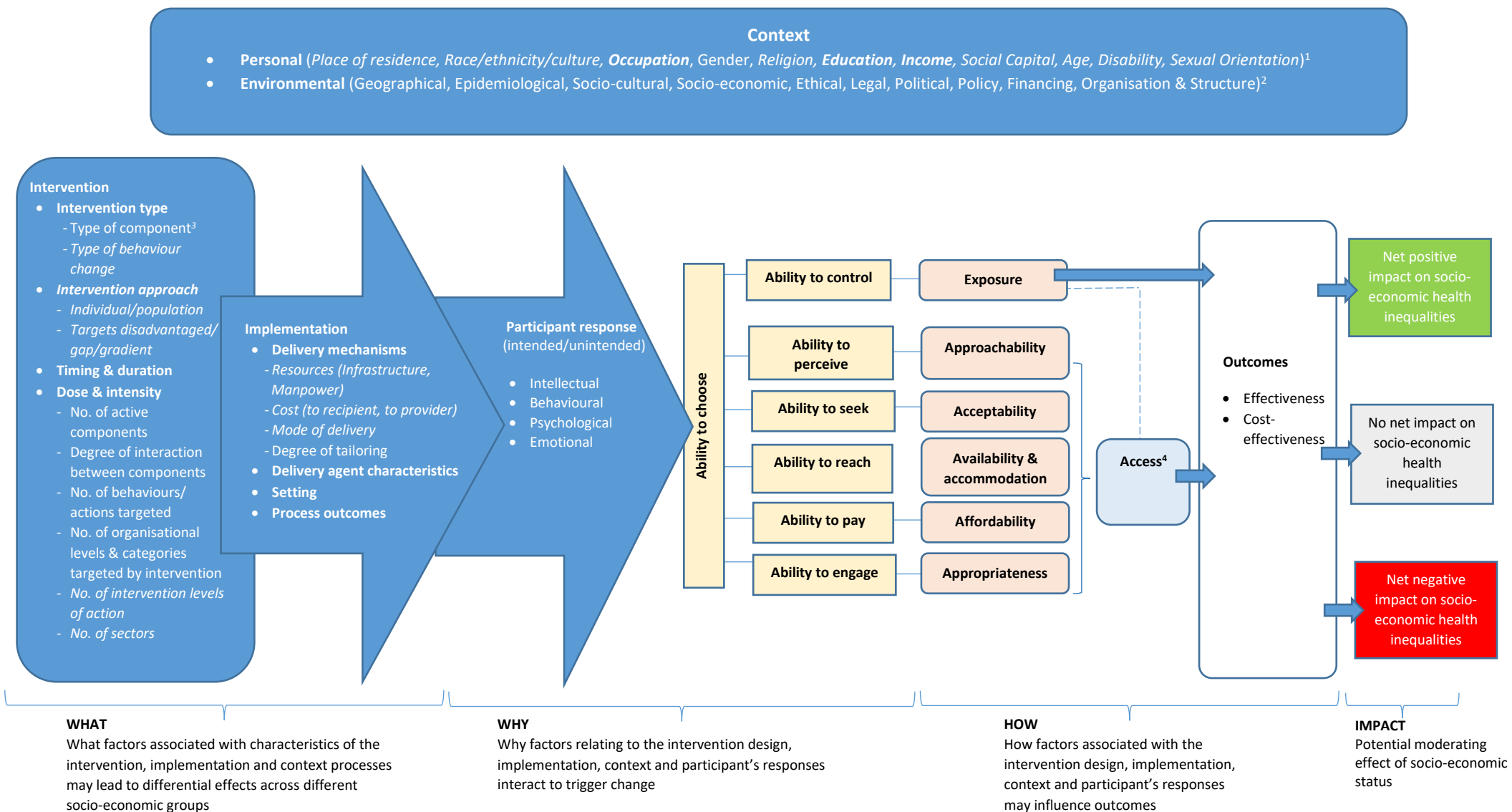
A two stage approach was adopted in generating the meta-framework. In the first stage we undertook thematic analysis of theories related to complexity in systematic reviews of

complex interventions, in order to identify common and unique factors of the intervention pathway that may result in differential effects. These factors provided the scaffold for the meta-framework. In the second stage we analysed health inequality intervention theories to verify which of these factors were also associated with differential effects across SES groups. New factors identified from health inequality intervention theories were incorporated into the meta-framework. Health inequality intervention theories also identified *how* and *why* differential effects may arise across SES groups. One author (MM) extracted and coded the data. A second author (NM) checked the data extraction and codes. Disagreement in the coding process were resolved through discussion.

5.4 Results

Twenty theories (reported in 24 publications) informed the development of the meta-framework. Four theories (reported in five publications) relate to complexity within systematic reviews of complex interventions (120, 134, 184-186) and 16 (reported in 19 publications) (24, 25, 32, 49, 70, 102, 163, 187-198) relate to health inequality intervention theories. The strengths and weaknesses of the theories informing the meta-framework are summarised in appendix 4, A4.3. When considered together, theories relating to complex interventions and socio-economic health inequalities can help to inform reviewers' understanding of *what*, *why* and *how* factors associated with the intervention pathway may result in differential effectiveness across SES groups (see figure 5.2). Appendices 4, A4.4 and A4.5 outline the definitions applied in the meta-framework and the contribution of each of the theories to the meta-framework.

Figure 5.2: Meta-Framework for Incorporating Socio-economic Health Inequalities in Evidence Synthesis^a



^aText in italics are additional factors identified by socio-economic health inequality theories as being associated with differential effects across SES groups. Key theories informing domains: ¹PROGRESS-PLUS (70), ²Adapted from Rohwer et al. (133), ³Adapted from McGill et al. (162), ⁴Levesque et al. (195).

5.4.1 ‘What’ factors may be associated with differential effects of healthcare interventions across socio-economic groups

Factors associated with differential effectiveness across complex interventions

Theories relating to complexity in systematic reviews of complex interventions identify four key factors of the intervention pathway associated with differential effects; intervention, implementation, context, participant response. Specific factors relating to intervention, implementation, context and participant response were also identified (see figure 5.2 and appendix 4, A4.5.1).

Factors associated with differential effectiveness across socio-economic groups

All factors identified in theories of complexity in systematic reviews as having the potential to result in differential effects across SES groups were verified in the health inequality intervention theories. Health inequality intervention theories also identify additional specific intervention, implementation, context, and participant response factors associated with differential effects across SES groups (see figure 5.2 and appendix 4, A4.5.2-A4.5.5).

Intervention factors associated with differential effectiveness across SES groups

All 16 socio-economic theories describe intervention factors which may be associated with differential effects across SES groups (see figure 5.2 and appendix 4, A4.5.2). In particular, they categorise factors relating to types of intervention components and identify six additional intervention factors as being associated with differential effectiveness across SES groups; type of component – pharmacological/non-pharmacological (clinical), type of behaviour change targeted by the intervention, individual or population level approach, targeting disadvantaged, gap or gradient approach, number of levels of action targeted and number of sectors targeted. Only two factors, ‘degree of interaction between components’ and ‘number of behaviours or actions targeted by an intervention’, and are supported by a single socio-economic health inequalities theory, other factors are supported by two or more theories.

Implementation factors associated with differential effectiveness across SES groups

Fifteen socio-economic health inequality theories highlight implementation factors associated with differential effectiveness across SES groups (see figure 5.2 and appendix 4, A4.5.3). These theories identify three additional implementation factors relating to delivery mechanisms as being associated with differential effectiveness across SES; resources (infrastructure, manpower), cost (cost to recipient, cost to provider) and mode of delivery (face-to-face, media). The majority of factors are supported by three or more theories.

Context factors associated with differential effectiveness across SES groups

All socio-economic health inequalities theories identify context factors associated with differential effectiveness across SES groups (see figure 5.2 and appendix 4, A4.5.4). All theories identify factors relating to personal context (i.e. individual socio-demographic characteristics). Twelve socio-economic health inequality theories identify factors relating to the wider environmental context (i.e. factors outside the control of an individual, e.g. laws, cultural beliefs). One health inequality framework, PROGRESS-plus (70), categorises factors relating to personal context. PROGRESS-plus identifies additional personal context factors not previously identified in the complexity theories. All context factors are supported by two or more socio-economic health inequality theories.

Participant response factors associated with differential effectiveness across SES groups

Fifteen socio-economic health inequality theories identify participant response factors associated with differential effectiveness across SES groups (see figure 5.2 and appendix 4, A4.5.5). The majority of socio-economic health inequality theories identify behavioural responses (e.g. adherence or motivation). All participant response factors are supported by four or more socio-economic health inequality theories.

5.4.2 'How' factors may be associated with differential effects of healthcare interventions across socio-economic groups?

Socio-economic health inequality theories suggest that differential effects across SES groups may occur during either the provision of, or response to an intervention (e.g. see (24, 49, 193). The key stages at which they may be introduced relate to, *effectiveness (relative and*

absolute effectiveness), *cost-effectiveness* and *access* to an intervention (see figure 5.2 and appendix 4, A4.5.6). Furthermore, differential effects may be exacerbated because of cumulative effects experienced (24, 49, 188, 190, 193, 198). In other words, if lower SES groups experience worse outcomes at each stage at which inequalities can arise compared to higher SES groups, then a greater overall reduction in effectiveness is likely for lower SES groups.

Differential effects in health outcomes may arise due to differences in absolute or relative effectiveness. Differences in absolute effects are mediated by differences in the baseline risk of outcomes in populations (102). For example, even if a new intervention is equally efficacious for both lower and higher SES groups, if lower SES groups have a higher baseline risk of mortality then the absolute difference in effectiveness will be greater for lower SES groups (49, 102, 189).

Differences in relative effects may arise due to differences in mechanisms of action and may be moderated by differences in recipient characteristics, the way in which an intervention is designed or implemented, or wider contextual influences (24, 193). For example, a greater relative reduction in obesity may be seen in higher SES groups than lower SES groups if lower SES groups are unable to afford healthier food options, or are exposed to unhealthier environments.

Differences in relative effects are also influenced by levels of access to an intervention. Based on a synthesis of the literature on the conceptualisation of access, Levesque et al.'s (196) framework offers the most comprehensive definition of access (see table 5.2). They describe how differences in levels of access are mediated by differences in approachability, acceptability, availability and accommodation, affordability and appropriateness. In addition, if interventions which are successful in reducing socio-economic health inequalities are not cost-effective, then they may not be implemented. However, if people value the reduction in inequalities, the benefit/cost ratio could be shifted.

Table 5.2: Defining access (Levesque et al. (196, 'A definition of access as an opportunity', 'Five dimensions of access capturing supply-side and demand-side determinants'))

Access: “the possibility to identify healthcare needs, to seek healthcare services, to reach healthcare services, to reach the healthcare resources, to obtain or use health care services, and to actually be offered services appropriate to the needs for care.”

Approachability: “people facing health needs can actually identify that some form of service exists, can be reached and have an impact on the health of the individual”

Acceptability: “cultural and social factors determining the possibility for people to accept the aspects of the service (e.g. the sex or social group of providers, the beliefs associated to systems of medicine) and the judged appropriateness for the persons to seek care.”

Availability and accommodation: “health services (either the physical space or those working in health care roles) can be reached both physically and in a timely manner.”

Affordability: “the economic capacity for people to spend resources and time to use appropriate services.”

Appropriateness: “the fit between services and clients need, its timeliness, the amount of care spent in assessing health problems and determining the correct treatment and the technical and interpersonal quality of the services provided”.

Lower levels of access and/or effectiveness among lower socio-economic groups may lead to a widening of health inequalities and have a negative impact on the health inequalities gap. Higher levels of access and/or effectiveness among lower socio-economic groups may lead to a narrowing of health inequalities and have a positive impact on the health inequalities gap. Equivalent levels or an overall balancing out of access and/or effectiveness between socio-economic groups may maintain existing health inequalities and have no impact on the health inequalities gap.

5.4.3 'Why' factors may be associated with differential effects of healthcare interventions across socio-economic groups

Socio-economic health inequality theories identify seven key mechanisms that may help to explain why interventions may have differential effects across SES groups (see table 5.3). Only one theory (196) explicitly presents mechanisms as part of a testable framework explaining why healthcare interventions may result in differential access. Mechanisms highlighted in other theories are often not described as an explicit part of a testable framework.

Table 5.3: Defining mechanisms associated with differential effectiveness across SES groups

Mechanisms	Definition	Examples ²	
		Potential for a positive impact on socio-economic health inequalities	Potential for a negative impact on socio-economic health inequalities
1. Choice			
1.1 Ability to choose	The ability to have a free choice in providing or receiving healthcare. Relates to an individual's life circumstances (e.g. religious or cultural beliefs, socio-economic status, vulnerable groups) or wider environmental factors (e.g. ethics, legal rights, political) that may influence the ability to choose.	"Low-income parents often struggle to afford the fruit and vegetables they know to be important for their children's health [23]. Using subsidies to make healthier food more affordable is a low-agency population intervention that may increase the choices available to these parents."(198)	"A common attribute of interventions that lead to increase socio-economic inequalities in health appears to be a reliance on voluntary behaviour change (<i>Mechanic, 2002</i>)."(24)
2. Effectiveness			
2.2 Ability to control	The ability to control behaviour or actions. Relates to an individual's life circumstances (e.g. risk of disease, epidemiological characteristics) or wider environmental factors (e.g. exposure to harmful environments) that may influence the ability to control. Corresponds to 'Exposure'.	"The relative efficacy of treated bed nets on childhood mortality is unlikely to differ across socio-economic status since the risk of malaria is similar across socio-economic gradients in areas of comparable endemicity. However, the absolute difference may be greater in the poorest people, who start with higher baseline mortality(359)."(49)	"Person" interventions appeared most likely to widen inequalities. This category included health education and dietary counselling. This may reflect the dependence on an individual choosing to behave differently, and sustain that change [78]. Other studies support this in highlighting that downstream interventions rarely reduce inequalities and may widen them."(163)
3. Access			
3.1 Ability to perceive	The ability to recognise a need for healthcare. Relates to knowledge, beliefs and understanding of health risks and awareness of the benefits of interventions designed to improve health. Corresponds to the dimension of access 'Approachability'. ¹	"As a result of these discussions the team revised their planned intervention to address these socio-economic barriers by: (i) including initial preliminary research to identify people's perception of health checks and how they could be redesigned in order to optimise people's needs and restrictions;...and; (iii) extending staff training to increase awareness of the social determinants of health inequalities in general and the socio-economic	"In India, for example, 30% of mothers of children who had not been vaccinated did not know that immunisation was important for the health of their child, and a further 33% did not know where to go to have their child vaccinated."(190)

Mechanisms	Definition	Examples ²	
		Potential for a positive impact on socio-economic health inequalities	Potential for a negative impact on socio-economic health inequalities
3.2 Ability to seek	The ability to have the personal autonomy and capacity to seek health care. Corresponds to the dimension of access 'Acceptability'. ¹	barriers to uptake of preventive services in particular."(197) "Increasing the number of female doctors can improve access to health care for women from Arabic-speaking countries living in Sweden[63]."(70)	"The way health checks are delivered, in terms of form and content and the people delivering them (in terms of professional, ethnic and gender background) can put people off from attending."(197)
3.3 Ability to reach	The ability to mobilise and the availability of transportation, occupational flexibility and knowledge about health services that allows an individual to reach an intervention both physically and in a timely manner. Corresponds to the dimension of access 'Availability and accommodation'. ¹	"Targeting can take several forms. One –typically called direct targeting – is to identify poor households or individuals and ways of getting services to them."(190)	"The facilities serving poor people are typically less well organised than are those for people who are better off, with inconvenient opening hours."(190)
3.4 Ability to pay	The ability to afford healthcare. Relates to the cost of accessing an intervention. Cost may be tangible (e.g. financial) or intangible (e.g. time). Corresponds to the dimension of access 'Affordability'.	"Ownership of malaria bednets decreases with decreasing household wealth ... distribution of free bednets or vouchers for bednets increases ownership."(70)	"The location and timing of health checks can have a negative impact on uptake by making access difficult, especially if people cannot access reliable and affordable public transport or cannot negotiate time out from work or caring responsibilities."(197)
3.5 Ability to engage	The ability to participate, interact with the intervention provided, be involved in decision-making, have the capacity to communicate and to receive appropriate care. Corresponds to the dimension of access 'Appropriateness'. ¹	"population interventions that require recipients to use little or no agency to benefit may be more effective and equitable. When food manufacturers reduce the salt content of bread, decreased salt intake occurs without individuals having to consciously engage with any information or actively change their behaviour [9]."(198)	"More socio-economically advantaged people, with better health literacy (a cognitive resource) [17], may find it easier to make sense of the information provided in public health messages."(198)

¹ as defined by Levesque et al.(196), see table 5.2. ²See appendix 4.6 for additional examples.

Appendix 4, A4.5.7 highlights the extent to which socio-economic health inequality theories support each mechanism. All theories support the identification of access mechanisms, 12 theories support the effectiveness mechanism and 10 support the choice mechanism. The way in which intervention, implementation and context factors interact will influence participant responses and trigger mechanisms. This, in turn, may have differential impact on socio-economic health inequalities resulting in either a net positive, negative, or no impact. Appendix 4.6 highlights some examples of how factors relating to intervention, implementation and context interact to trigger the key mechanisms resulting in a net positive, negative, or no impact on socio-economic health inequalities.

5.5 Discussion

Multiple theories and frameworks exist to prompt researchers to consider socio-economic health inequalities. To our knowledge, the meta-framework presented above (see figure 5.2) is the first attempt to provide reviewers with practical guidance on identifying factors and mechanisms associated with differential effects across SES groups. To our knowledge, it is also the first time that socio-economic health inequalities have been considered in a meta-framework within the wider context of complex interventions.

Waters et al. (199, p.462) suggest that consideration of the wider context and implementation should be “an essential, non-negotiable component of the review process.” None of the theories incorporated in the meta-framework focus in detail on all factors associated with the intervention pathway (i.e. intervention, implementation, context, participant response) (see appendix 4, A4.5). Furthermore, socio-economic health inequalities theories were found to be less explicit in detailing implementation, wider environmental context dimensions and mechanisms associated with differential effects of healthcare interventions. We identified only one SES theory that explicitly presented mechanisms associated with differential access to interventions in a testable framework (196). Although mechanisms are discussed in other theories, they are not explicitly presented within a framework. This suggests that a *single* health intervention theory, tool or framework, may be insufficient in helping not only reviewers, to predict *whether* and *how* interventions may result in differential effectiveness across different socio-economic groups, but also decision-makers and practitioners to assess the applicability of, and implement review findings.

Socio-economic theories also suggest that different mechanisms may be more closely related to different socio-economic characteristics than others. For example, the 'ability to perceive' and 'ability to engage' are more likely to be mediated by educational status, whereas 'ability to pay' is more likely to be mediated by income status. This may have implications for reviewers when defining 'socio-economic status'. Consequently, it is anticipated that some factors (e.g. setting, cost to recipient) may exert a stronger influence on differential effectiveness across SES populations than others. Further research is required in identifying which factors related to intervention, implementation, context and participant response are more closely associated with specific mechanisms and the resulting net impact (i.e. positive, negative or no impact) on socio-economic health inequalities.

The key mechanisms identified above are likely to be interdependent to differing extents. For example, Tugwell et al., (49) suggest that lower SES groups may have greater adherence (ability to engage) in use of bed nets because of their higher exposure to mosquito biting environments (ability to control). In addition, the key mechanisms may be triggered by other mechanisms specific to a particular context. For example, the Health Inequalities Assessment Toolkit (197) suggest that because people of lower SES may work longer hours, under poor working conditions, including job insecurity, then they may prioritise (ability to prioritise) providing for their families over attending health checks (ability to seek). The meta-framework identifies mechanisms at a broad level (i.e. not specific to a single intervention) and therefore can act as a prompt to develop and test hypotheses about specific mechanisms and interactions.

One of the key strengths of the meta-framework is its foundation in published theories, frameworks and logic models. In providing a conceptual framework to aid *a priori* understandings of what interventions may work for different SES groups and why, the meta-framework aims to make the use of theory more accessible to systematic reviewers. It can also act as an evaluation framework to inform a data extraction tool. In this way the meta-framework encourages reviewers to engage with, and build upon theory throughout the review process. Furthermore, in encouraging reviewers to consider context and implementation factors simultaneously with intervention effectiveness, the meta-framework also aims to increase the usefulness of systematic reviews in decision-making and changes to practice (199). Although developed explicitly for systematic reviews, the meta-framework may also be useful in informing socio-economic health inequality considerations in other types of reviews and primary research. Furthermore, whilst the meta-framework acknowledges the moderating effects of other health inequalities as

defined in PROGRESS-Plus (70) (e.g. gender, ethnicity), the focus here is on the moderating influence of SES.

The meta-framework is not designed to introduce rigidity into the review process (127). Its value lies in “its ability to allow an acceptable, systematic, tested and refined *a posteriori* reasoning rather than *post hoc* assumption of how interventions may work” (Chapter 4, p.103, (87, Discussion)). The meta-framework is flexible enough to allow new factors and mechanisms to be incorporated and can be used, for example, to inform data extraction within a ‘best fit’ framework synthesis (82).

Whilst the overlap of factors and mechanisms identified within the socio-economic theories enhances the internal validity of the meta-framework, additional testing and validation of the meta-framework is required to ensure it is fit for purpose (82). This will include for example, assessing whether additional factors and mechanisms associated with differential effects are identified from theories that meet the inclusion criteria but were not captured by the search. Methodological challenges in identifying and selecting theories, operationalising definitions and evaluating the meta-framework are discussed in greater detail elsewhere (see Chapter 6).

Depending on the review focus, not all parts of the meta-framework will need to be operationalised. Furthermore, it is beyond the scope of this study to explore all potential mechanisms and pathways to effectiveness. It does not attempt to incorporate specific behaviour change theories but recognises that such theories can help inform the interpretation of the meta-framework. Instead, the meta-framework aims to serve as an adaptable, transparent guide to prompt reviewers to consider whether to expect differential effects across SES due to differences in access, clinical effectiveness and cost-effectiveness.

5.6 Conclusions

By offering a systematic approach to the identification of socio-economic theories the meta-framework provides a strong theoretical platform with which to consider socio-economic health inequalities in systematic reviews. In providing a transparent, practical approach to using published theories to inform a programme theory for *what*, *how* and *why* interventions work for different SES groups, the meta-framework can enhance existing guidance on conducting systematic reviews that consider health inequalities increase awareness of how SES can moderate intervention effectiveness and encourage a greater engagement with theory throughout the review process.

Chapter 6: Methodological challenges when developing meta-frameworks in evidence synthesis: a worked example of a socio-economic health inequalities meta-framework (study 4)

6.1 Acknowledgement of contributions to study 4

I (MM) was responsible for the overall study design, undertook the searches, designed data collection, extracted data, undertook thematic analysis, constructed the framework and wrote the first draft and final draft of this study. Naiomh McMahon (NM) independently checked the data extraction, thematic analysis, framework construction and provided feedback on drafts of the study. Dr Andrew Booth advised on the design and commented on drafts and structure of the study. Professor Rumona Dickson, Professor Mark Gabbay and Dr Suzy Paisley supplemented the methodological and theoretical aspects of the study and provided feedback on drafts of the study.

6.2 Background

The 'best fit'-framework synthesis (BFFS) is an emerging qualitative framework approach that encourages systematic reviewers to incorporate theory from the outset of a review. Based on framework analysis, an *a priori* framework is created from existing theories and is used as a scaffold and/or window to inform data extraction and analysis of included studies in the synthesis (81, 82). Where data does not map directly to the framework, the approach is flexible enough to allow the generation of new themes to be added to the framework using thematic analysis. This pragmatic flexible approach involves both deductive and inductive use of theory to inform the review process (82).

The BFFS approach to the development of an *a priori* framework uses published theories alone. In this way, the BFFS approach differs from other types of framework synthesis, where diverse sources (e.g. theory, empirical evidence, personal experience and background literature) may feed into the framework development. It also differs from other approaches in firstly, using a systematic method to identify suitable frameworks and secondly, in combining both framework and thematic analysis to inform the synthesis (81). The method can be used when at least one published model or theory is available in the literature to inform the topic under review (80). As the BFFS name suggest, frameworks do not necessarily need to be a 'perfect-fit', rather 'fit-for-purpose'. In other words, frameworks may be borrowed from broader, related areas to inform the synthesis(200). Whilst the

number of published BFFS is increasing, few papers outline in-depth the processes and challenges involved in framework generation.

The developers of the BFFS method highlight conceptual, practical and methodological benefits for reviewers (80-82). Conceptual benefits include aiding reviewers in generating programme theories (i.e. an understanding of *what works, for whom* and *why* some interventions are successful in some contexts and not in others) and ensuring that important themes are less likely to be missed by the review team (82). The use of a framework to inform the coding and categorising of data is believed to be less time intensive (200, 201), thus offering a practical benefit for reviewers who may be working towards tight deadlines (80).

One of the key methodological benefits of the BFFS approach is that it encourages reviewers to deliberately engage with theory throughout the review process (82). Use of a 'best fit' framework therefore, intends to promote a more 'theory-led', rather than 'theory-informed' approach to the conduct of evidence systematic reviews, thus supporting recent calls for a better understanding on the use of theory within the systematic review process (131). In doing so, it aims to enhance the understanding of causal pathways, i.e. how and why interventions may work (or not work) under what circumstances (200, 202, 203). In addition, the BFFS approach aims to strengthen the validity of the review by presenting findings based on theoretical *a posteriori reasoning* rather than on a *post hoc assumption* of how interventions may work (see Chapter 4, (87)). In other words, it independently substantiates empirical findings and therefore offers a form of triangulation. As Booth and Carroll (82, p.705) observe, this can turn "a theoretically informed academic meta-evaluation framework into an authentic knowledge translation product". Finally, the use of a framework to code and categorise themes also offers greater transparency in reporting methods on how the themes to inform the synthesis are derived (80, 82, 200).

The case study reported here documents the development of a theory-led framework to facilitate an understanding of what interventions work for disadvantaged populations and under what circumstances (88). In particular, the framework aims to help reviewers formulate an understanding of how and why an individual's socio-economic status (i.e. income, educational or occupational status) may moderate intervention effectiveness at a broader level (i.e. not specific to a single intervention). The BFFS approach to framework development was selected over other types of framework development, since reviewers would need to engage with the wider (and potentially more generalisable) theoretical literature (82). The framework also needed to be flexible enough to allow for adaptation to specific interventions. It needs to be accepted therefore, that such a framework would not

necessarily be 'ideal', and indeed could not be 'ideal', but rather it needed to be a "best fit"(81). Such a framework may help reviewers to identify what factors and mechanisms (i.e. explanatory factors) associated with an intervention pathway may result in differential effects across different socio-economic groups. Furthermore, in the event of a lack of primary research, the framework can help reviewers hypothesise the likely applicability of their review findings and the potential for an intervention to indirectly widen or narrow socio-economic health inequalities (i.e. differences in health status due to an individual's income, educational or occupational status).

Carroll et al., (80, 81) highlight several challenges associated with the development of a 'best fit' framework. These include; difficulties in identifying theories to inform framework development due to poorly reported theoretical aspects in published abstracts, the need to clearly define themes within the framework to facilitate the coding process, and since the *a priori* framework does not need to be 'ideal' but rather, 'fit for purpose', the need for additional thematic analysis to interpret data not accommodated within the *a priori* framework. Previous worked examples of meta-framework generation have involved only a single theoretical perspective, albeit via either single or multiple models (80, 81). This study is the first to report in-depth on the processes and challenges involved in adopting an approach to meta-framework generation following the principles of 'best fit' framework synthesis in which two theoretical perspectives were considered, i.e., theories of complexity in systematic reviews of complex interventions and health inequality intervention theories (see Chapter 2.2.4). Whilst there is an example of a best-fit framework informed by two theoretical perspectives (83), the authors do not provide any detail on how the two theoretical perspectives were merged to generate the framework. Therefore, this research is the first to describe in detail how two theoretical perspectives were merged to generate a single meta-framework. Theories relating to complexity in systematic reviews of complex interventions can help to identify 'what' factors relating to an intervention pathway may be associated with differential effects. Health inequality intervention theories can firstly, verify which of these factors are associated with differential effects across different socio-economic groups and secondly, help explain how and why differences in effectiveness may be expected.

This study aims to contribute to the emerging science of the use of theory, framework construction and evaluation within systematic review methodology (82, 131) and address calls for further testing and refining of the 'best fit' approach called for by the developers (80). In developing our meta-framework, four key challenges relating to; i) identification of

theory, ii) selection of theory, iii) operationalisation of theory, and iv) evaluation of theory were identified. In providing transparency for the processes involved in, and the challenges arising from, the development of a meta-framework, this paper aims to provide a greater insight into framework generation that is often missing from the methods section of published framework synthesis. In providing more information on how the theories to inform the framework were identified and subsequently adapted for use, we aim to reduce the potential for selection bias (82).

6.3 Methods

The methodological approach followed BFFS guidance for developing a framework (81, 82) (see table 6.1).

Table 6.1: Guidance for developing a ‘best fit’ framework (based on Booth & Carroll (82))

Step 1: Identification of relevant theories, frameworks and models

Conduct searches to locate single or multiple relevant theories to inform framework development. The term ‘theory’ is used here to collectively refer to published theories, frameworks, models and guidance documents. For example, a framework could involve an a theoretical policy model or process, a taxonomy or a logic model. Theories do not need to be a ‘perfect fit’, rather they only need to be a ‘best fit’.

Step 2: Generating the framework

Generate an a priori framework using thematic analysis. This is done by ‘deconstituting’ concepts from each theory into a single framework. The framework recognises both themes that reciprocally translate across theories and unique themes derived in each of the theories (204).

Booth & Carroll (82) identified four variants of framework; single framework, meta-framework, logic model and test-retest (see table 6.2). In selecting a framework approach for considering socio-economic health inequalities in evidence syntheses we looked to incorporate two theoretical perspectives (theories of complexity in systematic reviews of complex interventions and health inequality intervention theories) into a single framework.

Where a framework is required to engage with concepts from different disciplines or bodies of knowledge, these may be derived from multiple frameworks that are subsequently merged within a “meta-framework”.

Table 6.2: ‘Best fit’ framework variants (Booth & Carroll(82))

Single framework: A single framework (e.g. Theory of Planned Behaviour(205)) is rich enough to provide themes for a ‘best fit’ framework. Frameworks do not necessarily have to be based on theory; they can also relate to processes or to a policy.

Meta-framework: Multiple theories with common and unique elements may be relevant to derive themes for a ‘best fit’ framework (e.g. Consolidated Framework for Implementation Research (CFIR)(206), developed from 19 frameworks).

Logic model: A visual representation of a programme theory, mapping out the links between the intervention and anticipated outcomes. Used when theorising is ‘relatively immature’.

