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**Title**

What types of interventions generate inequalities? Evidence from systematic reviews

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## What types of interventions generate inequalities? Evidence from systematic reviews

### Abstract

*Background.* Some effective public health interventions may increase inequalities, by disproportionately benefiting less disadvantaged groups ('intervention-generated inequalities' or IGIs). There is a need to understand which types of interventions are likely to produce IGIs, and which can reduce inequalities.

*Methods.* We conducted a rapid overview of systematic reviews to identify evidence on intervention-generated inequalities by socio-economic status (SES). We included any review of non-healthcare interventions in high-income countries presenting data on differential intervention effects on any health status or health behaviour outcome. Results were synthesized narratively.

*Results.* The following intervention types show some evidence of increasing inequalities (IGIs) between SES groups: media campaigns; and workplace smoking bans. However, for many intervention types, data on potential IGIs are lacking. By contrast, the following show some evidence of reducing health inequalities: structural workplace interventions; provision of resources; and fiscal interventions such as tobacco pricing.

*Conclusion.* Our findings are consistent with the idea that 'downstream' preventive interventions are more likely to increase health inequalities than 'upstream' interventions. More consistent reporting of differential intervention effectiveness is required to help build the evidence base on IGIs.

### *What is already known on this subject*

- \* Some successful public health interventions may increase inequalities by bringing about greater improvements in health or health behaviours in less disadvantaged groups.
- \* Some researchers have argued that 'downstream' interventions which focus on individual behaviour change are more likely to increase inequalities than 'upstream' social or policy interventions.

### *What this paper adds*

- \* There is robust evidence that some public health interventions types increase inequalities between socio-economic groups. Media campaigns may be particularly likely to do this.
- \* Several intervention types appear promising in reducing inequalities between socio-economic groups, including resource provision, fiscal interventions, and structural workplace interventions.
- \* This has important implications for those seeking to develop, implement and evaluate public health interventions, whether they explicitly aim to reduce inequalities or not.

## **INTRODUCTION**

A number of researchers have raised concerns about the possibility that public health interventions may increase inequalities in the population. This has been expressed as an ‘inverse prevention law’,<sup>[1]</sup> analogous to the ‘inverse care law’ posited for medical care by Tudor Hart,<sup>[2]</sup> stating that those in most need of benefiting from preventive interventions are least likely to receive them. That is, even where interventions are successful at improving health across the population, they may increase health inequalities. This can happen where an intervention is of greater benefit to advantaged (lower-risk) groups than to disadvantaged (higher-risk) groups. Such ‘intervention-generated inequalities’ (IGIs) may arise at a number of points in the implementation of an intervention, including intervention efficacy, service provision or access, uptake, and compliance.<sup>[3, 4]</sup> Conversely, some interventions may reduce inequalities, if they are of greater benefit to disadvantaged groups.

A number of intervention types have been investigated for the possibility of IGIs, and there is a substantial body of theoretical work and guidance on the kinds of interventions which are likely to reduce or increase inequalities.<sup>[5–7]</sup> However, few studies have sought to bring together what is known about IGIs across the whole field of public health interventions. The aim of this paper is to provide an overview of evidence from systematic reviews in order to provide preliminary indications as to which types of intervention are more likely to produce IGIs, and which have the potential to reduce inequalities.

## **METHODS**

The method used was a systematic review of reviews, with limited searching but systematic screening. Analogous methods have been widely used to produce ‘rapid reviews’: they aim to minimise selection bias, as in a full systematic review, but not to be fully comprehensive, and so cannot rule out publication bias.<sup>[8, 9]</sup> We searched MEDLINE using the string “(inequalit\$ or equit\$ or inequit\$ or disparit\$).tw.” in conjunction with SIGN’s filter for systematic reviews (<http://www.sign.ac.uk/methodology/filters.html#systematic>), and searched the bibliography from a recent review of reviews on inequalities.<sup>[10]</sup> We included systematic reviews which evaluated the effectiveness of any non-healthcare intervention in a high-income country on any health outcome, and which reported differences in intervention effectiveness between population groups, defined in terms of the PROGRESS-Plus framework.<sup>[11, 12]</sup> Full methods and the flow of literature are presented in the web-only appendix to this paper.

