Changing relationship between income inequality and mortality

Michael Murphy [1,2]

ABSTRACT

The recent paper by Dunn *et al* showed that the positive relationship between US state-level income inequality and mortality was small in the 1950s, rose to a large value around 1990 but had largely disappeared by 2019. We consider these findings in the context of the mechanisms that have been advanced for reasons why a positive relationship might be expected, and in relation to studies using alternative methods included in systematic reviews that fail to confirm an independent inequality/mortality relationship. Ecological studies, such as by Dunn *et al*, using subnational data have advantages compared with similar studies using cross-national data, but controls are typically confined to those available from sources such as decennial census, so scope for incorporating lagged effects and life course factors is limited. However, they are often the only studies with the statistical power to identify subnational differentials and time trends so they are complementary to rarely available sources such as high-quality long-term individual-level microdata data required for causal analyses. Income equality can arise not only due to citizens' positive preferences but also to external choices such as economic decline and globalisation, so examining the wider context is important when explaining excess levels of 'deaths of despair' in low-inequality US states. The apparent increasingly strong association between income levels and low mortality with a weakening inequality/mortality relationship has implications for policy recommendations.

INTRODUCTION

The paper by Dunn *et al*[1] in this journal explores the evolving relationship between income inequality and mortality rates in the 50 states of the USA from 1989 to 2019. Ross *et al*[2] identified a strong positive association in 1989 between mortality and state-level income inequality (as measured by the share of income received by the bottom 50% of the income distribution) at the same average (median) income level. Dunn *et al*[1] found that the 1989 association had weakened or reversed by 2019. The study employs a similar ecological approach but addresses some of the potential reservations about earlier findings by incorporating various adjustments. They highlight the complexities involved in establishing causality in this relationship and suggest that the observed shifts may be influenced by broader socioeconomic trends and policy changes over the decades.

The relationship between income inequality and health outcomes, particularly mortality, has long been a subject of academic inquiry and policy debate. Despite the widespread recognition of significantly worse health among economically and socially disadvantaged groups,[3 4] the mechanisms underlying these disparities remain contentious. Early 21st-century analyses, particularly those using cross-national and US state data, have played a pivotal role in shaping our understanding of this relationship.

Cross-national studies, while valuable, often grapple with issues such as the comparability of indicators like life expectancy and Gini income coefficients, the omission of crucial confounding variables, and researchers' choices regarding the study period and selection criteria for countries such as the range of income levels included. In contrast, studies using data from US states—comprising 50 observations from a single country with data collected uniformly across time and space by the same statistical organisation—are less susceptible to these concerns. Furthermore, the generally higher levels of income inequality in the USA compared with, for example, those in Europe, make it a particularly fertile ground for studying this issue.

Time trends in the inequality–mortality relationship

Lynch *et al*[5] had added a temporal perspective to the analyses of Ross *et al*,[2] concluding that state-level income inequality played a minimal role in explaining mortality differentials around 1950 but had become substantially more important by 1990. They showed[5] that the correlation between overall state-level age-adjusted mortality and the Gini coefficient rose from near 0 in the 1950s to a maximum of 0.58 in 1990, before dropping to 0.44 in 2000. Note that this study did not adjust for average state income. Dunn *et al*[1] extended the period covered to show that the strong relationship between state-level income inequality and a set of alternative mortality indicators observed in 1989 had diminished substantially or even reversed by 2019.

Explanations for the income inequality and mortality relationship

Preston[3] showed a strong positive relationship between real national income per capita and life expectancy at lower income levels, which weakened significantly at higher income levels, implying the necessity of additional explanatory variables. Around this time, Rodgers[6] posited that income inequality could be one such variable. Wilkinson[7] identified income inequality as a critical factor, suggesting it affects health not only through living standards but also via psychosocial pathways, impacting the entire population adversely. Lynch *et al*[8] emphasised the role of cumulative material disadvantages experienced by those at the lower end of the income distribution.

The 'Preston curve' or convexity effect suggests that if income inequality increases while average income remains constant in an area, the stronger negative health responses among those with below-average incomes will outweigh the limited positive benefits among those with above-average incomes.[9] Therefore, a positive correlation between income inequality and mortality is expected.

The psychosocial perspective has significantly influenced contemporary debates about inequalities in high-income countries. Wilkinson and Pickett's book '*The Spirit Level: Why Equality is Better for Everyone*',[10] which had 16 231 citations on Google Scholar as of July 2024, presented numerous examples of positive correlations between high-income inequality and adverse outcomes such as crime and violence as well as poor health. This framework, combined with a life course approach, underpinned the influential WHO report '*Social Determinants of Health: The Solid Facts*'.[11]

Major reviews of the area

While the ecological studies noted above have produced consistent results for the income inequality/mortality association, alternative approaches have been undertaken that have been included in major

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reviews. Wagstaff and van Doorslaer[12] concluded that absolute-income level variables were primarily responsible for the observed strong association between health and income inequality, suggesting that aggregate-level national or state-level studies are unsuitable for discriminating between competing hypotheses.