Test-retest: Involves testing the a priori framework against the evidence then retesting through sensitivity analysis. Test-retest is implicit in the ‘best fit’ approach, but additionally used when exploring or explaining a programme or intervention beyond simply itemising its characteristics

6.4 Results

6.4.1 Development of a meta-framework

Step 1: Identification of relevant theories, frameworks and models

Theories relating to complexity in systematic reviews of complex interventions and health inequality intervention theories were identified via database searches (MEDLINE, CINAHL, The Cochrane Library (CDSR, Other reviews, HTA), the Database of Promoting Health Effectiveness Reviews (DoPHER), the Campbell Collaboration Library of Systematic Reviews, 3ie (International Initiative for Impact Evaluation) database of systematic reviews, Google Scholar) and The Campbell and Cochrane Equity Methods Group website. We also identified theories by searching opportunistically from within relevant theoretical papers included in a recent study on the use of programme theory in SES focused systematic reviews(87) and via supplementary searches, in accordance with the BFFS guidance (82). Informal discussions with the framework development team and a member of the Cochrane Equity Methods Group also lead to the identification of additional relevant theories. Search alerts were set up in the databases to identify new, potentially relevant, theories throughout the development process.

Up until recently reviews either relied on the collective knowledge of the review team and relevant stakeholders in order to identify theory, or were limited to theories reported in the literature, identified serendipitously as a reviewer read through potentially relevant studies (207). Such approaches are criticised for lacking rigour and/or offering a potentially variable likelihood of success (207). Consequently, Booth & Carroll (207) developed the BeHEMOTH approach to support identification of models/theories to inform systematic reviews. In order to enhance the transparency of the search process BeHEMOTH was used to identify relevant theories from the databases (see table 6.3).

Table 6.3: The BeHEMOTH Framework (Booth & Carroll (207))

Elements of BeHEMOTH	Application to health inequality/SES theories of the effectiveness of healthcare interventions	Search terms	
Be	Behaviour of interest	Any behaviour of interest	<i>Not applied</i>
H	Health context	Search 1: Health inequalities, socio-economic status Search 2: systematic reviews of complex interventions	Health inequalit* OR health equit* or health inequit* OR socio-economic OR socio-economic OR disadvantaged OR depriv* OR "low income" OR "educational status" OR "occupational status" OR "occupational level" OR "educational level" OR "income level" OR "social class*" OR "social position*" OR poverty OR "social* disadvantage" OR "social inequalit*" OR "social inequit*" OR "social disparit*" (complex or complexity) AND (systematic review* OR evidence synthesis)
E	Exclusions	No exclusions	<i>Not applied</i>
MoTh	Models or Theories	Suggested search terms 'model* or theor* or concept* or framework*'	model* or theor* or concept* or framework* or guidance.

Whilst the BeHEMoTh framework offers a useful supplementary approach for the identification of behaviour change theory, this approach was modified in this study. Firstly, rather than searching for specific behaviour change theories, relevant theories were sought that focused on theories relating to complexity in systematic reviews of complex interventions or health inequality intervention theories. Secondly, search terms did not seek to exclude non-theoretical/technical models, and therefore comprised terms related to ['health inequalities terms' OR 'complexity in systematic reviews terms'] AND 'theory' terms. Thirdly, the term 'guidance' was added to identify systematic review equity guidance, which may potentially discuss theoretical concepts relating health inequalities or complex interventions.

Theories relating to complexity in systematic reviews of complex interventions and health inequality intervention theories were included. Theories on the causes and determinants of health inequalities were excluded. The first author (MM) screened the titles and abstracts against the inclusion criteria. Twenty theories (reported in 24 publications) were identified as representing a "best fit" in informing the meta-framework and were selected to inform the meta-framework generation. Four theories (reported in 5 publications) related to complex interventions and 16 (reported in 19 publications) discussed health inequality theories. Even though 16 health inequality intervention theories were indexed in MEDLINE, only seven were retrieved using the BeHEMoTh approach. Table 6.4 explores the reasons for non-retrieval. In summary, six theories were not retrieved by the theory terms used in the BeHEMoTh approach (32, 49, 102, 187, 190, 198), two theories were not retrieved by the health inequality terms (192, 196), and one theory was not retrieved by either the theory or health inequality terms (189).

Table 6.4: Reasons for non-retrieval of health inequality intervention theories indexed in MEDLINE

Theory, model, framework	Reason for non-retrieval
Whitehead (32)	Not retrieved by theory terms in title, abstract or MeSH. Searching for 'typology' would retrieve this record
Tugwell et al.(49)	Not retrieved by theory terms in title or MeSH. Although the term 'framework' appears in the abstract in the full-text paper, there is no abstract in the MEDLINE record.
Welch et al. (102)	Not retrieved by theory terms in title, abstract or MeSH. Searching for 'algorithm' would retrieve this record
Hart (187)	Not retrieved by theory terms in title, abstract or MeSH.
Victora et al. (189)	Not retrieved by health inequality or theory terms in title, abstract or MeSH.
Victora et al. (190)	Not retrieved by theory terms in title, abstract or MeSH.
Adams et al. (198)	Not retrieved by theory terms in title, abstract or MeSH.
Starfield et al. (192)	Not retrieved by health inequality terms in title, abstract or MeSH. Searching for "equity in health" would retrieve this record
Levesque et al. (196)	Not retrieved by health inequality terms in title, abstract or MeSH. Searching for health inequality terms in the source would retrieve this record

Sensitivity analysis was undertaken to assess the impact on meta-framework development by excluding theories not retrieved in MEDLINE due to theory terms in the BeHEMoTh approach and ii) theories not retrieved in MEDLINE due to health inequality terms.

Impact on meta-framework development because of non-retrieval of theories in MEDLINE due to theory terms in the BeHEMoTh approach

In evaluating the impact of theories not retrieved by the BeHEMoTh search in MEDLINE, one theory (49) not retrieved was excluded from the sensitivity analysis since it was one of two publications that discussed the same theory (49, 193), one of which (193) was captured by the search and *would* inform the meta-framework development.

Five theories not retrieved by the BeHEMoTh approach were therefore evaluated for their impact on the meta-framework development (see Appendix 5, A5.1 and Table 6.5 (n.b. two studies report on a single theory (189, 190). Missing these studies would result in seven factors associated with differential effects across SES relating to Intervention, Implementation and Participant response being omitted from the meta-framework.

Table 6.5: Factors omitted from meta-framework because of non-retrieval of theories in MEDLINE due to theory terms in the BeHEMOTH approach

Intervention	Dose and Intensity <ul style="list-style-type: none"> • Degree of interaction between components including independence and interdependence • No. of behaviours/actions targeted by intervention
Implementation	Mode delivery <ul style="list-style-type: none"> • Media
Participant response	Intellectual response <ul style="list-style-type: none"> • Skills • Competence Psychological response <ul style="list-style-type: none"> • Stigma • Self confidence

Impact on meta-framework development because of non-retrieval of theories in MEDLINE due to health inequality terms

In evaluating the impact of theories not retrieved by the health inequality terms in MEDLINE on meta-framework development, one theory not retrieved (192) was excluded from the sensitivity analysis since it was one of two publications that discussed the same theory (191, 192), one of which (191) was captured by the search and *would* inform the meta-framework development.

Two theories not retrieved by the health inequality terms were therefore evaluated for their impact on the meta-framework development (see Appendix 5, A5.2 and Table 6.6). Four factors associated with differential effects across SES would be omitted from the meta-framework, all relating to Participant response.

Table 6.6: Factors omitted from meta-framework because of non-retrieval of theories in MEDLINE due to health inequality terms

Participant response	Intellectual response <ul style="list-style-type: none"> • Health literacy Behavioural response <ul style="list-style-type: none"> • Self-management Psychological response <ul style="list-style-type: none"> • Stigma Emotional response <ul style="list-style-type: none"> • Self-efficacy
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Step 2: Generating the meta-framework

A two-stage approach was adopted in incorporating two theoretical perspectives into a single meta-framework. Stage one involved the creation of the meta-framework scaffold informed by four theories of complexity in systematic reviews of complex interventions. These theories helped us to identify what factors associated with an intervention pathway (i.e. type of intervention, context, implementation, participant response) may be associated with differential effects of interventions. In stage two, we analysed 16 health inequality intervention theories to verify which of these factors were also associated with differential effects across different SES groups and to identify mechanisms associated with how and why interventions may work differently across these groups. One author (MM) extracted and coded the data and named the themes for the meta-framework. A second author (NM) checked the data extraction, codes and themes. Disagreement in the process were resolved through discussion. The full meta-framework is reported elsewhere (see Chapter 5, (88)).

Meta-framework themes associated with *what* interventions may work differently for different SES groups

Stage 1: Establishing the scaffold for the meta-framework

In applying thematic analysis to theories relating to complexity in systematic reviews of complex interventions, four key themes were derived as being factors associated with differential effects of interventions; intervention, implementation, context and participant response. All four theories were clearly represented visually in a framework. Table 6.4 shows how the theories relating to complexity in systematic reviews of complex interventions were deconstituted to derive the intervention theme and corresponding sub-themes. Subthemes for implementation, context, participant response were derived in the same way.

Table 6.7: Stage 1 – Generating the ‘intervention’ theme and subthemes for the meta-framework

Theories	Anderson et al.,(184)	Rohwer et al.,(134) Pfadenhauer et al.,(208) ¹	Lewin et al.,(185)	Pigott & Shepherd (120) ¹	Themes / <i>subthemes</i> for meta-framework scaffold
Themes and sub-themes	Intervention complexity	Intervention (& comparison) Intervention Design Components <ul style="list-style-type: none"> • Technology and infrastructure • Education • Policy and regulations Execution <ul style="list-style-type: none"> • Timing and duration • Dose and intensity 	Number of active components Number of behaviours/actions targeted by intervention Number of organisational levels targeted by the intervention Degree of interaction between intervention components	Intervention Components included Dosage	Intervention <ul style="list-style-type: none"> • Intervention type <ul style="list-style-type: none"> - <i>Type of component</i> <ul style="list-style-type: none"> ○ <i>Technology and infrastructure</i> ○ <i>Education</i> ○ <i>Policy and regulations</i> • Timing & duration • Dose & Intensity <ul style="list-style-type: none"> - <i>Number of active components</i> - <i>Degree of interaction between components</i> - <i>Number of behaviours/actions targeted</i> - <i>Number of organisational levels targeted by the intervention</i>

¹Theories included other factors under ‘intervention’ which were realigned in accordance with our framework definitions (see ‘operationalising the framework’).

Step 2: Applying an equity lens to the meta-framework



The second step of meta-framework generation involved applying an ‘equity lens’ to theories of complexity in systematic reviews of complex interventions. This involved using the themes and subthemes derived in step 1 of meta-framework generation to code and categorise the health inequality intervention theories. In accordance with the BFFS approach, where data didn’t map to an existing theme or sub-theme, a new one was created (81). An iterative approach to categorising and coding of factors associated with differential effects across SES was required in which theories were constantly revisited, and categories and codes amended in light of the emergence of new subthemes.

Health inequality intervention theories which were clearly represented visually in a framework or typology (e.g. O’Neil, et al., (70) McGill et al., (163)) provided a useful starting point for verifying and refining the themes and subthemes derived in step 1 of meta-framework generation. For the majority of health inequalities intervention theories,

however, a line-by-line analysis was undertaken to derive key themes and sub-themes. A detailed approach to surface the themes and sub-themes was required since these were not necessarily explicit within a consolidated framework, but were found within the text of the papers describing the intervention. The worked example in table 6.5 uses a single theory (163) to show how the sub-themes for the 'Intervention' theme were derived from both a clearly defined typology (e.g. Price, Place, Product, Prescriptive, Promotion, Person) and from thematic analysis (e.g. 'type of behaviour change').

Table 6.8: Stage 2 - Applying an 'equity lens' to the meta-framework (worked example using McGill et al., (163)).

Intervention sub-themes derived from theories of complexity in systematic reviews of complex interventions	Applying an equity lens using McGill et al.,(163) to validate the 'Intervention' theme and sub-themes and derive new sub-themes (shown in italics) for the meta-framework.	Further explanation	
<p>Intervention type</p> <ul style="list-style-type: none"> • Type of component <ul style="list-style-type: none"> ○ Technology and infrastructure ○ Education ○ Policy and regulations 	<p>“The six intervention categories used in the analysis are thus:</p> <ul style="list-style-type: none"> • Price – fiscal measures such as taxes, subsidies, or economic incentives • Place – environmental measures in specific settings such as schools, work places (e.g. vending machines) or planning (e.g. location of supermarkets and fast food outlets) or community-based health education • Product – modification of food products to make them healthier / less harmful e.g. reformulation, additives, or elimination of a specific nutrient • Prescriptive – restrictions on advertising/marketing through controls or bans, labelling, recommendations or guidelines • Promotion – mass media public information campaigns • Person –Individual-based information and education (e.g. cooking lessons, tailored nutritional education/ counselling, or nutrition education in the school curriculum).” (163, 'Data synthesis'). 	<p>Intervention type</p> <ul style="list-style-type: none"> • Type of component <ul style="list-style-type: none"> ○ <i>Price</i> ○ <i>Place</i> ○ <i>Product</i> ○ <i>Prescriptive</i> ○ <i>Promotion</i> ○ <i>Person</i> 	<p>The 6 P's (Price, Place, Product, Prescriptive, Promotion, Person) provided a clear explicit typology for categorising intervention components associated with differential effects across SES populations. Elements of the 6Ps mapped onto the sub-themes already derived from complexity theories. For example, 'Person- individual information and education' mapped to 'Education' and 'Prescriptive – restrictions on advertising/marketing through control or bans' mapped to 'Policy and regulations'. Where terms were different but meanings were the same, we preferred terms identified within health inequality theories. Therefore, the 6P's typology replaced the initial subthemes for types of intervention components.</p>
	<p>“Downstream” interventions (which rely solely on individuals making and sustaining behaviour change) may therefore be more likely to be taken up by those who are of higher SEP and are more likely to widen the health gap between rich and poor”(163, 'Comparison with other research').</p>	<ul style="list-style-type: none"> • <i>Type of behaviour change targeted</i> 	<p>Two new sub-themes relating to intervention type were derived from thematic analysis of the text in McGill et al., (163); type of behaviour change targeted and intervention approach (individual/population). These new sub-themes were subsequently derived from other health inequality theories (e.g. see Frieden (194), Adams et al., (198)).</p>
	<p>“‘downstream’ interventions targeting individuals might increase inequalities” (163, 'Comparison with other research').</p>	<p>Intervention approach</p> <ul style="list-style-type: none"> • <i>Individual/population</i> 	

Intervention sub-themes derived from theories of complexity in systematic reviews of complex interventions	Applying an equity lens using McGill et al.,(163) to validate the 'Intervention' theme and sub-themes and derive new sub-themes (shown in italics) for the meta-framework.	Further explanation	
Timing & duration	<p>"In children, lower SEP is associated with a subsequent increased risk of adult cardiovascular morbidity and mortality, partly reflecting lower exposure to healthy foods [11]. This can then reinforce adult food preferences for less healthy foods [12]." (163, 'Background').</p> 	Timing & duration	The subtheme timing and duration mapped directly across both theoretical perspectives.
Dose & Intensity <ul style="list-style-type: none"> • Number of active components • Degree of interaction between components • Number of behaviours/actions targeted • Number of organisational levels targeted by the intervention 	<p>"evidence from tobacco control suggests that comprehensive strategies involving multiple interventions at multiple levels may be more powerful than narrower approaches" (163, 'Limitations').</p> 	Dose & Intensity <ul style="list-style-type: none"> • <i>No of levels of action targeted</i> 	One new sub-theme relating to dose & intensity was derived from McGill (163); number of levels of action targeted. This new sub-theme was subsequently derived from other health inequality theories (e.g. Whitehead (32), White et al., (24)).

Meta-framework themes and sub-themes associated with *why* interventions may work differently for different SES groups

Since the reasons why interventions may work differently across different SES groups are specific to health inequalities, only the health inequality intervention theories were analysed to derive mechanism themes for the meta-framework. Once again, in building the themes for the meta-framework we found it easier to start with theories in which mechanisms were clearly represented visually in a framework or typology. In this case, only one theory (Levesque et al., (196)) provided such an explicit framework. The Levesque et al., (196) visual framework was used as the initial scaffold on which to categorise mechanisms relating to access to an intervention, as well as points along the evaluation pathway when differential effects across SES groups may be introduced. Health inequality theories were thematically analysed and coded against Levesque et al., (196). As before, where data did not match existing themes, a new theme was created (e.g. see table 6.6). Two new themes and two new subthemes were derived.

Assessing the impact of poorly articulated theories on the development of the meta-framework

Given the advantages of clearly articulated theories and frameworks in identifying themes in meta-framework development, a sensitivity analysis was undertaken to assess the value of poorly articulated theories and frameworks to meta-framework development (see Appendix 5, A5.3). Five theories (187-190, 195, 197) were found which were not clearly represented visually in a framework or typology. Excluding these five theories in a sensitivity analysis resulted in the omission of just a single factor from the meta-framework associated with differential effects across SES (participant response – stigma).

Table 6.9: Generating mechanism themes for the meta-framework

Mechanisms (Levesque et al.,(196))	Applying an equity lens using health inequality intervention theories to refine and validate the mechanism themes and sub-themes.	Meta-framework themes and subthemes (New sub-themes derived from health inequality intervention theories are shown in italics)
Access		
• Ability to perceive	“In India, for example, 30% of mothers of children who had not been vaccinated did not know that immunisation was important for the health of their child, and a further 33% did not know where to go to have their child vaccinated.” (190, p.236)	• Ability to perceive
• Ability to seek	“In a poor rural area of Tanzania, the poorest children were 27% less likely to seek care from an appropriate provider than the least poor.” (189, p.235)	• Ability to seek
• Ability to reach	“The location and timing of health checks can have a negative impact on uptake by making access difficult.” (197, p.8)	• Ability to reach
• Ability to pay	“Ownership of malaria bednets decreases with decreasing household wealth ... distribution of free bednets or vouchers for bednets increases ownership.”(70, p.59)	• Ability to pay
• Ability to engage	“More socio-economically advantaged people, with better health literacy (a cognitive resource.) [17], may find it easier to make sense of the information provided in public health messages.” (198, ‘Intervention “Agency” Influences Intervention Effectiveness and Equity’)	• Ability to engage
Effectiveness		
	“The relative efficacy of treated bed nets on childhood mortality is unlikely to differ across socio-economic status since the risk of malaria is similar across socio-economic gradients in areas of comparable endemicity. However, the absolute difference may be greater in the poorest people, who start with higher baseline mortality.” (49, p.359)	• <i>Ability to control</i>
Choice		
	“Low-income parents often struggle to afford the fruit and vegetables they know to be important for their children’s health [23]. Using subsidies to make healthier food more affordable is a low-agency population intervention that may increase the choices available to these parents.” (198, ‘Why are low agency population interventions used?’)	• <i>Ability to choose</i>

6.4.2 Operationalising the framework

In order to facilitate thematic analysis, it quickly became apparent that it was necessary to provide definitions for the themes and subthemes informed by both theoretical

perspectives. Operationalising definitions of a framework is essential in order to aid the translation and integration of relevant sub-themes from individual theories (80) and to maintain the integrity of the review process in ensuring that independent reviewers are consistent in the coding of data extracted from primary studies (81). Booth and Carroll (82, 'Outstanding challenges in using the best fit framework approach') recommend the use of a glossary or coding guidance based on "elements in the original papers". However, in using the 'original papers' to generate definitions for our meta-framework themes and sub-themes we found that the definitions provided within the individual theories did not easily reciprocally translate to each other (204). We encountered terms that were different and had different meanings, terms that were the same and had the same meanings, terms that were the same but had different or overlapping meanings, terms that were different but had similar meaning, and terms which were not explicitly defined or conceptualised (37).

Table 6.7 illustrates difficulties we faced when defining themes based on the included theories and how we resolved them. The lack of consistency in defining some of the themes and subthemes across theories impacted on the ease with which the individual theories could be integrated with each other in a meta-framework and also therefore, on the time involved in generating the meta-framework. A full list of definitions applied in the meta-framework are reported elsewhere (88) (see appendix 4, A4.4).

In order to help reviewers operationalise the meta-framework, examples such as those shown in tables 6.5 and 6.6 were provided to illustrate how the data mapped to each of the themes and sub-themes.

Table 6.10: ‘Reciprocal translation’ of definitions across theories informing the meta-framework

Difficulties in ‘reciprocal translation’ of definitions	Definition examples (theme or subtheme within the meta-framework)	Definition resolution (¹ based on Booth et al., (37))
Terms that were different and had different meaning	Gender/Age (subthemes) Two different terms, clearly and consistently defined as different constructs across theories.	A direct translation of terms and definitions into the meta-framework. Each term adds to the ‘conceptual richness’ of the meta-framework. ¹
Terms that were different and had the same meaning	Person (163)/Education (134) McGill et al., (163) use the label ‘Person’ to refer to ‘individual-based information and education’, whereas Rohwer et al., (134) prefer the term ‘education’.	We chose to favour one of the terms and coded themes/subthemes in the meta-framework to correspond to the term operationalised. ¹ Terms reported in health inequality theories were preferred to those in theories of complexity in systematic reviews of complex interventions. In the example here ‘Person’ was preferred over ‘Education’ to describe an intervention component as it was reported in a health inequality theory (163).
Terms that were the same and had the same meaning	Degree of tailoring (subtheme) The degree of tailoring of an intervention was defined by Lewin et al., (185, 'table 1') as “The degree of tailoring intended or flexibility permitted across sites or individuals in applying or implementing the intervention”. In a similar way, White et al., (24, p.73) talk about “Interventions that are tailored for the needs of individuals or subgroups within a target population”	A direct translation of terms and definitions into the meta-framework. ¹
Terms that were the same but had different meaning	Implementation (theme) Implementation was used in different ways to refer to both the delivery of an intervention during the evaluation and to the scaling up of an intervention after evaluation. Relating to the former definition, Pigott & Shepherd (120, p.1247) define implementation as “how the intervention is implemented, that is, the dose of the intervention” whereas Rohwer et al., (134) and Pfadenhauer et al., (208, p.13) relate implementation to the latter definition; implementation is “an actively planned and deliberately initiated effort with the intention to bring a given object into policy and/or practice. These efforts are undertaken by agents, which either actively promote the use of the intervention or adopt the newly appraised practices.”	In choosing a preferred definition (in this example ‘implementation’ was defined as “the characteristics (i.e. delivery mechanisms, delivery agents and setting) of the implementation process during the evaluation period” (88) we drew on the wider literature on complex interventions, in particular the MRC Guidance Document on Process Evaluations of Complex Interventions (Moore et al., (209)) and the purpose of the meta-framework (i.e., to help reviewers identify whether it is likely that interventions under evaluation in the primary literature would have differential effects across different SES populations). We realigned themes/subthemes in the meta-framework to correspond to the definitions operationalised. ¹

Difficulties in 'reciprocal translation' of definitions

Definition examples (theme or subtheme within the meta-framework)

Definition resolution (based on Booth et al., (37))

Terms that were the same but had overlapping meaning

Socio-economic status (subtheme)

Braveman et al., (195) refer to socio-economic status as "reflected by, e.g., income, wealth, education, or occupation", whereas O'Neill et al., (70) refer to socio-economic status in the narrower terms, relating it to income only: "Inequalities in income impact a person's life chances (49) and therefore impact health." (70, p.61). They refer to 'educational status' and 'occupational status' as separate constructs.

Narrower definitions were applied as separate concepts (e.g. income, education, occupation). This allowed for theories that only referred to a single concept (e.g. income) to be accurately coded.

Terms that were not explicitly defined or conceptualised

Context (theme)

"situations in which we expect the effects of an intervention to be modified by variant properties or characteristics of the setting or context in which an intervention is implemented" (184, 'Background', 185).

More detailed definitions were sought and found in other theories.

6.4.3 Evaluating the framework

In order to be 'fit for purpose' Booth and Carroll (82) recommend that the quality of the theoretical framework is assessed. We evaluated the meta-framework in four ways; by considering the source of the theories, by assessing the extent to which each of the theories contributed to themes within the meta-framework, by testing the initial themes and sub-themes derived in complexity theories of systematic reviews of complex interventions (step 1 of meta-framework generation) and by sensitivity analysis to explore the impact on meta-framework development of excluding poorly articulated theories.

Only published theories were used to inform the meta-framework. A matrix approach was adopted to show the extent to which each of the theories contributed to the themes and sub-themes within the meta-framework (88). Individual theories varied in the extent to which, and ease with which, they contributed to the meta-framework. For example, theories varied in their richness in informing themes and sub-themes. In applying an equity lens (see table 6.5) the initial themes and sub-themes derived by complexity theories in systematic reviews of complex intervention were tested to see if they held true under theoretical conditions.

6.5 Discussion

Following the guidance on developing a 'best fit' framework (81, 82), this case study describes an approach in which two theoretical perspectives were combined into a single meta-framework. Complex intervention theories and health inequality theories were merged and reconstituted into a single meta-framework to help inform considerations of what interventions work for disadvantaged populations and under what circumstances in evidence synthesis. The 'best fit' framework methodology is still relatively in its infancy. Little detail is available on how frameworks are identified, selected, consolidated and reconciled and then subsequently used within the data extraction process. Particular challenges emerged relating to how to identify, select, operationalise and evaluate theories to inform development of the meta-framework.

6.5.1 Challenges in identifying theories to inform a meta-framework

We found the use of the BeHEMOTH framework offered us a transparent and auditable way of recording the search strategy to identify theory to inform evidence synthesis. Although

we were not interested in retrieving behaviour theories, by ‘dropping a concept’ (in this case the Behaviour of interest ‘Be’ and Exclusions ‘E’ (207, ‘table 3’)) the framework was easily modified to retrieve health inequality and complex intervention theories. However, seven of the theories used to inform the meta-framework in our case study were not retrievable using the theory terms (‘MoTH’) suggested in the BeHEMoTh strategy, i.e. ‘model* or theor* or concept* or framework*’. While this may partly reflect the poor standard of the reporting of theory (as reported elsewhere (207)), in this instance, it is more likely because the theories identified for the meta-framework are not mid-range or grand theories, but rather low-level theories. Low-level theories have been described as, ‘segregated hypotheses or isolated propositions, and typologies and taxonomies’, theories which ‘are used to predict, assume, describe, or organize aspects of the phenomena of interest but do not show the interrelationships between concepts’ (131, p.79). The addition of terms such as ‘typolog* or taxonom* or algorithm*’ to the BeHEMoTh approach would therefore have retrieved more relevant theories to inform the meta-framework (e.g., (32, 102)).

In addition, sensitivity analysis demonstrates that the theory terms in the BeHEMoTh search strategy would have resulted in the non-retrieval of low-level theories that contributed unique themes to the meta-framework. However, what is of more importance perhaps, is the ability of the BeHEMoTh strategy to retrieve *clearly articulated theories* that offer reviewers an explicit framework or typology that can quickly surface themes/subthemes to inform a best-fit framework. Of the six theories not retrieved in MEDLINE due to theory terms in the BeHEMoTh approach, two offered reviewers an explicit framework or typology (32, 198). Of those two, Adams et al., (198) identified two factors associated with the intervention that may lead to differential effects across SES that would have been missed (Degree of interaction between components including independence and interdependence and number of behaviours/actions targeted by intervention). In this case, amending the BeHEMoTh search to include the low-level theory terms identified above, is warranted.

Of the two theories missed by health inequality search terms, one (196) provided an explicit framework that contributed to the initial identification of mechanisms in the meta-framework. On further investigation, no health inequality terms are mentioned in either the title, abstract or MeSH. Standard methods of searching in these fields alone would never retrieve this study. However, searching for the term ‘equity’ in the *source* field (International Journal of Equity in Health) would retrieve this study. This may have wider implications for the retrieval of equity related research, for example, when thinking about the design of a health inequalities search filter. It also highlights the value of searching full-text to retrieve

theory related studies, since health inequality terms are mentioned in the full-text of Levesque et al.(196)

Furthermore, whilst the results of the sensitivity analysis has implications for the use of the BeHEMoTh search strategy when using it to identify 'low-level' theory, it may be less important when the resulting framework will be used to inform a best-fit framework synthesis, since additional themes identified during the analysis can be incorporated into a framework. It is also acknowledged that additional testing of the meta-framework is required to assess the value of the unique themes identified by the low-level theories missed by the BeHEMoTh strategy in informing evidence synthesis. The BeHEMoTh approach sets the scope of the search for theory, i.e. it defines which theories are relevant but also which theories are not relevant. The setting of the scope, however, is open to subjective judgment. Whilst it may not be necessary to 'find everything', the degree of saturation and the completeness of the framework, could therefore be tested further in two ways; 1) sensitivity of the search, i.e. do theories that fall within the scope but that are not found by the search make a difference or add anything to the framework? 2) adequacy of the scope, i.e. do theories that fall outside the BeHEMoTh scope add anything to the framework?

It is well recognised that it is difficult to design the 'perfect, single' search strategy for complex, ill-defined topics, and that iterative approaches using multiple different techniques are required. As noted elsewhere (80), the retrieval of theories in the databases was hampered by a lack of abstracts and appropriate indexing in the databases. This highlights a need for improvements in the indexing of low-level theories in the database. It also highlights the potential value of searching full-text sources, such as Google Scholar, when identifying theories. Our experience highlights the value of opportunistic and supplementary searching techniques, such as identifying theories used to inform topic-relevant systematic reviews, full-text searching and, in particular, contact with experts. Given that a perfect database strategy doesn't exist, we can conclude that 'opportunistic and supplementary searching' should be considered neither opportunistic nor supplementary. Instead it constitutes an integral component of a systematic, iterative approach when identifying theory to inform evidence synthesis.

Related to the issue of theory identification, a further challenge in developing a meta-framework arise from the relatively recent and growing interest in advancing methodological approaches to incorporating SES and complexity within research in general. Ten theories were published within the last five years. This recognises that approaches to synthesising evidence on 'what works, for whom, under what circumstance' remain

relatively immature (184, 210, 211). This finding impacted on the management of searches throughout this study. Search alerts set up in the databases proved particularly valuable in identifying new, potentially relevant, theories to inform the meta-framework throughout the development process.

6.5.2 Challenges in selecting theories to inform a meta-framework

Multiple theories and frameworks exist to prompt researchers to consider health inequalities. Review of the strengths and weaknesses of relevant theories suggests however, that a *single* health intervention theory, tool or framework, may be insufficient in helping reviewers new to health inequalities to predict *whether* and *how* interventions may result in differential effectiveness across different socio-economic groups (see appendix 4, A4.3, (88)). This is partly due to the fact that we were aiming to develop a meta-framework to inform considerations of what, how and why interventions work for different socio-economic groups at a generalisable level rather than at an intervention-specific level. The purpose of the meta-framework therefore dictated the selection of theories to inform the meta-framework. Some socio-economic health inequality theories were found to either lack detail on the diverse factors relating to the intervention pathway itself (i.e. intervention design, implementation, context or participant response), or to not differentiate between factors relating to different stages of the intervention process. Theories therefore didn't necessarily need to relate to all elements of the intervention pathway.

