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Excess mortality in Glasgow: further evidence of 'political effects' on population health

L. Schofield [a], D. Walsh [b, *], N. Bendel [c], R. Piroddi [d, e]

[a] Public Health Scotland, Gyle Square, 1 South Gyle Crescent, Edinburgh EH12 9EB, Scotland, UK
[b] Glasgow Centre for Population Health, Olympia Building, 2-16 Orr Street, Bridgeton Cross, Glasgow G40 2QH, Scotland, UK
[c] Manchester City Council, Town Hall Extension, Manchester M60 2LA, England, UK
[d] Department of Public Health Policy and Systems, University of Liverpool, Waterhouse Building, Block B, Brownlow Street, Liverpool L69 3GF, England, UK
[e] Business Intelligence Team, NHS Liverpool Clinical Commissioning Group, The Department, Lewis's Building, Renshaw Street, Liverpool L1 2SA, England, UK

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ABSTRACT

Objectives: The aim of the study was to update previous analyses of 'excess mortality' in Glasgow (Scotland) relative to the similar postindustrial cities of Liverpool and Manchester (England). The excess is defined as mortality after adjustment for socio-economic deprivation; thus, we sought to compare changes over time in both the deprivation profiles of the cities and the levels of deprivation-adjusted mortality in Glasgow relative to the other cities. This is important not only because the original analyses are now increasingly out of date but also because since publication, important (prepandemic) changes to mortality trends have been observed across all parts of the United Kingdom.

Study design and methods: Replicating as far as possible the methods of the original study, we developed a three-city deprivation index based on the creation of spatial units in Glasgow that were of similar size to those in Liverpool and Manchester (average population sizes of approximately 1600, 1500 and 1700 respectively) and an area-based measure of 'employment deprivation'. Mortality and matching population data by age, sex and small area were obtained from national agencies for two periods: 2003–2007 (the period covered by the original study) and 2014–2018. The rates of employment deprivation for each city's small areas were calculated for both periods. Indirectly standardised mortality ratios (SMRs) were calculated for Glasgow relative to Liverpool and Manchester, standardised by age and three-city deprivation decile. For context, city-level trends in age-standardised mortality rates by year, sex and city were also calculated.

Results: There was evidence of a stalling of improvement in mortality rates in all three cities from the early 2010s. After adjustment for area deprivation, all-cause mortality in Glasgow in 2014–2018 was c.12% higher than in Liverpool and Manchester for all ages (SMR 112.4, 95% CI 111.1–113.6) and c.17% higher for deaths under 65 years (SMR 117.1, 95% CI 114.5–119.7). The excess was higher for males (17% compared with 9% for deaths at all ages; 25% compared with 5% for 0–64 years) and for particular causes of death such as suicide and drug-related and alcohol-related causes. The results were broadly similar to those previously described for 2003–2007, although the excess for premature mortality was notably lower. In part, this was explained by changes in levels of employment deprivation, which had decreased to a greater degree in the English cities: this was particularly true of Manchester (a reduction of −43%, compared with −38% in Liverpool and −31% in Glasgow) where the overall population size had also increased to a much greater extent than in the other cities.

Conclusions: High levels of excess mortality persist in Glasgow. With the political causes recently established – the excess is a 'political effect', not a 'Glasgow effect' – political solutions are required. Thus, previously published recommendations aimed at addressing poverty, inequality and vulnerability in the city are still highly relevant. However, given the evidence of more recent, UK-wide, political effects on mortality – widening mortality inequalities resulting from UK Government 'austerity' measures – additional policies at UK Government level to protect, and restore, the income of the poorest in society are also urgently needed.

* Corresponding author.
E-mail address: David.Walsh.2@glasgow.ac.uk (D. Walsh).

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Introduction

The 'fundamental causes' of poor health and health inequalities are established as being socio-economic.[1–3] However, some populations exhibit notably higher mortality than their socio-economic profile would predict.[4–8] A prominent example in the United Kingdom is the case of excess mortality in Scotland's largest city, Glasgow[9–12] – unhelpfully described in the media as a 'Glasgow effect'.[13] Much of the discussion of this topic stemmed from a 2010 publication, which compared socio-economic disadvantage and mortality in Glasgow and in two postindustrial cities in England, Liverpool and Manchester.[9] The study showed that although the socio-economic profiles of all three cities were very similar, all-cause mortality in Glasgow was c.14% higher than in the two English cities, with premature mortality (<65 years) c.30% higher (after adjustment for any remaining differences in neighbourhood-level 'income deprivation'). This study generated considerable debate and hypothesising of potential causes of this excess[14–22] and resulted in a vast investigative research programme,[23] which ultimately led to an evidence-based explanation of the most likely causes.[11,12] Although complex and multifactorial, at its heart was a toxic combination of historical poor living conditions and adverse political decision-making, which, over time, had conferred greater disadvantage on Glasgow than in the comparator cities. The results, endorsed by numerous academics and key figures across the United Kingdom,[12] thereby emphasised that rather than being a 'Glasgow effect', excess mortality in the city instead represented a 'political effect'.

