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Towards a theory-led meta-framework for considering socioeconomic health inequalities within systematic reviews

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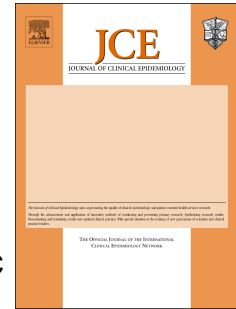
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1 **Title: Towards a theory-led meta-framework for considering socioeconomic health inequalities**
2 **within systematic reviews**

3

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22

23 **Abstract**

24 **Objective:** To develop a theory-led framework to inform reviewers' understanding of *what, how* and
25 *why* healthcare interventions may lead to differential effects across socio-economic groups.

26 **Study Design and Setting:** A meta-framework approach combined two theoretical perspectives
27 (socio-economic health inequalities and complex interventions) into a single framework to inform
28 socio-economic health inequality considerations in systematic reviews.

29 **Results:** Four theories relating to complexity within systematic reviews and 16 health inequalities
30 intervention theories informed the development of a meta-framework. Factors relating to the type
31 of intervention, implementation, context, participant response and mechanisms associated with
32 differential effects across socio-economic groups were identified. The meta-framework can inform;
33 reviewer discussions around how socio-economic status can moderate intervention effectiveness
34 during question formulation, approaches to data extraction and help identify *a priori* analysis
35 considerations.

36 **Conclusion:** The meta-framework offers a transparent, practical, theory-led approach to inform a
37 programme theory for *what, how* and *why* interventions work for different socio-economic status
38 groups in systematic reviews. It can enhance existing guidance on conducting systematic reviews
39 that consider health inequalities, increase awareness of how socio-economic status can moderate
40 intervention effectiveness and encourage a greater engagement with theory throughout the review
41 process.

42 **Keywords:** Systematic Review, Equity, Methodology, Framework, Programme Theory

43 **Running Title:** Meta-framework for socioeconomic health inequality considerations in systematic
44 reviews.

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What is New?**Key Findings**

A meta-framework was developed to help reviewers formulate an *a priori* understanding of the potential for their review findings to be moderated by socio-economic status.

What this adds to what is known

The meta-framework enhances existing guidance on conducting systematic reviews that consider health inequalities by offering reviewers practical guidance in identifying factors and mechanisms associated with differential effects of healthcare interventions across socio-economic groups.

What is the implication, what should change now

Use of the meta-framework promotes an explicit, practical, theory-led approach to inform a programme theory for *if, what* and *how* interventions work for different socio-economic status groups.

47 1. Introduction

48 Interventions which may be effective in improving the overall health of a population, may
49 inadvertently increase health inequalities(1-4)(i.e. differences in health status between individuals or
50 populations which are avoidable and unjust(5)). White et al.,(1, p.68) label these as ‘intervention
51 generated inequalities’ (IGIs) i.e., “all processes in the planning and delivery of an intervention have
52 the potential to widen inequalities within the target population, distinguished by a range of factors,
53 such as gender, age, ethnicity or SEP [socio-economic position]”. Such IGIs occur for example, when
54 an intervention improves the health of higher socio-economic status (SES) groups at a faster rate
55 than in lower SES groups (i.e. higher SES groups will benefit first, then lower SES groups will catch
56 up)(1, 2).

57 All healthcare interventions have the potential to impact on health inequalities. The net impact of an
58 intervention may be positive, negative, or have no discernible impact (see figure 1). Such an impact
59 may be the result of either intended, or unintended effects(1). It is imperative therefore, that all
60 reviews consider whether it is likely that their review findings have the potential to impact on health
61 inequalities(1, 3, 6).

62

63 INSERT FIGURE 1

64

65 Guidance on conducting systematic reviews that consider health inequalities encourages reviewers
66 to develop an understanding, or ‘programme theory’/logic model, from the outset of their review, of
67 what works, for disadvantaged populations, under what circumstance(7-10). However, much of the
68 guidance assumes that reviewers can recognise *a priori*, what, how and why interventions may result
69 in differential effects across different SES populations(11). Consequently, within the review guidance
70 there is a lack of detail on the specific factors and mechanisms (i.e. responses and changes in an

71 individuals' reasoning and actions) associated with the intervention pathway that may result in
 72 differential effects across SES groups(see table 1).

73

74 **Table 1: Guidance on conducting systematic reviews incorporating health inequalities.**

75

Guidance	Guidance item
PRISMA-Equity 2012 Extension(8)	Rationale 3: "Describe assumptions about mechanism(s) by which the intervention is assumed to have an impact on health equity."
PRISMA-Equity 2012 Extension(8)	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(12, '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) (10)	"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?"