Sensitivity analysis also found that poorly articulated theories added little in terms of unique themes/subthemes to the meta-framework. Given the time required to develop a meta-framework, this preliminary finding may suggest that reviewers may select more clearly articulated theories over poorly articulated theories to inform framework development. However, further evaluation of the value of poorly conceptualised theories in informing framework development is required.

6.5.3 Challenges in operationalising theory to inform a meta-framework

Informing a meta-framework using multiple theories can be a complex process. (206). Application of a meta-framework as a vehicle for data extraction within a systematic review requires (i) a degree of definition and specification by the originating author to ensure subsequent consistency of coding; (ii) interpretation by the compiler of the meta-framework

in relation to whether apparently similar concepts from different frameworks match completely, partially match, or are incongruent, irrespective of similarities or differences in actual language used and (iii) interpretation of extracted data to judge whether it matches existing labels or introduced new hitherto uncharted concepts.

One of the biggest challenges in compiling a meta-framework is in ensuring that “concepts translate across frameworks, that different domains from different frameworks are integrated with one another” (82, ‘Outstanding challenges in using the best fit framework approach’). Where possible, we aimed to follow the BFS guidance and apply definitions taken directly from the theories used to inform the meta-framework (82). However, our experience shows that this is not necessarily a straightforward task. It is perhaps not surprising, given the lack of an agreed definition and multiplicity of meanings within the wider literature, that inconsistencies in the conceptualisation of ‘context’ and ‘implementation’ were evident across the individual theories used to inform the meta-framework (208). The way in which concepts such as socio-economic status are defined, has implications not only for the type of data to be extracted for systematic reviews but also on the interpretation and understanding of underlying mechanisms. Furthermore, concepts in a meta-framework share the requirements of terms in a thesaurus in always being mutually exclusive. Therefore, it is essential that definitions are made explicit when adopting a meta-framework approach.

In operationalising definitions, we faced multiple challenges relating to both terminology and meanings. In addition to the issues identified by Booth et al., (37, see table 9.3 ‘a conceptual grid for reciprocal translation’, p.231). when attempting ‘reciprocal translation’ of themes across theories, we identified two further issues; firstly, we identified instances where terms were the same but meanings *overlapped* and secondly, instances when terms were explicit but their meanings were *not conceptualised*. In outlining how we arrived at our definitions (see table 6.7) we aim to help reviewers address these issues in framework development and increase the transparency of our meta-framework development.

Another challenge facing reviewers when deriving themes for a meta-framework is in electing a starting point for the exploration of theories. Through trial and error, it became clear that it was easier to start with theories characterised by an explicit framework or typology since not only could they be mapped directly into a meta-framework, but subsequently, they could be used to code and categorise theories where in-depth analysis would otherwise have been required to surface the themes/sub-themes. In this way,

development of a meta-framework is facilitated, while at the same time adhering to the principles of a 'best fit' framework approach.

Given that new themes and sub-themes may emerge at any time during the analysis of theories to inform a meta-framework, it is essential to adopt an iterative approach to categorising and coding. Theories were constantly revisited and amended in light of the emergence of new themes and sub-themes. Thus, meta-framework development does not follow a linear process and consequently, impacts on construction time. However, the time taken to develop a meta-framework should be offset against its potential to save time when analysing data within evidence synthesis.

6.5.4 Challenges in evaluating theory to inform a meta-framework

Outstanding challenges in using the 'best fit' framework approach include the need for a framework to be both 'fit for purpose' and useful (82). Given the origins of theories from the wider health inequality literature, not all factors in the meta-framework may be associated with differential effectiveness across SES. Furthermore, wider evaluation of the meta-framework, for example using it to inform a 'best fit' framework synthesis, may identify concepts present in the framework unsupported by the data. This suggests where an original theory is too context specific resulting in a type of error where the particular is wrongly supposed to be generalisable. This is not a reason to reject the theory but may question the value of individual components in the meta-framework. In addition, it is anticipated that some factors will exert a stronger influence on the effectiveness of interventions than others. Feedback on the meta-framework from experts in health inequalities will help assess 'fitness for purpose' and examine the usefulness of the terminology used in the framework (82). Further testing of the meta-framework will be undertaken through use in a 'best fit' framework synthesis.

Also in the specific context of a meta-framework there is an extent to which there is pretesting of the themes, in that themes and subthemes appearing across multiple/all theories are assumed to be well supported whereas those appearing uniquely in a single theory may either be context specific or, perversely, offer added value by uncovering a perspective that would otherwise be missed. In addition, a meta-framework informed by two theoretical perspectives offers a unique opportunity to test the initial themes and subthemes derived by one theoretical perspective (in this instance, theories of complexity

of systematic reviews of complex interventions) against the other (health inequality theories).

6.6 Strengths and limitations

A transparent approach was used to identify relevant theories, following the published BeHEMoTh approach (82). The search was further informed by the guidance for identifying theories for a 'best fit' framework (81, 82). A potential limitation of the search is that although the approach was systematic, the meta-framework was not generated as an output from a comprehensive systematic review. Such an approach is not considered essential to the development of a 'best fit' framework, since the idea is that the meta-framework need only provide a 'good enough' starting point, does not claim to be 'ideal' but merely 'fit for purpose' (82). Indeed, the 'best fit' process progressively strengthens the original framework as new concepts emerge from the data and are assimilated within a final framework that accommodates all the data.

A further strength lies in the transparent methodological approach to the development of the meta-framework. Reviewers can see how the original theories were merged to generate a single meta-framework, and how themes were derived and translated (200). Two authors (MM, NM) independently categorised and checked the themes/sub-themes. This was considered important in maintaining the integrity of the meta-framework, given the issues noted above in operationalising the framework definitions and translating and integrating the themes and sub-themes.

Finally, the meta-framework will be validated and refined in two ways; through further discussions with health inequality experts and reviewers and within a 'best fit' framework synthesis of factors and mechanisms associated with differential effects of healthcare interventions across different socio-economic groups. This process will also explore other outstanding challenges of a 'best fit' framework approach, namely (i) the consistency with which the concepts in the meta-framework are understood and operationalised by different coders, (ii) the transferability of the framework in promoting comparison of results across studies included in the synthesis, and (iii) the ability of the framework to stimulate new theoretical development (82).

6.7 Conclusions

Few papers outline in-depth the processes and challenges involved in framework generation to inform evidence synthesis. This paper is the first to describe in detail an approach to 'best fit' framework development in which two theoretical perspectives were combined into a single meta-framework. Informing a meta-framework using multiple theories can be a complex, time-consuming process. Four key challenges were identified relating to; identification of theory, selection of theory, operationalisation of theory and evaluation of theory. By making explicit the processes and challenges involved in meta-framework development, this paper guides reviewers through meta-framework generation and provides examples of how challenges can be overcome. In this way, this paper contributes to the field of theory use, framework development and evaluation in evidence synthesis methodology.

Chapter 7: Discussion

7.1 Introduction

In previous chapters, I discussed at length the findings of the individual studies in relation to the wider literature (see Chapters 3.6, 4.6, 5.5, 6.5). Therefore, in this chapter I: summarise the key findings of each of the studies and explain how they informed the development and evaluation of the meta-framework, highlight this research's contribution to knowledge, examine the impact of this research from both a personal and wider perspective, discuss the strengths and weaknesses of each of the studies and this research as whole and make recommendations for practice and further research arising from this work. In this way, I examine the extent to which the research questions posed have been answered and therefore, the extent to which I have addressed the aim of this thesis. For reference, I present the research aim and questions here (see table 7.1);

Table 7.1: Research aim and research questions

Research Aim: 'To explore how we can enable systematic reviewers to consider *a priori* whether, and how, an individual's socio-economic status (i.e. their income, educational or occupational status) may moderate the effectiveness of healthcare interventions, to help predict the likely impact on socio-economic health inequalities.'

Research question 1: To what extent does guidance on conducting systematic reviews that consider health inequalities assist reviewers in making a priori decisions as to whether, and how, an individual's socio-economic status (i.e. their income, educational or occupational status) may moderate the effectiveness of healthcare interventions?

Research question 2: Whether, and how, reviewers operationalise guidance on conducting systematic reviews that consider health inequalities to develop an understanding of whether their review findings may have differential effects across different socio-economic groups?

Research question 3: How can we enable reviewers to consider what, why and how interventions may result in differential effects across different socio-economic groups?

Research question 4: What methodological challenges arise in developing a theory-led meta-framework to inform socio-economic health inequality considerations in evidence synthesis?

In order to address the research questions posed in this work, I undertook four separate but linked studies (see tables 7.2-7.5). In the following section, I will highlight the key findings of the four studies and address how each of the four studies addressed each of the four research questions.

Table 7.2: Overview of Study 1

Study	Title	Aim and objectives	Key findings	RQ ¹
Study 1	Consideration of health inequalities in systematic reviews: a mapping review of guidance (see Chapter 3; (86))	<p><i>Aim:</i> To undertake a mapping review of existing guidance documents currently provided to assist reviewers when determining whether and how to incorporate considerations of health inequalities.</p> <p><i>Objectives:</i></p> <ul style="list-style-type: none"> • To provide an overview on the types of guidance, in particular the focus, scope and purpose of the guidance • To explore how the guidance is defined by authors • To describe the methods used to develop the guidance • To examine the comprehensiveness, overlap and operationalisation of the guidance 	<ul style="list-style-type: none"> • 20 guidance documents identified informing the planning, conduct, reporting, applicability assessments and knowledge translation. • Two guidance documents with a focus on SES inequalities do not define SES. • Guidance is defined in multiple ways; briefing notes, equity lens, recommendations, plausibility algorithm, tool, framework, guidance, guidelines. • Most guidance developed from input from researchers, health inequality experts, review methodologists, decision-makers, clinical epidemiologists, practitioners and journal editors. Only 2 report involving novice reviewers. • Guidance is written with an underlying assumption that reviewers will recognise if and how health inequalities matter. • Guidance is operationalised by way of examples but lacks detail on; i) the different ways in which health inequalities may contribute towards differential effects in health outcomes and ii) practical approaches to operationalisation. • Lack of evaluation of guidance when applied prospectively by those expected to use it. 	1, 3

¹RQ= Research Questions (see table 7.1).

Table 7.3: Overview of Study 2

Study	Title	Aim and objectives	Key findings	RQ ¹
2	Use of programme theory to understand the differential effects of interventions across socio-economic groups in systematic reviews—a systematic methodology review (see Chapter 4;(87))	<p><i>Aim:</i> To assess if, how and the extent to which systematic reviewers use programme theory to inform considerations of socio-economic inequalities in health.</p> <p><i>Objectives:</i></p> <ul style="list-style-type: none"> • To identify the extent to which reviewers use programme theory when articulating considerations of whether and how differences in intervention effectiveness on health may be expected across SES groups • To identify how reviewers rationalise an understanding of what and how interventions have differential effects in or across SES populations (e.g. use of programme theory terminology and tools, authority for their decision based on theory, empirical evidence, personal experience) • To identify the extent to which reviewers are using programme theory to inform the review process (e.g. to predict or explain a change in health status, to inform the approach to the methods) 	<ul style="list-style-type: none"> • Programme theory terminology (e.g., logic model, conceptual framework) is often inconsistently applied in the literature, is often implicit than explicit and informed by low-level theory. • Intervention theories were the most referenced. • 22/37 reviews used programme theory to incorporate considerations of both what and how interventions do/do not work in SES groups to both predict and explain their review findings. • 21/37 reviews tested their programme theories. • Reviewers were more likely to use programme theory in an ad hoc way at the start and/or end of the review using supplementary evidence rather than formal theory, or to test their assumptions or explanations of how interventions may or may not work for different SES groups. • Only 12 reviews in this study included evidence other than quantitative research to support their programme theory. • 8/37 reviews referenced review guidance on the conduct of systematic reviews incorporating health inequality considerations. 	1, 2, 3

¹RQ= Research Questions (see table 7.1).

Table 7.4: Overview of Study 3

Study	Title	Aim and objectives	Key findings	RQ ¹
Study 3	Toward a theory-led meta framework for considering socio-economic health inequalities within systematic reviews (see Chapter 5; (88))	<p><i>Aim:</i> To map out the factors and mechanisms associated with the intervention pathway that may lead to differential effects across socio-economic groups</p> <p><i>Objectives:</i></p> <ul style="list-style-type: none"> • To identify existing theories, guidance, and frameworks that consider what, how, and why health care interventions may lead to differential effects across socio-economic groups • To consider the strengths and limitations of these theories • To identify key factors and mechanisms within the theoretical literature associated with what, why, and how interventions may result in differential effects across SES groups • To develop a theory-led meta framework to inform reviewers' understanding of what, how, and why health care interventions may lead to differential effects across socio-economic groups 	<ul style="list-style-type: none"> • 4 theories relating to complexity within systematic reviews and 16 health inequalities intervention theories informed the development of a meta-framework. • Factors relating to intervention, implementation, context and participant response were identified. • 7 key mechanisms were identified that may help to explain why interventions may have differential effects across different SES groups; ability to choose, ability to control, ability to perceive, ability to seek, ability to reach, ability to pay and ability to engage. • A single theory may be insufficient in helping reviewers to predict whether and how interventions may result in differential effectiveness across different socio-economic groups and in helping decision-makers and practitioners to assess the applicability of, and implement review findings. • The meta-framework offers a transparent, systematic, practical theory-led approach with which to consider socio-economic health inequalities in systematic reviews. 	2, 3, 4

¹ RQ= Research Questions (see table 7.1).

Table 7.5: Overview of Study 4

Study	Title	Aim and objectives	Key findings	RQ ¹
Study 4	Methodological challenges when developing meta-frameworks in evidence synthesis : a worked example of a socio-economic health inequalities meta-framework (see Chapter 6)	<p><i>Aim:</i> To contribute to the emerging science of the use of theory, framework construction and evaluation within systematic review methodology</p> <p><i>Objectives</i></p> <ul style="list-style-type: none"> • To address calls for further testing and refining of the “best fit” approach • To provide a greater insight into framework generation that is often missing from the methods section of published framework synthesis 	<ul style="list-style-type: none"> • Challenges in identifying theory to inform development of the meta-framework include; many theories not retrievable using the theory terms (‘MoTH’) suggested in the BeHEMOTH strategy, poor indexing of low-level theory in databases, testing the sensitivity of the search and adequacy of the scope. • Challenges in selecting theory to inform development of the meta-framework include; lack of a single theory addressing all factors and mechanisms associated with differential effects across different SES groups, knowing which theory to start with, variation in the extent to which theories contributed to framework. • Challenges in operationalising theory to inform development of the meta-framework include; inconsistencies in defining concepts across theories. • Challenges in evaluating theory to inform development of the meta-framework include; assessing whether the meta-framework is ‘fit for purpose’, assessing the contribution of theories. 	3, 4

¹ RQ= Research Questions (see table 7.1).

7.2 Extent to which review guidance assists systematic reviewers to incorporate socio-economic health inequalities (research question 1)

Several key findings emerged from the mapping review (see Chapter 3.5) and methodology review (see Chapter 4.5) on the use of programme theory that greatly influenced how I addressed the overall aim of this research. In particular, the findings informed both the rationale for adopting a meta-framework approach and the subsequent development and dissemination of the meta-framework.

While guidance documents for systematic reviewers are consistent and rich in detailing the rationale and approaches to incorporating health inequality considerations (e.g. (18, 67, 68)), the mapping review findings suggest that there is an ‘underlying assumption’ across all the guidance that reviewers understand the different ways in which an individual’s circumstances may result in differential effectiveness (see Chapter 3.6). However, findings from empirical research (61), as well as experiences of the Evidence Synthesis Team at Liverpool from receiving proposals that fail to acknowledge the impact on health inequalities (see Chapter 1.1.5) and my own personal experience, as someone who, at the start of this research was unfamiliar with health inequalities, (see Chapter 1.8) suggests that this is not necessarily true. This ‘underlying assumption’ is perhaps one reason why in the review guidance, there is a lack of detail on its practical application.

Existing review guidance suggests that logic models or programme theory can help (67, 68) in testing assumptions about health inequalities. However, there is no practical guidance, nor worked example(s) on how this could be applied across *all* systematic reviews. The methodology study findings demonstrate that systematic reviewers are using logic models and programme theory to inform considerations of health inequalities (see Chapter 3.5) but they are very much specific to the topic under review and it is unclear how they were developed. For reviewers who are not only unfamiliar with health inequalities and concepts of equity, but also with developing programme theories and logic models, the lack of practical guidance could be a major barrier to operationalising the guidance.

Therefore, the ‘underlying assumptions’ of reviewer familiarity with health inequalities, was a key finding of the mapping review that informed the development of the meta-framework in a number of ways. Firstly, the meta-framework had to take a broad perspective in exploring all the different ways in which socio-economic status may moderate intervention effectiveness. This is achieved by considering a broad perspective in relation to what factors and mechanisms associated with an intervention pathway (i.e. intervention type,

implementation, context, participation response) may lead to differential effects. In this way, I aimed to improve the applicability of the meta-framework in informing socio-economic health inequality considerations of differential effects in *any* systematic review.

My own understanding of health inequalities and interpretation of the review guidance in the mapping review also influenced how I addressed the overall research aim. As someone who was unfamiliar with health inequalities at the start of this research process I found that the review guidance lacked conceptual definitions which would have helped with my understanding of the topic area. This informed my decision to provide explicit definitions of the terminology used in the meta-framework (see appendix 4, A4.4). In a similar way, my lack of familiarity with health inequalities encouraged me to include multiple worked examples of the application of the meta-framework (see appendix 4, A4.6). The use of worked examples helped me to visualise the ways in which socio-economic status may moderate intervention effectiveness. This is not necessarily something new; the mapping review found some evidence of the use of examples in the review guidance documents (see Chapter 3.5.4). However, most guidance documents either provided examples relating to a single topic, or gave no examples at all. As I discussed earlier, “if, as Welch et al. (102, 'Discussion, para. 1') suggest, reviewers “need to have a deep understanding of the content area” to make judgements about likely differential effects, then single examples drawn from topic-specific reviews may not be the best way to demonstrate guidance application” (see Chapter 3.6, p.62). In addition, the use of multiple examples was also influenced by the findings of Doull et al., (93) who when evaluating their guidance on incorporating sex and gender analysis in systematic reviews found that reviewers wanted many examples.

The extent to which review guidance assists systematic reviewers in incorporating socio-economic health inequalities is reliant on reviewers being aware of its existence in the first place. The methodology review on the use of programme theory found that few (8/37) systematic reviews incorporating considerations of socio-economic inequalities in health referenced the review guidance (see Chapter 4.5.3). One reason for this may be that reviewers are simply unaware of the guidance (N.B. other reasons include the short interval between publication of the review guidance and the systematic reviews included in the study, the fact that a number of guidance documents were published during the period selected for the sample (2013-2016), or reviewers didn't know how to operationalise the guidance (see Chapter 4.6). However, there is no empirical evidence to support these assumptions. It is perhaps no surprise that of the eight systematic reviews that did reference the guidance, all referenced a single guidance document, the PRISMA-Equity extension (67,

68). The PRISMA guidance for systematic reviews is an internationally recognised and accepted standard for the conduct and reporting of systematic reviews, developed by internationally renowned systematic review collaborations and disseminated widely. It was essential therefore that in achieving the overall aim of this research that the meta-framework was disseminated to a wider audience. By publishing the meta-framework in a high-impact, topic relevant journal (*Journal of Clinical Epidemiology*) and by presenting it at national and international conferences and to members of the Campbell and Cochrane Equity Methods Group in Ottawa, Canada (see Chapter 7.8 and appendix 1), I aimed to raise awareness of this research. I acknowledge however, that there is still more to do in raising awareness and encouraging use of the meta-framework.

7.3 Whether, and how, reviewers operationalise guidance on conducting systematic reviews that consider health inequalities to develop an understanding of whether their review findings may have differential effects across different socio-economic groups (research question 2).

The findings of the methodology study (see Chapter 4.5) on the extent to which reviewers operationalise the review guidance on the conduct of health inequality focused systematic reviews informed the overall research aim in relation to the development of the meta-framework. It confirmed in my mind that systematic reviewers are starting to slowly move away from only considering if an intervention works towards a better understanding of ‘what works and how’, but that there was a need for a practical guidance in making these decisions more explicit within systematic reviews. This is an encouraging finding, since it will be less likely that reviewers will need convincing of the potential value of the meta-framework in helping them to identify firstly, ‘what’ factors and mechanisms are associated with differential effectiveness and secondly, ‘how’ factors trigger mechanisms that may then lead to differential effectiveness.

A further finding influencing the development of the meta-framework was the lack of reference to formal theory (e.g. intervention theories such as Whitehead’s (32) typology of policies and interventions) in informing programme theory. Furthermore, the mapping review also found that reviewers rarely use formal theory to underpin the development of review guidance on the conduct of health inequality focused systematic reviews. In providing a theoretical underpinning for the meta-framework, I hope to increase indirectly the use of formal theory to inform the conduct of systematic reviews.

Finally, the findings of the methodology study also indicate that the use of theory to inform systematic reviews is ad-hoc and fragmented, often used at the beginning and/or end of the review, rather than to inform the whole review process. These observations also agree with those of Kneale et al., (127) who conducted a similar study on the use of logic models in systematic reviews. Using theory to inform the *whole* review process can help strengthen the validity of the review findings when making decisions on applicability. In particular, in instances where there is a lack of evidence on differential effects across SES groups, theory can help avoid *post-hoc assumptions* and allowing for *a posteriori reasoning* on the likely impact on socio-economic health inequalities. This finding influenced my decision to develop a practical tool that could embed theory throughout the whole review process (see table 7.9).

7.4 How can we enable reviewers to consider what, why and how interventions may result in differential effects across different socio-economic groups? (research question 3)

All study findings (see Chapters 3.6, 4.6, 5.5, 6.5) fed into the decision-making process on how to enable reviewers to incorporate socio-economic health inequalities in systematic reviews. A meta-framework met the criteria for a practical, theory-led approach that would enable reviewers to embed theory throughout the whole review process (see Chapter 2.2.3). In offering a transparent approach to data extraction, analysis and synthesis, the meta-framework also adopts the principles guiding the conduct of systematic reviews (42, 67, 68). The rationale for selecting a meta-framework over other approaches is discussed in greater depth elsewhere. (see Chapter 2.2.3).

The findings of the mapping review and my wider background reading informed the construction of the meta-framework using two theoretical perspectives. In particular, my reading of the guidance documents in the mapping review and wider reading around the topic area brought to my attention complex theories of systematic reviews of complex interventions. Welch et al's., (102) plausibility algorithm designed to help reviewers predict whether relative differences in effectiveness are likely across disadvantaged populations, explicitly identifies factors relating to participant characteristics and implementation that may lead to differential effects across different SES groups. In my wider reading to inform the background for this research I noted an association between these factors in the plausibility algorithm and factors described in theories of complexity in systematic reviews

of complex interventions (intervention, implementation, context, participant response). Upon re-reading other review guidance included in the mapping review, I noted that these factors were also described in the review guidance as relating to differential effects, but were not necessarily explicitly identified as intervention, implementation, context or participant response factors.

Furthermore, the authors explain that one reason for the low reliability of the plausibility algorithm was “due to multi-component questions covering several factors, and potential confusion of access to health care, prognostic factors and treatment-covariate interactions...this study suggests a need to further refine these questions to improve understanding.” (102, ‘Discussion’). I saw the potential for theories of complexity in systematic reviews of complex interventions to distinguish between these factors and therefore refine the questions in the plausibility algorithm. Therefore, complexity theories of systematic reviews of complex interventions informed the skeleton of the meta-framework. An analysis of health inequality intervention theories then verified these factors as leading to differential effects across different SES groups. Consequently, the meta-framework (see figure 5.2) is able to distinguish between the different factors associated with differential effects across different SES groups.

In assessing the suitability of the theories to inform the meta-framework, it became clear early on that a single theory may not be sufficient in helping reviewers predict whether and how SES moderates intervention effectiveness. For example, some socio-economic health inequality theories lacked detail on factors relating to the intervention, implementation, context or participant response. Using a multi-theory approach therefore, aimed to ensure consideration of all the different ways in which socio-economic status may moderate intervention effectiveness. The use of multiple theories also helped strengthen the validity of the meta-framework in cases where factors were well supported across the theories. Conversely, factors appearing uniquely in a single theory may either be context specific or, perversely, offer added value by uncovering a perspective that would otherwise be missed.

Furthermore, the two theoretical perspectives used to inform the meta-framework (i.e. complexity theories of systematic reviews of complex interventions and health inequality intervention theories) are not mutually exclusive. SES can be thought of as a characteristic of a complex intervention in that it is a characteristic of an intervention’s causal pathway which include “Multiple mediators and moderators of effect such as the background characteristics and environment of the patient” (117, ‘Table 1’). Whilst complexity theories of systematic reviews of complex interventions helped to identify factors associated with ‘what works for

different SES groups' they did not help to answer 'under what circumstance', i.e. they did not provide any details on the mechanisms. Since mechanisms are context specific, these could only be informed by the health inequality intervention theories.

7.5 What methodological challenges arise in developing a theory-led meta-framework to inform socio-economic health inequality considerations in evidence synthesis? (research question 4)

In developing a meta-framework, I adhered to the guidance on the use of frameworks to inform 'best fit' framework syntheses (80-82) (see Chapter 2.2.3). However, the guidance only includes the development of meta-frameworks from a single theoretical perspective. Therefore, in looking to the wider literature to inform the development of a meta-framework using two theoretical perspectives, I searched on the term 'meta-framework' in PubMed. Only 10 studies were retrieved (as of Nov 2018), none of which discuss the development of a meta-framework in any great depth. One study (83) was found that discussed best-fit framework development informed by two theoretical perspectives, however, there was no detail on how the two theoretical perspectives were practically integrated into a single meta-framework. Limited advice on developing meta-frameworks is available. As far as I am aware therefore, this is the first study to report in detail on the development of a meta-framework informed by two theoretical perspectives by using one theoretical perspective (theories of complexity in systematic reviews of complex interventions) to inform the scaffold of the meta-framework and the other theoretical perspective (health inequality intervention theories) to validate and add context to the scaffold. With little detail in the literature to guide me, I felt it was important to document the challenges and outline my methods for overcoming them to assist others looking to development similar meta-frameworks and to advance the methodological literature on the development of meta-frameworks. In undertaking the development of the meta-framework, four key challenges relating to how frameworks are identified, selected, consolidated and reconciled were identified (see Chapter 6.5). These challenges are discussed in greater detail elsewhere (see Chapter 6.5), therefore I will now highlight how some of these challenges informed the development of a meta-framework.

Difficulties in the retrieval of theory to inform the meta-framework arose because of: authors not explicitly labelling their work as 'theory', a lack of indexing terms for describing low-level theory and theories being published during the meta-framework development process.

Whilst this highlighted the importance of supplementary and opportunistic searching in the retrieval of theory, it also meant that not all theories were identified at the start of the process. This meant that an iterative approach to categorising and coding of factors associated with differential effects across SES was required in which all theories were constantly revisited, and categories and codes amended in light of the emergence of new factors.

In addition, through trial and error, it became clear that when building the meta-framework, it was easier to start with theories characterised by an explicit framework or typology. Not only could they be mapped directly into a meta-framework, but subsequently, they could be used to code and categorise theories where in-depth analysis would otherwise have been required to surface the themes/sub-theme. However, some theories with explicit frameworks or typologies were only identified once the development process was underway. As a result, when a new explicit framework or theory was identified during the building of the meta-framework, all theories had to be revisited, re-categorized and recoded.

Perhaps the biggest challenge of all was ensuring that concepts translated across theories. Multiple issues arose relating to both terminology and meanings; i) terms were different and had different meaning, ii) terms were different and had the same meaning, iii) terms were the same and had the same meaning, iv) terms were the same but had different meaning, v) terms that were the same but had overlapping meaning and vi) terms that were not explicitly defined or conceptualised (link to table on reciprocal translation). For example, socio-economic status has been defined in at least two ways; (i) to describe an individual's income/educational/occupational status (114) and ii) to describe income status alone (70). Clearly defined concepts and factors therefore are essential for meta-framework operation (186). This is especially important when considering what factors may trigger mechanisms of action since, the mechanisms, ““ability to perceive” and “ability to engage” are more likely to be mediated by educational status, whereas “ability to pay” is more likely to be mediated by income status.” (see Chapter 5.5, p.118; (88, p.91).

In addition, it was not always possible to translate all concepts across the 20 theories used to inform the development of the meta-framework. For example, there is no agreed definition of ‘context’ across the theories. In this instance, the definition of context as incorporating both personal and environmental characteristics was based by the wider literature on health inequalities, complex interventions and realist methodologies (See table 7.6). By using the wider literature relating to both theoretical perspectives that informed the meta-framework and the underpinning realist informed epistemology of the meta-

framework it was still possible therefore to ensure that the 'context' translated across theories, albeit at a broader level.

Table 7.6: Defining 'context' for the meta-framework

<p>The definition of context for the meta-framework was informed by the following:</p> <ul style="list-style-type: none">• Wider literature on health inequalities: The WHO define contextual factors as “contextual factors are external environmental factors (for example, social attitudes, architectural characteristics, legal and social structures, as well as climate, terrain and so forth); and internal personal factors, which include gender, age, coping styles, social background, education, profession” (212, p10).• Wider literature on complex interventions One of the theories used to inform the meta-framework, the CICI framework for use in systematic reviews define context as including for example, “Social or socio-economic status attributed to education, income, occupation” ...“gender, age, ethnicity” (186, 'Additional file').• Wider literature on realist methodologies In Dalkin et al's., paper on 'What's in a mechanism', the authors illustrate that intervention resources are introduced into a context, as such distinguishing between the resources that the intervention provides and the pre-existing context: “Intervention resources are introduced in a context, in a way that enhances a change in reasoning. This alters the behaviour of participants which leads to outcomes”. In this way context is defined as anything that existed before an intervention is introduced – i.e. an individual's SES (213, '2 Our way forward').
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In redefining concepts and constantly revisiting theories to re-categorise and recode, I realised that the value of explicitly defining concepts in the meta-framework lay not only in helping those unfamiliar with health inequalities to understand the terminology, but also in helping reviewers to interpret the meta-framework in a consistent manner during data extraction. In addition, as theories were not all identified at the start of the process, some definitions were amended slightly throughout the development process. In these instances, it was necessary once again, to revisit all theories, re-categorise and recode. In describing the

decision-making process involved in the 'reciprocal translation' of definitions across theories informing the meta-framework, and providing worked examples addressing the problems encountered in operationalising definitions, I aimed to enhance the transparency of the 'reciprocal translation' process. All of the issues highlighted above therefore, meant that the meta-framework development process was very time intensive.

7.6 Contribution to knowledge

This research involved the integration of subject, theoretical and methodological perspectives. I believe that my research contributes to the current state of knowledge on advancing methodologies in incorporating socio-economic health inequalities considerations in systematic reviews.