The role of political determinants of health is of course well understood.[24–29] Importantly, since the publication of the 2010 paper, the United Kingdom has experienced further such political effects on health: widening inequalities across the United Kingdom attributed to UK Government 'austerity' measures that have slashed the income of, and consequently increased death rates among, the poorest and most vulnerable in society.[30–36] Postindustrial parts of the United Kingdom (including Glasgow, Liverpool and Manchester) have been shown to have been most affected by these policies.[37,38] This, alongside other changes that have taken place since 2010, for example, to national and local governments, begs a number of questions regarding the extent to which the findings of the original 2010 research may have now changed. The aim of this project, therefore, was to update those analyses and thereby answer three research questions: to what extent have levels of deprivation changed over time; how does mortality in Glasgow compare with Liverpool and Manchester, after adjustment for area deprivation; and to what extent have levels of such excess mortality changed over time?

Methods

To maximise comparability, as far as possible, we replicated the original methodology used in the 2010 study (which analysed mortality data for 2003–2007 in relation to area deprivation in 2005).[11,12]

Geographical units of analysis

Cities were defined by their current local authority boundaries. The spatial units used in the measurement of neighbourhood deprivation in Scotland and England (so-called 'datazones' and 'lower-layer super output areas' [LSOAs], respectively) differ in size, with the average population of datazones being approximately half of LSOAs. As this is problematic in comparing neighbourhood disadvantage levels, a new set of spatial units for Glasgow, of a similar size to those in Liverpool and Manchester, was created by merging neighbouring, similarly deprived, areas using specialist software, the AZ Tool:[39,40] this has been used previously in related research.[4] Note that the spatial units created for this purpose in the 2010 study could not be used because an updated version of datazones (2011 datazones) has since been produced. Similarly, a new set of LSOAs (2011 LSOAs) was introduced in England following the 2011 census. Thus, the units of analysis for this study were merged 2011 datazones and 2011 LSOAs.

Creation of a three-city area deprivation index

The previous three-city research used a measure of 'income deprivation', based on UK Government Department of Work & Pensions (DWP) data. However, because of recent social security changes, that measure cannot be compared over time. Instead, we used the similar measure of 'employment deprivation', also derived from DWP data, and included in both the 2004 and 2016 versions of the Scottish Index of Multiple Deprivation (SIMD).[41,42] A measure of exclusion from work, it is calculated as the percentage of the working-age population in each area in receipt of either unemployment-related or sickness-related social security payments. Although the definition has changed slightly between the 2004 and 2016 SIMD, it is comparable between those time points.[4,42] Nationally, it is also highly correlated with both the overall SIMD score and the overall English Index of Multiple Deprivation score.[4,9] We repeated the original analyses of 2003–07 all-cause mortality using this measure of deprivation, and there was very little difference in the results compared with those based on the original income deprivation measure. The online appendix contains further details of these comparisons, alongside full definitions of the measures of deprivation.

For Glasgow, employment deprivation data were obtained from the 2004 and 2016 SIMD; for the English cities, identical data for the same periods were obtained directly from DWP. A three-city deprivation index was thereby created based on levels of employment deprivation in each small area (merged datazone or LSOA) and from which population-weighted deciles were derived.

For additional context, employment deprivation data for other UK cities (three largest in Scotland, four largest in England with the exception of London) were also obtained from DWP.

Mortality and population data

For the main updated analyses, mortality data (by sex, 5-year age group, cause of death and small area) for 2014–2018, and matching population denominator data for 2016 (the period mid-point), were obtained from the National Records of Scotland for Glasgow and from the Office for National Statistics for Liverpool and Manchester. The same causes of death as before were examined (defined by the same ICD codes): these are listed in online appendix Table A1.

To assess the impact of the different measures of deprivation in the earlier period, all-cause mortality data (2003–2007) and population data (2005) were also accessed from the same sources. To provide context to the main mortality analyses, city-level all-cause mortality data (and matching population data) by sex and age were obtained for 1981–2018.

Statistical analyses

Indirectly standardised mortality ratios (SMRs) were calculated for Glasgow relative to Liverpool and Manchester combined, standardised by 5-year age group and three-city deprivation decile, for all-cause deaths for the period 2003–2007 (to assess the impact of using the different measure of deprivation) and for all-cause and cause-specific deaths in 2014–18. Analyses were stratified by sex

and age group: all ages, 0–14 years, 15–44 years, 45–64 years, 65+ years and 0–64 years.

For background/context to the main mortality analyses, trends in directly age-standardised mortality rates per 100,000 population by year and city were also calculated, using the 2013 World Health Organisation standard population.[43]

Results

Population/spatial units

In the 2010 study, the average population sizes of the small area units of analysis (merged 2001 datazones/2001 LSOAs) in Glasgow, Liverpool and Manchester were 1626, 1502 and 1717, respectively. In the updated analyses, the equivalent sizes for merged 2011 datazones and 2011 LSOAs were 1662, 1626 and 1919. Further details are included in the online appendix (Table A2).

