



# Health Inequalities Research

## NEW METHODS, BETTER INSIGHTS?

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# FOREWORD

Dear reader,

Health, be it physical, mental or social, is undoubtedly one of the most precious cornerstones in people's lives. It enables us to thrive, lead meaningful, fulfilling lives and fully participate in our communities. Most recently, this has become more apparent with the COVID-19 pandemic: although the disease has reached all parts of society, the most vulnerable groups have been affected more severely to pose a greater risk to their physical, mental, social and economic well-being. With this, the health gap between different socio-economic groups has grown larger, exacerbating the inequalities long known to researchers.

Such health disparities often have their root causes in a variety of factors ranging from education, employment status to level of income. Analysing and understanding the role of social determinants can aid in advancing the research and ultimately informing public policy on possible strategies to mitigate health inequalities.

In an effort to explore this pivotal topic through the lens of different disciplines, the European Federation of Academies of Sciences and Humanities (ALLEA) and the Federation of European Academies of Medicine (FEAM) initiated a joint project on health inequalities in Europe aimed at reviewing existing research findings. They established a scientific committee chaired by the Royal Netherlands Academy of Arts and Sciences (KNAW), which led the project from the outset to the publication of this final report. In between, several expert workshops were held to share, examine and review the latest scientific insights into socio-economic differences in health. This report is the outcome of those deliberations followed by a peer-review process.

We are delighted to share this report including its annexes with you. It has been elaborated by the ALLEA–FEAM–KNAW scientific committee, chaired by Johan Mackenbach. We thank the committee for the substantial efforts that went into facilitating this project, which could not be more timely and relevant.

We wish you a pleasant reading.

Antonio Loprieno  
*President of ALLEA*

George Griffin  
*Immediate Past President of FEAM*

# SUMMARY

People who are worse off in socio-economic terms on average die younger, and within their shorter lives often have more health problems. These “health inequalities” are a persistent challenge for public policy in all European countries and have been studied extensively by researchers from various disciplines.

While these research efforts have importantly increased our understanding of health inequalities, and have supported the development of policies and interventions that may help to reduce health inequalities, three fundamental questions remain topics for scientific debate: (1) to what extent are health inequalities *caused* by differences in education, occupational class or income? (2) what is the relative importance of specific factors involved in the relationship between education, occupational class or income and health? (3) what is the effectiveness of interventions and policies to reduce health inequalities?

Recently, new quantitative research methods have been developed, such as “counterfactual” approaches to causal inference, applications of genetics, advanced methods of mediation and moderation analysis, and “quasi-experimental” methods to study “natural experiments” with interventions and policies. These methods promise to shed new light on these questions, and this report reviews their strengths and limitations as well as the first substantive results that studies applying these methods have produced.

We conclude that these new methods can indeed contribute to a better understanding of health inequalities, and thus help to develop effective policies and interventions. Moreover, these new methods have pointed to several limitations of the conventional methods, which need to be taken into account when interpreting the results of previous research. However, the newer methods also have limitations, and, if properly executed, conventional studies retain their value. For robust conclusions, it will often be necessary to “triangulate” the results of studies using different approaches, taking into account the particular strengths and weaknesses of each approach.

In substantive terms, application of these new methods has led to some new insights in the causal role of education and income on health, in the possible role of genetics in generating health inequalities, and in the effects of interventions and policies on health inequalities. However, it is too early to say whether new methods of mediation and moderation analysis will change current views on the relative contributions of specific factors involved in health inequalities.

We therefore recommend expanding the use of these new methods, and making the investments in data infrastructure that are required for their application, such as birth cohort and other life-course studies which are necessary for mediation and moderation analyses, and data linkage facilities which are necessary to study natural experiments. This is the responsibility not only of national research funding bodies but also of the European Commission's research funding mechanisms which should foster international cooperation and between-country comparisons.

In the meantime, there is sufficient robust "explanatory" evidence to underpin interventions and policies to tackle health inequalities. Large-scale implementation should, however, be accompanied by rigorous evaluation efforts, for which a stronger commitment to evaluation among both policy-makers and researchers is necessary.

# 1. INTRODUCTION

People who are worse off in socio-economic terms on average die younger, and within their shorter lives often have more health problems. In many European countries, differences in average life expectancy at birth between people with a lower and a higher level of education, occupation or income amount to between 5 and more than 10 years, and differences in healthy life expectancy often amount to even more than 15 years. These “health inequalities” have become a major concern for health policy-makers and have, over the past four decades, been studied extensively by researchers from various disciplines.