76

77

78 Furthermore, in explaining the low reliability of a plausibility algorithm designed to predict relative
 79 differences in effectiveness of interventions across SES populations, Welch et al.,(12, 'Discussion')
 80 suggest that it "may be due to multi-component questions covering several factors, and potential
 81 confusion of access to health care, prognostic factors and treatment-covariate interactions.". This
 82 suggests that reviewers need to recognise firstly, *what* factors relating to an intervention pathway
 83 (e.g. the intervention, participant characteristics and access) may moderate intervention
 84 effectiveness and secondly, *if, how* and *why* these factors may result in differential effects across
 85 different SES groups.

86 Empirical evidence however, suggests that reviewers struggle to understand how interventions
 87 under review may impact on health inequalities(12-15). If reviewers are not able to recognise such
 88 issues, then they may be less likely to incorporate health inequality considerations in systematic

89 reviews(11). Thus, a framework that offers the potential to facilitate the identification of factors and
90 mechanisms associated with what, how and why interventions may work across different SES
91 groups, may help reviewers to operationalise the guidance on conducting systematic reviews that
92 consider health inequalities.

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

100 Given the lack of evaluation of differential effects of interventions across disadvantaged populations,
101 Whitehead(5, p.477) states that it is “imperative to adopt a theory based approach to guide the
102 development and implementation of actions aimed at tackling social inequalities in health.”. Several
103 theories and frameworks exist to help reviewers hypothesise how interventions may or may not
104 work across socio-economic groups, but few distinguish between the factors associated with the
105 intervention pathway that may result in differential effectiveness. However, theories relating to
106 complexity in systematic reviews of complex interventions can help reviewers to identify such
107 factors. For example Rohwer et al.,(16) highlight factors relating to participants, intervention design,
108 context and implementation that reviewers should consider when hypothesising how an
109 intervention may or may not work.

110 Therefore, in considering two theoretical perspectives i.e. health inequality interventions and
111 complexity in systematic reviews of complex interventions within a single framework, we aim to map
112 out the factors and mechanisms associated with the intervention pathway that may lead to
113 differential effects across socio-economic groups. In combining multiple theories into a single

114 framework, we adopted a meta-framework approach. This approach identifies both common and
115 unique elements from across multiple theories to inform a single meta-framework(17, 18). The
116 objectives are to; i)identify existing theories, guidance and frameworks that consider what, how and
117 why healthcare interventions may lead to differential effects across socio-economic groups,
118 ii)consider the strengths and limitations of these theories iii)identify key factors and mechanisms
119 within the theoretical literature associated with what, why and how interventions may result in
120 differential effects across SES groups and iv)develop a theory-led meta-framework to inform
121 reviewers' understanding of what, how and why healthcare interventions may lead to differential
122 effects across socio-economic groups inform considerations of socio-economic health inequalities in
123 systematic reviews.

124

125

126

127 **2. Methods**

128 We adhered to the best-fit framework synthesis guidance on developing a meta-framework(17, 18).

129 This guidance was selected as it offers a theory-led, systematic approach to meta-framework

130 development to help reviewers generate programme theories and test them in systematic reviews.

131 A meta-framework is generated by firstly identifying relevant theories from the published literature.

132 Common and unique themes contributed by each theory are identified and 'deconsituted' into a

133 single meta-framework(18).

134

135 We sought theories (the term theory is used here to collectively refer to published theories,

136 frameworks, models and guidance documents) relating to complexity in systematic reviews of

137 complex interventions and health inequality intervention theories about how socio-economic status

138 may influence the effectiveness of an intervention. Systematic searches were undertaken in eight
139 resources following guidance on searching for theory(18)(see table 2 and Appendix A). Theories
140 were also identified opportunistically from within relevant theoretical papers, an earlier published
141 work on the use of programme theory in SES focused systematic reviews(11) and informal
142 discussions with health inequality experts. We excluded theories on the causes and determinants of
143 inequalities since they do not focus on interventions.

144

145 **Table 2: Resources used to identify relevant theories**

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, Campbell and Cochrane Equity Methods Group website, contact with equity experts

146

147

148 A novel two stage approach was adopted in generating the meta-framework. In the first stage we
149 undertook thematic analysis of theories related to complexity in systematic reviews of complex
150 interventions, in order to identify common and unique factors of the intervention pathway that may
151 result in differential effects. These factors provided the scaffold for the meta-framework. In the
152 second stage we analysed health inequality intervention theories to verify which of these factors
153 were also associated with differential effects across SES groups. New factors identified from health
154 inequality intervention theories were incorporated into the meta-framework. Health inequality
155 intervention theories also identified *how* and *why* differential effects may arise across SES groups.
156 One author(MM) extracted and coded the data. A second author(NM) checked the data extraction
157 and codes. Disagreement in the coding process were resolved through discussion.

