Modelling policies to address health inequalities

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It is often argued that public health research, especially epidemiology, is too focused on describing health challenges at the expense of informing evidence-based actions.[1,2] In *The Lancet Public Health*, Johan P Mackenbach and colleagues[3] build on their previous work describing mortality inequalities across Europe to develop a better understanding of potential intervention pathways. Drawing on longitudinal mortality records and cross-sectional survey data, they investigate the potential contribution of eight different risk factors to inequalities in life expectancy across Europe and conclude that, although smoking, low income, and obesity are important, substantial progress requires action across multiple risk factors.

The study is another important step in moving health inequalities research from description to intervention. Given the number of countries included, the authors are to be congratulated for conducting this challenging research that addresses an issue of major public health importance. As the authors acknowledge, methodological limitations remain, and we are, therefore, only beginning to realise the potential of modelling studies in health inequalities research.

Mackenbach and colleagues applied the frequently used population attributable fraction to relate the different risk factors to life expectancy. This assumes effect estimates for risk factors are causal rather than associational. However, considerable limitations exist in the observational research underpinning many of these effect estimates. A further assumption noted by the authors is that the effect estimates for risk factors remain the same across socioeconomic groups, but whether this is the case is debatable.[4,5] Although differential exposure refers to the potential for greater risk among socioeconomically disadvantaged people to arise from a higher prevalence of that risk factor, the effect size might itself differ between groups. This implies that it is possible for a risk factor to contribute to health inequalities without being socially patterned. Furthermore, survey estimates of risk factor prevalence used in this study are prone to misestimation, with alcohol consumption particularly problematic, because consumption often varies considerably over time and recall might be directly affected by intake.

Given that randomised controlled trials are likely to provide only partial evidence for many of these risk factors, triangulation across different approaches might be fruitful.[6] Rather than relying on traditional observational analyses of epidemiological data, natural experiment studies (for example, studying the real-world effects of policy changes affecting a given risk factor on health inequalities), causal epidemiological approaches (such as mediation analyses using G-estimation or marginal structural models), or Mendelian randomisation analyses might be particularly valuable. Consistency in findings across these differing approaches, which are subject to different assumptions, could strengthen causal inference. Relatedly, transparent and reproducible methods are needed to choose effect estimates from the available evidence base. Although Mackenbach and colleagues describe the sources of their effect estimates, the process for choosing them is less clear. Furthermore, assessing the trustworthiness of these parameters (for example, using the GRADE Working Group's approach to establish certainty of evidence[7]) might be worthwhile and would help readers to better understand the robustness of findings.

This latest study reflects an important step towards translation of research into policy. However, potential to further narrow the translation gap remains. A major advantage of modelling is the potential to study specific interventions. For example, rather than investigating the theoretical potential for reducing smoking, existing tobacco control interventions (such as smoke-free legislation, increased taxation, or mass media campaigns) can be assessed. Doing so is undoubtedly challenging but is likely to be particularly valued by policymakers.[8] Moving towards studying specific policies, rather than scenarios, will also help in understanding the potential trade-off between improvements in overall population health and reducing health inequalities. The Informing Investment to reduce Inequalities (Triple I) model attempts to do this across multiple risk factors.[9]

Modelling studies show considerable promise in producing policy-relevant evidence to guide actions to tackle health inequalities. Mackenbach and colleagues' latest work illustrates their potential. However, more sophisticated approaches are needed to best meet this potential. The rapid increase in computing power makes microsimulation models (which model a realistic population of individuals) and agent-based models (that

also allows interactions between individuals) feasible.[10] Allowing for heterogeneity between individuals makes such approaches well suited to studying the distribution of policy effects—ideal for health inequalities research. These modelling approaches could have also allowed sensitivity analyses to be far more extensive—for example, varying the risk factor effects (by socioeconomic group) and prevalence estimates. Although models will always be dependent on assumptions, critical interrogation of these assumptions helps improve confidence in the findings of such studies. Modelling studies, such as Mackenbach and colleagues' Article, will hopefully facilitate meaningful action on health inequalities at last.

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1 Petticrew M, Platt S, McCollam A, Wilson S, Thomas S. "We're not short of people telling us what the problems are. We're short of people telling us what to do": an appraisal of public policy and mental health. *BMC Public Health* 2008; **8:** 314.
2 Katikireddi SV, Higgins M, Smith KE, Williams G. Health inequalities: the need to move beyond bad behaviours. *JECH* 2013; **67:** 715–16.
3 Mackenbach JP, Valverde JR, Bopp M, et al. Determinants of inequalities in life expectancy: an international comparative study of eight risk factors. *Lancet Public Health* 2019; **4:** e529–37.
4 Diderichsen F, Hallqvist J, Whitehead M. Differential vulnerability and susceptibility: how to make use of recent development in our understanding of mediation and interaction to tackle health inequalities. *Int J Epidemiol* 2018; **48:** 268–74.
5 Katikireddi SV, Whitley E, Lewsey J, Gray L, Leyland AH. Socioeconomic status as an effect modifier of alcohol consumption and harm: analysis of linked cohort data. *Lancet Public Health.* 2017; **2:** e267–76.
6 Munafò MR, Smith GD. Robust research needs many lines of evidence. *Nature* 2018; **553:** 399–401.
7 Guyatt GH, Oxman AD, Kunz R, Vist GE, Falck-Ytter Y, Schünemann HJ. What is "quality of evidence" and why is it important to clinicians? *BMJ* 2008; **336:** 995–98.
8 Katikireddi SV, Bond L, Hilton S. Perspectives on econometric modelling to inform policy: a UK qualitative case study of minimum unit pricing of alcohol. *Eur J Public Health* 2014; **24:** 490–95.
9 McAuley A, Denny C, Taulbut M, et al. Informing investment to reduce inequalities: a modelling approach. *PLoS One* 2016; **11:** e0159256.
10 Arnold KF, Harrison WJ, Heppenstall AJ, Gilthorpe MS. DAG-informed regression modelling, agent-based modelling and microsimulation modelling: a critical comparison of methods for causal inference. *Int J Epidemiol* 2018; **48:** 243–53.