These research efforts have substantially increased our understanding of health inequalities. Originally starting with descriptive research, the field has moved into an increasingly sophisticated explanatory mode, and has more recently made progress in developing and evaluating policies and interventions that may help to reduce health inequalities. However, at least three fundamental questions remain topics for scientific debate:

- (1) to what extent are health inequalities *caused* by differences in education, occupational class or income (“causation”)?;
- (2) what is the relative importance of specific factors involved in the relationship between education, occupational class or income and health (“mediation and moderation”)?;
- (3) what is the effectiveness of interventions and policies to reduce health inequalities (“effectiveness”)?

Crucially, not only are the answers to these three questions being debated, but also how these questions should be answered: what are the best methods to study health inequalities? Recently, several new quantitative research methods have been introduced that promise to shed more light on each of these questions. Examples include the use of “counterfactual” methods for establishing causality, the use of new “mediation” techniques to study the role of specific factors in generating health inequalities, and the use of “natural (or quasi-) experiments” for evaluating policies and interventions. Application of these newer methods has produced valuable insights, but the results sometimes seem to be in conflict with the conclusions of studies using more conventional methods. As a result, it is not always clear how the results of studies using different methods should be weighed, and there is no consensus yet among scientists from different disciplines on the relative merits of these new approaches.

The European Federation of Academies of Sciences and Humanities (ALLEA) and the Federation of European Academies of Medicine (FEAM) have therefore initiated a project to bring together experts from various scientific disciplines to assess the theoretical and methodological issues involved, and to develop recommendations for future cross-disciplinary research, with the ultimate aim of helping to narrow the enormous health gap between socio-economic groups in all European countries. The report is therefore aimed at scientists involved in health inequalities research and at national and European policy-makers interested in using research results for reducing health inequalities.

This report presents the general conclusions of this project in a concise and accessible format. After a description of the approach of the project (section 2), the main conclusions will be presented in three sections, corresponding to the three issues mentioned above: causation (section 3), mediation and moderation (section 4), and effectiveness of policies and interventions (section 5). The report ends with general recommendations (section 6). The scientific underpinnings for the conclusions summarized in this report can be found in a series of more detailed background documents that also contain extensive references to the scientific literature: three discussion papers ([Annexes 2, 4 and 6](#)) and three workshop reports ([Annexes 3, 5 and 7](#)).



## 2. APPROACH

To implement the project, ALLEA and FEAM established a committee on health inequalities by asking their member academies to nominate leading scientists from various disciplinary backgrounds and countries ([Annex 1](#)). The Royal Netherlands Academy of Arts and Sciences (Koninklijke Nederlandse Akademie van Wetenschappen, KNAW) took the lead in performing the work by providing the chair and secretary to the committee for desk-research, organizing meetings and drafting discussion papers.

The project was done in two phases. In the first phase, the committee reviewed the scientific literature to chart the main areas of scientific agreement and disagreement in the first two topics, “causation” and “mediation/moderation”. The results from this review were presented in a discussion paper, *“Health inequalities: an interdisciplinary exploration of socioeconomic position, health and causality”*, which served as input for an international symposium on 24 May 2018 in Amsterdam, The Netherlands, bringing together key opinion leaders from various scientific backgrounds. The symposium showed that further discussion was necessary, and that it would be desirable to add a third topic: effectiveness of interventions and policies.

In the second phase, the remaining areas of debate with regard to “causation” and “mediation/moderation” were topics for in-depth discussion in two workshops, organized in collaboration by, respectively, the German National Academy of Sciences Leopoldina (see [Annex 3](#) for the workshop report) and the French National Academy of Medicine (see [Annex 5](#) for the workshop report). As input to these workshops, the chair and secretary of the commission prepared new versions of the discussion paper(s) on “causation” and “mediation/moderation”, which were then revised in light of the discussions (see [Annexes 2 and 4](#) for the final versions).

A third workshop on “effectiveness of interventions and policies” was organized in collaboration with the Italian Academy of Medicine (see [Annex 7](#) for the workshop report). The input for this workshop consisted of a discussion paper on interventions and policies, prepared by Professor Clare Bambra (Newcastle University, UK) and Dr Peter Craig (University of Glasgow, UK) ([Annex 6](#)).

On the basis of all these documents, internal deliberations and an external review (see [Annex 8](#)), the committee wrote this final report. The committee expresses its gratitude to the national academies that have supported this initiative, to the large number of experts participating in the workshops, and to the external reviewers for their constructive comments.