It should be noted that a differential intervention effect does not necessarily imply an IGI. Strictly speaking, we can identify an IGI only where we know that an intervention has created a health inequality where none existed at baseline, or widened an existing inequality. To confirm this, we would need detailed information on the study sample at baseline, showing that more disadvantaged groups on the relevant demographic (PROGRESS-Plus) dimension are worse off, or at least no better off, with respect to the relevant health variable(s). However, such baseline data are often not recoverable from secondary or tertiary research findings. For this reason, our analysis focuses on differences in intervention effect between groups of lower and higher socio-economic status (SES; broadly defined to include measures such as income, occupational status, employment status,

housing tenure, or level of education), rather than on other PROGRESS-Plus factors such as gender or ethnicity. This is because, while the existence and direction of an inequality gradient by SES for most health behaviour and health status variables is reasonably well-established, and can in most cases be legitimately assumed to exist at study baseline in the absence of detailed data, in many cases the gradient by gender or ethnicity is unclear and cannot be imputed. For example, cigarette smoking is less prevalent in several minority ethnic groups in the UK than in the white population,[13] so a hypothetical intervention which reduced smoking more in the latter than the former could not be seen as creating an IGI. We intend to carry out further methodological and empirical work on identifying IGIs by other (non-SES) dimensions of PROGRESS-Plus.

## RESULTS

We located 12 reviews meeting the inclusion criteria, covering a range of intervention types and populations. Table 1 shows the evidence organised into five broad categories of intervention.

Table 1. Findings on inequalities in intervention effect by SES

<b>Intervention type and intervention</b>	<b>Outcome type</b>	<b>Findings</b>
<b>Education, communication and information</b>		
Individual or group education (with or without resource provision)	Parents' child safety behaviours	No difference (13 analyses) or reduced inequalities (3 analyses) by SES (housing tenure / employment status; N of primary studies unclear)[14]
Printed communication materials	Awareness of folic acid benefits	Increased inequalities by SES (measure unclear; 1 primary study)[15]
Media campaigns	Smoking behaviour	Increased inequalities by SES (education / income; 18 primary studies)[16]
Media campaigns	Folic acid intake	Increased inequalities by SES (measure unclear) from national campaign; with additional targeted component, no difference (1 primary study)[15]
Health warnings on tobacco products	Smoking behaviour	No difference by SES (education; 2 primary studies)[17]
<b>Multi-component settings-based interventions</b>		
Multi-component school-	Physical activity and/or	Increased inequalities by SES (income / area-level disadvantage; 2 primary

based interventions	healthy eating behaviours	studies)[18]  No difference by SES (occupational class / income; 3 primary studies)[19]
School-based interventions	Smoking behaviour	No data found[20]
Multi-component community-based interventions	Physical activity behaviour	No difference by SES (education / income; 2 primary studies)[21]
Community-based interventions	Smoking behaviour	No data found[20]
<b>Resource provision and fiscal interventions</b>		
Free fruit provision in schools	Healthy eating behaviours	No difference (5 analyses) or reduced inequalities (1 analysis) by SES (parental education / income; 1 primary study)*[22]
Free folic acid supplements	Folic acid intake	Reduced inequalities by SES (income; 1 primary study)[15]
Tobacco price increases	Smoking behaviour	Reduced inequalities by SES (occupation, income), but increased inequalities by SES (education; ≥5 primary studies)[17]  Reduced inequalities by SES (occupational status; 1 primary study)[23]
<b>Regulatory and workplace interventions</b>		
Restrictions on tobacco sales to minors	Smoking-related outcomes	No data found[17, 23]
Restrictions on tobacco advertising	Smoking-related outcomes	No data found[17]
Workplace interventions to increase employee control or participation; changes to working hours	Various health status outcomes	Reduced inequalities by SES (occupational status; 5 systematic reviews)[24]
Workplace smoking bans	Smoking-related outcomes	Increased inequalities by SES (occupational status / education / income; 6 primary studies)[17]

<b>Other interventions</b>		
Housing , transport, unemployment and welfare, agriculture and food, water and sanitation, adult education	Any health status outcome	No data found[25]

\*This presentation follows the analysis reported in the primary study[26] rather than that in the review itself.