158

159 3. Results

160 Twenty theories (reported in 24 publications) informed the development of the meta-framework.
161 Four theories (reported in five publications) relate to complexity within systematic reviews of
162 complex interventions(16, 19-22) and 16(reported in 19 publications)(1, 3-5, 10, 12, 23-35) relate to
163 health inequality intervention theories. The strengths and weaknesses of the theories informing the
164 meta-framework are summarised in Appendix B. When considered together, theories relating to
165 complex interventions and socio-economic health inequalities can help to inform reviewers'
166 understanding of *what*, *why* and *how* factors associated with the intervention pathway may result in
167 differential effectiveness across SES groups (see figure 2 and Appendix C). Appendix D outlines the
168 contribution of each of the theories to the meta-framework.

169 INSERT FIGURE 2

170

171 3.1 'What' factors may be associated with differential effects of healthcare interventions across 172 socio-economic groups

173 3.1.1 Factors associated with differential effectiveness across complex interventions

174 Theories relating to complexity in systematic reviews of complex interventions identify four key
175 factors of the intervention pathway associated with differential effects; intervention,
176 implementation, context, participant response. Specific factors relating to intervention,
177 implementation, context and participant response were also identified (see figure 2 and appendix
178 D(D1)).

179

180 3.1.2 Factors associated with differential effectiveness across socio-economic groups

181 All factors identified in theories of complexity in systematic reviews as having the potential to result
182 in differential effects across SES groups were verified in the health inequality intervention theories.

183 Health inequality intervention theories also identify additional specific intervention,
184 implementation, context, and participant response factors associated with differential effects across
185 SES groups (see figure 2 and appendix D(D2-D5)).

186

187 *3.1.3 Intervention factors associated with differential effectiveness across SES groups*

188 All 16 socio-economic theories describe intervention factors which may be associated with
189 differential effects across SES groups (see figure 2 and appendix D(D2)). In particular, they categorise
190 factors relating to types of intervention components and identify six additional intervention factors
191 as being associated with differential effectiveness across SES groups; type of component –
192 pharmacological/non-pharmacological (clinical), type of behaviour change targeted by the
193 intervention, individual or population level approach, targeting disadvantaged, gap or gradient
194 approach, number of levels of action targeted and number of sectors targeted. Only two factors,
195 ‘degree of interaction between components’ and ‘number of behaviours or actions targeted by an
196 intervention’, and are supported by a single socio-economic health inequalities theory, other factors
197 are supported by two or more theories.

198 *3.1.4 Implementation factors associated with differential effectiveness across SES groups*

199 Fifteen socio-economic health inequality theories highlight implementation factors associated with
200 differential effectiveness across SES groups (see figure 2 and appendix D(D3)). These theories
201 identify three additional implementation factors relating to delivery mechanisms as being associated
202 with differential effectiveness across SES; resources (infrastructure, manpower), cost (cost to
203 recipient, cost to provider) and mode of delivery (face-to-face, media). The majority of factors are
204 supported by three or more theories.

205 *3.1.5 Context factors associated with differential effectiveness across SES groups*

206 All socio-economic health inequalities theories identify context factors associated with differential
207 effectiveness across SES groups (see figure 2 and appendix D(D4)). All theories identify factors
208 relating to personal context (i.e. individual socio-demographic characteristics). Twelve socio-
209 economic health inequality theories identify factors relating to the wider environmental context (i.e.
210 factors outside the control of an individual, e.g. laws, cultural beliefs). One health inequality
211 framework, PROGRESS-plus(4), categorises factors relating to personal context. PROGRESS-plus
212 identifies additional personal context factors not previously identified in the complexity theories. All
213 context factors are supported by two or more socio-economic health inequality theories.

214 *3.1.6 Participant response factors associated with differential effectiveness across SES groups*

215 Fifteen socio-economic health inequality theories identify participant response factors associated
216 with differential effectiveness across SES groups (see figure 2 and appendix D(D5)). The majority of
217 socio-economic health inequality theories identify behavioural responses (e.g. adherence or
218 motivation). All participant response factors are supported by four or more socio-economic health
219 inequality theories.

220

221 **3.2 'How' factors may be associated with differential effects of healthcare interventions across** 222 **socio-economic groups ?**

223 Socio-economic health inequality theories suggest that differential effects across SES groups may
224 occur during either the provision of, or response to an intervention (e.g. see(1, 3, 30). The key stages
225 at which they may be introduced relate to, *effectiveness (relative and absolute effectiveness), cost-*
226 *effectiveness* and *access* to an intervention (see figure 2 and appendix D(D6)). Furthermore,
227 differential effects may be exacerbated because of cumulative effects experienced(1, 3, 24, 26, 30,
228 35). In other words, if lower SES groups experience worse outcomes at each stage at which
229 inequalities can arise compared to higher SES groups, then a greater overall reduction in
230 effectiveness is likely for lower SES groups.

231 Differential effects in health outcomes may arise due to differences in absolute or relative
232 effectiveness. Differences in absolute effects are mediated by differences in the baseline risk of
233 outcomes in populations(12). For example, even if a new intervention is equally efficacious for both
234 lower and higher SES groups, if lower SES groups have a higher baseline risk of mortality then the
235 absolute difference in effectiveness will be greater for lower SES groups(3, 12, 25).