This report has several limitations that need to be mentioned to prevent misunderstandings about what this report is (and is not) about. First, the committee has focused on several new quantitative research methods, and has not dealt with qualitative approaches, such as anthropological or biographical studies of the causal pathways between low socio-economic position and ill-health. As mentioned above, the reason for the particular focus of this report is that there is much discussion about the merits of some of the newer quantitative methods. This should not, however, be taken as an indication that the committee disregards qualitative research methods; on the contrary, the committee fully recognizes their value, but simply did not have the resources also to cover this vast field.

Secondly, the review of empirical evidence was limited to countries with relatively high incomes. It is likely that the role of various mechanisms and factors differs between high-income countries and low- and middle-income ones, in which absolute poverty is far more common. Within the European setting, this may apply to countries in Eastern Europe, where the role of material disadvantage in generating health inequalities may be more pervasive than in Western Europe. Unfortunately, the committee did not have the resources to review empirical evidence at a more global scale, but is confident that most of its conclusions about the value of new quantitative research methods apply beyond the context of high-income countries.

Thirdly, this report focuses on socio-economic health inequalities, defined as systematic differences in the occurrence of health problems (disease, disability, death, etc.) within countries between people with a lower and a higher socio-economic position, as indicated by their level of education, occupational class, income or similar characteristics. So, although we will use the shorthand term "health inequalities" throughout this report, it does not deal with other social determinants of health, such as ethnicity and migrant status. It also does not deal with between-country differences. There are, again, good reasons for this focus: socio-economic health inequalities are large within all European countries, and they are very pervasive, in the sense that inequalities in health between other social groupings (men–women, urban–rural, migrant–non-migrant, etc.) tend to be partly determined by differences in socio-economic conditions. Nevertheless, the committee emphasizes that other types of health inequality are also very important, and deserve to be studied (and addressed by public policy) in their own right.

# 3. CAUSAL ROLE OF EDUCATION, OCCUPATIONAL CLASS AND INCOME IN GENERATING HEALTH INEQUALITIES<sup>1</sup>

## 3.1 Introduction

The relationship between indicators of socio-economic position such as education, occupational class and income on the one hand, and various health indicators on the other, is one of the most widely reproduced findings in population health research. Although education, occupational class and income are not equivalent concepts, they all predict health outcomes in a robust way. There is no doubt that, even in high-income countries, people with a lower socio-economic position on average live substantially shorter lives, and have substantially higher rates of morbidity than people with a higher socio-economic position. When confronted with these findings, most people agree that this state of affairs is undesirable. However, to what extent these relationships always represent causal effects of socio-economic conditions on health outcomes is another matter.

This is because some of the associations could also be due to “selection” (i.e. health status affecting socio-economic position, instead of the other way around) or to “confounding” (i.e. “third” factors which are related to both socio-economic position and health, but which do not lie on a causal pathway linking socio-economic position to health, such as cognitive ability). Social-epidemiological studies have tried to eliminate these alternative explanations, for example by using longitudinal designs (to make sure that a lower socio-economic position precedes ill-health instead of the other way around) and by using multivariate analysis techniques (to statistically control for third factors). However, as in other areas of epidemiological research, there has always remained some doubt on how successful these strategies are.

Disentangling these different explanations for the relationship between socio-economic position and health is important, not only for scientific reasons but also because it matters for policy. If socio-economic position causally determines health, this opens up a whole array of potential countermeasures against health inequalities, such as increasing the educational achievement of those at the bottom of the social hierarchy,

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<sup>1</sup> For more details, and a full account of the argumentation behind this section including references, see [Annexes 2 and 3](#).

or efforts to reduce income inequalities, or other redistributive social and economic policies. On the other hand, to the extent that health-related selection plays an important role, social security policies that protect people with health problems against loss of income may be considered.

Recently, two developments in health inequalities research have shed some new light on the issue of “causation”: counterfactual approaches and genetic studies.

### **3.2 New insights from the “counterfactual” approach to causal inference**

It is well known that the – theoretically – best way to study causation is by conducting experiments, in which the investigators actively manipulate exposure to the putative causal factor, and decide who will be exposed and who will not, preferably using some randomization procedure. Such planned experiments are often impractical when one wants to study the effect of education, occupation or income on health, and other approaches are therefore necessary.

As mentioned above, the conventional approach in social epidemiology has been to rely on carefully conducted observational studies, but over the past decades new methods have been introduced which have blurred the boundaries between experimental and observational studies. In addition to planned experiments, “natural” experiments have come to be seen as important opportunities for assessing the effects of socio-economic (or any other) factors on health. Also, new analytical techniques have been developed that mimic experimental conditions, but actually use observational data.