While there are obviously limitations to the methodology used here, the results presented in Table 1 point to the following conclusions. The following intervention types show some evidence of increased inequalities (IGIs) in health behaviour outcomes: mass media campaigns; and workplace smoking bans. The following show some evidence of reducing, or at least not increasing, inequalities in health behaviour outcomes: reducing price barriers; and fiscal interventions such as tobacco pricing. (Kendrick and colleagues[14] also find reduced inequalities as a result of safety education. However, as they observe, these findings may be accounted for by the resource provision components which formed part of several of the included interventions.) Structural workplace interventions also appear to reduce inequalities in health status outcomes. The evidence on educational interventions, and on multi-component school- and community-based interventions, is equivocal.

It is clear from Table 1 that there is limited evidence from systematic reviews on possible IGIs arising from many other preventive interventions which are widely recommended and implemented (see discussion below). In addition, most of the findings on IGIs relate only to health behaviour rather than health status outcomes.

## **DISCUSSION**

The findings of this overview are congruent with existing summaries of what is known about the effect of different intervention types on inequalities. A widely used framework to think about public health interventions is the distinction between ‘upstream’ interventions focusing on social or policy-level determinants, such as reducing price barriers, and ‘downstream’ interventions focused on individual factors, such as education. Several researchers argue that upstream interventions are more likely to reduce socio-economic inequalities in health than downstream interventions.[4, 27]

Our findings are broadly consistent with these ideas, although in no case is the evidence conclusive. Downstream interventions do not appear to reduce inequalities, and may increase them. Mass media interventions may be particularly a concern here, on the basis of Niederdeppe and colleagues’ findings on smoking behaviour,[16] and indicate that media programmes should be implemented with caution. Conversely, several upstream interventions have the potential to reduce inequalities. Bambra and colleagues’ findings on the health status outcomes of structural workplace interventions are encouraging;[24] there is also limited but consistent evidence that resource provision interventions and tobacco pricing may have the potential to reduce inequalities in health behaviours.

However, for many intervention types, the evidence base on the effect on inequalities in any health outcomes appears to be very limited. This includes many upstream interventions, such as structural environmental change and legislative or regulatory controls (other than workplace interventions). This said, some forms of upstream intervention, particularly those that involve facilitating access to healthcare, were not included in the present review. A more inclusive review would provide a fuller picture, and our conclusion that downstream interventions are more likely to produce IGIs should be regarded as tentative and provisional.

This paper is based on a systematic, albeit focused, review of reviews, and thus provides an overview of the most robust available research findings on IGIs. However, the methodology adopted has limitations. Interventions on which primary data on IGIs exists, but which have not been covered by a systematic review with an equity focus, will not have been included. Even aside from this, the searches were intentionally limited with respect both to sources and to terms, and the criterion requiring reviews to have an explicit focus on inequalities or disadvantaged groups may have excluded some reviews presenting relevant data. We have not retrieved the primary studies included in the reviews, and so are reliant on review authors' characterisations of the findings. Our findings may therefore be affected by selective reporting biases, both in the reviews themselves and in their included primary studies.[28] Finally, we included only reviews reporting on differences in the effect of interventions on inequalities between SES groups. Thus, we did not include reviews of interventions targeted at low-SES (or other) groups, unless they also provided evidence of differential effectiveness. This paper is therefore mainly a pointer towards further work. However, it contributes to the small evidence base on the potential harms of well-intentioned public health interventions.

This review indicates that further research on IGIs would be of value. We would make two main recommendations. First, systematic reviews of primary studies should seek to identify differential effects by SES and other PROGRESS groups, and should report all planned analyses of differential effect, whether a significant difference is found or not, so that potential equity-related harms are routinely reported. This could be included in reporting guidelines such as CONSORT or STROBE, along the lines of the equity extension currently being considered for PRISMA.[28] Second, where practicable, researchers should seek to explore in more detail what kind of interventions increase or reduce inequalities. These findings could then be used to develop a taxonomy of intervention characteristics and components, and to quantify the likely risk of IGIs as a result of different intervention types, thus providing a more robust and more readily applicable evidence base for guidance on reducing inequalities.



**Competing interests**

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**Contributorship Statement**

MP and TL originated the idea for the paper. TL carried out searching, screening and data extraction, and wrote the first draft. MP, VW and PT advised on the methods and interpretation of the findings.

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