236 Differences in relative effects may arise due to differences in mechanisms of action and may be
237 moderated by differences in recipient characteristics, the way in which an intervention is designed
238 or implemented, or wider contextual influences(1, 30). For example, a greater relative reduction in
239 obesity may be seen in higher SES groups than lower SES groups if lower SES groups are unable to
240 afford healthier food options, or are exposed to unhealthier environments.

241 Differences in relative effects are also influenced by levels of access to an intervention. Based on a
242 synthesis of the literature on the conceptualisation of access, Levesque et al.'s(33) framework offers
243 the most comprehensive definition of access (see table 3). They describe how differences in levels of
244 access are mediated by differences in approachability, acceptability, availability and
245 accommodation, affordability and appropriateness. In addition, if interventions which are successful
246 in reducing socio-economic health inequalities are not cost-effective, then they may not be
247 implemented. However, if people value the reduction in inequalities, the benefit/cost ratio could be
248 shifted.

249

250 **Table 3: Defining access** (Levesque et al. (33, 'A definition of access as an opportunity', 'Five
251 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”.

252

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

259

260 **3.3 ‘Why’ factors may be associated with differential effects of healthcare interventions across** 261 **socio-economic groups**

262 Socio-economic health inequality theories identify seven key mechanisms that may help to explain
 263 why interventions may have differential effects across SES groups (see table 4). Only one theory(33)
 264 explicitly presents mechanisms as part of a testable framework explaining why healthcare
 265 interventions may result in differential access. Mechanisms highlighted in other theories are often
 266 not described as an explicit part of a testable framework.

267

268 **Table 4: 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."(35)	"A common attribute of interventions that lead to increase socioeconomic inequalities in health appears to be a reliance on voluntary behaviour change (<i>Mechanic, 2002</i>)."(1)
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 socioeconomic status since the risk of malaria is similar across socioeconomic gradients in areas of comparable endemicity. However, the absolute difference may be greater in the poorest people, who start with higher baseline mortality(359)."(3)	"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."(34)
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 barriers to uptake of preventive services in particular."(10)	"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."(26)
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	"Increasing the number of female doctors can improve access to health care for women from Arabic-speaking countries living in Sweden[63]."(4)	"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."(10)
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."(26)	"The facilities serving poor people are typically less well organised than are those for people who are better off, with inconvenient opening hours."(26)
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'. ¹	"Ownership of malaria bednets decreases with decreasing household wealth ... distribution of free bednets or vouchers for bednets increases ownership."(4)	"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.”(10)
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].”(35)	“More socioeconomically 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.”(35)

269 ¹ as defined by Levesque et al.(33), see table 1. ²See appendix D for additional examples.

270 Appendix D(D7) highlights the extent to which socio-economic health inequality theories support
 271 each mechanism. All theories support the identification of access mechanisms, 12 theories support
 272 the effectiveness mechanism and 10 support the choice mechanism. The way in which intervention,
 273 implementation and context factors interact will influence participant responses and trigger
 274 mechanisms. This, in turn, may have differential impact on socio-economic health inequalities
 275 resulting in either a net positive, negative, or no impact. Appendix E highlights some examples of
 276 how factors relating to intervention, implementation and context interact to trigger the key
 277 mechanisms resulting in a net positive, negative, or no impact on socio-economic health inequalities.

278

279 4 Discussion

280 Multiple theories and frameworks exist to prompt researchers to consider socio-economic health
 281 inequalities. To our knowledge, the meta-framework presented above (see figure 2) is the first
 282 attempt to provide reviewers with practical guidance on identifying factors and mechanisms
 283 associated with differential effects across SES groups. To our knowledge, it is also the first time that
 284 socio-economic health inequalities have been considered in a meta-framework within the wider
 285 context of complex interventions.

286 Waters et al.(36, p.462) suggest that consideration of the wider context and implementation should
 287 be “an essential, non-negotiable component of the review process.” None of the theories
 288 incorporated in the meta-framework focus in detail on all factors associated with the intervention

289 pathway (i.e. intervention, implementation, context, participant response) (see Appendix D).
290 Furthermore, socio-economic health inequalities theories were found to be less explicit in detailing
291 implementation, wider environmental context dimensions and mechanisms associated with
292 differential effects of healthcare interventions. We identified only one SES theory that explicitly
293 presented mechanisms associated with differential access to interventions in a testable
294 framework(33). Although mechanisms are discussed in other theories, they are not explicitly
295 presented within a framework. This suggests that a *single* health intervention theory, tool or
296 framework, may be insufficient in helping not only reviewers, to predict *whether* and *how*
297 interventions may result in differential effectiveness across different socio-economic groups, but
298 also decision-makers and practitioners to assess the applicability of, and implement review findings.
299 Socio-economic theories also suggest that different mechanisms may be more closely related to
300 different socio-economic characteristics than others. For example, the ‘ability to perceive’ and
301 ‘ability to engage’ are more likely to be mediated by educational status, whereas ‘ability to pay’ is
302 more likely to be mediated by income status. This may have implications for reviewers when
303 defining ‘socio-economic status’. Consequently, it is anticipated that some factors (e.g. setting, cost
304 to recipient) may exert a stronger influence on differential effectiveness across SES populations than
305 others. Further research is required in identifying which factors related to intervention,
306 implementation, context and participant response are more closely associated with specific
307 mechanisms and the resulting net impact (i.e. positive, negative or no impact) on socio-economic
308 health inequalities.