These methods usually apply the “counterfactual” (or “potential outcomes”) approach, which tries to bring methodological rigour to causal inference. Some of these methods exploit occasions when people’s exposure to socio-economic conditions changes in a quasi-random way, independent from the researchers’ actions (“natural experiments”). Examples include a change in compulsory schooling age, which can be used to study the effect of education on health in later life, and lotteries, which can be used to study the effect of a change in income on health. Other methods use advanced statistical techniques, such as “instrumental variables” or “regression discontinuity”, to identify subsets of data within which exposure varies in a quasi-random way, to isolate the effect of socio-economic conditions in observational data.

Now that these counterfactual techniques have been applied for some time, it is possible to take stock of new insights about a causal effect of socio-economic indicators, particularly education and income, on health. (They have not often been used to study the health effects of occupational class yet.) An important caveat is that practical application of this new approach has been limited to a narrower range of questions than many health inequalities researchers would like to answer. This is because this

approach requires the investigators to identify a well-defined and measurable difference in exposure; for example one extra year of education at the age of 16, or giving people a certain amount of money such as one would win in a lottery.

Proponents of this approach argue that studying these well-defined exposures is particularly relevant, because the results of a study can readily be translated into recommendations for policy. Others, however, argue that such studies capture only a limited part of the effect of socio-economic conditions on health. Because health inequalities are generated in a lifelong process of cumulative exposure to favourable or unfavourable living conditions, they warn against generalizing from such “well-defined” effects to explain health inequalities in the real world.

Despite this caveat, some substantive conclusions can be drawn from the application of counterfactual techniques to health inequalities. Many of these new studies have found that more years of schooling lead to a reduction in mortality in mid-life and beyond, albeit with large variations in effect size. This is to be expected, because the beneficial effects of schooling depend on context, the quality of education, the educational curricula, behavioural responses and many other factors. Nevertheless, these studies show that at least part of the association between education and health is due to a causal effect of education on health.

For income the picture is more nuanced. Counterfactual studies on the effect of income on physical health in adulthood have led to inconsistent results. On the basis of these studies it cannot be concluded that income causally affects physical health in adulthood in high-income countries. However, it is important to note that these studies have generally captured modest and temporary changes in income only, and have not captured the effects of a lifelong low or high income.

Furthermore, it should be emphasized that the evidence for a causal effect of parental income on children’s health is relatively strong. In this case, results of studies using a counterfactual approach clearly corroborate findings from more “conventional” longitudinal studies among children, which are considered to be less sensitive to selection bias than studies among adults. It can therefore be concluded that at least part of the association between parental income and children’s health is due to a causal effect of income on health.

### **3.3 New insights from genetic studies**

The second new development in quantitative health inequalities research that promises to shed new light on “causation” is the application of genetics. People’s genetic make-up is a potential “confounder” of the relationship between socio-economic indicators and health: if genetic factors predisposing to ill-health were more prevalent in lower socio-economic groups, this should be considered as a confounding factor because

a person's genotype temporally precedes his or her socio-economic position. With the advent of genetic techniques, such as whole-genome sequencing, it has become possible to investigate a confounding role of genetics directly.

Before going into the results, however, it should be noted that this is a highly contentious area. Some health inequalities researchers think it is not helpful to study the role of genetics in generating health inequalities, because it detracts from addressing remediable environmental conditions, or even believe that it is dangerous because of potential eugenic implications. Others, however, think that identifying the role of genetic factors involved in health inequalities can improve our understanding of the complex mechanisms underlying health inequalities, and may even strengthen the case for compensatory policies aiming to improve health outcomes in disadvantaged groups.

It is also important to keep in mind that, whatever the role of genetic factors in health inequalities is, it is likely to be very complex. It is clear that in matters of health both "genes" and the "environment" are likely to play a role, in various combinations and interactions. Also, finding a role for genetic factors does not necessarily imply biological determinism: genes may operate through environmental channels, such as children's experiences in the school system or differences in behaviour, and these can be intervened on through social policies. Furthermore, the early environment may increase or decrease the expression of specific genes through epigenetic mechanisms.

Most of the evidence collected so far on the role of genetics in social inequalities deals with the way genetic determinants of cognitive ability influence educational outcomes. (There is emerging, and somewhat similar, evidence for income.) Although educational achievement is partly dependent on the parents' socio-economic position, educational achievement is also dependent on an individual's own cognitive ability, which is strongly genetically determined. It has recently been estimated that "polygenic risk scores" could explain more than 10% of all inter-individual differences in educational achievement, through differences in cognitive ability, but also through personality traits such as self-control and risk aversion.