7.6.1 Builds on review guidance to inform health inequality considerations in systematic reviews

This research addresses calls for further methodological research to identify factors associated with differential effects and to identify how socio-economic factors may moderate intervention effectiveness (20). In particular, it builds on previous attempts to develop tools to help systematic reviewers to consider health inequalities (18, 102). For example, the meta-framework refines the plausibility algorithm (102) questions further by identifying and distinguishing between factors and mechanisms associated with intervention types, implementation, context, and access. As far as I am aware, the mapping review (see Chapter 3, (86)) is the first study summarising the range of guidance available for conducting health inequality focused systematic reviews. It is also the first study detailing the guidance available for informing socio-economic health inequalities at various stages of the systematic review process.

7.6.2 Provides a theory-led practical approach to operationalising review guidance on conducting systematic reviews that consider health inequalities

The mapping review of guidance to help reviews conduct systematic reviews that consider health inequalities identified a gap around the lack of practical help for reviewers looking to adhere to the guidance in using theory to inform systematic reviews that consider health

inequalities (see Chapter 3.6). The meta-framework (see figure 5.2) is a first attempt at offering a practical tool to help reviewers operationalise the review guidance on using theory to identify factors and mechanisms associated with differential effects across SES groups.

7.6.3 Advances systematic review methodologies

In describing in detail, an approach using two theoretical perspectives (theories of complexity in systematic reviews of complex interventions and health inequality intervention theories) to inform the development of a single meta-framework, this research contributes to the emerging science of the use of theory, framework construction and evaluation within systematic review methodology. Previous examples of the meta-framework approach have only considered a single theoretical perspective (e.g.214).

When attempting ‘reciprocal translation’ of themes across theories in the meta-framework it was important to ensure clarity in terminology and meanings. In addition to the four issues identified by Booth et al. (37, see table 9.3 ‘a conceptual grid for reciprocal translation’, p.231) I identified an additional two issues (see table 7.7, v-vi).

Table 7.7 Extending Booth et al’s., (37, table 9.3 p.231) conceptual grid for reciprocal translation (Extension items in bold)

i)	Neither terms nor ideas/concepts match
ii)	Terms match but refer to different ideas/concepts
iii)	Ideas/concepts match but assigned different terms
iv)	Both terms and ideas/concepts match
v)	Terms explicit but not conceptualised
vi)	Terms match but ideas/concepts only overlapped.

7.6.4 Advances information retrieval techniques in identifying theory

In modifying the published framework, BeHEMOTH (207) designed to identify theories in the literature to retrieve relevant theories to inform the meta-framework, this research also

contributes to knowledge within the information retrieval field. Specifically, it contributes to the evidence base on identifying low-level theory.

7.6.5 Demonstrates the role of theory in informing systematic review guidance development

The mapping review found that only five of the 20 review guidance documents on the conduct of systematic reviews that incorporate health inequalities had theoretical underpinnings. Using theory to inform guidance development helped to address one of the limitations of the plausibility algorithm (102) designed to help reviewers to predict whether differences in relative effects are likely between lower and higher socio-economic groups. The authors suggest that the content of the questions in the algorithm was confusing, suggesting that they were multicomponent covering several factors and therefore required additional refinement. Using two theoretical perspectives, (theories of complexity in systematic reviews of complex interventions and health inequality theories to inform the meta-framework unpicked these multi-components (intervention, implementation, context, participant response, access). Theoretical input also identified specific factors associated with these multi-components. The findings of this research therefore demonstrate not only the value of theory in informing systematic review guidance development, but also the value of considering theories, in this case, theories of complexity in systematic reviews of complex interventions, not directly associated with the topic under review (i.e. socio-economic health inequalities).

7.6.6 Advances the role of theory in informing the conduct of systematic reviews

The theory-led meta-framework (see Chapter 5, (88)) addresses calls in the health inequalities and systematic review methodological literature for the use of theory to inform action on health inequalities (32, 50, 68, 131, 215). As far as I am aware, this research was the first to explore the use of programme theory of in socio-economic health inequality focused systematic reviews, (see Chapter 4, (87)) and the first time that socio-economic health inequality intervention theories have been considered in a meta framework within the wider context of complex intervention theories. In doing so, I hope this research makes the use of theory more accessible to systematic reviewers whilst at the same time, encouraging reviewers to engage with, and build upon theory throughout the whole review process.

7.6.7 May improve usefulness of systematic reviews in informing practice and policy

In encouraging reviewers to consider ‘what works, for disadvantaged populations and how’, the meta-framework addresses calls for further research on how to make judgements about applicability and how to consider the role of context at different levels (20). In cases where evidence on the impact of socio-economic health inequalities is lacking, the meta-framework may provide a structure for reviewers to hypothesise whether it is likely that the review findings are applicable to disadvantaged populations. In doing so, it may allow reviewers to make a decision on whether it is likely that an intervention may indirectly widen or narrow socio-economic health inequalities. As a result, the meta-framework has the potential to improve the usefulness of systematic reviews in informing policy and practice.

7.7 Strengths and limitations

Throughout my research I have highlighted in-depth the strengths and limitations (see table 7.8). This in itself is a strength of my research. As a researcher, I believe it is vital to argue where the strengths lie in your work in order to increase the validity of the conclusions and to allow others to assess the applicability of your work. Conversely, and perhaps more importantly, acknowledging the limitations is an acceptance of the fact that undertaking research, regardless of how it is done, is never straightforward and will never produce a ‘gold-standard’ piece of work (by which I mean, a piece of research that will be 100% robust and applicable in all circumstances). Our job as researchers is to strive to *minimise* bias whilst accepting that it will be impossible to eliminate bias completely from our research. Therefore, limitations however small, are likely to be present.

Table 7.8: Summary of strengths and limitations reported through this research

Study (chapter)	Strengths	Limitations
Study 1 (see Chapter 3,(86))	<ul style="list-style-type: none"> • Details the guidance available for informing socio-economic health inequalities at various stages of the systematic review process • In the absence of a validated search filter, search terms were informed by those used in a published Cochrane methodological review of health inequality focused systematic reviews • Second information professional checked the accuracy of the search strategy • Targeted searching techniques were adopted (scanning of relevant systematic review organisational websites, reference checking and contacting known experts in the field) 	<ul style="list-style-type: none"> • Did not seek to critique the individual items/questions in the guidance or recommend one guidance over another • Involving only one person in study selection, data extraction and synthesis may have introduced selection bias • Limiting to English language publications when it is acknowledged that other languages, such as Spanish, may offer extensive coverage of literature regarding inequalities may have introduced publication bias • Only a small number of key databases in health were searched • No formal quality appraisal of the review guidance was undertaken
Study 2 (see chapter 4, (87))	<ul style="list-style-type: none"> • Included full-text searches rather than simply undertaking title and abstract searches alone • Full-text screening took place of records in which SES was not mentioned in the title or abstract • Included studies that were either explicit or implicit in use of programme theory • Two reviewers independently extracted the data on programme theory 	<ul style="list-style-type: none"> • Did not seek to examine the quality or richness of the programme theory used in systematic reviews nor to establish the fidelity or utility of use of theory • Short interval between the publication of guidance and included studies may result in a more modest indication of the extent to which reviewers are operationalising the PRISMA equity guidance • Studies in which it was not possible to separate out SES analysis were excluded, possibly missing relevant theories • Did not assess other contributions to programme theories (review team/stakeholder contributions) • Only included studies in which reviewers were explicit in reporting programme theory reported • Did not examine the fidelity, utility or richness of programme theory

Study (chapter)	Strengths	Limitations
Study 3 (chapter 5, (88))	<ul style="list-style-type: none"> • Multiple theories incorporated in the meta framework ensured all factors associated with the intervention pathway (i.e., intervention, implementation, context, participant response) were identified. • Quality of the meta-framework assessed by considering the source of the theories, by assessing the extent to which each theory contributed to the meta-framework and by testing the initial themes and sub-themes derived in complexity theories of systematic reviews of complex interventions • Makes the use of theory more accessible to systematic reviewers, encouraging them to engage with and build upon theory throughout the review process. • Meta-framework can be used as a tool to inform the whole review process (e.g. inform decisions on a priori analyses, act as a data extraction tool, inform judgements of applicability, particularly in the absence of review evidence) • Acknowledges the moderating effects of other health inequalities as defined in PROGRESS-Plus (O’Neill et al., 2014). • Two authors independently generated and checked the themes/sub-themes. 	<ul style="list-style-type: none"> • Quality of the theories informing the meta-framework not assessed • Additional testing and validation of the meta-framework is required to ensure it is fit for purpose (see below) • Does not attempt to incorporate specific behaviour change theories but recognizes that such theories can help inform the interpretation of the meta-framework • It is beyond the scope of this study to explore all potential mechanisms and pathways to effectiveness
Study 4 (chapter 6)	<ul style="list-style-type: none"> • Transparent approach in; i) identifying relevant theories using the BeHEMoTh framework (82) ii) outlining derivation of definitions to inform the meta-framework, iii) merging multiple theories to generate a single meta-framework, iv) deriving and translating themes and sub-themes in the meta-framework • A meta-framework informed by two theoretical perspectives offers a unique opportunity to test the initial themes and subthemes derived by one theoretical perspective (in this instance, theories of complexity of systematic reviews of complex interventions) against the other (health inequality intervention theories). 	<ul style="list-style-type: none"> • Meta-framework not generated as an output from the result of a comprehensive systematic review • Outstanding challenges include; (i) the consistency with which the concepts in the meta-framework are understood and operationalised by different coders, (ii) the transferability of the framework in promoting comparison of results across studies included in the synthesis, and (iii) the ability of the framework to stimulate new theoretical development (82)

In considering the research as a whole, the strengths and limitations of this research relate both to the topic (socio-economic health inequalities) and the methods employed.

7.7.1 Strengths and limitations relating to the topic area – socio-economic health inequalities

At the start of this research, it is fair to say that I was unfamiliar with the topic area that formed the focus of this research, i.e. socio-economic health inequalities. For me therefore, the biggest challenge in undertaking this research was the fact that I was researching an area that was largely new to me (see Chapter 1.8). One may see this lack of knowledge on the topic areas as a limitation. In hindsight however, this unfamiliarity was probably one of the main strengths of this research. Because of my unfamiliarity with socio-economic health inequalities, I endeavoured to ensure that the meta-framework was transparent and explicit in providing my audience with clear definitions and worked examples to help those who are also new to this topic area. Given the inconsistencies in definitions applied across many of the theories used to inform the meta-framework (see Chapter 6.4.2), I felt it was even more important to provide clear definitions in order to ensure consistency when using the meta-framework to inform data extraction in systematic reviews. Therefore, as my prior knowledge was minimal, in epistemological terms I am relatively unbiased.

7.7.2 Strengths and limitations relating to the methods

One of the key strengths of the methods used in this research is the use of published theory to inform the meta-framework. I focused on theory specifically as I wanted to ensure that the meta-framework can inform decisions on ‘what works for disadvantaged populations and under what circumstance’ at the broadest level, i.e. not specific to a single intervention. Therefore, reviewers would need to engage with the wider (and potentially more generalisable) theoretical literature (82). One of the advantages of using theory to inform systematic reviews is that it has the potential to enhance applicability assessments by ensuring “a posteriori reasoning rather than post hoc assumption of how interventions may work”. This avoids the need to introduce evidence to the discussion in an unsystematic way (i.e. does not meet review inclusion and exclusion criteria) that may be of poor quality and have little direct relevance to the topic under review (182) and therefore, avoiding misleading conclusions (50). Furthermore, in using theories of complexity of systematic reviews of complex interventions the meta-framework ensures that reviewers to consider context and

implementation factors simultaneously with intervention effectiveness. In this way, the meta-framework aims to increase the usefulness of systematic reviews in informing policy and practice (199).

Another key strength derives from my information specialist background (see Chapter 1.7). The evidence base underpinned all of my research and I undertook literature searches for published, unpublished and grey literature and utilised my contacts with experts in the field to identify additional relevant literature. I considered unpublished and grey literature to be particularly important to locate due to the very recent methodological developments in this area. In this way, I aimed to minimise publication bias (42, 106). My skills as an information specialist meant that I could easily employ search techniques to ensure my searches were sensitive enough so as not miss anything. However, having spent many years undertaking literature searches as part of my role as a Clinical Information Specialist, I was mindful of how easy it is to make an error in conducting literature searches. Any error, however small in a search strategy, can have significant consequences for the retrieval of relevant studies therefore; I ensured that a second information professional checked my searches. My knowledge of information retrieval techniques meant that I was already aware of the targeted BeHEMoTh search technique to identify theory (82). Since I was working in a newly emerging area of interest, I set up search alerts to identify new studies as my research unfolded. In accordance with my positionality of providing a transparent approach in the conduct of my research, I ensured that all of my search strategies are available for others to scrutinise.

Although developed specifically for systematic reviewers, the meta-framework may be applicable for use in informing other research designs. However, I recognise that I have yet to test the applicability of the meta-framework in informing other research designs (see Chapter 7.10.2). Finally, one of the benefits of publishing my work as I went was the valuable feedback I received from peer reviewers on my submitted publications. This enhanced the validity of the meta-framework since it also involved expert input from peer reviewers and may therefore, also be seen as a strength.

Three limitations of this research relate directly to the development and evaluation of the meta-framework. Firstly, the meta-framework requires additional testing, validating and refining. It was beyond the scope of this research to fully test and validate the meta-framework. However, I aim to continue this work as part of my post-doctoral studies. Secondly, only published theories informed the development of the meta-framework. However, I fully recognise the contribution of other forms of evidence, for example

supplementary evidence, key informant experience (126) in informing programme theory in systematic reviews. For example, the value that key informants may play in moving the meta-framework from generalisable theories of how and why *any* interventions may work for disadvantaged populations to specific theories on how and why *a particular* intervention may work for disadvantaged populations. I plan to explore the contribution of these forms of evidence to the meta-framework as part of my post-doctoral research. Finally, meta-framework development does not follow a linear process and consequently, is very time intensive. However, the time taken to develop a meta-framework should be offset against its potential to save time when analysing data within evidence synthesis (200, 201).

It is also worth noting here why I chose to focus on theory, rather than other types of evidence in informing the development of the meta-framework. A previous attempt to assist reviewers in considering health inequalities in systematic reviews used data gathered from a literature review, key informant interviews and methodology studies to develop a plausibility algorithm to predict whether differences in relative effects were likely for disadvantaged populations (102). However, testing of the plausibility algorithm revealed low reliability with recommendations of further refinement of the questions. Raters involved in testing the algorithm used theory to inform their decisions, but the authors do not expand further on this. In discussing the influence of context on improvement success, Øvretveit (216) suggest that 'observer theories' still need to be supported with the theoretical literature. However, in developing the plausibility algorithm, the authors (102) do not refer to the use of published theory. Therefore, I felt there was a gap in exploring the value of theory to inform review guidance on the conduct of systematic reviews that consider health inequalities.

Finally, one minor limitation of the meta-framework is that it does not distinguish between factors and mechanisms associated with relative effects from those associated with absolute effects. Rather, the meta-framework provides a holistic overview of differential effects from the perspective of disadvantaged populations.

7.8 Dissemination of knowledge

The results of this research are relevant to systematic reviewers who are looking to examine the effectiveness of health interventions and who may be unfamiliar with health inequalities, policy and decision makers and those funding reviews. In addition, the results of this research will also be relevant to those developing meta-frameworks for use in evidence synthesis. As health and social care reforms, quality and efficiency improvements are expected to make

appropriate use of the best available relevant literature, a user-friendly framework that ensures that the evidence syntheses used are equity sensitive will be increasingly important to prevent distortion of investments to further disadvantage the most vulnerable groups.

In accordance with my positionality (see Chapter 1.8) and the fact that the methodology review on the use of programme theory identified few systematic reviews that referenced the health inequality review guidance (see Chapter 4.5), I disseminated my research findings throughout the research process. I presented my findings at local, national and international conferences (see appendix 1). Furthermore, in choosing to present at both public health focused and methodology focused conferences, I ensured that I disseminated my research amongst subject and methodological experts. I also travelled to Ottawa, Canada to discuss with, and present my research to, members of The Campbell and Cochrane Equity Methods Group. Finally, the fact that I published three of my studies in the peer-reviewed literature also demonstrates my contribution to knowledge (86-88).

7.9 Implications for practice

This research proposes the following implications for practice relating to the dissemination of the meta-framework and the use/misuse of the meta-framework to inform socio-economic health inequalities in systematic reviews and the wider implications relating to information retrieval practice and research in general.

7.9.1 Raising awareness of the meta-framework

Due to a large interval between the publication of review guidance on the conduct of systematic reviews that incorporate health inequality considerations and the updating of systematic review guidance, the omission of such guidance from systematic review handbooks places a greater emphasis on guidance authors themselves to raise awareness of the existence of such tools to encourage greater uptake. The methodology review findings therefore also agree with calls from Welch et al., (68) for increased awareness of health inequality review guidance amongst reviewers and journal editors.

7.9.2 Use/misuse of the meta-framework to inform socio-economic health inequalities in evidence synthesis

The meta-framework offers reviewers a practical approach to addressing the underuse of theory to inform evidence synthesis. It does this by encouraging reviewers to incorporate theories of how and why interventions may or may not work for different socio-economic groups during different stages of review process (see table 7.9). It requires reviewers of effectiveness studies to move from a positivist stance in considering 'what works' to a more realist informed way of thinking to consider 'what works, for different socio-economic groups and under what circumstance'.

Whilst it is beyond the scope of this research to validate the meta-framework in a worked evidence synthesis, tables 7.10 and 7.11 present a hypothetical worked example of how the meta-framework can help to inform socio-economic health inequality considerations in a systematic review of interventions to increase uptake of mass cancer screening programmes. In particular, the meta-framework can be used at the early scoping stage of the review process to prompt discussion amongst the review team and stakeholder involvement to clarify whether the problem under review is unequally distributed among different socioeconomic groups, why we might expect differential effects (i.e. mechanisms) and what factors may lead to differential effects (see table 7.10 column 2 'Examples'). Starting with the mechanisms, the framework can help to generate discussion around whether it is likely that the factors specified in the meta-framework associated with the intervention, implementation, context and participant response may trigger the mechanisms (see table 7.10, column 3 'Factors associated with differential effects'). Not all mechanisms and factors may/need be considered relevant.

Decisions on which factors may be considered important for knowledge translation (i.e. improving the 'usefulness' of the review findings) can then be prioritised through further discussion with the review team and stakeholders. This can then inform decisions on the focus of the review question (for example, whether to have an equity focus, or incorporate considerations of equity within a broader focus), the type of data to collect in the review and potential analysis/subgroup analysis. For example, the relevant factors selected may be used within a framework synthesis or as data extraction fields in a standard, conventional systematic review. These are all potential ways in which the meta-framework may be used to inform evidence synthesis. Further testing in full evidence synthesis is required.

Table 7.9 Potential use of the meta-framework to inform the review process (steps in review process based on Boland et al., (42, p.9))

Steps in review process	Use of Meta-framework	Further elaboration
1: Planning your review 2: Performing scoping searches, identifying the review question and writing your protocol	Informs initial decisions on whether it is likely that interventions may lead to differential effects across different SES groups and therefore whether to incorporate socio-economic health inequality considerations in systematic reviews	In consultation with stakeholders, reviewers can use the framework to identify and prioritise <i>a priori</i> , potential mechanisms and factors associated with differential effects. Can help refine the review question (e.g. whether to have a socioeconomic health inequality focus, or a broader question incorporating socioeconomic health inequality considerations)
3: Literature searching	Uses an adapted version of the BeHEMoTh searching approach to identify low-level programme theories	
4: Screening titles and abstracts	May help to inform inclusion criteria for screening	In refining the review question, the framework can inform considerations of whether to include SES considerations as part of the inclusion criteria
5: Obtaining papers		
6: Selecting full-text papers	May help to inform inclusion criteria for screening	
7: Data extraction	Offers a transparent template for data extraction	Data can be extracted on the factors identified in the framework as being associated with differential effects across SES
8: Quality assessment		
9: Analysis and synthesis	Informs <i>a priori</i> analysis of which factors are associated with differential effects and identify possible explanatory factors (i.e. mechanisms) for why some interventions may widen, narrow or have no impact on the health inequality gap. Use of a framework to code and categorise themes also offers greater transparency in reporting methods on how the themes to inform the synthesis are derived. Where data does not map directly to the framework, the approach is flexible enough to allow the generation of new themes to be added to the framework using thematic analysis. Strengthens the validity of the review by presenting findings based on theoretical <i>a posteriori</i> reasoning rather than on a post hoc assumption of how interventions may work. In other words, it independently substantiates empirical findings and therefore offers a form of triangulation.	Relevant factors selected may be used within a framework synthesis or as data extraction fields in a standard, conventional systematic review and/or used in subgroup analysis
10: Writing up, editing and disseminating	Addresses calls for the inclusion of health inequality considerations in evidence synthesis. Address calls for reviews to consider ‘what works, for whom, under what circumstance’	

Table 7.10: Using the meta-framework to inform SES considerations in a systematic review of interventions to increase uptake of mass cancer screening programmes

Mechanism (why might we expect differential effects?)	Examples (via discussions with review team, wider PPI or supported by empirical evidence)	Factors associated with differential effects (Potential data to extract in the review)
Ability to perceive	Lower SES groups may be less likely to underestimate their risk of cancer, be less aware of their risk of cancer (e.g. hold misconceptions that a screening test is not applicable if you are not experiencing symptoms of cancer), or less aware of the benefit of screening for earlier cancer diagnosis and treatment	<ul style="list-style-type: none"> • Education • Type of component – Education • Delivery mechanisms – Degree of tailoring • Participant response – knowledge • Participant response – health literacy
Ability to seek	Higher SES groups may be more likely to visit their GP early in the cancer diagnosis pathway and therefore, are more likely to be referred for screening	<ul style="list-style-type: none"> • Education • Mode of delivery – direct contact
Ability to reach	Lower SES groups may experience difficulty physically getting to screening appointments due to poor transportation or lack of convenient appointment times (as they may be in low paid work and cannot afford to take time off work, or have family commitments)	<ul style="list-style-type: none"> • Occupation • Setting • Timing and duration • Place of residence • Geography
Ability to pay	<p>Lower SES groups may be less likely to afford to travel, or pay for parking to attend for screening</p> <p>Greater disparities amongst lower SES groups may be seen in countries other than the UK with different healthcare systems (fee-paying)</p>	<ul style="list-style-type: none"> • Income • Setting • Income • Delivery mechanisms – cost to recipient • Geography • Funding

Mechanism (why might we expect differential effects?)	Examples (via discussions with review team, wider PPI or supported by empirical evidence)	Factors associated with differential effects (Potential data to extract in the review)
Ability to engage	<p>Lower SES groups may be less likely/able to read information provided</p> <p>Personalised reminders may be more effective in increasing uptake among lower SES groups</p> <p>Combined or multiple interventions may be more effective in lower SES groups compared to a single intervention</p> <p>Lower SES groups may be more embarrassed or fear attending screening therefore the method of screening may need to also be acceptable to these groups.</p>	<ul style="list-style-type: none"> • Education • Type of component - Education • Mode of delivery • Degree of tailoring • Dose and intensity – No. of active components • Education • Participant response – embarrassment, fear • Dose and intensity – No. of behaviours targeted
Ability to control	<p>Lower SES groups have lower incidence of cancer, but higher rates of mortality as they are less likely to attend for screening. If the uptake of mass screening is uniform across different socio-economic groups, lower SES groups are likely to gain extra benefit.</p>	<ul style="list-style-type: none"> • Epidemiology
Ability to choose	<p>Screening is an intervention which relies on the individual to adopt a voluntary behaviour change to attend. Interventions which are voluntary are less likely to be effective in people of lower socioeconomic status.</p>	<ul style="list-style-type: none"> • Type of behaviour change

Table 7.11: Summary of factors associated with differential effects across SES groups in a systematic review on interventions to increase uptake of mass cancer screening programmes

Context	<p><i>Personal</i></p> <ul style="list-style-type: none"> • Education • Income • Occupation • Place of residence <p><i>Environmental</i></p> <ul style="list-style-type: none"> • Epidemiology • Geography • Funding
Intervention	<ul style="list-style-type: none"> • Intervention type - Type of component (education), Type of behaviour change (voluntary) • Timing and duration • Dose and intensity – No. of active components, No. of behaviours targeted
Implementation	<ul style="list-style-type: none"> • Delivery mechanisms - Degree of tailoring, cost to participant • Setting • Mode of delivery – Direct contact
Participant response	<ul style="list-style-type: none"> • Intellectual – knowledge, health literacy • Emotional - fear, embarrassment

In using the meta-framework to answer questions such as why interventions work or not, for whom and in which contexts, reviewers will need to draw on a broader range of research, both quantitative and qualitative (44). This is particularly true for gaining an understanding of relative differences. Evidence for assessing mechanisms, for example the acceptability of an intervention, may come from experimental and nonexperimental evaluations, as well as qualitative research (51). The meta-framework therefore promotes a mixed-methods approach to systematic reviews.

Whilst the meta-framework aims to overcome underuse of theory to inform socio-economic health inequality considerations in systematic reviews, it is also important to avoid superficial use and misuse of the meta-framework (217). Birken et al., (217) explain that superficial use of frameworks occur when researchers cite the framework in the background or discussion sections but do not use the framework to inform data collection, analysis or reporting of the findings. This research confirms these observations; the study on the use of programme theory in systematic reviews found theory not to be integrated throughout the review

process and that reviewers were more likely to use theory in an ad-hoc way at the start (introduction) or end (discussion) of a review (see Chapter 4.5.6). As outlined above (table 7.9), the meta-framework encourages reviewers to adopt a theory-led approach by using the meta-framework throughout the review process in order to enhance the validity of the review findings. Thus, the meta-framework encourages reviewers to avoid superficial misuse of theory to inform evidence synthesis.

Misuse of the meta-framework may arise if reviewers attempt to apply it in a rigid way, i.e. look to incorporate only those factors and mechanisms highlighted in the meta-framework. A flexible approach is required to consider additional factors and mechanisms that may lead to differential effects of interventions across different SES groups. Given that the meta-framework only looks to identify factors and mechanisms at the broadest level, it is likely that reviewers will need to consider additional factors and mechanisms specific to the type of intervention under review (see Chapter 5.5).

Reviewers will also need to decide *what* factors of the intervention, implementation or context to include and whether or not to consider mechanisms of action. One would not expect reviewers to examine every factor in the meta-framework. As Doull et al., (93, 'Discussion', para 3) argue, the extent to which sex and gender analysis should be incorporated in systematic reviews depends upon what is "appropriate and/or feasible for that question". Similarly, the authors of the PROGRESS-Plus framework (70, p.62) argue that it is "not intended to encourage data dredging but to identify the most important factors that drive inequities in health". The same reasoning also applies here when considering the extent to which factors in the meta-framework should be incorporated in systematic reviews. Indeed, further challenges arise for the reviewers when looking at to incorporate large numbers of subgroup analyses that are beyond the scope of this thesis (e.g. the risk of spurious inferences resulting from underpowered subgroup populations) and which are highlighted and dealt with in more detail elsewhere (93, 218, 219). Prioritisation of factors and mechanisms can take place during the initial stages of the review planning in consultation with the review team and stakeholders.

The findings of this research do not intend to dictate that all systematic reviewers should *incorporate* considerations of socio-economic health inequalities in every review. Rather, it supports an argument for all reviewers to consider the *potential* for their findings to reduce or increase health inequalities and provides them with the tools to make explicit *what* they should consider when anticipating differential effects across SES. This is an argument also echoed by Cochrane and Campbell Collaborations who have called for the effects of

interventions on SES health inequalities to be *considered* by systematic review authors (39, 90). The potential consequences of ignoring differential effects of interventions across different SES populations are supported by evidence highlighting that interventions shown to be effective in improving the health of a population may actually benefit higher SES groups more than lower SES groups, thereby widening the health inequalities gap (21-23).

Neither is it the aim of this research to dictate *how* systematic reviewers should incorporate considerations of SES health inequalities in their analysis. For example, if differential effects across SES populations are shown to potentially exist, then it wouldn't necessarily follow that an SES health inequality *focused review question* is therefore required. Making inequalities the focus of the review question is just one way to incorporate such considerations in systematic reviews (93). Indeed, Welch et al (68, p.5) highlight two categories of systematic reviews that incorporate health inequality considerations to different extents; 1) those that assess effects of interventions targeted at disadvantaged or at-risk populations. These may not include health inequality outcomes but by targeting disadvantaged populations will reduce inequalities; 2) those that assess effects of interventions aimed at reducing social gradients across populations or among subgroups of the population. Included within this category are systematic reviews that do not have a health inequality focused but where it is important to consider health inequalities.

Within these systematic review categories, reviewers may choose to assess the impact on socio-economic health inequalities in different ways depending upon the type of data. For example, a Cochrane methodological review of systematic reviews assessing effects on health inequalities identified both descriptive and analytical approaches (e.g. descriptive reporting and analysis of effects, subgroup analysis, regression, or applicability assessment) (Welch et al., 2010). The meta-framework does not intend to dictate what methodological approach *should be adopted* in the assessment of socio-economic health inequalities. At the same time however, I recognise that the meta-framework *can* inform hypothesis testing, analysis and synthesis within a 'best fit'-framework synthesis approach.

7.9.3 Wider implications for information retrieval practice

The findings of this research propose four recommendations for information retrieval practice. Firstly, adapting the BeHEMOTH framework by adding terms such as 'typolog*' or 'taxonom*' or 'algorithm*' to the theory terms ('MoTh') suggested in the BeHEMOTH strategy, i.e. 'model*' or 'theor*' or 'concept*' or 'framework*' may help in retrieving relevant low-level

theories. Secondly, that ‘opportunistic and supplementary searching’ (i.e. identifying theories used to inform topic-relevant systematic reviews, full-text searching and, in particular, contact with experts) in the development of frameworks to inform evidence synthesis should be considered neither opportunistic nor supplementary. Instead it constitutes an integral component of a systematic, iterative approach when identifying theory to inform evidence synthesis. Thirdly, and specifically for those developing frameworks in new and emerging areas, this research highlights the need to set up search alerts to identify new, potentially relevant, theories to inform frameworks during the development process. Finally, the findings of this research recommend the need for improvements in the indexing of low-level theories in the database.

7.9.4 Wider implications for research practice

In using the meta-framework to inform decisions on differential effectiveness of interventions, systematic reviewers are reliant on the assessment and reporting of differential effects across SES groups and detailed descriptions of interventions, implementation and context in the primary literature. This research as a whole, therefore also supports the calls from others of a need for primary research to incorporate assessments of differential effects across different SES groups and better reporting of interventions, implementation and context (120, 185, 186).

7.10 Recommendations for research

This research proposes the following recommendations for further research relating to; the further development and evaluation of a meta-framework to inform socio-economic health inequality considerations in systematic reviews, the wider research on developing frameworks to inform evidence synthesis and the wider development of review guidance in general.

7.10.1 Further research on developing a meta-framework to inform socio-economic health inequality considerations in evidence synthesis

Further research is required to distinguish between factors and mechanisms in the meta-framework leading to relative effectiveness and those leading to absolute effectiveness.