309 The key mechanisms identified above are likely to be interdependent to differing extents. For
310 example, Tugwell et al.,(3) suggest that lower SES groups may have greater adherence (ability to
311 engage) in use of bed nets because of their higher exposure to mosquito biting environments (ability
312 to control). In addition, the key mechanisms may be triggered by other mechanisms specific to a
313 particular context. For example, the Health Inequalities Assessment Toolkit(10) suggest that because
314 people of lower SES may work longer hours, under poor working conditions, including job insecurity,

315 then they may prioritise (ability to prioritise) providing for their families over attending health
316 checks (ability to seek). The meta-framework identifies mechanisms at a broad level (i.e. not specific
317 to a single intervention) and therefore can act as a prompt to develop and test hypotheses about
318 specific mechanisms and interactions.

319 One of the key strengths of the meta-framework is its foundation in published theories, frameworks
320 and logic models. In providing a conceptual framework to aid *a priori* understandings of what
321 interventions may work for different SES groups and why, the meta-framework aims to make the use
322 of theory more accessible to systematic reviewers. It can also act as an evaluation framework to
323 inform a data extraction tool. In this way the meta-framework encourages reviewers to engage with,
324 and build upon theory throughout the review process. Furthermore, in encouraging reviewers to
325 consider context and implementation factors simultaneously with intervention effectiveness, the
326 meta-framework also aims to increase the usefulness of systematic reviews in decision-making and
327 changes to practice (36). Although developed explicitly for systematic reviews, the meta-framework
328 may also be useful in informing socio-economic health inequality considerations in other types of
329 reviews and primary research. Furthermore, whilst the meta-framework acknowledges the
330 moderating effects of other health inequalities as defined in PROGRESS-Plus(4) (e.g. gender,
331 ethnicity), the focus here is on the moderating influence of socio-economic status.

332 The meta-framework is not designed to introduce rigidity into the review process(37). Its value lies
333 in “its ability to allow an acceptable, systematic, tested and refined *a posteriori reasoning* rather
334 than *post hoc assumption* of *how* interventions may work”(11, Discussion). The meta-framework is
335 flexible enough to allow new factors and mechanisms to be incorporated and can be used, for
336 example, to inform data extraction within a best-fit framework synthesis(18).

337 Whilst the overlap of factors and mechanisms identified within the socio-economic theories
338 enhances the internal validity of the meta-framework, additional testing and validation of the meta-
339 framework is required to ensure it is fit for purpose(18). This will include for example, assessing

340 whether additional factors and mechanisms associated with differential effects are identified from
341 theories that meet the inclusion criteria but were not captured by the search. Methodological
342 challenges in identifying and selecting theories, operationalising definitions and evaluating the meta-
343 framework are discussed in greater detail elsewhere.(38)

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

351

352 **5 Conclusions**

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

360

361

362 **Abbreviations**

363 **3ie:** International Initiative for Impact Evaluation database

364 **IGI:** Intervention generated inequalities

365 **SEP:** Socio-economic position

366 **SES:** Socio-economic status

367

368 **Declarations**

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379

380 **Contributions to study**

381 MM was responsible for the overall design of the study, designed and conducted the search,

382 designed data collection, extracted data, undertook thematic analysis, constructed the framework

383 and wrote the first draft and final draft of this paper. NMCM independently checked the data

384 extraction, thematic analysis and construction of the framework. AB advised on the design and

385 commented on drafts of the study. RD, MG, SP supplemented the methodological and theoretical

386 aspects of the study and provided feedback on drafts of the study.