In combination with the fact that some of the genes that are associated with educational achievement also are associated with smoking, obesity, depression and various chronic health conditions, this implies that genetic factors may well confound the relationship between education and health. Although it is not yet clear what the extent of this confounding bias might be, these findings imply that one cannot safely assume that the associations between socio-economic indicators and health, even if found in longitudinal studies, wholly rest on causal effects of socio-economic conditions on health. To clarify this, further research into the role of genetics, including gene-environment interactions, will be necessary.

## 4. RELATIVE IMPORTANCE OF SPECIFIC FACTORS INVOLVED IN THE RELATIONSHIP BETWEEN EDUCATION, OCCUPATIONAL CLASS OR INCOME AND HEALTH<sup>2</sup>

### 4.1 Introduction

Socio-economic health inequalities have a complex explanation, not only in terms of “what causes what”, but also in terms of how the underlying causal pathways actually work: what are the specific factors involved in this relationship? There are many candidates, which range from psychosocial stress in the workplace to lack of access to medical treatment, and from adverse childhood experiences to smoking. A thorough understanding of these factors is not only scientifically interesting, but also highly policy-relevant, because it allows one to identify potential targets for interventions and policies that may help to reduce health inequalities. Over the past four decades, many studies have sought to identify the specific factors involved, and then to quantify their relative importance using a statistical technique called “mediation analysis”. (This is almost always done in the context of observational studies, although experimental study-designs could or should perhaps be considered as well.)

“Mediators” are defined as factors that represent an intermediate step in the effect of one variable, in this case education, occupational class or income, on another variable, in this case health. All the specific factors mentioned above (as well as scores of other factors) are known to be more prevalent in lower socio-economic groups, and are known to be detrimental to health. So they are likely to be involved in the relationship. But how important are they, and are some more important than others? Mediation analysis can tell us which part (say, percentage) of health inequalities is accounted for by each factor, and thus allows us not only to identify potential targets for interventions but also to prioritize those targets to maximize the impact of policies aimed at reducing health inequalities.

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<sup>2</sup> For more details, and a full account of the argumentation behind this section including references, see [Annexes 3 and 4](#).

Recently, however, the conventional method of mediation analysis has come under critique, and alternative methods have been proposed. It has also become clear that a simple scheme of “mediation” is unlikely to account for all of the contributions of specific factors to health inequalities. This is because third variables may not only act as mediators but also as “moderators” of the relationship between socio-economic indicators and health.

## **4.2 New insights from mediation analysis**

Mediation analysis is usually applied within the framework of large-scale epidemiological studies with information on people’s socio-economic conditions, other health determinants and health outcomes. Because such studies have become much more common, and data for mediation analysis thus become more widely available, there is now a wealth of information on the relative contribution of a range of different factors to health inequalities from a range of high-income countries.

Study results suggest that five groups of specific health determinants play an important role in the explanation of health inequalities: early childhood environment, material living conditions, social and psychological factors, health-related behaviours and access to good-quality health care. Where comparative evidence is available, it shows that the relative contribution of these determinants differs between countries, thereby illustrating the more general phenomenon that the nature of health inequalities is rather strongly context-dependent. Nevertheless, quantitative estimates from mediation analyses suggest that the contribution of some of these factors, particularly material living conditions, social and psychological factors, and health-related behaviours, is often substantial (e.g. 10–40% each of inequalities in mortality in some countries).

However, in recent years new methodological developments have cast some doubt on these results. The results just mentioned were obtained with a relatively simple form of mediation analysis (i.e. the “difference method” developed by Baron and Kenny), which has come under critique. One criticism is that the results are biased when there is uncontrolled confounding, which is difficult to eliminate in the three-way relationship between socio-economic indicators, specific health determinants and health outcomes. Another criticism is that the results are biased when the effect of health determinants differs between socio-economic groups (“effect heterogeneity”), which may well be the case (as will be argued in more detail in the section on “moderation” below).

New methods of mediation analysis have therefore been designed that can circumvent these problems. These methods (like the new methods for assessing causality discussed in the previous section) apply a “counterfactual” approach, and therefore also have a more straightforward connection to policy, because they directly estimate the effect on health inequalities of “counterfactually” removing a mediator.