Further research is also required in identifying which factors related to intervention, implementation, context, and participant response are more closely associated with specific mechanisms (e.g. ability to engage) and the resulting net impact (i.e., positive, negative, or no impact) on socio-economic health inequalities. Further assessment of the quality of the theories informing the meta-framework is also required.

7.10.2 Further research on evaluating a meta-framework to inform socio-economic health inequality considerations in evidence synthesis

The completeness of the meta-framework could be tested further in two ways: i) sensitivity of the search, i.e. do theories that fall with the scope but that are not found by the search make a difference or add anything to the framework? ii) adequacy of the scope, i.e. do theories that fall outside the BeHEMOTH scope add anything to the framework in terms of identifying additional factors or mechanisms.

A qualitative survey of systematic reviews and public health professionals with expertise in socio-economic health inequalities may also be useful in assessing the face validity of the meta-framework, highlighting omissions from the meta-framework and providing additional worked examples.

Applying the meta-framework in a prospective evaluation by review teams in a 'best fit' framework synthesis will assess how well the meta-frameworks in practice. This implementation phase will assess whether it is 'fit-for-practice' barrier to, and enablers for, its wider use and application. For example, it will capture how well the meta-framework is interpreted or operationalised by those it is designed to assist. In particular it will address some of the outstanding challenges of the 'best fit' framework synthesis namely; (i) the consistency with which the concepts in the meta-framework are understood and operationalised by different coders, (ii) the transferability of the framework in promoting comparison of results across studies included in the synthesis, and (iii) the ability of the framework to stimulate new theoretical development.

The health inequality intervention theories used to inform the meta-framework were largely considered from a public health perspective and therefore the meta-framework is designed to be used to inform public health evidence synthesis. Although the meta-framework acknowledges pharmacological as an intervention type, further research is needed to assess

the transferability of the meta-framework for use in other types of evidence synthesis and research designs.

7.10.3 Informing wider research on developing frameworks to inform evidence synthesis

In informing wider research on the development of frameworks to inform evidence synthesis the findings of this research informs the following recommendations for researchers when searching for theory, selecting theory and operationalising frameworks.

Recommendations on searching to identify theory to inform framework development have already been discussed in relation to the wider implications for information retrieval practice (see Chapter 7.9.3). When selecting theory to inform framework development this research recommends that to aid in the categorisation of themes and sub-themes, researchers start with theories characterised by an explicit framework or typology. Finally, to avoid end-user misinterpretation when operationalising frameworks to inform evidence synthesis, researchers should clearly define terminology used within the framework and provide multiple worked examples to illustrate framework application.

7.10.4 Wider development of systematic review guidance

Further research should also examine the contribution novice reviewers and those unfamiliar with the topic area may have on the development and evaluation of guidance to support the conduct of systematic reviews that consider health inequalities.

7.11 Impact of my research

Whilst recognising that research impact may not necessarily be immediate, I outline below how this research has already had an impact on my own knowledge, understanding and practice and on the wider community.

7.11.1 Impact on my own knowledge, understanding and practice

Undertaking this research has greatly increased my knowledge and understanding of health inequalities and the importance of the need for researchers to consider health inequalities

in all research, not just systematic reviews. Consequently, when reading research I am more aware of the impact of research findings on disadvantaged populations. I also find myself to be more critical of research in which there is a lack of consideration of health inequalities, when there is a clear need to address them.

Although I consider myself experienced in searching and data extraction to inform systematic reviews, this research challenged me in new ways. Firstly, although I was aware of the BeHeMOTH search approach to identify theory (207), I had never applied it in practice. In searching for low-level theory to inform the meta-framework I learned to appreciate the value of searching full-text resources such as Google Scholar in overcoming the limitations of the traditional databases. Going forward, this knowledge will inform my approach to searching to inform theory-led systematic reviews (e.g. realist reviews). Furthermore, in adapting the published BeHEMoTh framework for retrieving theoretical literature I have come to understand that whilst frameworks provide guidance, they may not necessarily be a perfect fit. Furthermore, I agree with Kneale et al., (127) who advocate that logic models, like frameworks, should not over-complicate or introduce rigidity but should enhance the contribution of programme theory. In applying these principles, the meta-framework offers reviewers a flexible approach in developing programme theory. Furthermore, in providing sound underpinning evidence as to how and why the BeHEMoTh framework needed adapting to achieve the aims of this research, it made me realise that it is fine to challenge the work of others.

Secondly, extracting data on programme theory is not as straightforward as say, extracting data on outcome measures. This is largely because outcome measures are explicit, better defined and often reported in the results section, so are quick to identify. In undertaking this research, I found that reviewers were not explicit in labelling their understanding of how and why an intervention may or may not work as 'programme theory'. Rather, programme theory is an assumption made by the reviewer that is implicit within the text, could occur anywhere in the study and as a result, harder to identify. The more the papers I read, the easier it became to spot the programme theory. I felt that I needed to read the papers several times and data checked several times over a period of a few months before I felt confident that I had extracted the programme theories. Familiarity with the data therefore, is crucial to the identification of the programme theory.

In going forward, the methods used to inform my research have already influenced my own practice. As a co-applicant on a recent grant application, I proposed the use of the 'best fit' framework synthesis (BFFS) approach in reviewing the evidence base to inform the

development of a conceptual model to guide action to reduce socio-economic inequalities in cancer experience and outcomes. The BFFS approach incorporating a theoretical framework(s) was subsequently written into the research bid (awaiting outcome February 2019).

7.11.2 Impact on the wider community

Despite the very recent publication of my research findings (86-88), its impact on the wider academic community (both scholars and students) can already be demonstrated.

My paper on the use of programme theory to inform socio-economic considerations in systematic reviews (see section) is cited by individuals who lead the field in the use of programme theory and logic models in systematic reviews and who lead reviews and synthesis at the Evidence for Policy and Practice Information and Coordinating Centre (EPPI-Centre), International Initiative for Impact Evaluation and Centre of Excellence for Development Impact and Learning (220, 221).

As part of the 'best fit'-framework methodology, it was essential to involve other researchers in checking the accuracy and interpretation of my work. Whilst not directly responsible for the design and conduct of my research, by involving other PhD students who were unfamiliar with data extraction and the use of theory to inform systematic reviews and 'best fit' framework synthesis, I hope that I am helping to build research capacity. Conversely, as someone with expertise in information retrieval, I was also well placed to support other PhD students at the University of Liverpool with their systematic review searches.(222)

Ultimately, I hope that my research will also impact on patients and disadvantaged populations. This will not impact in a direct way per se, rather in an indirect way by encouraging researchers to think about the impact of their review findings on socio-economic health inequalities at very start of the research process when formulating review questions. However, in order to try to address health inequalities, researchers need not only to consider health inequalities, but also report on it. In this way, I hope that the meta-framework will encourage reviewers to incorporate assessments of socio-economic health inequalities in systematic reviews, thereby increasing the applicability and usefulness of systematic reviews in informing practice and policy.

Effective dissemination in targeting the audience for this work (i.e. reviewers/researchers) therefore is crucial for ensuring that the meta-framework is embedded as a tool for informing

the research process. This is even more important when considering that only 8/37 health inequality focused systematic reviews included in my study on the use of programme theory acknowledged the guidance on the conduct of systematic reviews incorporating health inequality considerations (see Chapter 4.5.2). Furthermore, whilst I have presented on and published the findings of this research (see appendix 1) there is no guarantee that the target audience are yet aware of my work. Consequently, there is much more to do in raising awareness of the meta-framework. I hope to achieve this through further testing and refining of the meta-framework (see Chapter 7.10.2), and encouraging its implementation with the support of the Academic Health Science Networks and NIHR CLAHRCs, evidence synthesis academic networks, The Campbell and Cochrane collaborations and the NICE guideline development groups and their contractors in UK.

Chapter 8: Conclusion

All health care interventions have the potential to impact on socio-economic health inequalities. Interventions shown to improve population health may inadvertently widen socio-economic health inequalities. Therefore, it is essential that all systematic reviewers consider the *potential* for their review findings to increase or reduce the health inequality gap.

This research found that in encouraging systematic reviewers to consider what interventions work or don't work, and how, for different socio-economic groups, there is an underlying assumption in the guidance on the conduct of systematic reviews that consider health inequalities, that reviewers have an understanding of how socio-economic status moderates intervention effectiveness. Furthermore, in advocating the use of theory to hypothesise the likely impact of interventions on health inequalities, the review guidance highlights the need for skills in understanding theoretical sensitivity in being able to generate, test and refine possible explanations for why interventions may lead to differential effects across SES groups in systematic reviews. Such knowledge and skills are essential if reviewers are to operationalise the review guidance on the conduct of health inequality focused systematic reviews. My own experience and the findings of this research suggest however, that not all reviewers are familiar with socio-economic health inequalities and that theory is often used in an ad-hoc, fragmented way within systematic reviews.

In developing a practical, transparent, theory-led meta-framework, this research enables systematic reviewers to consider *a priori* whether, and how, an individual's socio-economic status may moderate the effectiveness of healthcare interventions, to help predict the likely impact on socio-economic health inequalities. Drawing upon theoretical literature from two perspectives (theories of complexity of systematic reviews of complex interventions and health inequality intervention theories) the meta-framework allows reviewers to distinguish between factors and mechanisms associated with differential effects across different socio-economic groups. Furthermore, in developing a systematic approach to the identification and integration of theory, the meta-framework provides a strong theoretical foundation with which to consider socio-economic health inequalities in systematic reviews.

Ultimately, the use of the meta-framework relies on reviewers adopting a paradigm shift in thinking, moving from a positivist stance in considering only 'if and what works' to a more realist informed way of thinking to consider 'what works, for different socio-economic groups, under what circumstance'. In using the meta-framework to answer questions such

as why interventions work or not, for whom and in which contexts, reviewers will need to draw on a broader range of research, both quantitative and qualitative. The meta-framework therefore promotes a mixed-methods approach to systematic reviews.

This research contributes to methodological advances in the fields of population health focused systematic reviews and information retrieval. The meta-framework advances knowledge on factors and mechanisms associated with differential effects across different socio-economic groups. One of the key contributions of this research is that the meta-framework can inform socio-economic health inequality considerations at different stages in the review process in particular, during question formulation, literature searching, data extraction, analyses and synthesis and assessments of applicability. Used in this way, the meta-framework encourages reviewers to consider socio-economic health inequalities throughout the *whole* systematic review process.

In adopting an approach to the development of the meta-framework using two theoretical perspectives this research also contributes to the emerging science of the use of theory, framework construction and evaluation within systematic review methodology. The theoretical underpinnings of the meta-framework can help reviewers avoid ad-hoc, fragmented use of theory in systematic reviews. Moreover, in the event of a lack of evidence of the impact of socio-economic status on differential effectiveness of health interventions, the meta-framework can ensure that assessments of the applicability of the findings to disadvantaged populations are based on *a posteriori* reasonings rather than *post-hoc* assumptions. In this way, the meta-framework aims to increase the usefulness of systematic reviews in informing health care practice and policy.

Acknowledgement of funding

This PhD was funded by the NIHR CLAHRC NWC.

Disclaimer

The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.

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Appendices

Appendix 1: Study outputs

- **A1.1 Position paper**
- **A1.2 Peer-reviewed publications**
- **A1.3 Presentations**

A1.1 Position paper

Health Inequalities and Evidence Synthesis as part of the CLAHRC NWC

An Overview

Purpose

One of the NIHR CLAHRC NWC's guiding principles is that,
"we will ensure all our activities remain focused on work that has the potential to reduce health inequalities." ([NIHR CLAHRC NWC](#))

Ensuring that the primary research funded by the CLAHRC NWC does have this focus is relatively straightforward and although the methods for carrying out such research and the appropriate measurement of outcomes is often complex, they are known and there are examples of good practice that can be followed. However, the methods of taking a health inequality focus when synthesising existing evidence is less clear and the methods to do so are in the early stages of development.

This background paper is the result of work done by Michelle Maden as part of her CLAHRC NWC PhD Studentship. The purpose is to provide background to guide the CLAHRC Research Selection Sub-committee and the Steering Committee and to illustrate some of the various ways that health inequalities can potentially be addressed as part of evidence synthesis proposals submitted for funding.

Background

Previous research has highlighted an absence of evidence with regards to the extent systematic reviews take into account issues of health inequalities when analysing and making recommendations for further research and practice (Welch et al., 2010; Baxter, 2007; Bambra et al., 2010). This is due in part to the availability of data on health inequalities reported in the primary literature and a failure on the part of review authors to consider in particular, differential impacts by socio-economic status (Welch et al, 2010; Petticrew et al., 2004; Gibson et al., 2011). Both the Cochrane and Campbell Collaborations have called for the effects of interventions on socio-economic status to be routinely examined by *all* systematic review authors (Tugwell et al., 2006; Petticrew et al., 2014).

However, Bambra et al (2010) conducted a systematic review of reviews that examined evidence of interventions related to the social determinants of health. They examined 30 systematic reviews and found that the effects of interventions on health inequalities were unclear. They also concluded that limiting the scope of evidence synthesis to those which have a direct focus on health inequalities may only provide limited data on reducing the health inequalities gap.

In the past, health inequality focused evidence syntheses have been criticised for being driven by individual rather than population level interventions targeted at selected groups not necessarily typical of the general population (Blaxter, 2007). Even when reviews focus on disadvantaged populations they often neglect to assess the differential impacts by socio-economic status (Welch, et al., 2010; Bambra et al., 2010; Blaxter, 2007; Lorenc et al., 2012) and are therefore limited in their generalisability in relation to what works, for whom and under what circumstance.

For systematic reviews to be more useful to healthcare managers and policy-makers they need to incorporate how the review findings would impact on differential effects by subgroup and consider the contextual factors that may affect how applicable the review findings are to the local population (Lavis et al., 2006; Oxman et al., 2009; Burford et al., 2013).

Welch et al, (2013) in their guidance on conducting systematic reviews with a focus on health equity define 3 categories of health inequalities focused reviews:

Category 1: Those that assess the effects of interventions in disadvantaged populations

Category 2: Those that assess the effects of interventions aimed at reducing social gradients across populations

Category 3: Those that assess the effects of interventions not aimed at reducing inequity but where it is important to understand the effects of the intervention on equity, either positively or negatively.

Health inequality evidence synthesis review questions may, therefore, have either a direct (categories 1&2) or indirect (category 3) focus on health inequalities. Examples of evidence synthesis where the main aim of the review was not to reduce health inequalities but where it was important to consider the effects of the intervention on health inequalities can be found in three recent Cochrane Reviews (Waters et al., 2011; Lewin et al., 2010; Tully et al., 2013).

Evidence synthesis theme in CLAHRC NWC

This theme has two components. The first is to support partners to apply for funds to conduct evidence synthesis reviews and the second is to provide continuing professional development on the methods for conducting reviews to inform professional practice. Although these were initially seen as independent activities, in practice there is a significant amount of overlap.

In an ideal world we would want evidence synthesis projects within the CLAHRC NWC to fall within either Category 1 or 2 as outlined above. However, our experience to date with the application for funds to conduct evidence synthesis research projects is that the potential collaborators are not starting from a perspective of health inequalities in the formulation of their research question(s).

One reason for this may be that there is currently no clear evidence that there is an issue of health inequalities. Or it may be that the researchers have not considered the importance of health inequalities. However, given that we know that interventions shown to be effective in improving the health of a population, may actually widen the health inequalities gap while others reduce it (Arblaster, 1996; Blaxter, 2007; Lorenc et al., 2012) it is imperative that *all reviewers* consider the *potential* for their findings to reduce or increase health inequalities.

Methodological work to examine how considerations of health inequalities can be incorporated into evidence synthesis is a relatively new and emerging area of research (Petticrew et al., 2014; Welch et al., 2013). Guidance and tools are available to help reviewers consider health inequality issues when formulating their review proposals (Welch et al., 2012; Oxman et al., 2009; O'Neill et al., 2014). Using these tools along with the NWC

CLAHRC Health Inequalities Assessment Toolkit, we propose that we will continue to work with reviewers/collaborators to help them consider how their work will impact on health inequalities and to identify recommendations for the types of data required to address health inequality issues.

In terms of how the proposals for funds to conduct evidence synthesis are assessed we recommend that:

1. Priority be given to proposals that assess the effects of interventions in disadvantaged populations or that assess the effects of interventions aimed at reducing social gradients across populations
2. At a minimum evidence synthesis proposals must consider the impact of their review findings on health inequalities and their differential impact across social groups to identify whether their recommendations could have a positive or negative effect on the health inequality gap
3. All evidence synthesis proposals must include recommendations for future research on the type of data that needs to be collected to address actual or potential health inequality issues.

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A1.2 Peer-reviewed publications

- Maden M. Consideration of health inequalities in systematic reviews: a mapping review of guidance. *Systematic Reviews*. 2016;5(1):202.
- Maden M, Cunliffe A, McMahon N, Booth A, Carey GM, Paisley S, et al. Use of programme theory to understand the differential effects of interventions across socio-economic groups in systematic reviews-a systematic methodology review. *Systematic Reviews* 2017;6(1):266.
- Maden M, McMahon N, Booth A, Dickson R, Paisley S, Gabbay M. Toward a theory-led meta-framework for considering socio-economic health inequalities within systematic reviews. *Journal of Clinical Epidemiology*. 2018;104:84-94.

A1.3 Presentations

Oral presentations

- A Meta-framework for Incorporating Health Inequalities in Systematic Reviews. HTAi, Westin Bayshore Hotel, Vancouver, 1st-5th June 2018.
- Towards a theory-led meta-framework for incorporating health inequalities in systematic reviews. (Oral presentation) IPHS Postgraduate Research Conference Day, the Foresight Centre, University of Liverpool, 14th December 2017.
- Towards a rationale for the incorporation of considerations of equity in evidence synthesis. Campbell and Cochrane Equity Methods Group, Ottawa, March 2016.
- Incorporating considerations of the impact of review findings on health inequalities (HI) into evidence synthesis. (Oral presentation) IPHS Postgraduate Research Conference Day, the Foresight Centre, University of Liverpool, 14th July 2015.

Poster presentations

- A Meta-framework for Incorporating Health Inequalities in Systematic Reviews. (Poster presentation) Society for Social Medicine, 62nd Annual Scientific Meeting, University of Glasgow, 5th-7th September 2018.
- Towards a rationale for the incorporation of health inequalities in evidence synthesis: A review of equity guidance for systematic reviews. Public Health PhD symposium, Liverpool John Moores University, 7th July 2016.

Appendix 2: Study 1 Mapping Review Supplementary Material

- **A2.1 International evidence synthesis organisation websites**
- **A2.2 Medline search strategy**
- **A2.3 Development of guidance**
- **A2.4 Citation analysis of guidance**

A2.1 International evidence synthesis organisation websites

- Agency for Healthcare Research and Quality (www.ahrq.gov)
- The Cochrane Collaboration (www.cochrane.org)
- The Campbell and Cochrane Equity Methods Group (<http://methods.cochrane.org/equity/>)
- Centre for Reviews and Dissemination at the University of York (<http://www.york.ac.uk/crd/>)
- EPPI-Centre (<http://eppi.ioe.ac.uk/>)
- Health Technology Assessments (<http://www.nets.nihr.ac.uk/programmes/hta>)
- European Network for Health Technology Assessments (EUnetHTA – www.eunetha.net)
- National Institute for Health and Care Excellence (NICE – www.nice.org.uk)
- Joanna Briggs (<http://joannabriggs.org/sumari.html>)

A2.2 Medline search strategy

OVID Medline

- 1 exp Meta-Analysis as Topic/
- 2 systematic review.tw.
- 3 meta-analys\$.tw.
- 4 meta-epidemiolog\$.tw.
- 5 exp "Review Literature as Topic"/
- 6 (Cochrane adj2 review).tw.
- 7 ((qualitative or realist or evidence or narrative or knowledge) adj synthesis).tw
- 8 integrative review.tw
- 9 meta-synthesis.tw
- 10 meta-ethnography.tw
- 11 or/1-10
- 12 (gender-based OR gender-related OR gender differences OR gender factors).tw.
- 13 ((sex OR gender) adj2 (analysis OR specific OR difference? OR factor? OR inequit\$ OR disparit\$ OR inequalit\$)).tw.
- 14 exp sex factors/
- 15 exp geriatrics/
- 16 ((ethnic\$ OR race OR racial OR religio\$ OR cultur\$ OR minorit\$ OR refugee OR indigenous OR aboriginal) adj3 (analysis OR difference\$ OR specific OR disparit\$ OR inequalit\$ OR inequit\$)).tw.
- 17 exp homosexuality/
- 18 exp disabled persons/
- 19 ((poverty OR low-income OR socio-economic\$ OR social) adj2 (analysis OR disadvantage\$ OR specific OR difference? OR factor? OR inequalit\$ OR depriv\$ OR inequit\$ OR disparit\$)).tw.
- 20 exp Educational Status/
- 21 exp Socio-economic Factors/
- 22 ((discriminat\$ OR social exclu\$ OR social inclu\$) adj3 (religion OR culture OR race OR racial OR aboriginal OR indigenous OR ethnic\$)).tw.
- 23 ((urban OR rural OR inner-city OR slum) adj2 (difference\$ OR specific OR analysis OR inequit\$ OR disparit\$ OR inequalit\$)).tw.
- 24 ((resource-poor OR (low-income adj countr\$) OR (middle income adj countr\$) OR africa OR developing countr\$ OR south america OR china OR asia OR latin america) adj2 (relevance OR analysis OR specific OR difference OR applicab\$ OR inequit\$ OR disparit\$ OR inequalit\$)).tw.
- 25 health adj2 inequalit*.tw
- 26 health adj2 equit*.tw
- 27 health adj2 inequit*.tw
- 28 ((social gradient* or gap) adj3 (reduc* or difference* or disparit* or increase* or inequit* or inequalit* or equit* or disadvantage*)).tw
- 29 exp Health Status Disparities/
- 30 or/12-29
- 31 (guidance or guideline* or tool* or method* or framework* or model*).ti.
- 32 11 AND 30 AND 31

A2.3: Development of guidance

Guidance	Aim/Audience	Development method	Operationalisation	Strengths/Limitations
<p>HI focused guidance</p> <p>Doull, et al. (93)</p> <p>Welch, et al., for the Sex/Gender Methods Group. (94)</p> <p>Puil, et al., for the Sex/Gender Methods Group. (95)</p> <p>Doull, et al., for the Sex/Gender Methods Group. (96)</p>	<p>To translate knowledge about sex/gender analysis into a user-friendly 'briefing note' format and evaluate its use in aiding in the implementation of sex/gender analysis in systematic reviews</p> <p>Reviewers and editors of Cochrane Aids/ hypertension and musculoskeletal groups</p>	<p><u>Guidance development process</u></p> <ul style="list-style-type: none"> • Informed by literature reviews Built on existing structured guidance for systematic reviewers • Feedback and revision sought • Evaluated by 19 participants attending a workshop at the 2012 Canadian Cochrane Symposium • Underpinned by 'diffusion of innovations theory' <p><u>Who else was involved</u></p> <p>Members of the Cochrane Collaboration HIV/AIDS, Hypertension, and Musculoskeletal Review Groups with expertise in methodology, sex/gender analysis, systematic reviews, policy and knowledge translation, and additional clinical experts</p>	<p>Four sections:</p> <p>Sections 1-3 define the issue, definitions and rationale for considering sex and gender analysis</p> <p>Section 4 has 13 items to consider in relation to sex and gender (question formulation; context; population; intervention/ comparator; outcomes; study design; searching for studies; data collection; risk of bias; data analysis; additional analyses; presenting results and summary of findings; interpreting and drawing conclusions)</p> <p>Topic specific descriptive examples provided</p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> • Wide range of expertise and systematic review experience involved in development • Consensus-based • Provides rationale, evidence and examples to operationalise guidance • Piloted and evaluated • Open access <p><u>Limitations</u></p> <ul style="list-style-type: none"> • Evaluated by a self-selecting group attending Cochrane Meeting • Terminology used (logic model, context) may not be "widely accepted" or understood
<p>NIHR CLAHRC North West Coast (97)</p>	<p>To help ensure that all activities of the NIHR CLAHRC NWC have potential to contribute to reducing health inequalities</p> <p>Aimed specifically at anyone undertaking CLAHRC NWC work (including reviewers) but also anyone wishing to consider HI in their research</p>	<p><u>Guidance development process</u></p> <p>Collaborative process in a series of workshops in 2014/5</p> <p><u>Who was involved</u></p> <p>NIHR CLAHRC NWC staff and partners</p>	<p>Four sections:</p> <ol style="list-style-type: none"> 1: Clarifying the health inequality dimensions of the problem 2: Designing your intervention/action 3: Evaluating and/or monitoring the impact of your activity 4: Planning for wider impacts on health inequalities <p>26 questions</p> <p>Each section also includes a Health Inequalities Assessment of an exemplar proposal for applied research</p> <p>Links to resources that provide more information about the issues covered in each section</p> <p>Guidance provided on how to use HIAT</p>	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> • Revised after feedback from users, plan to revise regularly after further user feedback • Encourages involvement of the public/team approach in considering equity in reviews • Addition of further resources Worked example provided Open access <p><u>Limitations:</u></p> <ul style="list-style-type: none"> • Limited information on how the guidance was developed or tested. • Long checklist • Worked example is not a systematic review therefore further details on <i>how</i> reviewers can operationalise individual items is required

Guidance	Aim/Audience	Development method	Operationalisation	Strengths/Limitations
O'Neill, et al. (70)	<p>To assess the utility of an acronym, place of residence, race/ ethnicity/culture/language, occupation, gender/ sex, religion, education, socio-economic status, and social capital ("PROGRESS") to guide the conceptualization of disadvantage, data extraction, and to inform equity analyses in systematic reviews.</p> <p>Reviewers Researchers Users</p>	<p>Authors demonstrate how an existing framework PROGRESS, the framework for the PRISMA Equity Extension, can be applied to systematic reviews</p>	<p>Asks reviewers to consider variations in health across 8 factors: place of residence, race/ethnicity/culture/ language, occupation, gender/sex, religion, education, socio-economic status, and social capital</p> <p>For each PROGRESS factor examples are provided that demonstrate differences in burden of disease and an effective intervention that could reduce that burden.</p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> • Considers multiple equity dimensions <p><u>Limitations</u></p> <ul style="list-style-type: none"> • Limited examples provided. Further detail on how reviewers can operationalise individual items is required • Not evaluated • Not open access
Nasser, et al. (98)	<p>To develop and pilot an equity lens to help researchers develop a more equity-oriented approach toward priority setting and agenda setting in systematic reviews</p> <p>Reviewers</p>	<p><u>Development process</u></p> <ul style="list-style-type: none"> • A workshop presenting survey results from a previous project • Literature review • Workshop for refinement of the equity lens. • Piloted • Underpinned by conceptual framework for priority setting <p><u>Who was involved</u></p> <p>15 people attending the 2008 Cochrane Colloquium attended the first workshop, 12 attending the 2009 Cochrane Collaboration attended the second workshop</p>	<p>Two checklists:</p> <ol style="list-style-type: none"> 1. 9 questions assessing priority setting, from identifying the questions and stakeholders to the evaluation strategy. 2. 8 questions assessing the outcome evaluation of priority setting 	<p><u>Strengths</u></p> <ul style="list-style-type: none"> • Piloted <p><u>Limitations</u></p> <ul style="list-style-type: none"> • Evaluated by a self-selecting group attending Cochrane Meeting • Not open access
Oxman, et al. (99)	<p>To present a structured approach to considering the impacts of policy and programme options on inequities, to inform decisions about what options to implement and how to implement them</p> <p>Users</p>	<p>Not reported</p>	<p>4 questions that can be used to guide considerations when using systematic reviews regarding impacts on inequities.</p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> • Descriptive examples provided • Open access <p><u>Limitations</u></p> <ul style="list-style-type: none"> • No information available on how the guidance was developed or evaluated.

