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Improving the validity of estimates of mortality inequalities by education in England & Wales

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Abstract
Health inequalities are an important societal injustice. Understanding their scale and trends, and how they compare internationally, is needed to inform policy and practice, and also in order to evaluate the impacts of different policies. Many studies comparing health inequality trends across Europe have used educational attainment as a means of ranking adult populations, but there have been challenges as a consequence of the educational attainment data being missing, or categorising a very large proportion of the total population into a single group. *Janssen et al.* have recognised this challenge and have proposed an innovative and helpful method to overcome the problems of missing data. Although these are useful improvements, they still leave > 80% of the population categorised in the same group for some years, limiting the validity of the inequality measure.

Describing long-term trends in mortality inequalities, particularly in ways which are internationally comparable, have been an essential pre-requisite to understanding the impacts of particular policies or more general institutional and political approaches (such as welfare state type) [1–3]. However, after descriptive data have been produced, the limitations and uncertainties in the underlying data and calculations can often be forgotten or ignored. For example, calculation of long-term trends in mortality inequalities by educational attainment in England & Wales (E&W) is limited by the nature of the available data on education in the 1971, 1981 and 1991 censuses, each of which classified over 80% of the population into a single category ('no education' or 'missing'), precluding meaningful population ranking [4, 5]. This has not prevented influential authors from making bold statements about mortality inequality trends in E&W and how they may be related to policy decisions [1, 6].

Janssen et al.. in this issue of *Population Health Metrics* have recognised this data challenge and its implications, and propose a method of overcoming these shortcomings to provide a more robust estimate [7]. The underlying data used are the individual educational attainment data contained within the England & Wales Census, linked probabilistically to subsequent mortality records.

The approach by *Janssen et al.* involves several steps. First, where education data was missing from one census but available from another, this was used. Although this potentially could misclassify some people whose education changes over time, this is still likely to reduce misclassification overall by increasing the proportion of the sample with education data, and is a very useful addition. Second, mortality rates in the linked data (from the 1% sample of the Census – the Longitudinal Study [8]) were compared with administrative records for the whole population, and correction made for biases that may have arisen from international migration. This should make

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the data more comparable with actual population mortality rates, especially in the years just prior to a census, but is separate from the issues in relation to educational attainment data. This is related to the third adjustment, which seeks to correct for a trend break in 1981 for those with middle and low education by redistributing some people from the low-education to the middle- education group. Fourth, correction was made for an expected overestimation of the population between 2011 and 2017 due to missed emigration. Finally, adjustment was made to align the samples with the age-sex-year estimates of population and mortality from the Human Mortality Database.

The net result of all of these adjustments, despite massively reducing the proportion of the population with missing data, still leaves over 80% of the population classified into a single (low education) group for the period 1971-2000 [7]. Fundamentally, this causes a challenge for the calculation of inequalities because the vast majority of the population are not ranked differently (the calculation of the inequality indices are based on a weighted regression through the ranked mortality categories [9]). Although the authors recognise this limitation, they argue that their adjustments (which still leave > 80% of the population in the same group) overcome this problem. The adjustments which act to bring the overall mortality estimates into line with administrative data (making the cohort data more generalisable) may be appropriate and useful, but do not address this fundamental issue.

The trend results presented in Fig. 4 (in *Janssen et al.)* indicate that inequalities in mortality by educational attainment in absolute and relative terms for men and women improved after 1991, improved earlier when measured in absolute terms for men and women, and improved in relative terms for women after around 1981 [7]. As the authors note, this contrasts with other trend data on mortality inequalities which use alternative means of ranking the population (including occupational social class and area deprivation), which show trends *tracking in the opposite direction* for long time periods, and which could therefore lead to the *polar opposite conclusion* being reached about the effectiveness of particular policy approaches [10].

It is no doubt theoretically possible for different measures of socioeconomic position, relating to different exposures and causal pathways, to show different trends [11]. Furthermore, all ranking measures (not least area deprivation) have their limitations [12]. However, for the purpose of monitoring trends in health inequalities (and indeed for the evaluation of policy exposures on health inequalities), the robustness and consistency of the measure is paramount. It seems unlikely to me that mortality inequality trends diverge so substantially for real rather than artefactual reasons [4, 5, 10].

The risk of classifying such a large proportion of the population into a single group is that the resulting regression equation inaccurately reflects the actual experience of mortality inequality across the population because of the failure to categorise and rank so many people into different groups. The added risk for educational attainment specifically as a ranking tool, is that the meaning and implications of education has so radically changed over the generations (in terms of the consequences for social closure, opportunity hoarding, position in the labour market, etc [11])., that the value for social ranking may be profoundly different across cohorts (with the implication that a large proportion of the population within this single large category do not, in fact, share similar socioeconomic exposures).

There also remain some counterintuitive trends within the data, for example, the proportion of the population classified as having low education is higher in 1981 and 1991 than in 1971 (Table 1 in *Janssen et al.*), some of which might be explained by the slightly higher proportion of remaining missing data in 1971. This may reflect changes in educational classifications more than a real increase in the experience of low education, but again generates a little uncertainty about the validity of the underlying classification.

Fortunately, the quality of education data from UK Censuses has markedly improved since 2001, and a much more nuanced ranking can now be obtained. Janssen and colleagues should be commended for their work to improve the quality of earlier data [7], but I remain sceptical about whether the trends described prior to 2001 are sufficiently robust to draw conclusions, especially in light of divergent trends using other ranking measures [10].

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Competing interests
The authors declare no competing interests.

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