Applications to health inequalities data are still rare, and it is therefore not yet clear to what extent the new methods lead to substantially different results. Some head-to-head comparisons of the “conventional” and the “counterfactual” approaches have found different results, but others have not. More importantly, it has become clear that, if applied correctly, the results of the conventional approach are likely to be no less valid than those of the new approach. But this is an important “if”: “correct application” means adequate control for confounding and (having checked for) absence of effect heterogeneity.

Systematic reviews of the available evidence as gathered with the “conventional” approach should therefore check whether the “difference method” has been applied correctly. This has not been common practice, so there is a clear need for re-assessment of the evidence base. At the same time, new evidence should be collected with the “counterfactual” approach wherever possible. In the meantime, the results obtained with the conventional method may still be used to guide policy as long as the results are not used as if they are numerically precise.

### **4.3 New insights from moderation analysis**

As mentioned above, a simple model of “mediation” cannot take into account all possible ways in which specific factors and their interactions contribute to health inequalities. To take an earlier example: if the low educated are not only exposed to more stressful situations in the workplace (this would be “mediation”) but are also less able to cope with the stress, leading to more health problems (this would be “moderation”), simple mediation analysis will not fully show the contribution of this factor to health inequalities. Moderation captures the intuition that health inequalities may partly be explained by the fact that people in lower socio-economic groups are more “susceptible” (in a biological sense) or “vulnerable” (in a psychological or social sense) to the negative health effects of various health determinants.

Although there is a long history of theorizing about moderation, and although it seems rather plausible, empirical evidence has remained scarce. A major barrier has been that, to establish moderation, very large datasets are required not only to reliably estimate the “main effects” of socio-economic position and health determinants, but also their “interaction effects” (i.e. the extent to which the effect of the health determinant differs between socio-economic groups or vice versa). Furthermore, most of the available evidence has been generated with a “conventional” method of moderation analysis, which is an extension of the “conventional” method of mediation analysis, and unable to clearly separate mediation from moderation.

Fortunately, new methods of moderation analysis have been developed, as an extension of the new methods of mediation analysis mentioned above, and first applications have produced promising results. These confirm the intuition that health inequalities can

to some extent be explained by the fact that people in lower socio-economic groups are more “susceptible” or “vulnerable” to certain health risks, in the sense that the effects of some health determinants, such as smoking, excessive alcohol consumption or psychosocial stressors in the work environment, are stronger in lower than in higher socio-economic groups.

More research is needed before more definitive conclusions can be drawn, and before findings on moderation can be translated into specific recommendations for policy; however, further research on the role of moderation, building on the theoretical frameworks that have been developed, can potentially fill a large gap in our understanding of health inequalities.

Whereas mediation (i.e. differential exposure to health determinants) suggests that a change in the distribution of health determinants would be an effective measure against health inequalities, moderation (i.e. differential susceptibility or vulnerability to health determinants) points to the importance of strengthening the resilience of individuals and taking protective or compensatory measures. Also, substantial moderation effects suggest that “universal” policies (i.e. social or health policies targeting the whole population instead of disadvantaged people only) may have larger effects in lower socio-economic groups, thereby helping to reduce health inequalities. Findings on mediation and moderation therefore complement each other, thus extending the possibilities for health inequality interventions.

# 5. EFFECTIVENESS OF INTERVENTIONS AND POLICIES TO REDUCE HEALTH INEQUALITIES<sup>3</sup>

## 5.1 Introduction

Since the 1980s, when health inequalities were “rediscovered” as a public health problem in many high-income countries, research has improved our understanding to a stage that allows us to identify entry-points for interventions and policies. Around the year 2000, several European countries had reached this stage, and because some of their efforts have been accompanied by scientific evaluation studies it is possible to take stock of what works in practice and what does not.

Evaluating policies and interventions for their impact on health inequalities has proved to be very challenging, among other things because planned experiments are often difficult to conduct. However, as for the other two questions discussed in this report, new quantitative research methods have been introduced which promise to be important additions to the existing “tool-box” of health inequalities researchers. These methods originate in the same “counterfactual” philosophy for establishing causality as mentioned previously, and make use of “natural experiments” (changes in interventions or policies that occur in a “natural”, i.e. non-manipulated, setting) or sophisticated statistical techniques to identify quasi-random variation within observational data. Together, these “quasi-experimental” methods can substantially increase the range of interventions and policies that can properly be evaluated.

## 5.2 New insights from systematic reviews of “what works”

On the basis of the current understanding of how health inequalities arise, there is a very broad spectrum of (specific) interventions and (broader) policies that could be considered. One important distinction is by their main entry-point, for example education or income, or hazardous working conditions, excessive alcohol consumption, access to cancer screening, etc.