Guidance	Aim/Audience	Development method	Operationalisation	Strengths/Limitations
				<ul style="list-style-type: none"> Terminology used may not be “widely accepted” or understood Greater detail required on <i>how</i> reviewers can operationalise the items
<p>Tugwell, et al. (78)</p> <p>Ueffing, et al., for the Campbell and Cochrane Equity Methods Group. (69)</p>	<p>To provide guidance on assessing equity for users and authors of systematic reviews of interventions</p> <p>Reviewers Users Journal editors</p>	<p><u>Development process</u></p> <ul style="list-style-type: none"> 4 working sessions Built on previous work by the members of the Measurement and Evidence Knowledge Network Panel members reviewed the evidence and drafted guidance Feedback and revision sought <p><u>Who was involved</u> International leaders in systematic reviews and health equity, mixed methods experts, social scientists, economists, experts in systematic reviews, experts in public health and health equity, experts from low and middle income countries, and policy advisers who use systematic reviews. Members of the Campbell and Cochrane Equity Methods Group and the Measurement and Evidence Knowledge Network</p>	<p>7 recommendations underpinned by 16 checklist items</p> <p>Examples provided</p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> Wide range of expertise involved in development Consensus-based Descriptive examples provided Addition of resources to signpost reviewers to sources of help when attempting to answer the questions. <p><u>Limitations</u></p> <ul style="list-style-type: none"> Terminology used may not be “widely accepted” or understood Greater detail required on <i>how</i> reviewers can operationalise the items
Tugwell, et al. (100)	<p>‘Propose an evidence based framework – or “cascade” – for equity-orientated knowledge translation.’</p> <p>Reviewers Researchers Users</p>	<p><u>Development process</u> Not reported</p> <p><u>Who was involved</u> Not reported</p>	<p>5 steps</p> <p>Examples demonstrate how the steps are applied to 2 systematic reviews</p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> Descriptive examples provided to operationalise items Open access <p><u>Limitations</u></p> <ul style="list-style-type: none"> No information available on how the guidance was developed or tested. Does not define equity
<p>Welch, et al. (67)</p> <p>Welch, et al. (68)</p> <p>Burford, et al. (101)</p>	<p>‘To provide structured guidance on transparently reporting methods and results for equity focused reviews. To legitimise and emphasize the importance of reporting health equity results.’</p> <p>Reviewers</p>	<p><u>Development process</u> Consensus-based - Followed guidance for developing reporting guidelines</p> <ul style="list-style-type: none"> Identifying need Reviewing the literature (systematic review and methodological study) Gathering expert opinion (online survey) Exploring consensus Piloting 	<p>14-item equity extension of existing guidance for the reporting of systematic reviews</p> <p>Provides detailed rationale, evidence, whenever available, an exemplar for recommending each item and examples of good practice.</p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> Wide range of expertise involved in development Involved non-expert reviewers in development Consensus-based Followed guidance on developing reporting guidelines Provides rationale, evidence, exemplars and examples to operationalise items

Guidance	Aim/Audience	Development method	Operationalisation	Strengths/Limitations
		<p><u>Who was involved</u></p> <ul style="list-style-type: none"> Equity researchers, decision-makers, clinical epidemiologists, systematic review methodologists, Journal editors, funders, practitioners, review authors with LMIC focus, methodologists/statisticians, novice systematic reviewers and established systematic reviewers involved with equity and/or complex population intervention systematic reviews 		<ul style="list-style-type: none"> Evaluated Open access <p><u>Limitations</u></p> <ul style="list-style-type: none"> Terminology used may not be “widely accepted” or understood Greater detail required on <i>how</i> reviewers can operationalise some items e.g. approach to logic model
Welch, et al. (102)	<p>To develop and assess inter-rater agreement for an algorithm for systematic review authors to predict whether differences in effect measures are likely for disadvantaged populations relative to advantaged populations</p> <p>Reviewers</p>	<p><u>Development process</u></p> <ul style="list-style-type: none"> Follows established methods of checklist development Review of existing guidance Systematic review of methods for assessing effects on health equity Survey of Practitioners/Managers Evaluated face and conceptual validity amongst 4 clinical methodologists Inter-rater reliability assessed amongst 35 methodologists, clinicians, users of SRs assessed the algorithm against a pre-selected sample of 10 SRs. Piloted <p><u>Who was involved</u></p> <p>Authors, practitioners/managers, clinicians, methodologists, users, members of Cochrane Collaboration</p>	<p>3 questions</p> <p>Examples operationalise how each of the questions may result in differential effects</p>	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> Wide range of expertise involved in development Follows established methods of checklist development Descriptive examples provided to operationalise items <ul style="list-style-type: none"> Evaluated Open access <p><u>Limitations</u></p> <ul style="list-style-type: none"> Low Inter-rater reliability Tested by individuals rather than review teams who evaluated the algorithm against summarised information from the reviews Subject expertise of the raters is unclear, this may have impacted on whether they would anticipate differential effects. Multi-component questions cover several factors
Welch, et al. (40)	<p>To provide guidance on how to conduct equity-focused systematic reviews consistent with the recommendations of PRISMA-E 2012 to facilitate the use of both guidance documents. This article also discusses challenges related to knowledge</p>	<p><u>Who was involved</u></p> <p>Campbell and Cochrane Equity Methods Group, Cochrane Public Health Review Group, methodologists, funders, journal editors, clinicians and public health practitioners</p> <p><u>Development process</u></p> <ul style="list-style-type: none"> Series of methodology meetings 	<p>10 steps to considering health equity in reviews</p> <p>Recommendations with a few brief examples from exemplar reviews</p>	<p><u>Strengths</u></p> <ul style="list-style-type: none"> Wide range of expertise involved in development Descriptive examples provided to operationalise items Open access <p><u>Limitations</u></p>

Guidance	Aim/Audience	Development method	Operationalisation	Strengths/Limitations
	translation for equity-focused systematic reviews. Reviewers	<ul style="list-style-type: none"> • Systematic review of methods to assess equity in systematic reviews • Methods study • WHO Task force on evidence-informed policies about health systems • PRISMA-Equity (2012) guidance 		<ul style="list-style-type: none"> • Terminology used) may not be “widely accepted” or understood • Greater detail required on <i>how</i> reviewers can operationalise the items
Generic focused guidance				
Armstrong, Waters, Doyle. (editors) (103) Armstrong, Waters, on behalf of the Guidelines for Systematic Reviews in Health Promotion and Public Health Taskforce. (104)	Guidance to authors for the preparation of Cochrane Intervention reviews (including Cochrane Overviews of reviews). Reviewers	Not reported	N/A ¹	
Chambers & Wilson (105)	To enable researchers to present and contextualize evidence from systematic reviews and other sources of synthesized and quality-assessed evidence Researchers	Uses the Oxman et al., (99) criteria	4 ²	<p><u>Strengths</u></p> <ul style="list-style-type: none"> • As above for Oxman et al. (99) • Authors offer advice on operationalising guidance in absence of evidence in reviews, “by information gathered locally, using documents produced by or relevant to the NHS, such as Joint Strategic Needs Assessments and equity audits.” <p><u>Limitations</u> As above for Oxman et al. (99)</p>
CRD (106)	To promote high standards in commissioning and conduct, by providing practical guidance for undertaking systematic reviews evaluating the effects of health interventions. Reviewers	Not reported	N/A ³	

¹ Signposts reviewers to The Campbell and Cochrane Equity Methods Group, ² Follows tools developed by SUPPORT collaboration (99), ³ Signposts reviewers to PROGRESS and The Campbell and Cochrane Equity Methods Group

A2.4 Citation analysis of guidance*

Guidance	Times cited (English language only)	Cited in SR (HI focused reviews)	Cited in SR protocol (HI focused reviews)	Cited in non-SR
Chambers D, Wilson P. A framework for production of systematic review based briefings to support evidence-informed decision-making. <i>Syst Rev.</i> 2012;9(1):32	33	4 (1)	1	28
Doull M, Welch V, Puil L, Runnels V, Coen SE, Shea B, O'Neill J, Borkhoff C, Tudiver S, Boscoe M. Development and evaluation of 'briefing notes' as a novel knowledge translation tool to aid the implementation. <i>PLoS One.</i> 2014 Nov 5;9(11):e110786.	18		2 (2)	16
Nasser M, Ueffing E, Welch V, Tugwell P. An equity lens can ensure an equity-oriented approach to agenda setting and priority setting of Cochrane Reviews. <i>J Clin Epidemiol.</i> 2013;66:511–21	16			16
O'Neill J, Tabish H, Welch V, Petticrew M, Pottie K, Clarke M, Evans T, Pardo Pardo J, Waters E, White H, Tugwell P. Applying an equity lens to interventions: using PROGRESS ensures consideration of socially stratifying factors to illuminate inequities in health. <i>J Clin Epidemiol.</i> 2014;67:56–64. doi:10.1016/j.jclinepi.2013.08.005	170	47(41)	8 (8)	115
Oxman AD, Lavis JN, Lewin S, Fretheim A. SUPPORT Tools for evidence informed health Policymaking (STP). 10. Taking equity into consideration when assessing the findings of a systematic review. <i>Health Res Policy Syst.</i> 2009;7 Suppl 1:S10	51	5(4)	1(1)	45
Tugwell P, Petticrew M, Kristjansson E, Welch V, Ueffing E, Waters E, Bonnefoy J, Morgan A, Doohan E, Kelly M. Assessing equity in systematic reviews: realising the recommendations of the Commission on Social Determinants of Health. <i>BMJ.</i> 2010;341:c4739	113	25(20)	6(6)	82
Tugwell P, Robinson V, Grimshaw J, Santesso N. Systematic reviews and knowledge translation. <i>Bull World Health Organ.</i> 2006;84(8):643–51.	86	2(1)		84
Welch V, Petticrew M, Tugwell P, Moher D, O'Neill J, Waters E, White H, PRISMA-Equity Bellagio group. PRISMA-Equity 2012 Extension: Reporting Guidelines for Systematic Reviews with a Focus on Health Equity. <i>PLoS Med.</i> 2012;9(10):e1001333.	263	118(56)	21(8)	124

Welch V, Petticrew M, Petkovic J, Moher D, Waters E, White H, Tugwell P, PRISMA-Equity Bellagio group. Extending the PRISMA statement to equity focused systematic reviews (PRISMA-E 2012): explanation and elaboration. <i>J Clin Epidemiol.</i> 2016;70:68–89.	87	47(13)	6(5)	34
Burford BJ, Welch V, Waters E, et al. Testing the PRISMA-equity 2012 reporting guideline: the perspectives of systematic review authors. <i>PLoS ONE.</i> 2013;8, e75122.	16	2(1)		14
Welch V, Brand K, Kristjansson E, Smylie J, Wells G, Tugwell P. Systematic reviews need to consider applicability to disadvantaged populations: interrater agreement for a health equity plausibility algorithm. <i>BMC Med Res Methodol.</i> 2012;12:187.	17	1(1)		16
Welch VA, Petticrew M, O'Neill J, Waters E, Armstrong R, Bhutta ZA, Francis D, Perez Koehlmoos T, Kristjansson E, Pantoja T, Tugwell P. Health equity: evidence synthesis and knowledge translation methods. <i>Syst Rev.</i> 013;2:43.	44	13(10)		31

* Citation data only available for 12/20 guidance review documents

SR = Systematic Review

HI = Health Inequality

Appendix 3: Study 2 Methodology Study Supplementary Material

- **A3.1 Databases and websites searched**
- **A3.2 Search strategies**

A3.1 Databases and websites searched

- MEDLINE (Ovid)
- CINAHL (EbscoHost)
- The Cochrane Database of Systematic Reviews (<http://www.cochranelibrary.com/>)
- Centre for Reviews and Dissemination Database (<http://www.cochranelibrary.com/>)
- Health Technology Assessments (<http://www.cochranelibrary.com/>)
- Database of promoting health effectiveness reviews (DoPHER) (<https://eppi.ioe.ac.uk/webdatabases4/Intro.aspx?ID=9>)
- NIHR Journals Library (<https://www.journalslibrary.nihr.ac.uk/>)
- Campbell Collaboration Library of Systematic Reviews (<https://www.campbellcollaboration.org/library.html>)
- 3ie (International Initiative for Impact Evaluation) database of systematic reviews (<http://www.3ieimpact.org/en/evidence/systematic-reviews/>)
- Google Scholar (<https://scholar.google.co.uk/>)

A3.2 Search strategies

Medline (OVID)

1 exp Meta-Analysis/
2 systematic review*.tw.
3 meta-analys*.tw.
4 ((narrative or integrative or mixed-method) adj2 (review* or synthesis)).tw.
5 ((evidence or knowledge) adj2 synthes*).tw.
6 (cochrane adj2 review*).tw.
7 1 or 2 or 3 or 4 or 5 or 6
8 exp *Educational Status/
9 exp *Socio-economic Factors/
10 exp *Health Status Disparities/
11 exp *Income/
12 exp *Employment/
13 exp *Social Class/
14 socio-economic*.mp.
15 disadvantaged.mp.
16 deprived.mp.
17 "low income".mp.
18 "educational status".mp.
19 "occupational status".mp.
20 ((poverty or income or educational* or occupation* or "low income" or social) adj2 (analysis or disadvantage* or specific or difference* or factor* or inequalit* or depriv* or inequit* or disparit*)).mp.
21 ((occupation* or income* or education* or social) adj3 (grade* or level* or status)).mp.
22 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21
23 7 and 22
24 limit 22 to systematic reviews or meta-analysis
25 23 or 24
26 limit 25 to (english language and yr="2013 - 2016")

CINAHL

S1 (MH "Meta Analysis")
S2 (MH "Systematic Review")
S3 TX ("systematic review*" OR meta-analys* OR "Cochrane review" OR "meta-synthesis" OR "integrative review" OR "evidence synthesis" OR "narrative review*" OR "knowledge synthesis" OR "mixed-method review*")
S4 S1 OR S2 OR S3
S5 (MM "Socio-economic Factors+")
S6 (MM "Educational Status")
S7 (MM "Health Status Disparities")
S8 (MM "Income+")
S9 (MM "Employment Status")
S10 (MM "Social Class+")
S11 TX Socio-economic OR socio-economic OR disadvantaged OR depriv* OR "low income" OR "educational status" OR "occupational status"
S12 TX (poverty or income or educational* or occupation* or "low income" or social) N2 (analysis or disadvantage* or specific or difference* or factor* or inequalit* or depriv* or inequit* or disparit*)
S13 TX (occupation* or income* or education* or social) N3 (grade* or level* or status)

S14 S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13
S15 (S4 AND S14)
S16 (S4 AND S14) Limiters - Publication Year: 2013-2016

Google Scholar

"socio-economic status" "systematic review" "differential effect*"

"socio-economic status" "narrative review" "differential effect*"

"socio-economic status" "meta-analysis" "differential effect*"

The Cochrane Library

#1MeSH descriptor: [Educational Status] explode all tre

#2MeSH descriptor: [Socio-economic Factors] explode all trees

#3MeSH descriptor: [Health Status Disparities] explode all trees

#4MeSH descriptor: [Income] explode all trees

#5MeSH descriptor: [Employment] explode all trees

#6MeSH descriptor: [Social Class] explode all trees

#7Socio-economic or socio-economic or disadvantaged or depriv* or "low income" or "educational status" or "occupational status"

#8(poverty or income or educational* or occupation* or "low income" or social) near/2 (analysis or disadvantage* or specific or difference* or factor* or inequalit* or depriv* or inequit* or disparit*)

#9(occupation* or income* or education* or social) near/3 (grade* or level* or status)

#10 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 Publication Year from 2013 to 2016

The Campbell Library

(Socio-economic OR socio-economic OR disadvantaged OR depriv* OR "low income" OR "educational status" OR "occupational status" OR "occupational level" OR "educational level" OR "income level" OR "social class*" OR "social position*" OR poverty OR "social* disadvantage" OR "social inequalit*" OR "social inequit*" OR "social disparit*") all text Limit to reviews, 2013-2016

3ie

Limit to effectiveness review, 2013-2016

Database of promoting health effectiveness reviews (DoPHER)

"Socio-economic" OR "socio-economic" OR "disadvantaged" OR "depriv*" OR "low income" OR "educational status" OR "occupational status" OR "occupational level" OR "educational level" OR "income level" OR "social class*" OR "social position*" OR poverty OR "social* disadvantage" OR "social inequalit*" OR "social inequit*" OR "social disparit*"

Appendix 4: Study 3 Supplementary Material

- **A4.1 Resources used to identify relevant theories**
- **A4.2 Search strategy**
- **A4.3 Strengths and limitations of theories in informing a meta-framework**
- **A4.4 Definitions informing the meta-framework**
- **A4.5 Contribution of theories in informing the meta-framework**
- **A4.6 Mechanisms associated with differential effects of interventions across SES groups**

A4.1 Resources used to identify relevant theories

- MEDLINE
- CINAHL
- The Cochrane Library (CDSR, Other reviews, HTA)
- Database of Promoting Health Effectiveness Reviews (DoPHER)
- Campbell Collaboration Library of Systematic Reviews
- 3ie (International Initiative for Impact Evaluation) database of systematic reviews
- Google Scholar
- Campbell and Cochrane Equity Methods Group website
- Contact with equity experts

A4.2 Search strategy

[(Health inequalit* OR health equit* or health inequit* OR socio-economic OR socio-economic OR disadvantaged OR depriv* OR "low income" OR "educational status" OR "occupational status" OR "occupational level" OR "educational level" OR "income level" OR "social class*" OR "social position*" OR poverty OR "social* disadvantage" OR "social inequalit*" OR "social inequit*" OR "social disparit*") OR ((complex or complexity) AND (systematic review* OR evidence synthesis))] AND [model* or theor* or concept* or framework* or guidance]

A4.3 Strengths and limitations of theories in informing a meta-framework

Complex intervention theories

Study	Focus/Theory	Key complexity focus	Overview	Strengths	Limitations
Anderson et al., (184)	Complex interventions Dimensions of complexity	Intervention design, Intervention implementation, Participant response, Context	<p>Conceptual approach to categorising and describing intervention complexity in systematic reviews of complex interventions.</p> <p>Define four dimensions of complexity;</p> <p>Intervention complexity: “situations in which we expect the effect of an intervention to be modified by variant properties or characteristics of the intervention itself.”</p> <p>Implementation complexity: “situations in which we expect the effect of an intervention to be modified by variant properties or characteristics of the implementation process.”</p> <p>Context complexity: “situations in which we expect the effect of an intervention to be modified by variant properties or characteristics of the setting or context in which an intervention is implemented.”</p> <p>Participant response: “situations in which we expect the effect of an intervention to be modified by variant characteristics of participants receiving the intervention.”</p>	<p>Aimed at systematic reviewers</p> <p>Considers the wider context of <i>if</i> and <i>how</i> interventions may work differently under different circumstances</p> <p>Distinguishes between stages of intervention process (provision and response)</p>	<p>Not health inequality/SES focus</p> <p>Limited detail on specific factors relating to the dimensions of complexity that may lead to differential effectiveness of interventions</p> <p>Limited detail on mechanisms</p>
Pigott & Shepherd (120)	Complex interventions Features of a complex intervention that can lead to heterogeneity of results	Intervention design, Intervention implementation, Participant response, Context,	<p>Describes the components of a complex intervention that can lead to heterogeneity of results</p> <p>Identifies four dimensions of complexity; intervention (includes design and delivery), context, target participants and focus of the outcomes.</p>	<p>Aimed at systematic reviewers</p> <p>Defines specific factors of complexity that may lead to differential effectiveness of interventions</p> <p>Incorporates outcomes as a separate dimension of complexity</p>	<p>Not health inequality /SES focus</p> <p>Factors relating to intervention design and implementation are not seen as separate dimensions of complexity</p> <p>Limited detail on factors relating to mechanisms</p>

<p>Rohwer et al.(134); Pfadenhauser et al. (223)</p>	<p>Complex interventions Systems-based logic model template (134) incorporating the Context and Implementation of Complex Interventions (CICI) framework (223)</p>	<p>Intervention design, Intervention implementation, Participant response, Context</p>	<p>Developed as part of wider guidance on the use of logic models in health technology assessments of complex interventions. Testable logic model. Aims to unpick elements the complexity of an intervention by describing 1) the “What?” of an intervention, i.e. the properties or characteristics of the intervention design; 2) the “How?”, “Who?” and “Where?” of the intervention, i.e. the characteristics of the implementation process during the evaluation period and 3) characteristics relating to the context. As an <i>a priori</i> model it provides systematic reviewers with an opportunity to present their programme theory. Incorporates the Context and Implementation of Complex Interventions (CICI) Framework (186).</p>	<p>Aimed at systematic reviewers Testable logic model Considers the wider context of <i>if</i> and <i>how</i> interventions may work differently under different circumstances Defines specific factors of complexity that may lead to differential effectiveness of interventions Incorporates intervention theory into logic model</p>	<p>Not health inequality /SES focus Descriptive model rather than explanatory No detail on factors relating to mechanisms Implementation and context defined differently to other complexity frameworks.</p>
<p>Lewin et al., (185)</p>	<p>Complex interventions Intervention Complexity Assessment Tool for Systematic Reviews (iCAT_SR)</p>	<p>Intervention design, Intervention implementation, Participant response, Context</p>	<p>The iCAT_SR aims to assess and categorise levels of intervention complexity in systematic reviews. Comprises of six ‘core’ and four ‘optional’ dimensions for assessing intervention complexity. Aims to facilitate a greater understanding of intervention complexity.</p>	<p>Aimed at systematic reviewers Testable framework Considers the wider context of <i>if</i> and <i>how</i> interventions may work differently under different circumstances Defines specific factors of intervention design and delivery that may lead to differential effectiveness of interventions Distinguishes between stages of intervention process (provision and response)</p>	<p>Not health inequality/SES focus Limited detail on specific factors relating to dimensions of context and participant response that may lead to differential effectiveness of interventions Limited detail on factors relating to mechanisms</p>

Socio-economic health inequality intervention theories

Study	Focus/Theory	Key complexity focus	Overview	Strengths	Limitations
Tudor-Hart (187)	SES 'Inverse care law'	Implementation, Context	The 'inverse care law' states that "the availability of good medical care tends to vary inversely with the need of the population served." [28, p. 412]. In other words, lower socio-economic populations will have the poorest access to health care services, because lower SES groups are more likely to suffer ill health. This in turn places a greater demand on the availability of services and resources in more socio-economically deprived areas.	SES focus. Defines 'access' as a point at which socio-economic health inequalities may be introduced. Highlights environmental contextual factors and mechanisms influencing intervention effectiveness.	Limited detail provided on factors relating to intervention or participant response.
Tanahashi (188)	Health inequalities Service provision and health coverage	Implementation	Conceptual framework highlighting five stages in the provision of an intervention which may affect healthcare coverage: 1) availability coverage, 2) accessibility coverage, 3) acceptability coverage, 4) contact coverage.	Focus on 'access' and 'effectiveness' in the provision of an intervention. Highlights mechanisms relating to implementation that may lead to differential effects.	Limited detail provided on factors or mechanisms relating to intervention, context or participant response.
Victoria et al. (189, 190)	SES 'inverse equity hypothesis'	Participant response	The 'inverse equity hypothesis' states that "following the introduction of new public-health interventions, inequities in infant and child health status between richer and poorer groups in society usually widen before they get smaller and improve." [30, p. 1093].	SES focus. Highlights 'access' and 'uptake' as points at which socio-economic health inequalities may be introduced.	No detail provided on factors relating to implementation and context.
Graham & Kelly (25)	Health inequalities Tackling health inequalities continuum	Intervention	Outlines three approaches to reducing health inequalities; 1) targets the most disadvantaged populations aiming to improve their absolute position regardless of whether there are improvements in the health across the whole population or in the highest socio-economic groups, 2) health gap aiming to reduce the relative health difference gap between the most disadvantaged and least disadvantaged, 3) health gradient aiming to reduce health	Health inequality focus. Identifies target of interventions that are more equity sensitive.	Limited detail on specific factors relating to implementation, participant response and context. Limited detail on factors relating to mechanisms.

			<p>inequalities across all social groups. It seeks to achieve equity in health by improving the health of the population disproportionately with those of lower socio-economic status receiving greater benefit.</p> <p>These three approaches increase in equity sensitivity as you move from one that targets disadvantaged populations to one that aims to close the gap between the most and least disadvantaged to the most equity sensitive approach of reducing social gradients in health.</p>		
Starfield (191, 192)	<p>Health inequalities/SES</p> <p>Pathways of influence on equity in health</p>	<p>Intervention, Implementation, Context, Participant response</p>	<p>Depicts individual and population pathways of influence on equity in health. Focuses on the political and policy context.</p> <p>Highlights the importance of societal influences on health inequalities and the need for population-based approaches to tackle health inequalities.</p> <p>Extends beyond the health sector to consider influences on health from occupational & environmental policy; social policy; economic policy.</p>	<p>SES focus.</p> <p>Testable framework.</p> <p>Depicts individual and population-based approaches.</p> <p>Useful for identifying wider environmental contextual factors.</p>	<p>Does not distinguish between domains of complexity.</p> <p>Less useful when considering non-policy approaches to reducing SES health inequalities or factors relating to implementation.</p>
Tugwell et al. (49); Welch et al. (193)	<p>SES</p> <p>The Equity-effectiveness Loop</p>	<p>Intervention, Implementation, Context, Participant response</p>	<p>The equity effectiveness loop framework highlights points in the intervention process where socio-economic health inequalities may arise and how they arise.</p> <p>The framework is based on six iterative steps; 1) Burden of illness, 2) Differential equity effectiveness, 3) Economic evaluation, 4) Knowledge translation and implementation, 5) Monitoring of program, 6) Reassessment.</p> <p>Community effectiveness is often lower than efficacy due to a staircase effect due to lower awareness, access, or coverage; screening, diagnosis or targeting; provider compliance and customer adherence.</p> <p>Defines access as depending on 5 factors: 1) availability; 2) accessibility; 3) affordability; 4) acceptability; and 5)</p>	<p>SES focus.</p> <p>Testable framework, supported with empirical evidence.</p> <p>Focuses specifically on population health interventions and policies that aim to narrow the gap between the most and least disadvantaged.</p> <p>Considers both individual risk factors that may lead to absolute differences in effectiveness and response factors that may lead to relative differences in effectiveness.</p> <p>Highlights specific factors relating to the domains of complexity that may lead to differential effectiveness of interventions.</p>	<p>Steps don't distinguish between domains of complexity.</p> <p>Less useful when considering key factors relating to intervention and wider environmental context.</p>

			<p>accommodation (defined as a modification of an intervention to suit consumer preferences).</p> <p>Argues that lower SES have lower efficacy at each of these four steps. A cumulative effect ('staircase effect') may be seen if the most disadvantaged have a greater reduction in efficacy at all four steps.</p>	<p>Highlights potential 'real-world' modifiers of effectiveness (i.e. mechanisms) in the provision of, and response to, an intervention: access, diagnostic accuracy, provider compliance, and consumer adherence.</p>	
White-head (32)	Health inequalities Typology	Intervention	<p>Interventions designed to tackle health inequalities are categorised into four levels of action; 1) Strengthening individuals, 2) Strengthening communities, 3) Improving living and working conditions, 4) Promoting healthy macro policies.</p> <p>Recognises that interventions that address structural barriers to achieving an improvement in health status are likely to be more effective in tackling health inequalities than interventions that address non-structural barriers.</p>	<p>Health inequality/SES focus.</p> <p>Testable typology, supported with empirical evidence.</p> <p>Most useful when considering differential effectiveness of interventions across several levels of action.</p> <p>Links an intervention's levels of action with its effect on health inequalities gap and gradient.</p> <p>Considers context.</p>	<p>Less useful when considering interventions targeting a single level of action (key characteristics of an intervention and implementation).</p>
White et al. (24)	SES Framework	Intervention, Implementation, Context, Participant response	<p>Identifies key stages in implementation of an intervention where socio-economic health inequalities may arise; including identification of need, underestimation of risk, compliance, uptake and efficacy.</p> <p>Recognises that small socioeconomic gradients may be seen at each stage leading to a larger cumulative effect.</p>	<p>SES focus.</p> <p>Testable framework, supported with empirical evidence.</p> <p>Distinguishes between 'provision' and 'response' factors related with differential effects of interventions.</p> <p>Detail provided on specific factors relating to the domains of complexity that may lead to differential effectiveness of interventions.</p>	<p>Less useful when considering factors relating to context.</p>
Frieden (194)	Health Inequalities	Intervention	<p>A conceptual 5-tier framework for public health action. Interventions are arranged in a pyramid with those at the base requiring less individual effort and have greater population impact than those at the top.</p>	<p>Testable framework, supported with empirical evidence.</p> <p>Depicts individual and population-based approaches.</p>	<p>Less useful when considering factors relating to implementation.</p>

	The Health Impact Pyramid Conceptual framework		From the bottom up the interventions address; 1) socio-economic determinants, 2) public health interventions that change the context for health, 3) protective interventions with long-term benefits, 4) direct clinical care and 5) counselling and education.		
Braveman et al. (195)	Health inequalities Social injustice	Context	Highlights that if health inequalities are 'avoidable' then this is grounded in ethical and human rights principles and reflects issues of social injustice in access to healthcare.	Health inequality focus. Focuses on the issue of social justice.	Limited detail on dimensions of complexity and key factors other than issues relating to social justice. Not specifically aimed at systematic reviewers. Doesn't distinguish between dimensions of complexity.
Welch et al. (102)	SES/sex & gender Health equity plausibility algorithm	Intervention, Implementation, Context, Participant response	The health equity plausibility algorithm aims to help reviewers predict whether differential effects of health interventions could be expected across SES groups. Asks reviewers to consider whether differences in the magnitude of relative effect of the intervention versus the control for the outcome of interest may be influenced by; 1) differences in patient/community/population characteristics, 2) differences in the way that the intervention is delivered, 3) differences in the comparator across the patient, community or population.	Aimed at systematic reviewers. SES focus. Focuses on whether or not reviewers should expect relative differences.	Lack of inter-rater reliability. Multi-component nature of the questions (i.e. algorithm does not distinguish between dimensions of complexity). Limited detail provided on specific factors relating to the dimensions of complexity that may lead to differential effectiveness of interventions (e.g. participant response - underlying pathophysiology). Limited detail on factors relating to context or mechanisms. Assumes reviewers have an understanding of the ways in which SES characteristics may impact on intervention effectiveness.

<p>Levesque et al. (196)</p>	<p>Health inequalities</p> <p>A conceptual framework of access to health care</p>	<p>Implementation, Context, Participant response</p>	<p>Five dimensions of access in the provision and response of healthcare. Five dimensions of access in the provision of services are; 1) Approachability, 2) Acceptability, 3) Availability & accommodation, 4) Affordability, 5) Appropriateness. Five corresponding mechanisms are 1) Ability to perceive, 2) Ability to seek, 3) Ability to reach, 4) Ability to pay, 5) Ability to engage.</p>	<p>Health inequality focus.</p> <p>Testable framework, supported with empirical evidence.</p> <p>Identifies mechanisms associated with access to healthcare.</p> <p>Identifies factors and mechanisms relating to implementation, context and participant response.</p> <p>Incorporates and extends the definition of access proposed in the equity effectiveness loop [35] and the intervention-generated inequalities framework [1].</p> <p>Follows White et al.'s [1] framework in recognising determinants of access as pertaining to both the provision of an intervention and the response to an intervention.</p>	<p>Limited detail on factors relating to intervention.</p> <p>No detail on factors or mechanisms associated with efficacy.</p>
<p>O'Neill et al. (70)</p>	<p>Health inequalities</p> <p>PROGRESS-PLUS framework</p>	<p>Participant response</p>	<p>PROGRESS is an acronym and refers to Place of residence, Race/ethnicity/culture/ language, Occupation, Gender/sex, Religion, Education, Socio-economic status, and Social capital. 'Plus' incorporates age, disability, sexual orientation.</p> <p>Equity guidance for systematic reviewers [8,9, 10] recommend using the 'PROGRESS-PLUS when considering the impact of socio-demographic factors across which interventions may have differential effects in systematic reviews.</p> <p>Aims to overcome focus on a single 'social stratifier' and highlights the fact that these health inequality dimensions are often inter-related.</p>	<p>Health inequality/SES focus.</p> <p>Identifies factors relating to personal context and participant response that may have an impact on the effectiveness of healthcare interventions.</p> <p>Some detail provided on mechanisms of impact.</p> <p>Testable framework, supported with empirical evidence.</p>	<p>Limited detail on factors relating to intervention, environmental context or implementation that may lead to differential effectiveness of interventions.</p>

<p>NIHR CLAHRC North West Coast (97)</p>	<p>Health inequalities Health Inequalities Assessment Toolkit (HIAT)</p>	<p>Intervention, Implementation, Context, Participant response</p>	<p>HIAT aims to ensure that research conducted has the potential to reduce health inequalities. Comprises of four sections with a focus on socio-economic health inequalities; 1) Clarifying what aspects of health inequalities and their socio-economic drivers are relevant to the problem to be addressed, 2) Designing intervention/ action to maximize potential to reduce health inequalities, 3) Evaluating and/or monitoring the impact of your activity on health inequalities and the drivers, 4) Planning for wider impacts on health inequalities and its drivers.</p>	<p>SES focus. Sections 1-3 most useful for planning whether SES inequalities will impact on intervention effectiveness in a systematic review. Examples of factors relating to mechanisms of impact and participant response provided in worked example.</p>	<p>Doesn't distinguish between dimensions of complexity. Not specifically aimed at systematic reviewers. Assumes reviewers have an understanding of the ways in which SES characteristics may impact on intervention effectiveness. Limited detail on factors relating to intervention.</p>
<p>McGill et al. (163)</p>	<p>Health inequalities 6P's Typology</p>	<p>Intervention</p>	<p>Six categories of intervention; Price – fiscal measures (e.g. taxes, subsidies, or economic incentives). Place – environmental measures in specific settings such as schools, work places (e.g. vending machines) or planning (e.g. location of supermarkets and fast food outlets) or community-based health education. Product – modification of food products to make them healthier/less harmful e.g. reformulation, additives, or elimination of a specific nutrient. Prescriptive – restrictions on advertising/marketing through controls or bans, labelling, recommendations or guidelines. Promotion – mass media public information campaigns. Person –Individual-based information and education (e.g. cooking lessons, tailored nutritional education/ counselling, or nutrition education in the school curriculum).</p>	<p>Policy focus. Testable typology, tested and refined in SES focused systematic review. Categories based on 'mechanisms of underlying change'.</p>	<p>Limited detail on dimensions of complexity and key factors other than intervention. Does not include clinical (pharmacological and non-pharmacological) interventions. Framework testable at category level (i.e. what type of interventions are more effective), rather than looking to identify factors associated with successful interventions across categories.</p>
<p>Adams et al. (198)</p>	<p>Health inequalities</p>	<p>Intervention</p>	<p>Highlights the level of agency i.e. the extent to which recipients must use their personal resources, or "agency," to benefit from an intervention.</p>	<p>Health inequality focus. Detail provided on mechanisms of impact relating to level of agency.</p>	<p>Limited detail on dimensions of complexity and key factors other than intervention design and participant response.</p>

	Level of agency		Population interventions that require individuals to use a low level of individual agency to benefit are more likely to be effective, and equitable, than interventions requiring more agency, because individuals do not have to consciously engage with any information or actively change their behaviour, so then there is less room for attrition at each of the many steps from intervention delivery to outcome.		Doesn't distinguish between dimensions of complexity. Not specifically aimed at systematic reviewers.
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A4.4: Definitions informing the meta-framework

A4.4.1: Defining dimensions of the intervention pathway

Intervention: Describes the properties or characteristics (i.e. components and execution) of the intervention design (134, 184)

Implementation: Describes the characteristics (i.e. delivery mechanisms, delivery agents and setting) of the implementation process during the evaluation period (134, 184, 224).