387

388 **Disclaimer**

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

391

392 **References**

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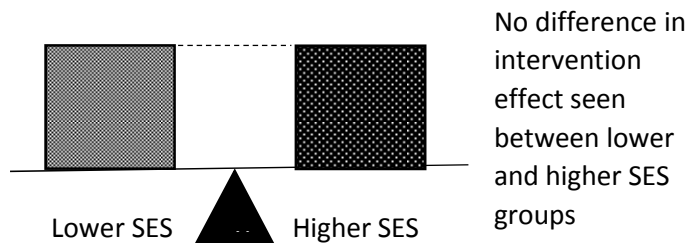
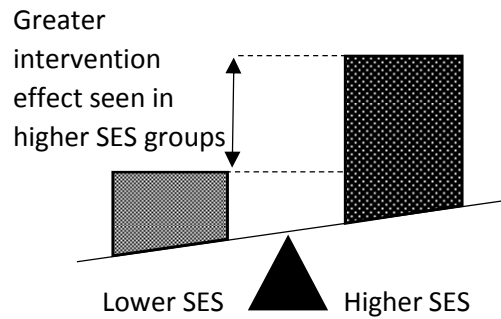
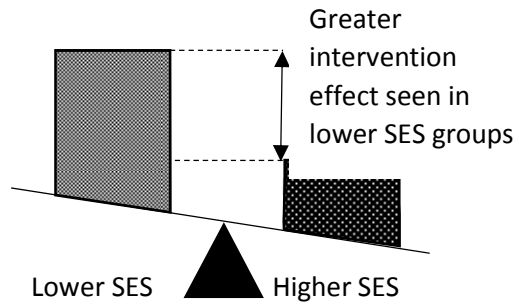
- 394 1. White M, Adams J, Heywood P. How and why do interventions that increase health overall
395 widen inequalities within populations? In: Babones S, editor. *Social Inequality and Public Health*.
396 Bristol: Policy Press; 2009. p. 65-83.
- 397 2. Lorenc T, Petticrew M, Welch V, Tugwell P. What types of interventions generate
398 inequalities? Evidence from systematic reviews. *Journal of Epidemiology and Community Health*.
399 2013;67(2):190-3.
- 400 3. Tugwell P, de Savigny D, Hawker G, Robinson V. Applying clinical epidemiological methods to
401 health equity: the equity effectiveness loop. *BMJ*. 2006;332(7537):358-61.
- 402 4. O'Neill J, Tabish H, Welch V, Petticrew M, Pottie K, Clarke M, et al. Applying an equity lens to
403 interventions: using PROGRESS ensures consideration of socially stratifying factors to illuminate
404 inequities in health. *Journal of Clinical Epidemiology*. 2014;67(1):56-64.
- 405 5. Whitehead M. A typology of actions to tackle social inequalities in health. *Journal of*
406 *Epidemiology and Community Health*. 2007;61(6):473-8.
- 407 6. Bonnefoy J, Morgan A, Kelly M, Butt J, Bergman V. *Constructing the evidence base on the*
408 *social determinants of health: a guide*. Geneva: WHO Measurement and Evidence Knowledge
409 Network; 2007.
- 410 7. Tugwell P, Petticrew M, Kristjansson E, Welch V, Ueffing E, Waters E, et al. Assessing equity
411 in systematic reviews: realising the recommendations of the Commission on Social Determinants of
412 Health. *BMJ*. 2010;341:c4739.
- 413 8. Welch V, Petticrew M, Tugwell P, Moher D, O'Neill J, Waters E, et al. PRISMA-Equity 2012
414 extension: reporting guidelines for systematic reviews with a focus on health equity. *PLoS Medicine*
415 2012;9(10):e1001333.
- 416 9. Welch V, Petticrew M, Petkovic J, Moher D, Waters E, White H, et al. Extending the PRISMA
417 statement to equity-focused systematic reviews (PRISMA-E 2012): explanation and elaboration.
418 *Journal of Clinical Epidemiology*. 2016;70:68-89.
- 419 10. NIHR CLAHRC North West Coast. *Health inequalities assessment toolkit (HIAT)*. 2017
420 [Available from: <http://www.hiat.org.uk/>].
- 421 11. Maden M, Cunliffe A, McMahon N, Booth A, Carey GM, Paisley S, et al. Use of programme
422 theory to understand the differential effects of interventions across socio-economic groups in
423 systematic reviews-a systematic methodology review. *Systematic Reviews* 2017;6(1):266.
- 424 12. Welch V, Brand K, Kristjansson E, Smylie J, Wells G, Tugwell P. Systematic reviews need to
425 consider applicability to disadvantaged populations: inter-rater agreement for a health equity
426 plausibility algorithm. *BMC Medical Research Methodology*. 2012;12:187.