Another important distinction is between interventions and policies that focus on improving the situation of the most disadvantaged groups, versus those that focus on reducing the “steepness” of the whole health gradient from lower to higher socio-

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<sup>3</sup> For more details, and a full account of the argumentation behind this section including references, see [Annexes 5 and 6](#).

economic groups (or on something in-between). Still another distinction is between interventions and policies that target individuals and their behaviour, and those that try to change the macro-context in which individuals live (again, with several other possibilities in-between).

These distinctions are important, because there is much more evidence for how effective the “simpler” options are (i.e. addressing specific mediating factors, focusing on disadvantaged groups, targeting individuals and their behaviour) than for the more complex ones. This is partly because the “simpler” options are easier to implement, and partly because they are easier to study using conventional methods such as randomized controlled trials and other well-established research designs. However, this is unfortunate because the more complex options (i.e. addressing inequalities in education and income, flattening the whole gradient, changing the macro-context) are potentially much more effective. This “inverse evidence law” should be kept in mind when assessing the available evidence.

A way of summarizing the available evidence on the effectiveness of interventions and policies to reduce health inequalities is by conducting “umbrella reviews”, i.e. structured overviews of systematic reviews of empirical evaluation studies. Over the past decade, 12 such umbrella reviews have been published, each based on substantial numbers of systematic reviews which in their turn were based on hundreds of separate effectiveness studies. Although this suggests that evidence is abundantly available, in reality the evidence base is still rather thin.

The overall conclusion from these umbrella reviews is that there is evidence – albeit limited in size and quality – that some interventions and policies are effective in reducing health inequalities. These include several interventions and policies targeting health-related behaviours (e.g. raising tobacco taxes, taxing unhealthy foods and drinks), some other public health interventions (e.g. water fluoridation, population-based cancer screening) and some workplace and housing interventions (e.g. increasing job control, increasing housing warmth). At the macro-level, only increasing unemployment insurance generosity was found to be effective in reducing health inequalities.

For many other interventions and policies that were evaluated in the umbrella reviews, no evidence for effectiveness was found. In addition to highlighting that there is very little evidence on more “complex” options, the authors of these umbrella reviews point out that the quality of the evidence in individual studies is often rather weak owing to methodological issues, such as focusing on short-term outcomes, the possibility of bias due to low response rates and high attrition, and study populations that are too small. All in all, the results of these evaluations seem quite mixed, and raise the question of how to proceed with implementing policies and interventions aimed at reducing health inequalities.

Many of those working in the field of health inequalities feel that, because health inequalities are such a major public health problem, it is unethical to delay large-scale interventions and policies until their effectiveness has been proved beyond reasonable doubt. They argue that the more robust and extensive descriptive and explanatory evidence on health inequalities, such as described in Annexes 2 and 4, combined with the more limited evidence on effectiveness of interventions and policies, is sufficient to justify large-scale implementation of plausible countermeasures. However, others correctly argue that interventions and policies may have unintended negative side-effects, and have opportunity costs in the sense that they may stand in the way of other – perhaps more effective – interventions and policies. The committee therefore recommends that, if policy-makers decide on large-scale implementation of non-proven interventions and policies, these are accompanied by adequate evaluation efforts.

### **5.3 New methodological developments (again)**

How can gaps in the evidence base on what works and what does not be filled more rapidly? One of the reasons why planned experiments (e.g. randomized controlled trials) are often unfeasible is that they depend on the willingness of policy-makers to implement policy changes as experiments. While this is understandable, this willingness is also subject to change, as the recent popularity of randomized experiments in economic and social policy in the USA and the UK shows. This suggests that health inequalities researchers could also more often create and use opportunities for experiments in their field. It may also be possible to add evaluations of health impact more often onto planned experiments in other fields.

In addition to this, a recent development that can help to generate more evidence on interventions and policies is the use of “quasi-experimental” methods. These provide an alternative when a planned experiment is ruled out for political, ethical or practical reasons, or simply when a policy has already been implemented in the past without concurrent evaluation efforts. Quasi-experimental methods therefore considerably widen the range of opportunities for rigorous evaluation.

These quasi-experimental methods are part of the same evolving “tool-box” as those that have been used to strengthen causal inference. Examples are “interrupted time-series analysis” and “difference-in-difference” methods (which are often used for evaluating natural experiments), and “propensity scores”, “instrumental variables” and “regression discontinuity” (which are often used to identify quasi-random variation within observational data). Each of these has their own indications and specific strengths and weaknesses.