Context: Relates to “factors which are external to the intervention, but which may impede or strengthen the effects of an intervention.” (224). In particular, context is taken to relate to both environmental factors, i.e., “factors that are outside of an individual’s control, such as the laws, government, cultural beliefs, family, and work.” and personal factors, i.e. such as those encompassed in the PROGRESS acronym (70).

Participant response: Relates to how participant’s respond to an intervention.

Mechanisms: How factors relating to the intervention design, implementation, context and participant’s responses interact to trigger changes in an individual’s reasoning and actions (224).

A4.4.2: Defining intervention factors associated with differential effects across SES groups^{1,2,3}

Domain/Factor	Definition
Intervention	Characteristics of the intervention design.
Intervention type¹	Relates to the ‘what is delivered’ part of the intervention.
Type of component²	In applying an equity lens, the 6P’s framework (163) describes six types of interventions; 1. Price (fiscal measures such as taxes, subsidies, or economic incentives), 2. Place (environmental measures in specific settings such as schools, work places (e.g. vending machines) or planning (e.g. location of supermarkets and fast food outlets), 3. Product (modification of food products to make them healthier/less harmful), 4. Prescriptive (restrictions on advertising/ marketing through controls or bans, labelling, recommendations or guidelines), 5. Promotion (mass media public information campaigns), 6. Person (Individual-based information and education). The 6Ps framework is a policy focused framework and as such, excluded clinical (pharmacological and non/pharmacological) interventions. Clinical interventions were highlighted in other theories, most notably in Frieden’s (194) Health Impact Pyramid, therefore, we present an adapted version of McGill et al.’s (163) 6P framework and propose a 7P framework with the addition of Pharmacological/non-pharmacological clinical interventions.
Type of behaviour change targeted	Relates to whether the type of intervention component requires a voluntary change (e.g. adding fluoride to water supplies) or compulsory change (e.g. wearing of seatbelts or bicycle helmets) in behaviour.
Intervention approach	Relates to ‘who’ is the target of the intervention.
Individual/population	Interventions may be universal, targeted at population level, or individual, targeted at individuals.
Targeted/Gap/Gradient	Interventions that target the most disadvantaged populations (individuals or groups) aim to improve their absolute position regardless of whether there are improvements in the health across the whole population or in the highest socio-economic groups. Interventions that target the health inequality gap aim to reduce the relative health difference gap between the most disadvantaged and least disadvantaged populations. Interventions that target the gradient, aim to reduce health inequalities across all social groups. This approach recognises that social inequalities in health increase with declining socio-economic status. It seeks to achieve equity in health by improving the health of the population disproportionately with those of lower socio-economic status receiving greater benefit.

Domain/Factor	Definition
Timing & duration¹	Refers to ‘when’ the intervention is delivered and ‘how long’ for. Timing may relate to the time of day an intervention is delivered (e.g. during working hours), or the time period during an individual’s life-span (e.g. early childhood). Duration refers to the length of time required to access and receive an intervention.
Dose & intensity¹	Refers to ‘how much’ and ‘how intensely’ an intervention is delivered.
No. of active components³	Number of discrete, active components of the intervention that could be implemented independently of other components, (i.e. single component, more than one component, more than one component delivered as a bundle, varies across interventions to be considered/included in review).
Degree of interaction between components including independence and interdependence³	Level of interaction between intervention components, e.g. the degree to which effectiveness is dependent upon the combination of components or sequence of delivery (i.e. independent - one component/action or components act independently, moderate interaction – some degree of interaction but no evidence of synergistic/dysnergistic effects, high-level interaction – substantial interaction/inter-dependency between components/actions).
No. of behaviours/actions targeted by intervention³	Number of behaviours or actions targeted by an intervention (i.e. single target, dual target, multi-target, varies across interventions considered for/included in review).
No. of organisational levels & categories targeted³	Levels refers to who the intervention is targeted at (i.e. single category - intervention directed only at single category of individuals (e.g. nurses, low income) within the individual level (e.g. professionals or patients or policy makers), Multi-category - intervention directed at two or more categories of individuals within the individual level (e.g. primary care professionals and primary care patients), Multi-level - intervention directed at two or more levels.)
No of levels of action targeted	Number of levels of action targeted. For example, Whitehead defines four levels of action as 1) strengthening individuals, 2) strengthening communities, 3) improving living and working conditions, 4) promoting healthy macro-policies.
No. of sectors targeted	Number of sectors involved in the intervention design (e.g. health/social/environmental/economic sectors).

¹Definitions based on Rohwer et al. (134), ²Definitions based on McGill et al. (163), ³Definitions based on Lewin et al. (185).

A4.4.3: Defining implementation factors associated with differential effects across SES groups^{1,2}

Domain/Factor	Definition
Implementation	
1. Delivery mechanisms¹	Refers to the ‘how is intervention delivered’ part of the intervention process.
1.1 Resources	Resources required to deliver an intervention.
1.1.1 Infrastructure	Refers to the infrastructure (e.g. facilities, drugs etc.)
1.1.2 Manpower	Refers to the people required to deliver an intervention.
1.2 Cost	Costs involved in the provision and receipt of an intervention. Costs may be tangible (financial) or intangible (time).
1.2.1 Cost to recipient	Costs incurred by those receiving an intervention.
1.2.2 Cost to provider	Costs incurred by those providing an intervention
1.3 Mode of delivery	Refers to the way in which an intervention is delivered (e.g. face-to face, via the media).
1.4. Degree of tailoring²	Extent to which an intervention is tailored or modified for disadvantaged populations (i.e. Inflexible – intervention highly standardised with minimal variation site to site, Moderately tailored/flexible – some variation in implementation from site to site permitted with some intervention components tailored/flexible to disadvantaged populations, Highly tailored/flexible – high level of variation in implementation from site to site permitted and/or intervention tailored to disadvantaged populations.)
2. Delivery agent characteristics¹	Refers to the ‘who’ is delivering the intervention and their characteristics (e.g. knowledge, skills).
3. Setting¹	Refers to the ‘where’ the intervention is delivered. The location in which the intervention is delivered and its characteristics.
4. Process outcomes¹	Refers to outcomes regarding intervention implementation (e.g., quality, provider compliance or fidelity of an intervention).

¹Definitions based on Rohwer et al. (134), ²Definitions based on Lewin et al.(185).

A4.4.4: Defining context factors associated with differential effects across SES groups^{1,2}

Domain/Factor	Definition
Context	
1. Personal¹	Context factors relating to the social differentiation characteristics of an individual.
1.1 Place of residence	The place in which an individual lives. Includes region, town, community, and low-, middle-, high-income countries.
1.2 Race/ethnicity/culture/language	An individual's racial ethnic or cultural background and the language they speak/understand.
1.3 Occupation	An individual's work status (employed/unemployed) or position in the occupational hierarchy (e.g. professional, manual worker).
1.4 Gender and sex	Biological differences (sex) or differences in socially constructed roles associated with the sexes (gender).
1.5 Religion	An individual's religious or non-religious affiliations.
1.6 Education	An individual's educational status (e.g. degree-level, secondary-level).
1.7 Income	An individual's economic position (e.g. low-income, high-income).
1.8 Social capital	An individual's level of social relationships and networks.
1.9 Age	Relating to an individual's age.
1.10 Disability	Relating to an individual's disability.
1.11 Sexual orientation	An individual's sexual orientation (e.g. heterosexual, homosexual, bi-sexual, etc.).
Environmental²	Context factors that are outside of an individual's control.
2.1 Geographical	Broader physical environment, landscapes and resources, including infrastructure (e.g., existing public transport infrastructure) available in a given setting.
2.2 Epidemiological	Population distribution of diseases or conditions. The attributable burden of disease, as well as determinants of needs in populations.

Domain/Factor	Definition
2.2 Socio-cultural	Relating to the wider social (e.g. social roles and relationships) and cultural (e.g. family beliefs, customs, institutions) conditions in which individuals are born, live and work.
2.3 Socio-economic	Wider socio-economic influences (e.g. levels of unemployment, market forces, trends in earnings and incomes).
2.4 Ethical	Relating to aspects of fairness, justice, morality and standards of conduct and principles that govern the behaviour or conduct of individuals or institutions.
2.5 Legal	Rules and regulations that protect the rights and societal interests of a population.
2.6 Political	Relating to the distribution of power, assets and interests within a population, the organisations involved and the rules (both formal & informal) that govern interactions between them.
2.7 Policy	Policies and processes of government or other organisations (public or private) that may directly or indirectly influence the implementation of an intervention.
2.8 Funding	Mechanisms by which the implementation of an intervention is funded by governmental, non-governmental, private-sector or philanthropical organisations.
2.9 Organisation & structure	Relating to organisational structural resources, social architecture and culture and the networks through which it operates in the implementation of an intervention.

¹Definitions based on O'Neill et al.(70), ²Definitions based on/adapted from Rohwer et al.(134) and Pfadenhauer et al.(223).

A4.4.5: Defining participant response factors associated with differential effects across SES groups¹

Domain/Factor	Definition
Participant response	
Intellectual response	Relating to intellectual outcomes such as knowledge, skills, or cognition.
Behavioural response	Relating to behavioural outcomes such as adherence or motivation.
Psychological response	Relating to psychological outcomes such as stress or coping.
Emotional response	Relating to emotional outcomes such as fear or distrust.

¹Definitions based on Pigott & Shepherd (120).

A4.5: Contribution of theories in informing the meta-framework

A4.5.1: Contribution of theories to the identification of domains and factors associated with differential effects in systematic reviews of complex interventions

Domains of complex interventions	Factors associated with differential effects of complex interventions	Anderson et al.(184)	Rohwer et al.(134)/ Pfadenhauer et al.(223)	Lewin et al.(185)	Pigott & Shepherd (120)
Intervention complexity		✓	✓	✓	✓
	Type of intervention components		✓		✓
	Number of active components			✓ ²	
	Number of behaviours/actions targeted by intervention			✓ ²	
	Number of organisational levels & categories targeted by intervention			✓ ²	
	Timing and duration of intervention		✓		
	Dose and intensity of intervention		✓		✓
Implementation complexity	Degree of interaction between intervention components			✓ ³	
		✓	✓ ⁵	✓	✓
	Delivery agent characteristics (level of knowledge, skills, motivation, beliefs)		✓	✓ ⁴	
	Delivery mechanisms (degree of tailoring)		✓	✓ ⁴	✓
Context complexity	Setting	✓	✓	✓ ³	✓
	Process outcomes		✓		
		✓	✓ ⁵	✓	✓
	Personal (gender)	✓	✓		✓
Participant response	Environmental (geographical, epidemiological, policy, funding, organisation and structure, ethical, legal, political, socio-cultural, socio-economic)	✓	✓		✓
		✓ ⁵	✓ ⁵	✓ ³	✓
	Intellectual response		✓	✓ ²	✓
	Behavioural response		✓		✓
Other complexity considerations¹	Psychological response				✓
	Emotional response				✓
	<i>Nature of causal pathway between intervention and outcome it is intended to affect</i>			✓ ²	
	<i>Healthcare outcomes</i>		✓		
			✓		

¹ Other factors relating to complex interventions that lie outside of the four domains of complexity. ² Considered core factors.

³ Considered optional factors. ⁴ Level of skills required by those delivering an intervention and degree of tailoring were considered core, other factors relating to provider factors were considered optional. ⁵ Factors associated with context, participant response and implementation were realigned according to the definitions outlined in Appendix 4, A4.4.

A4.5.3: Implementation factors associated with differential effects across SES groups (*additional factors identified by SES theories in italics*)

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Implementation	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1. Delivery mechanisms	✓	✓	✓		✓						✓	✓	✓	✓	✓	✓
1.1 Resources	✓	✓	✓		✓						✓	✓	✓			
1.1.1 Infrastructure	✓	✓	✓									✓	✓			
1.1.2 Manpower	✓	✓	✓									✓	✓			
1.2 Cost	✓	✓	✓		✓	✓	✓		✓			✓	✓	✓	✓	✓
1.2.1 Cost to recipient	✓	✓	✓			✓	✓		✓			✓	✓	✓	✓	✓
1.2.2 Cost to provider		✓				✓						✓			✓	
1.3 Mode of delivery			✓				✓					✓	✓			
1.3.1 Face to face							✓						✓			
1.3.2 Media							✓									
1.4 Degree of tailoring						✓		✓					✓	✓		
2. Delivery agent characteristics	✓	✓	✓		✓	✓						✓	✓	✓		
3. Setting	✓	✓	✓								✓	✓	✓	✓	✓	
4. Process outcomes	✓	✓	✓			✓				✓	✓	✓	✓			
4.1 Quality	✓	✓	✓			✓				✓	✓	✓	✓			
4.2 Fidelity			✓			✓						✓				

A4.5.4: Context factors associated with differential effects across SES groups

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Context	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No. of deprivations					✓		✓	✓	✓							
1. Personal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.1 Place of residence					✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
1.2 Race/ethnicity/culture/language			✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.3 Occupation	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.4 Gender			✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.5 Religion		✓			✓	✓					✓		✓	✓		
1.6 Education			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.7 Income	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.8 Social capital	✓			✓	✓	✓	✓				✓	✓	✓	✓	✓	✓
1.9 Age			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.10 Disability											✓	✓	✓	✓		
1.11 Sexual orientation											✓	✓	✓	✓		
2. Environmental	✓		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	
2.1 Geographical	✓		✓		✓	✓	✓		✓			✓	✓	✓		
2.2 Epidemiological	✓				✓	✓										
2.2 Socio-cultural	✓		✓		✓		✓		✓			✓	✓			
2.3 Socio-economic	✓		✓	✓	✓		✓		✓			✓				
2.4 Ethical	✓		✓				✓		✓	✓		✓				
2.5 Legal					✓		✓			✓						
2.6 Political	✓		✓		✓		✓		✓	✓						
2.7 Policy					✓		✓									
2.8 Funding	✓		✓		✓				✓							
2.9 Organisation & structure	✓		✓		✓						✓					

A4.5.5: Participant response factors associated with differential effects across SES groups

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Participant response	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
1. Intellectual response	✓		✓				✓					✓	✓	✓	✓	✓
Knowledge	✓		✓				✓					✓	✓			
Skills							✓									
Competence																
Health literacy												✓				
2. Behavioural response			✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓
Adherence						✓			✓				✓			
Motivation									✓			✓				
Substitution						✓										
Social norms									✓				✓			
Sustainable								✓								
Risk taking								✓								
Self-management												✓				
3. Psychological response			✓		✓		✓						✓			✓
Empower			✓		✓		✓									
Stigma			✓													
Stress					✓											
Self-esteem							✓					✓				
Self-confidence							✓									
4. Emotional response							✓		✓			✓	✓	✓		
Beliefs							✓					✓	✓			
Suspicion									✓							
Self-efficacy												✓				
Trust													✓			

A4.5.6: How socio-economic health inequalities may be introduced on the intervention pathway

Stages at which socio-economic health inequalities may arise	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
1. Effectiveness																
1.1 Exposure	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
2. Access ¹																
2.1 Approachability		✓	✓		✓	✓	✓	✓				✓	✓	✓		✓
2.2 Acceptability	✓	✓	✓		✓				✓			✓	✓	✓		✓
2.3 Availability & accommodation	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
2.4 Affordability		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
2.5 Appropriateness	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
3. Cost -effectiveness						✓									✓	

¹Based on Levesque et al's., (196) definition of access

A4.5.7: Why socio-economic health inequalities may be introduced (mechanisms)

Mechanisms	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
1. Choice	✓		✓				✓	✓	✓	✓		✓	✓	✓		✓
1.1 Ability to choose	✓		✓				✓	✓	✓	✓		✓	✓	✓		✓
2. Effectiveness	✓		✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
2.2 Ability to control	✓		✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
3. Access¹	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.1 Ability to perceive		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓		✓
3.2 Ability to seek	✓	✓	✓		✓				✓			✓	✓	✓		✓
3.3 Ability to reach	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
3.4 Ability to pay		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
3.5 Ability to engage	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓

¹ Access mechanisms taken from Levesque et al. (196).

A4.6: Mechanisms associated with differential effects of interventions across SES groups

A4.6.1 Ability to choose

Freedom to choose relates to the wider societal context of justice and ethics (195). The ability to choose may influence both access and effectiveness mechanisms and can arise as a result of factors relating to the provision of, or response to, an intervention. In response to an intervention, the lack of a free choice may impact negatively when vulnerable individuals are prevented from accessing an intervention by others (e.g. see table A4.6.1; 7, 9). An individual's life circumstance may also reduce their ability to choose. For example, if individuals within lower SES groups cannot afford to pay for an intervention then they don't have a 'free choice' in accessing an intervention (e.g. see table A4.6.1; 1).

Conversely, restricting 'free choice' in the provision of an intervention, by introducing compulsory behaviour change interventions may result in positive impacts on socio-economic health inequalities. Individuals still in effect, have 'freedom of choice' in that they can choose to opt-out of compulsory behaviour change (e.g. smokers can choose to smoke outside of areas where smoking bans are enforced). However, more individual effort is required to 'opt-out' than to 'opt-in' (194, 198). Freedom to choose, may have a negative impact in the provision of an intervention, if for example, individuals required to deliver an intervention choose not to work in more disadvantaged areas (e.g. see table A4.6.1; 6).

Table A4.6.1: Factors influencing ‘ability to choose’ and the impact on socio-economic health inequalities¹

Mechanism	Example	Factors associated with differential effects across SES populations [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
Ability to choose	1. “Low-income parents often struggle to afford the fruit and vegetables they know to be important for their children’s health [23]. Using subsidies to make healthier food more affordable is a low-agency population intervention that may increase the choices available to these parents.” (198)	Intervention - Type of component - Price Intervention – Dose & intensity (low agency) Implementation - Cost to recipient – Financial (subsidies) Context – Personal - Income	+
	2. “It is therefore particularly unjust that those who are socially disadvantaged should also experience additional obstacles to opportunity based on having worse health. Ratifying human rights agreements obliges governments to direct special effort toward equalizing the rights of vulnerable groups facing more obstacles to realizing their rights.” (195)	Context – Personal Context - Environmental – Ethical, Political, Legal	
	3. “Prevalence and length of childhood diarrhea episodes are inversely related to mothers’ education... Educating girls and mothers can improve food safety and reduces the risk of diarrhea for infants.” (70)	Intervention – No. of organisational levels & categories targeted (multi-category) Context - Personal – Age, Education Context - Environmental – Socio-cultural	
	4. “In many cultures, having a son is preferable to a daughter, and over centuries, this has resulted in infanticide of baby girls, neglect, and, with diagnostic ultrasound, sex-selective abortions...Incentives (i.e., pensions for parents of girls) and poster/media campaigns to promote daughters have helped reduce expressions of son preference[62]”. (70)	Intervention - Type of component – Price (incentive), Promotion Context – Personal - Race/ethnicity/culture/language Context – Personal – Gender/sex	
	5. “A common attribute of interventions that lead to increase socio-economic inequalities in health appears to be a reliance on voluntary behaviour change (Mechanic, 2002).”(32)	Intervention - Type of behaviour change targeted (voluntary) Context – Personal – Income, Education, Occupation Participant response - Behavioural	
	6. “those most able to choose where they will work tend to go to middle-class areas, and that the areas with highest mortality and morbidity tend to get those doctors who are least able to choose where they will work.” (187)	Implementation - Delivery agent characteristics Context – Environmental – Geographical, Epidemiological	

<p>7. "Once they become sick, poor children are not as likely as their better-off peers to be taken to an appropriate health-care provider, such as a village health worker, a dispensary, a health centre, a hospital, or a private doctor." (190)</p>	<p>Context – Personal – Income, Age Context – Environmental – Socio-cultural</p>
<p>8. <i>"Diverting resources into mosques alone would mean reduced access and uptake for people who won't or can't go to mosques."</i> (18)</p>	<p>Implementation – Setting Context – Personal - Religion</p>
<p>9. <i>"children may not be given a choice to refuse health services because of religious beliefs, but their parents make the decision. As aforementioned for culture, in certain contexts, adhering to religious beliefs is not an individual choice but is imposed by the community or family."</i> (70)</p>	<p>Context - Personal – Age, Religion, Race/ethnicity/culture/language Context - Environmental – Socio-cultural Participant response – Emotional (beliefs)</p>

²Examples in italics highlight the potential impact on SES health inequalities as a result of interactions between SES and other PROGRESS-Plus factors.

A4.6.2 Ability to control

Even if individuals are free to choose whether or not to access an intervention, their ability to control effectiveness may be hampered by personal or environmental context factors. For example, risk of disease or exposure to harmful outcomes may be related to socio-economic characteristics (e.g. see table A4.6.2; 3,7) or the wider geographical context (e.g. see table A4.6.2; 2). Such factors may influence an individual's ability to control their behaviours or actions over time. 'Ability to control' may be greater if population level interventions target a compulsory behaviour change, thus minimising the reliance on individuals, and those around them, to control their own behaviours or actions (e.g. see table A4.6.2;8).

Table A4.6.2: Factors influencing ‘ability to control’ and the impact on socio-economic health inequalities¹

Mechanism	Example	Factors associated with differential effects across SES populations [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
Ability to control	<p>1. “modern diets contain many times the minimum daily requirement of sodium—mostly from packaged foods and restaurant meals—making it difficult for individuals to control their intake.²⁷ Reducing dietary sodium can reduce hypertension at the population level.^{28,29} A healthier food environment can be created by decreasing salt in packaged foods. This is happening in the United Kingdom, which introduced four-year sodium reduction targets,³⁰ and in Finland, where dietary sodium intake decreased approximately 25% in the past 30 years.³¹” (194)</p>	<p>Intervention – Type of behaviour change targeted (compulsory)</p> <p>Intervention – Type of component – Product</p> <p>Intervention – Intervention approach - Population</p>	<p>+</p>
	<p>2. “Category 3 includes interventions to create supportive environments for becoming smoke-free, ranging from regulations and laws to control smoking in public places and ban the supply of cigarettes to children, to curbing the promotional activities of the tobacco industry through restrictions on paid advertisements and brand sponsorship. Given that the environments in disadvantaged areas are often the most polluted by tobacco smoke, coupled with the tactic of some tobacco promotions of targeting poorer areas specifically these interventions, although universal, have the potential for a greater impact in poorer groups and areas.” (32)</p>	<p>Intervention – Type of component – Prescriptive, Promotion</p> <p>Intervention – Approach – Targeted, Universal</p> <p>Context – Environmental – Geographical</p> <p>Context – Personal – Income, Place of Residence</p>	
	<p>3. “The relative efficacy of treated bed nets on childhood mortality is unlikely to differ across socio-economic status since the risk of malaria is similar across socio-economic gradients in areas of comparable endemicity. However, the absolute difference may be greater in the poorest people, who start with higher baseline mortality⁽³⁵⁹⁾.” (49)</p>	<p>Intervention – Type of component - Place</p> <p>Context -Personal – Income, Age, Education, Occupation</p> <p>Context – Environmental - Epidemiological</p>	
	<p>4. “More affluent parents may have more strategies for resisting their children’s “pester power” for less healthy foods (a psychological resource) [18].” (198)</p>	<p>Context -Personal – Income, Age</p> <p>Context – Environmental – Socio-cultural</p> <p>Participant response - Behaviour</p>	
	<p>5. “Due to a higher risk burden, those of lower SEP are likely to gain extra benefit if a risk factor is uniformly reduced across the entire population. Therefore being more likely to reduce inequalities [16,20].” (163)</p>	<p>Context -Personal – Income, Education, Occupation</p> <p>Context – Environmental - Epidemiological</p>	

Mechanism	Example	Factors associated with differential effects across SES populations [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
	6. “Person” interventions appeared most likely to widen inequalities. This category included health education and dietary counselling. This may reflect the dependence on an individual choosing to behave differently, and sustain that change [78]. Other studies support this in highlighting that downstream interventions rarely reduce inequalities and may widen them.” (163)	Intervention – Type of component – Person Intervention – Type of behaviour change targeted (voluntary)	-
	7. “By contrast with children born to better-off families, poor children are more exposed to risks for disease through inadequate water and sanitation, indoor air pollution, crowding, poor housing conditions, and high exposure to disease vectors. ^{22,23} . They are also more likely to have lower resistance to infectious diseases because they are undernourished (an underlying cause of about 50% of deaths in children younger than 5 years), ²⁴ to have diets deficient in one or more essential micronutrients (eg, vitamin A, iron, zinc), to have a low birthweight as a result of poor maternal nutrition, infections during pregnancy, and short birth intervals, and to have recurrent disease episodes.” (190)	Context – Personal – Income, Age Context – Environmental – Epidemiological, Geographical	
	8. even the best programs at the pyramid’s higher levels (<i>i.e. counselling and education, clinical interventions</i>) achieve limited public health impact, largely because of their dependence on long-term individual behavior change. (194)	Intervention – Type of component – Person, Pharma/non-Pharma Intervention – Type of behaviour change targeted (voluntary)	
	9. <i>Specifically, because of women’s role in the household, they may experience greater exposure to indoor air pollution, which increases rates of asthma. Similarly, in areas where women travel for water or to wash clothes, they experience greater exposure to stagnant water that breeds malaria-infected mosquitoes and puts them at greater risk for disease. (70)</i>	Context – Personal – Gender Context – Environmental – Socio-cultural, Geographical, Epidemiological	

¹Examples in italics highlight the potential impact on health inequalities as a result of interactions between SES and other PROGRESS-Plus factors.

A4.6.3 Ability to perceive

The ability to recognise the existence of health problems relates to an individual's ability to understand their own health status, risk of disease or harmful outcomes and potential benefits of an intervention. In response to an intervention, knowledge of health status and risk of disease is more likely therefore, to be influenced by an individual's educational status (e.g. see table A4.6.3; 5,6). The ability to perceive also relies on providers' knowledge in identifying disadvantaged populations as being in need of help (e.g. see table A4.6.3; 1,4), the communication strategies of providers in increasing the visibility of services and raising awareness of the potential benefits of interventions (e.g. see table A4.6.3; 2,6).

Table A4.6.3: Factors influencing ‘ability to perceive’ and the impact on socio-economic health inequalities¹

Mechanism	Example	Factors associated with differential effects across SES populations that may influence ‘ability to perceive’ [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
Ability to perceive	1. “As a result of these discussions the team revised their planned intervention to address these socio-economic barriers by: (i) including initial preliminary research to identify people’s perception of health checks and how they could be redesigned in order to optimise people’s needs and restrictions;...and; (iii) extending staff training to increase awareness of the social determinants of health inequalities in general and the socio-economic barriers to uptake of preventive services in particular.” (18)	Context – Personal – Income, Education, Occupation Participant response Implementation – Delivery agent characteristics - knowledge	+
	2. Services can make themselves more or less known among various social or geographical population groups. Various elements such as transparency, information regarding available treatments and services and outreach activities could contribute to make the services more or less approachable. (196)	Intervention – Does & intensity – No. of active components, Degree of interaction between components including independence and interdependence Implementation – Process outcome (awareness)	+/-
	3. “the notion of ability to perceive need for care among populations is crucial and determined by such factors such as health literacy, knowledge about health and beliefs related to health and sickness.” (196)	Context – Personal – Education, Religion Participant response – Intellectual (knowledge), Emotional (beliefs)	+/-
	4. Diagnostic accuracy in targeting people in greatest need depends on providers’ knowledge and is likely to be high for least poor and poorest people alike. (49)	Implementation – Delivery agent characteristics - knowledge	
	5. “Well-educated people are also more likely to have more knowledge about health and preventive health [48].” (70)	Context – Personal – Education Participant response – Intellectual (knowledge)	
	6. “In India, for example, 30% of mothers of children who had not been vaccinated did not know that immunisation was important for the health of their child, and a further 33% did not know where to go to have their child vaccinated.” (190)	Context – Personal – Education Participant response – Intellectual (knowledge), Implementation – Process outcome (awareness)	-

¹Examples in italics highlight the potential impact on health inequalities as a result of interactions between SES and other PROGRESS-Plus factors.

A4.6.4 Ability to seek

In response to an intervention, personal context factors demonstrate great potential to influence the ability of an individual to seek out healthcare.

Although socio-economic status may influence the ability to seek (e.g. see table A4.6.4; 6, 7), other personal context factors such as religion, culture or gender may have a greater influence (e.g. see table A4.6.4; 3). Implementation factors relating to delivery agent characteristics therefore, have an important role to play in increasing access across disadvantaged populations (e.g. see table A4.6.4; 5,7).