Lynch *et al*[13] systematically reviewed 98 aggregate and multilevel studies examining the associations between income inequality and health. They concluded that there was little evidence that income inequality is a major, generalisable determinant of population health differences within or between rich countries. They reinforced the point that only individual-level studies have the potential to discriminate between most of the hypotheses advanced, and such studies provide strong support for the 'absolute-income hypothesis', but little or no support for the 'income-inequality hypothesis'.

More recently, Shimonovich *et al*[14] produced a detailed systematic review of 14 cohort studies of mortality and income inequalities. Their review focused only on multilevel studies, as aggregate-level studies have been largely discounted. They found that half the studies were at serious risk of bias, there were only small associations between income inequality and all-cause mortality, and no evidence of causality, although the evidence base is limited.

Challenges and considerations in the inequality–mortality relationship

The apparent major change in the relationship between income distribution and mortality across US states from 1950 to 2019 raises important questions about the mechanisms involved and the robustness of findings. Several challenges need to be addressed:

1. Ecological interpretation: Ecological results do not identify individual-level relationships.[9] They may suggest that similar results hold, but this can lead to misleading conclusions: an example is that while above-average overall levels of 'diseases of affluence' were found in some earlier high-income settings, these diseases were more common among the most disadvantaged groups in such societies.
2. Causal inference: Using contemporaneous variables to infer causality is problematic, given that people's health is substantially determined by their life course experiences.
3. Measurement issues: The measurement of income levels and income inequality is complex, particularly as these indicators tend to increase over time with population ageing.[9]
4. Perceptions of inequality: The assumption that people's perceptions of inequality are based on a single state-level income inequality indicator may be overly simplistic, given significant variations in state size and population.[15]

While fixed effects or lagged variable models can mitigate some of these issues,[16] the limitations of ecological data remain significant. Additionally, identifying a mechanism that would explain differences in inequality without simultaneously influencing other factors in the area is challenging.

The robustness of the income inequality and mortality relationship has been questioned. Some studies find that income inequality fails to remain statistically significantly associated with overall mortality level or even reversed when other variables, such as the state-level proportion of graduates, racial composition and US Census region or latitude and longitude, are included.[9] The variety of geographical areas, methods, extent of controls applied and data used has resulted in contradictory findings, which have been noted in review papers.

Examples of successful low-inequality societies, such as the Nordic countries with high levels of well-being and economic conditions, are sometimes used to argue for the benefits of low inequality. However, these countries have pursued this path over extended periods including substantial public investment in a high-productivity workforce, while low inequality can also result from negative factors such as the decline of traditional industries. An area may have low inequality because there are few well-off residents and consequently low levels of publicly funded social and health services and employment prospects—the economic and psychosocial conditions linked to 'deaths of despair'. In the USA, the highest levels of income inequality are in states with high average incomes and tax revenues, such as New York and California. Over recent decades, the relationship between income levels and mortality has become stronger while the relationship between income distribution has been weakening.[17]

Establishing causality

While many studies have shown positive associations between indicators of inequality and poor health outcomes, these findings do not necessarily imply causality. Statistically significant results are also more likely to be published, leading to a 'file drawer' problem in evaluating existing literature and some results may be produced post hoc. Introductory statistical courses emphasise that correlation does not imply causation and that models excluding key variables can be unreliable and potentially misleading. Addressing these issues is particularly challenging in complex systems with numerous, sometimes unmeasured, relevant variables working across extended time scales. Lundberg[18] has characterised the difficulties in establishing causal relationships for health inequalities as an 'inconvenient truth'.

To address the limitations of earlier studies, large individual-level multilevel longitudinal data sets and methods, some only recently developed, to identify causal pathways from observational data are required. Such studies are rare but do provide evidence that there is a positive causal link from income inequality to mortality, see, for example, Zhao *et al*[19] using the Panel Study of Income Dynamics. While promising, few such data sets are available and issues such as identification of time trends, geographical variability and the role of psychosocial factors remain unresolved.

Deaths of despair

The reasons for areal-level mortality differentials remain a topic of high interest, but recently attention has particularly concentrated on 'deaths of despair' among white working-age males in disadvantaged parts of the USA, which has increasingly broadened to include other groups and countries. While several proximate causes, such as the availability of powerful opioids and access to handguns, have been identified in the USA, the underlying cause is often attributed to a widening social and economic gap between disadvantaged groups from the rest of society.[20] Income inequality has played a limited role in these discussions, with more emphasis placed on longer-term trends such as the collapse of manufacturing industries and globalisation.[21] The term 'despair' implies an absence of hope, especially regarding future improvement, whereas the association between income inequality and mortality has been based on the current income distribution.

CONCLUSION

The relationship between income inequality and mortality is complex and

evolving. While earlier studies highlighted a strong positive association, more recent analyses suggest that this relationship has diminished or even reversed. Various mechanisms, from psychosocial pathways to cumulative material disadvantages, have been proposed to explain this relationship. However, establishing causality remains challenging due to the multifaceted nature of health determinants and the potential for numerous confounding variables. Future research should continue to explore individual-level data and consider long-term trends to provide a more nuanced understanding of this critical public health issue while recognising that the relationship between absolute income and health is becoming markedly stronger over time. Actions recommended to reduce income inequalities will increasingly need to assess the likely impact on mortality levels.

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