They are particularly useful for evaluating the health impacts of policies which are primarily implemented for other reasons (as in the case of most social and economic

policies), and/or when health impacts take a long time to accrue (so that planned experiments would require withholding the intervention from the control group for too long). They can also be used to measure the health effect of withdrawing a seemingly beneficial policy—a situation in which a randomized experiment is even more unlikely to be possible than when a potentially beneficial policy is introduced.

A key strength of these approaches is that, by definition, they evaluate interventions and policies as they are implemented (or withdrawn) in practice, rather than in an artificial research setting, so that there is more reason to believe that the results are generalizable to other real-life settings. However, there are some downsides as well. One is that, compared with planned experiments, there is more uncertainty about whether the intervention or policy was indeed the main cause of the measured effects on health. Opportunities for evaluating natural experiments also often depend heavily on the availability, quality and relevance of routinely collected data, which often depends on an adequate data linkage infrastructure. Fortunately, many countries are making good progress in improving their data infrastructure.

Several promising examples are now available of studies that have used these methods for evaluating the impact of interventions and policies on health inequalities. These methods can also be used to evaluate the impact of bundles of policies, as illustrated by some recent studies that have evaluated the long-term impact of the English national strategy to reduce health inequalities (1997–2010) by using interrupted time-series and difference-in-difference analyses.

## 6. CONCLUSIONS AND RECOMMENDATIONS

This report has reviewed several new quantitative research methods that have recently been introduced to the field of health inequalities, and that may shed more light on three fundamental issues: (1) to what extent are health inequalities caused by differences in education, occupational class or income? (2) what is the relative importance of specific factors involved in the relationship between education, occupational class or income and health? (3) what is the effectiveness of interventions and policies to reduce health inequalities?

The general conclusion is that these new approaches hold considerable promise, and are a valuable addition to the health inequalities researchers' tool-box. This applies to all the approaches reviewed: the "counterfactual" approach to causal inference; new statistical methods for mediation and moderation analysis; inclusion of genetics in explanatory research; and evaluation of policies and interventions with quasi-experimental methods. Results obtained with these methods have already added some important new insights, or at least hint at the possibility of answering important questions in the future.

However, although these new approaches bring more scientific rigour to health inequalities research, the results that have been obtained so far with these new approaches should not be overrated. For example, in the case of the "counterfactual" approach to causal inference there seems to be a paradox, in the sense that the stricter one is on establishing causality and the closer one gets to identifying a causal effect, the farther one may get from actually understanding how socio-economic position – as a lifelong experience of living in socio-economic (dis)advantage – affects health. More generally, there often seems to be a trade-off between precise answers to limited questions and less precise answers to broader questions.

This and other limitations of the new methods discussed in this report imply that conventional methods have by no means lost their relevance. On the contrary, straightforward descriptive studies (e.g. for monitoring purposes), conventional mediation analyses and planned experiments retain their value. All of these deserve further support by research funding agencies. The same applies to qualitative studies, which fall outside the scope of this report, such as anthropological studies to explain health inequalities from people's lived experiences, and case studies of comprehensive, multi-faceted regional or national programmes to reduce health inequalities. For robust

conclusions, it will often be necessary to “triangulate” the results of studies using different approaches, taking into account the particular strengths and weaknesses of each approach, against the background of well-established theoretical knowledge.

In view of the magnitude of health inequalities, also compared with other population health problems, this area deserves substantial research funding. With its expanding evidence base and the incorporation of new methodological developments, health inequalities research can play an important role in helping European countries cope with this societal challenge. There is also a need for investments in data infrastructure, for example in birth cohort and other life-course studies which are necessary for mediation and moderation analyses, and data linkage facilities which are necessary to study natural experiments. Because study results are often context-dependent, it is important that all countries collect their own evidence. Adequate research funding is not only the responsibility of national research funding bodies, but also of the European Commission which can play an important role in fostering international cooperation and between-country comparisons.

While continued research is necessary, and while this will benefit from the expanded methodological tool-box, there is already considerable evidence (summarized above) to support action against health inequalities. In practice, policy-making is very rarely based on “perfect” evidence, and the methodological issues highlighted in this report should thus not be used as an “excuse for inaction”. Indeed, much of the current evidence is solid enough to serve as entry-points for actions aimed at reducing health inequalities. Moreover, implementing policies based on the available evidence, and then evaluating what is effective, is a very potent source of knowledge on understanding health inequalities, and can be used to improve those very policies.



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