- 427 13. Runnels V, Tudiver S, Doull M, Boscoe M. The challenges of including sex/gender analysis in
428 systematic reviews: a qualitative survey. *Systematic Reviews* 2014;3:33.
- 429 14. Maden M, Dickson R. Health Inequalities and Evidence Synthesis as part of the CLAHRC
430 NWC. Position Statement. Liverpool: Evidence Synthesis Theme, CLARHC NWC, University of
431 Liverpool; 2015.
- 432 15. Maden M. Consideration of health inequalities in systematic reviews: a mapping review of
433 guidance. *Systematic Reviews*. 2016;5(1):202.
- 434 16. Rohwer A, Booth A, Pfadenhauer L, Brereton L, Gerhardus A, Mozygemba K, et al. Guidance
435 on the use of logic models in health technology assessments of complex interventions. 2016.
- 436 17. Carroll C, Booth A, Leaviss J, Rick J. "Best fit" framework synthesis: refining the method. *BMC*
437 *Medical Research Methodology*. 2013;13:37.
- 438 18. Booth A, Carroll C. How to build up the actionable knowledge base: the role of 'best fit'
439 framework synthesis for studies of improvement in healthcare. *BMJ quality & safety*.
440 2015;24(11):700-8.
- 441 19. Anderson LM, Petticrew M, Chandler J, Grimshaw J, Tugwell P, O'Neill J, et al. Introducing a
442 series of methodological articles on considering complexity in systematic reviews of interventions.
443 *Journal of Clinical Epidemiology*. 2013;66(11):1205-8.
- 444 20. Lewin S, Hendry M, Chandler J, Oxman AD, Michie S, Shepperd S, et al. Assessing the
445 complexity of interventions within systematic reviews: development, content and use of a new tool
446 (iCAT_SR). *BMC Medical Research Methodology*. 2017;17(1).
- 447 21. Pfadenhauer L, Rohwer A, Burns J, Booth A, Lysdahl K, Hofmann B, et al. Guidance for the
448 Assessment of Context and Implementation in HTA and Systematic Reviews of Complex
449 Interventions.: The Context and Implementation of Complex Interventions (CICI) Framework. 2016.
- 450 22. Pigott T, Shepperd S. Identifying, documenting, and examining heterogeneity in systematic
451 reviews of complex interventions. *Journal of Clinical Epidemiology*. 2013;66(11):1244-50.
- 452 23. Hart J. The inverse care law. *The Lancet*. 1971;1(7696):405-12.
- 453 24. Tanahashi T. Health service coverage and its evaluation. *Bulletin of the World Health*
454 *Organization*. 1978;56(2):295-303.
- 455 25. Victora C, Vaughan J, Barros F, Silva A, Tomasi E. Explaining trends in inequities: evidence
456 from Brazilian child health studies. *The Lancet*. 2000;356:1093-8.
- 457 26. Victora C, Wagstaff A, Armstrong Schellenberg J, Gwatkin D, Claeson M, Habicht J-P.
458 Applying an equity lens to child health and mortality: more of the same is not enough. *The Lancet*.
459 2003;362:233-41.
- 460 27. Graham H, Kelly M. Health inequalities: concepts, frameworks and policy. In: Agency HD,
461 editor. London2004.
- 462 28. Starfield S. What can we learn from equity research and interventions? *Australian Journal of*
463 *Primary Health*. 2004;10(3):7-10.
- 464 29. Starfield B. Pathways of influence on equity in health. *Social Science & Medicine*.
465 2007;64(7):1355-62.
- 466 30. Welch V, Tugwell P, Morris EB. The equity-effectiveness loop as a tool for evaluating
467 population health interventions. *Revista de Salud Publica (Bogota, Colombia)*. 2008;10 Suppl:83-96.
- 468 31. Frieden T. A Framework for Public Health Action: The Health Impact Pyramid. *American*
469 *Journal of Public Health*. 2010;100:590-5.
- 470 32. Braveman P, Kumanyika S, Fielding J, LaVeist T, Borrell L, Manderscheid R, et al. Health
471 Disparities and Health Equity: The Issue Is Justice. *American Journal of Public Health*.
472 2011;101:S149-S55.
- 473 33. Levesque J, Harris M, Russell G. Patient-centred access to health care: conceptualising access
474 at the interface of health systems and populations. *International Journal for Equity in Health*.
475 2013;12:18.

- 476 34. McGill R, Anwar E, Orton L, Bromley H, Lloyd-Williams F, O'Flaherty M, et al. Are
477 interventions to promote healthy eating equally effective for all? Systematic review of
478 socioeconomic inequalities in impact. *BMC Public Health*. 2015;15:457.
- 479 35. Adams J, Mytton O, White M, Monsivais P. Why Are Some Population Interventions for Diet
480 and Obesity More Equitable and Effective Than Others? The Role of Individual Agency. *PLoS*
481 *Medicine*. 2016;13(4):e1001990.
- 482 36. Waters E, Hall BJ, Armstrong R, Doyle J, Pettman TL, de Silva-Sanigorski A. Essential
483 components of public health evidence reviews: capturing intervention complexity, implementation,
484 economics and equity. *Journal of public health (Oxford, England)*. 2011;33(3):462-5.
- 485 37. Kneale D, Thomas J, Harris K. Developing and Optimising the Use of Logic Models in
486 Systematic Reviews: Exploring Practice and Good Practice in the Use of Programme Theory in
487 Reviews. *PLoS One*. 2015;10(11):e0142187.
- 488 38. Maden M, McMahan N, Booth A, Dickson R, Paisley S, Gabbay M. Methodological challenges
489 when developing meta-frameworks in evidence synthesis: A worked example of a socio-economic
490 health inequalities meta-framework. Manuscript in preparation.
- 491 39. Moore G, Audrey S, Barker M, Bond L, Bonell C, Cooper C, Hardeman W, Moore L, O'Cathain
492 A, Tinati T, Wright D, Baird J. Process evaluation in complex public health intervention studies: the
493 need for guidance. *Journal of Epidemiology and Community Health*. 2014;68:101-102.