Table A4.6.4 : Factors influencing ‘ability to seek’ and the impact on socio-economic health inequalities¹

Mechanism	Example	Factors associated with differential effects across SES populations that may influence ‘ability to seek’ [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
Ability to seek	1. <i>“Increasing the number of female doctors can improve access to health care for women from Arabic-speaking countries living in Sweden[63].” (70)</i>	Context - Personal – Gender, Race/ethnicity/culture/language Implementation – Delivery agent characteristics (gender)	+
	2. <i>“It was also recognized that the health trainers needed to be acceptable to the target group. Ideally they should be from South Asian communities and the team decided to explore whether it would be possible for target communities to be involved in selecting the health trainers.” (18)</i>	Implementation – Delivery agent characteristics (Race/ethnicity/culture/language)	
	3. <i>“Lower immunization rates among Amish populations lead to outbreaks of disease [68]...Vaccine information provided by trusted medical providers leads to increased immunization rates [69].”(70)</i>	Context - Personal – Race/ethnicity/culture/language Implementation – Delivery agent characteristics	
	4. “Ability to seek health care relates to the concepts of personal autonomy and capacity to choose to seek care (ability to have a free choice) knowledge about health care options and individual rights that would determine expressing the intention to obtain health care. A good example would be female discrimination regarding the initiation of care or abuse and neglect discouraging ethnic minorities to seek care. This relates to the challenge of ensuring that care meets the needs of different cultural, socio-economically disadvantaged and vulnerable populations.” (196)	Context – Environmental – Ethical Context - Personal – Gender, Race/ethnicity/culture/language, Income, Education, Occupation Participant characteristics – Intellectual (Knowledge)	+/-
	5. “Acceptability relates to cultural and social factors determining the possibility for people to accept the aspects of the service (e.g. the sex or social group of providers, the beliefs associated to systems of medicine) and the judged appropriateness for the persons to seek care.”(196)	Context – Personal Implementation – Delivery agent characteristics (gender, income, education, occupation) Participant response – Emotional (beliefs)	
	6. “In a poor rural area of Tanzania, the poorest children were 27% less likely to seek care from an appropriate provider than the least poor.”(190)	Context – Personal – Place of residence (rural), Income (low), Age (child)	-
	7. The way health checks are delivered, in terms of form and content and the people delivering them (in terms of professional, ethnic and gender background) can put people off from attending.” (18)	Intervention – type of components Implementation - Delivery agent characteristics (occupation, education, race/ethnicity/culture/language/gender)	

¹Examples in italics highlight the potential impact on health inequalities as a result of interactions between SES and other PROGRESS-Plus factors.

A4.6.5 Ability to reach

If interventions are to be made available to the most disadvantaged populations then individuals must be able to reach them. In response to an intervention, an individual's occupational status may influence the ability to reach if they are unable to attend because they have less flexibility in their working conditions (e.g. see table A4.6.5; 5, 7, 8). Income status may also affect the ability to reach if they cannot afford to get to where the services are located (e.g. see table A4.6.5; 10). The ability to reach may relate to implementation factors in the provision of an intervention, including setting, resources, mode of delivery and delivery agent characteristics (e.g. see table A4.6.5; 10); intervention factors, including the approach to intervention (e.g. see table A4.6.5; 1,9) and timing and duration (e.g. see table A4.6.5; 2,7, 10); and the wider geographical and organisation and structure context (e.g. see table A4.6.5; 4, 8).

Table A4.6.5: Factors influencing ‘ability to reach’ and the impact on socio-economic health inequalities

Mechanism	Example	Factors associated with differential effects across SES populations that may influence ‘ability to reach’ [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
Ability to reach	1. “Targeting can take several forms. One—typically called direct targeting—is to identify poor households or individuals and ways of getting services specifically to them.” (190)	Intervention – Approach – Targeted Context – Personal – Income	+
	2. “Sure Start is designed to intervene in a critical period in early childhood to improve the health and life chances of children from poor backgrounds.” (32)	Intervention – Timing and duration Context – Personal – Age	
	3. “[Health care has been made]...more accessible through road improvements, outreach, or deployment of services in poor areas.” (190)	Implementation – Setting Implementation – Resources Context – Personal – Income, Place of Residence Context – Environmental – Geographical	
	4. “Availability and accommodation refers to the fact that health services (either the physical space or those working in health care roles) can be reached both physically and in a timely manner. Availability constitutes the physical existence of health resources with sufficient capacity to produce services (existence of productive facilities) [7] . It results from characteristics of facilities (e.g. density, concentration, distribution, building accessibility), of urban contexts (e.g. decentralisation, urban spread, and transportation system) and of individuals (e.g. duration and flexibility of working hours) . It also relates to characteristics of providers (e.g. presence of the health professional, qualification) and modes of provision of services (e.g. contact procedure and possibility of virtual consultations).” (196)	Implementation – Setting Implementation – Resources – Manpower, Infrastructure Implementation – Delivery agent characteristics (skills, educational status) Implementation – Cost – Cost to recipient (time) Context – Personal – Occupation Context – Environmental – Geographical Implementation – Mode of delivery	+/-
	5. “Ability to reach health care relates to the notion of personal mobility and availability of transportation, occupational flexibility, and knowledge about health services that would enable one person to physically reach service providers.” (196)	Context – Occupation, Age, Disability Context – Environmental – Geographical	

Mechanism	Example	Factors associated with differential effects across SES populations that may influence 'ability to reach' [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
		Participant response - Knowledge	
	6. "Provider compliance is estimated as the likelihood that health care providers will prescribe or recommend an intervention for someone in need." (193)	Implementation – Delivery agent characteristics (knowledge) Implementation – Process outcome - Fidelity	
	7. "The facilities serving poor people are typically less well organised than are those for people who are better off, with inconvenient opening hours." (190)	Intervention - Timing & duration Implementation – Process outcome - Quality Context – Personal – Income Context – Environmental – Organisation & Structure	-
	8. "People who work long hours under poor working conditions, including job insecurity, may prioritise providing for their families over attendance at health-checks." (18)	Context -Personal – Occupation	
	9. "new resources usually go initially to rich people.42 Programming of new interventions has to counteract this usual evolution. Even when interventions are equitably targeted, rich people take advantage of them more rapidly than do poor people, so that inequity ratios could widen initially when a new effective intervention becomes available." (190)	Intervention – Approach - Population Context – Personal – Income	
	10. "The location and timing of health checks can have a negative impact on uptake by making access difficult, especially if people cannot access reliable and affordable public transport ." (18)	Intervention – Timing & duration Implementation – Setting Implementation – Cost – Cost to recipient (time, financial) Context -Personal - Income Context – Environmental - Geographical	

A4.6.6 Ability to pay

The 'ability to pay' has the potential to impact greatly on socio-economic health inequalities because it is directly linked to an individual's income status and indirectly linked to occupational status and educational status. Costs involved to recipients may be; tangible and direct, i.e., they may not be able to afford to purchase an intervention (e.g. see table A4.6.6; 1,5), tangible and indirect, i.e., they may not be able to afford transportation costs to reach an intervention (see table A4.6.6; 7) intangible and direct, i.e., they may not be able to afford the time away from work to participate in an intervention, or intangible and indirect, i.e. they may not be able to afford the time required to reach an intervention (see table A4.6.6; 7,10). Socio-economic health inequalities arising from the 'ability to pay' may also relate to the provision of an intervention. For example, interventions which are effective in reducing socio-economic health inequalities may be more resource intensive and more expensive, resulting in lower cost-effectiveness (see table A.4.6.6; 8).

Table A4.6.6: Factors influencing ‘ability to pay’ and the impact on socio-economic health inequalities

Mechanism	Example	Factors associated with differential effects across SES populations that may influence ‘ability to pay’ [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
Ability to pay	1. “Another intervention in this category is to increase access to goods and services to help quitting, such as providing free nicotine replacement treatment to smokers for whom cost is a barrier.” (32)	Intervention - Approach - Targeted Intervention – Type of component – Price (incentive) Implementation – Cost to recipient – Financial (no cost) Context – Personal - Income	+
	2. “Targeting can take several forms. One—typically called direct targeting—is to identify poor households or individuals and ways of getting services specifically to them. An example would be distribution to poor families of vouchers that entitle them to free services for which others must pay.” (190)	Intervention - Approach - Targeted Intervention – Type of component – Price (incentive) Implementation – Cost to recipient – Financial (no cost) Context – Personal - Income	
	3. “Ownership of malaria bednets decreases with decreasing household wealth ... distribution of free bednets or vouchers for bednets increases ownership.” (70)	Intervention – Type of component – Place, price (incentive) Implementation – Cost to recipient – Financial (no cost/low cost) Context – Personal - Income	
	4. Pricing policy in this context provides another example of the important concept of differential impact. Although the policy is universal in that the pricing changes are applied across the board to cigarettes bought by any member of the public, the effect on the purchase of cigarettes is not uniform. Young people and lower-income groups show a greater response to price by reducing consumption as the price goes up.” (32)	Intervention – Type of component – Price (disincentive) Intervention - Approach – Population Implementation – Cost to recipient – Financial (cost) Context – Personal – Income, Age	
	5. “Affordability reflects the economic capacity for people to spend resources and time to use appropriate services. It results from direct prices of services and related expenses in addition to opportunity costs related to loss of income.	Implementation – Cost – Cost to recipient (financial, time)	

Mechanism	Example	Factors associated with differential effects across SES populations that may influence 'ability to pay' [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
	Furthermore it can vary by type of services and depends on the capacity to generate the resources to pay for care (e.g. mode of payment, mobilisation of resources)." (196)	Context – Personal – Income Context – Environmental – Socio-economic	
	6. "Ability to pay for health care is a widely used concept within the health services and health economics literature [8,(190). It describes the capacity to generate economic resources -through income, savings, borrowing or loans - to pay for health care services without catastrophic expenditure of resources required for basic necessities (e.g. sale of home). (196)	Context – Personal – Income	
	7. "The location and timing of health checks can have a negative impact on uptake by making access difficult, especially if people cannot access reliable and affordable public transport or cannot negotiate time out from work or caring responsibilities." (18)	Intervention – Timing & duration Implementation – Setting Implementation – Cost to recipient – Financial, Time Context – Personal – Income, Occupation Context – Environmental - Geographical (public transport infrastructure)	-
	8. "Developing interventions to reach populations with low income and low education might be more expensive because of the need for increased intensity, multifaceted interventions, and appropriate reading level. This will result in less favourable cost effectiveness ratios." (49)	Intervention – Dose & intensity (high intensity) Intervention - No of active components (more than one component/more than one component delivered as a bundle) Implementation – Cost to provider – Financial (cost) Implementation – Degree of tailoring – (moderately tailored) Context – Personal – Income, Education	
	9. "They [poorer people] tend to live in underserved areas and therefore incur high time and costs when seeking health care." (190)	Implementation – Cost to recipient – Financial (high cost), Time Implementation – Resources (availability)	

Mechanism	Example	Factors associated with differential effects across SES populations that may influence 'ability to pay' [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
	10. "People who work long hours under poor working conditions, including job insecurity, may prioritise providing for their families over attendance at health-checks." (18)	<p>Context – Environmental - Geographical</p> <p>Implementation – Cost to recipient – Financial (cost), Time</p> <p>Context – Personal – Occupation</p>	

A4.6.7 Ability to engage

From a participant perspective, the ability to engage is related to behavioural capabilities (e.g. see table A4.6.7;1,3,7). An individual's socio-economic status may impact upon behavioural responses resulting in either a positive or negative impact on health inequalities. For example, lower SES groups may be more likely to adhere to an intervention if they experience higher exposure to harmful environments (e.g. see table A4.6.7; 1). Intellectual capabilities may also influence the ability to engage with an intervention. For example, higher SES groups may have greater capability to make sense of an intervention (e.g. see table A4.6.7;9). Factors relating to the provision of an intervention that may influence the ability to engage include the level of agency (e.g. see table A4.6.7; 2,8) the type of behaviour change (e.g. see table A4.6.7;2,4). Implementation factors that may influence ability to engage include the quality of the intervention, including the quality of the resources, or level of skill of delivery agents (e.g. see table A4.6.7; 10, 11).

Table A4.6.7: Factors influencing ‘ability to engage’ and the impact on socio-economic health inequalities¹

Mechanism	Example	Factors associated with differential effects across SES populations that may influence ‘ability to engage’ [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
Ability to engage	1. “Typical adherence of consumers in trials of bed nets is around 70%. We have postulated greater adherence in the poorest because of higher exposure to nuisance biting mosquitoes”. (49)	Intervention – Type of component – Place Context – Personal – Income Context – Environmental - Geographical Participant response – Behavioural (adherence)	+
	2. “population interventions that require recipients to use little or no agency to benefit may be more effective and equitable. When food manufacturers reduce the salt content of bread, decreased salt intake occurs without individuals having to consciously engage with any information or actively change their behaviour [9].” (198)	Intervention – Approach – Population Intervention – Dose & intensity Intervention – Type of component – Product, Personal Intervention – Type of behaviour change targeted - Compulsory	
	3. “the team recognized that some socio-economic factors shaping uptake of health checks can also be expected to impact on the uptake and sustainability of medication use or advice about changing diets or increasing physical activity. Suggestions for how these risks could be minimized included: <ul style="list-style-type: none"> • Extending the support provided by the Health Trainers for people identified as at risk to help them act on recommendations. • Developing ways of linking people identified as ‘at risk’ of CVD or other health problems during the health check to wider resources that could offer support (10).” (18) 	Context – Personal – Income, Education, Occupation Participant response – Behavioural (sustain)	
	4. “population interventions that require recipients to use little or no agency to benefit may be more effective and equitable. When food manufacturers reduce the salt content of bread, decreased salt intake occurs without individuals having to consciously engage with any information or actively change their behaviour [9]....By reducing the need for individual decisions, there is less room in low-agency interventions for attrition at each of the many steps from intervention delivery to health outcome.” (198)	Intervention – Approach – Population Intervention – Dose & intensity – No. of active components Participant response – Behavioural Intervention – Type of behaviour change targeted	
	5. “Type 2 diabetes is more common among people from certain ethnic backgrounds ... Culturally appropriate health education is effective in increasing adherence to lifestyle changes.”(70)	Intervention – Type of component – Personal	

Mechanism	Example	Factors associated with differential effects across SES populations that may influence 'ability to engage' [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
		Implementation – Degree of tailoring Context – Personal – Race/ethnicity/culture/language Context – Environmental - Epidemiological Participant response – Behavioural (adherence)	
	<p>6. “Appropriateness denotes the fit between services and clients need, its timeliness, the amount of care spent in assessing health problems and determining the correct treatment and the technical and interpersonal quality of the services provided [7,27]. Adequacy relates to the appropriateness (what services are provided) and quality (the way in which they are provided) of health services and its integrated and continuous nature [7,27].” (196)</p>	Intervention Implementation Implementation – Process outcome – Quality	+/-
	<p>7. “Ability to engage in health care would relate to the participation and involvement of the client in decision-making and treatment decisions, which is in turn strongly determined by capacity and motivation to participate in care and commit to its completion. This dimension is strongly related to the capacity to communicate as well as notions of health literacy, self-efficacy and self-management in addition to the importance of receiving care that is actually appropriate for the person, given its resources and skills.” (196)</p>	Participant response – Behavioural (motivation, self-efficacy, self-management), Intellectual (health literacy, communication) Implementation – Process outcome – Quality	
	<p>8. “Population interventions like Change4Life that focus on providing advice, guidance, and encouragement rely heavily on individuals being able and motivated to engage with this advice, guidance, and encouragement. These types of interventions have been described as highly “agentic”: recipients must use their personal resources, or “agency,” to benefit. The effectiveness and equity of these interventions has been questioned.” (198)</p>	Intervention – Approach – Population Intervention – Type of component – Personal Intervention – Dose & intensity - No. of behaviours/actions targeted by intervention	-
	<p>9. “More socio-economically advantaged people, with better health literacy (a cognitive resource.) [17], may find it easier to make sense of the information provided in public health messages.” (198)</p>	Context – Personal – Income, Education, Occupation Participant response – Intellectual (health literacy)	
	<p>10. “The opportunity for a person to utilise the services of untrained practitioners (e.g. witch doctors, healers) cannot be equated to the opportunity for another person - wealthier - to utilise highly specialised services, if these services generate different health outcomes or satisfaction towards services. Utilisation of services with inherently differential technical qualities - either through the utilisation of different types of providers or through differential prescription practices - cannot be seen as equally appropriate care.” (196)</p>	Implementation – Delivery agent characteristics (knowledge, skills) Implementation – Process Outcomes – (quality, satisfaction) Implementation – Mode of delivery	

Mechanism	Example	Factors associated with differential effects across SES populations that may influence 'ability to engage' [Context – Personal – Income, Education, Occupation]	Potential impact on socio-economic health inequalities
	<p>11. "Once there, they (<i>poor children</i>) are less likely to receive appropriate care because facilities serving poor communities are not as likely to have well-trained staff or to be stocked with drugs as facilities serving wealthier communities. 27,28." (189)</p>	<p>Context – Personal - Income</p> <p>Implementation – Resources – Infrastructure</p> <p>Implementation – Delivery agent characteristics</p> <p>Context – Personal – Income, Age</p> <p>Context – Environmental – Geographical</p>	

¹Examples in italics highlight the potential impact on health inequalities as a result of interactions between SES and other PROGRESS-Plus factors.

Appendix 5: Study 4 Supplementary Material

- **A5.1 Sensitivity analysis: Impact on meta-framework development because of non-retrieval of theories in MEDLINE due to theory terms in the BeHEMoTh approach**
- **A5.2 Sensitivity analysis: Impact on meta-framework development because of non-retrieval of theories in MEDLINE due to health inequality terms**
- **A5.3 Sensitivity analysis: Impact on meta-framework development due to exclusion of poorly-articulated theories/frameworks**

Implementation factors associated with differential effects across SES groups (*additional factors identified by SES theories in italics*)

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Implementation	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Delivery mechanisms	✓	✓	✓		✓						✓	✓	✓	✓	✓	✓
1.1 Resources	✓	✓	✓		✓						✓	✓	✓			
1.1.1 Infrastructure	✓	✓	✓								✓	✓				
1.1.2 Manpower	✓	✓	✓								✓	✓				
1.2 Cost	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
1.2.1 Cost to recipient	✓	✓	✓			✓	✓		✓		✓	✓	✓	✓	✓	✓
1.2.2 Cost to provider		✓				✓					✓				✓	
2.3 Mode of delivery			✓				✓				✓	✓				
1.3.1 Face to face							✓					✓				
1.3.2 Media							✓									
1.4 Degree of tailoring						✓		✓				✓	✓	✓		
2. Delivery agent characteristics	✓	✓	✓		✓	✓					✓	✓	✓	✓		
3. Setting	✓	✓	✓								✓	✓	✓	✓	✓	
4. Process outcomes	✓	✓	✓			✓				✓	✓	✓	✓			
4.1 Quality	✓	✓	✓							✓	✓	✓				
4.2 Fidelity			✓			✓					✓					

Context factors associated with differential effects across SES groups

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Context	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No. of deprivations					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Personal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.1 Place of residence					✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
1.2 Race/ethnicity/culture/language			✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.3 Occupation	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.4 Gender			✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.5 Religion		✓			✓	✓					✓		✓	✓		
1.6 Education			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.7 Income	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.8 Social capital	✓			✓	✓	✓	✓				✓	✓	✓	✓	✓	✓
1.9 Age			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.10 Disability											✓	✓	✓	✓		
1.11 Sexual orientation											✓		✓	✓		
4. Environmental	✓		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	
2.1 Geographical	✓		✓		✓	✓	✓		✓			✓	✓	✓		
2.2 Epidemiological	✓				✓	✓			✓							
2.2 Socio-cultural	✓		✓		✓		✓		✓			✓	✓			
2.3 Socio-economic	✓		✓	✓	✓		✓		✓			✓				
2.4 Ethical	✓		✓				✓		✓	✓		✓				
2.5 Legal					✓		✓			✓						
2.6 Political	✓		✓		✓		✓		✓	✓						
2.7 Policy					✓		✓									
2.8 Funding	✓		✓		✓				✓							
2.9 Organisation & structure	✓		✓		✓							✓				

Participant response factors associated with differential effects across SES groups

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Participant response	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
5. Intellectual response	✓		✓				✓					✓	✓	✓	✓	✓
Knowledge	✓		✓				✓					✓	✓			
Skills							✓									
Competence							✓									
Health literacy												✓				
6. Behavioural response			✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓
Adherence						✓			✓				✓			
Motivation									✓			✓				
Substitution						✓										
Social norms									✓				✓			
Sustainable								✓								
Risk taking								✓								
Self-management												✓				
7. Psychological response			✓		✓		✓						✓			✓
Empower			✓		✓		✓									
Stigma			✓													
Stress					✓											
Self-esteem							✓					✓				
Self-confidence							✓									
8. Emotional response							✓		✓			✓	✓	✓		
Beliefs							✓					✓	✓			
Suspicion									✓							
Self-efficacy												✓				
Trust													✓			

How socio-economic health inequalities may be introduced on the intervention pathway

Stages at which socio-economic health inequalities may arise	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Weich et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
1. Effectiveness																
1.1 Exposure	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
2. Access ¹																
2.1 Approachability		✓	✓		✓	✓	✓	✓				✓	✓	✓		✓
2.2 Acceptability	✓	✓	✓		✓				✓			✓	✓	✓		✓
2.3 Availability & accommodation	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
2.4 Affordability		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
2.5 Appropriateness	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
3. Cost -effectiveness						✓									✓	

¹Based on Levesque et al's., (196) definition of access

Why socio-economic health inequalities may be introduced (mechanisms)

Mechanisms	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
1. Choice	✓		✓				✓	✓	✓	✓		✓	✓	✓		✓
1.1 Ability to choose	✓		✓				✓	✓	✓	✓		✓	✓	✓		✓
2. Effectiveness	✓		✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
2.2 Ability to control	✓		✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
3. Access¹	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.1 Ability to perceive		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
3.2 Ability to seek	✓	✓	✓		✓	✓			✓			✓	✓	✓		✓
3.3 Ability to reach	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
3.4 Ability to pay		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
3.5 Ability to engage	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓

¹ Access mechanisms taken from Levesque et al. (196).

Implementation factors associated with differential effects across SES groups (*additional factors identified by SES theories in italics*)

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Implementation	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Delivery mechanisms	✓	✓	✓		✓						✓	✓	✓	✓	✓	✓
1.1 Resources	✓	✓	✓		✓						✓	✓	✓			
1.1.1 Infrastructure	✓	✓	✓									✓	✓			
1.1.2 Manpower	✓	✓	✓									✓	✓			
1.2 Cost	✓	✓	✓		✓	✓	✓		✓			✓	✓	✓	✓	✓
1.2.1 Cost to recipient	✓	✓	✓			✓	✓		✓			✓	✓	✓	✓	✓
1.2.2 Cost to provider		✓	✓			✓						✓			✓	
3.3 Mode of delivery			✓				✓					✓	✓			
1.3.1 Face to face							✓						✓			
1.3.2 Media							✓									
1.4 Degree of tailoring						✓		✓					✓	✓		
2. Delivery agent characteristics	✓	✓	✓		✓	✓						✓	✓	✓		
3. Setting	✓	✓	✓								✓	✓	✓	✓	✓	
4. Process outcomes	✓	✓	✓			✓				✓	✓	✓	✓			
4.1 Quality	✓	✓	✓							✓	✓	✓	✓			
4.2 Fidelity			✓			✓						✓				

Context factors associated with differential effects across SES groups

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Context	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No. of deprivations																
5. Personal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.1 Place of residence					✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
1.2 Race/ethnicity/culture/language			✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.3 Occupation	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.4 Gender			✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.5 Religion		✓			✓	✓	✓				✓	✓	✓	✓	✓	✓
1.6 Education			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.7 Income	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.8 Social capital	✓			✓	✓	✓	✓				✓	✓	✓	✓	✓	✓
1.9 Age			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.10 Disability											✓	✓	✓	✓		
1.11 Sexual orientation											✓	✓	✓	✓		
6. Environmental	✓		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	
2.1 Geographical	✓		✓		✓	✓	✓		✓			✓	✓	✓		
2.2 Epidemiological	✓				✓	✓										
2.2 Socio-cultural	✓		✓		✓		✓		✓			✓				
2.3 Socio-economic	✓		✓	✓	✓		✓		✓			✓				
2.4 Ethical	✓		✓				✓		✓	✓		✓				
2.5 Legal					✓		✓			✓						
2.6 Political	✓		✓		✓		✓		✓	✓						
2.7 Policy					✓		✓									
2.8 Funding	✓		✓		✓				✓							
2.9 Organisation & structure	✓		✓		✓							✓				

Participant response factors associated with differential effects across SES groups

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Participant response	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
9. Intellectual response	✓		✓				✓				✓	✓	✓	✓	✓	✓
Knowledge	✓		✓				✓					✓	✓			
Skills							✓									
Competence							✓									
Health literacy												✓				
10. Behavioural response			✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓
Adherence						✓			✓				✓			
Motivation									✓			✓				
Substitution						✓										
Social norms									✓				✓			
Sustainable								✓								
Risk taking								✓								
Self-management												✓				
11. Psychological response			✓		✓		✓						✓			✓
Empower			✓		✓		✓									
Stigma			✓													
Stress					✓											
Self-esteem							✓					✓				
Self-confidence							✓									
12. Emotional response							✓		✓			✓	✓	✓		
Beliefs							✓					✓	✓			
Suspicion									✓							
Self-efficacy												✓				
Trust													✓			

How socio-economic health inequalities may be introduced on the intervention pathway

Stages at which socio-economic health inequalities may arise	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Weich et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
1. Effectiveness																
1.1 Exposure	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
2. Access ¹																
2.1 Approachability		✓	✓		✓	✓	✓	✓				✓	✓	✓		✓
2.2 Acceptability	✓	✓	✓		✓				✓			✓	✓	✓		✓
2.3 Availability & accommodation	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
2.4 Affordability		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
2.5 Appropriateness	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
3. Cost -effectiveness						✓									✓	

¹Based on Levesque et al's., (196) definition of access

Why socio-economic health inequalities may be introduced (mechanisms)

Mechanisms	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
1. Choice	✓		✓				✓	✓	✓	✓		✓	✓	✓		✓
1.1 Ability to choose	✓		✓				✓	✓	✓	✓		✓	✓	✓		✓
2. Effectiveness	✓		✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
2.2 Ability to control	✓		✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
3. Access¹	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.1 Ability to perceive		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓		✓
3.2 Ability to seek	✓	✓	✓		✓				✓			✓	✓	✓		✓
3.3 Ability to reach	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
3.4 Ability to pay		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
3.5 Ability to engage	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓

¹ Access mechanisms taken from Levesque et al. (196).

Implementation factors associated with differential effects across SES groups (*additional factors identified by SES theories in italics*)

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Implementation	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Delivery mechanisms	✓	✓	✓		✓						✓	✓	✓	✓	✓	✓
1.1 Resources	✓	✓	✓		✓						✓	✓	✓			
1.1.1 Infrastructure	✓	✓	✓									✓	✓			
1.1.2 Manpower	✓	✓	✓									✓	✓			
1.2 Cost	✓	✓	✓		✓	✓	✓		✓			✓	✓	✓	✓	✓
1.2.1 Cost to recipient	✓	✓	✓			✓	✓		✓			✓	✓	✓	✓	✓
1.2.2 Cost to provider		✓				✓						✓			✓	
4.3 Mode of delivery			✓				✓					✓	✓			
1.3.1 Face to face							✓						✓			
1.3.2 Media							✓									
1.4 Degree of tailoring						✓		✓					✓	✓		
2. Delivery agent characteristics	✓	✓	✓		✓	✓						✓	✓	✓		
3. Setting	✓	✓	✓								✓	✓	✓	✓	✓	
4. Process outcomes	✓	✓	✓			✓				✓	✓	✓	✓			
4.1 Quality	✓	✓	✓			✓				✓	✓	✓	✓			
4.2 Fidelity			✓			✓						✓				

Context factors associated with differential effects across SES groups

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Context	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No. of deprivations																
7. Personal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.1 Place of residence					✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
1.2 Race/ethnicity/culture/language			✓		✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
1.3 Occupation	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1.4 Gender			✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	
1.5 Religion		✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	
1.6 Education			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.7 Income	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.8 Social capital	✓			✓	✓	✓	✓			✓	✓	✓	✓	✓		
1.9 Age			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.10 Disability											✓	✓	✓	✓		
1.11 Sexual orientation											✓	✓	✓	✓		
8. Environmental	✓		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	
2.1 Geographical	✓		✓		✓	✓	✓		✓			✓	✓	✓		
2.2 Epidemiological	✓				✓	✓										
2.2 Socio-cultural	✓		✓		✓		✓		✓			✓	✓			
2.3 Socio-economic	✓		✓	✓	✓		✓		✓			✓				
2.4 Ethical	✓		✓				✓		✓	✓		✓				
2.5 Legal					✓		✓		✓	✓						
2.6 Political	✓		✓		✓		✓		✓	✓						
2.7 Policy					✓		✓									
2.8 Funding	✓		✓		✓				✓							
2.9 Organisation & structure	✓		✓		✓							✓				

Participant response factors associated with differential effects across SES groups

	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
Participant response	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
13. Intellectual response	✓		✓				✓					✓	✓	✓	✓	✓
Knowledge	✓		✓				✓					✓	✓			
Skills							✓									
Competence							✓									
Health literacy												✓				
14. Behavioural response			✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓
Adherence						✓			✓				✓			
Motivation									✓			✓				
Substitution						✓										
Social norms									✓				✓			
Sustainable								✓								
Risk taking								✓								
Self-management												✓				
15. Psychological response			✓		✓		✓						✓			✓
Empower			✓		✓		✓									
Stigma			✓													
Stress					✓											
Self-esteem							✓					✓				
Self-confidence							✓									
16. Emotional response							✓		✓			✓	✓	✓		
Beliefs							✓		✓			✓	✓			
Suspicion									✓							
Self-efficacy												✓				
Trust													✓			

How socio-economic health inequalities may be introduced on the intervention pathway

Stages at which socio-economic health inequalities may arise	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49) ; Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Weich et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
1. Effectiveness																
1.1 Exposure	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
2. Access ¹																
2.1 Approachability		✓	✓		✓	✓	✓	✓				✓	✓	✓		✓
2.2 Acceptability	✓	✓	✓		✓				✓			✓	✓	✓		✓
2.3 Availability & accommodation	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
2.4 Affordability		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
2.5 Appropriateness	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
3. Cost-effectiveness						✓									✓	

¹Based on Levesque et al's., (196) definition of access

Why socio-economic health inequalities may be introduced (mechanisms)

Mechanisms	Hart (187)	Tanahashi (188)	Victoria et al. (189, 190)	Graham & Kelly (25)	Starfield (191, 192)	Tugwell et al. (49); Welch et al. (193)	Whitehead (32)	White et al. (24)	Frieden (194)	Braveman et al. (195)	Welch et al. (102)	Levesque et al. (196)	O'Neill et al. (70)	NIHR CLAHRCNWC (18)	McGill et al. (163)	Adams et al. (198)
1. Choice	✓		✓				✓	✓	✓	✓		✓	✓	✓		✓
1.1 Ability to choose	✓		✓				✓	✓	✓	✓		✓	✓	✓		✓
2. Effectiveness	✓		✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
2.2 Ability to control	✓		✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
3. Access¹	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.1 Ability to perceive		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
3.2 Ability to seek	✓	✓	✓		✓				✓			✓	✓	✓		✓
3.3 Ability to reach	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
3.4 Ability to pay		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
3.5 Ability to engage	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓

¹ Access mechanisms taken from Levesque et al. (196).