494

Difference in intervention effectiveness between lower socio-economic (SES) and higher SES groups



Impact on health inequalities

Positive net impact

Intervention likely to reduce inequalities: the intervention preferentially improved the health in people of lower SES.

Negative net impact

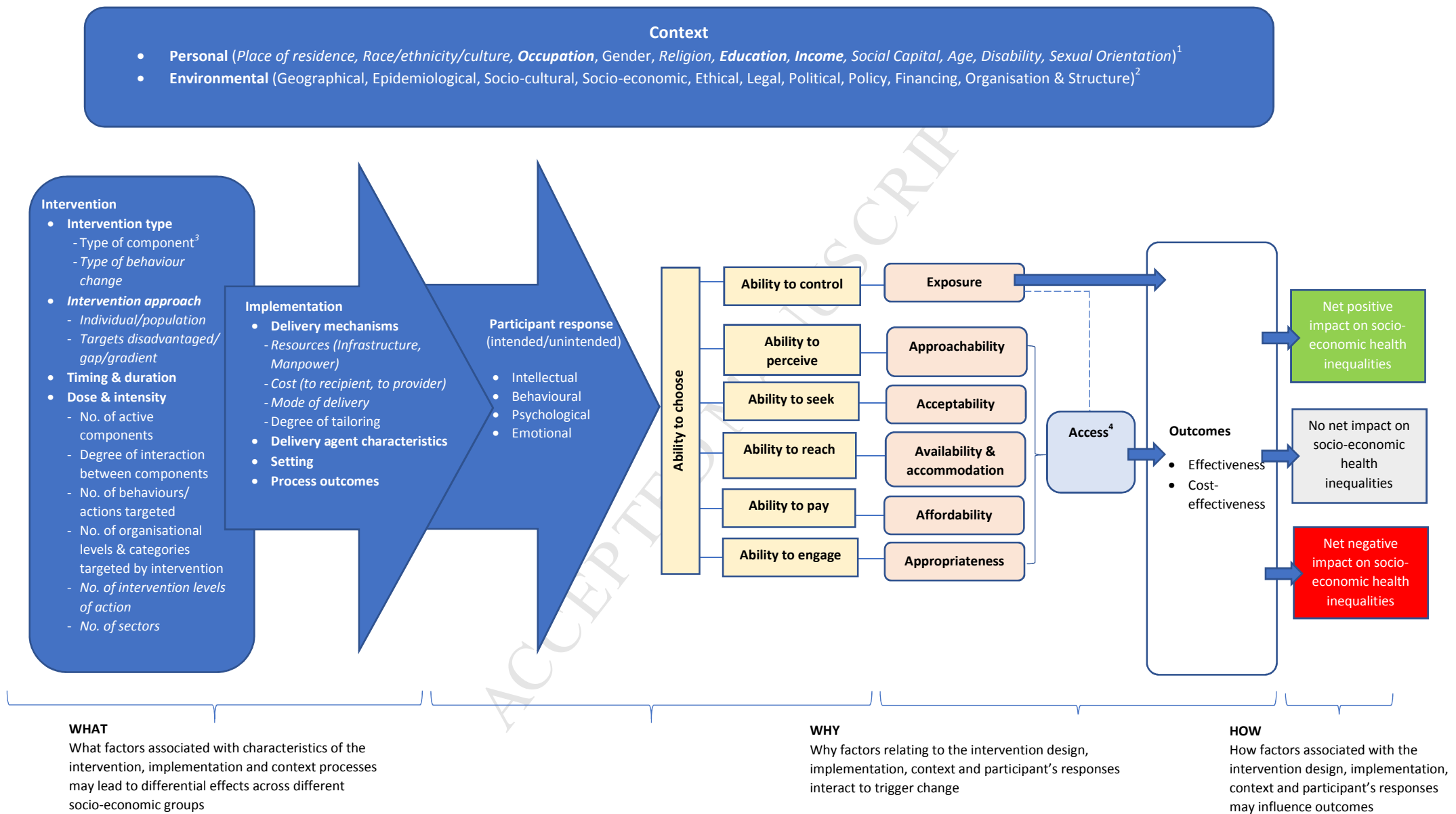
Intervention likely to widen inequalities: the intervention preferentially improved the health in people of higher SES.

No net impact

Intervention had no preferential impact by SES.

Figure 1 Potential impact of healthcare interventions on health inequalities

Figure 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 [4], ²Adapted from Rohwer et al. [16], ³Adapted from McGill et al. [34], ⁴Levesque et al. [33].