Between 2005 and 2016 (the original and new analyses mid-points), the estimated populations of all three cities increased – but more substantially in Manchester. Glasgow's total population increased by approximately 8% and Liverpool's by approximately 11%; however, the equivalent increase in Manchester was approximately 22% (Table A2).

Deprivation

Reflecting the income deprivation–based analyses published previously, overall levels of 2004 employment deprivation were very similar in the three cities, with between 22% (Manchester) and 24% (Liverpool) of the working-age population classed as employment deprived; the figure for Glasgow was 23%. However, Fig. 1 shows that employment deprivation levels had fallen considerably in all three cities by 2016: to 12.5% in Manchester, 15% in Liverpool and 16% in Glasgow. In relative terms, the decrease was greatest in Manchester: the change between the two periods represents a −43% decline, compared with −38% (Liverpool) and −31% (Glasgow).

Fig. 1 also shows that employment deprivation decreased across all parts of Great Britain; however, Glasgow, Liverpool and especially Manchester saw the greatest relative reductions.

Mortality analyses

To contextualise the main mortality analyses, Fig. 2 shows trends in male and female all-cause mortality rates between 1981 and 2018 for all ages and 0–64 years, presented as 3-year rolling averages. The two periods covered in the main analyses presented below (2003–07 and 2014–2018) are highlighted/shaded. In contrast to previous trends, there has been a stalling of improvement in male all-age mortality rates since 2012/2014 in all three cities (but especially in Glasgow and Liverpool); this has been demonstrated and quantified previously.[36] For females of all ages, there has been no improvement in Glasgow rates since 2009/2011; although the same is broadly true of the English cities, the greater fluctuation in rates makes this more difficult to discern. For premature mortality (deaths <65 years), changes in male trends from 2012/2014 are particularly noticeable in Glasgow and Manchester. There is much more fluctuation in female rates, although rates in Liverpool have increased consistently since 2011/2013.

Of relevance to the analyses presented below is that the gap in female premature mortality rates between Glasgow and both English cities reduced between the two periods of analysis (2003/2007 and 2014/2018); this is also true in comparing male premature rates between Glasgow and Liverpool (but not Manchester).

Fig. 3 examines in more detail the all-cause mortality gap between Glasgow and the two English cities for the 2014–18 period, showing SMRs for Glasgow relative to Liverpool and Manchester combined, adjusting not only for age but also for employment deprivation. All-age mortality in Glasgow for males in the period 2014–18 was approximately 17% higher after adjustment (SMR: 116.7; 95% confidence intervals [CIs] 119.6–123.5); for females, the equivalent figure was approximately 9% (SMR 108.5, 95% CI 106.8–110.2). For deaths under the age of 65 years, the excess in Glasgow was approximately 25% for males (SMR 125.1, 95% CI 121.6–128.7) and c.5% for females (SMR 105.4, 95% CI 101.5–101.5).

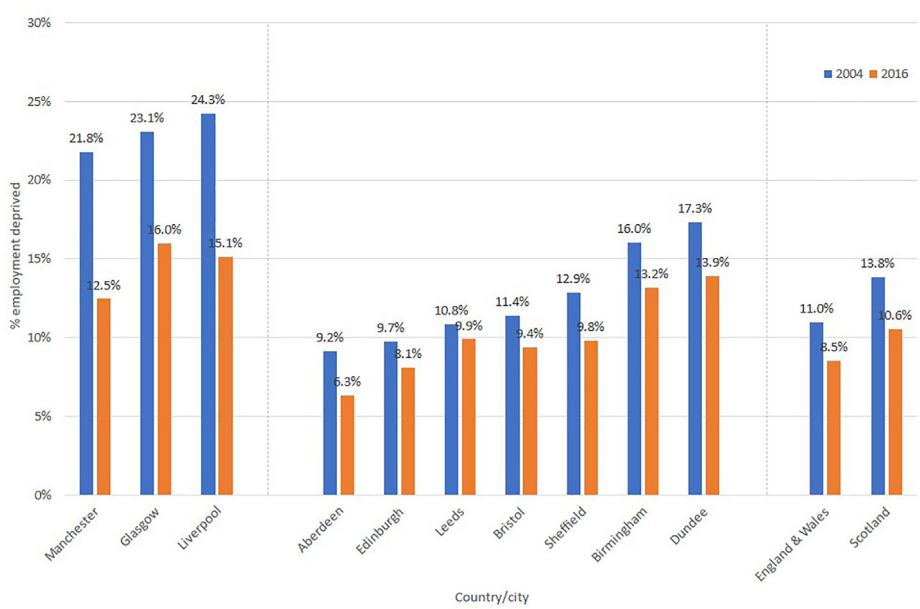

Fig. 1. Percentage of working-age population classed as 'employment deprived' in 2004 and 2016: Glasgow, Liverpool and Manchester compared with Scotland, England and Wales and selected UK cities.

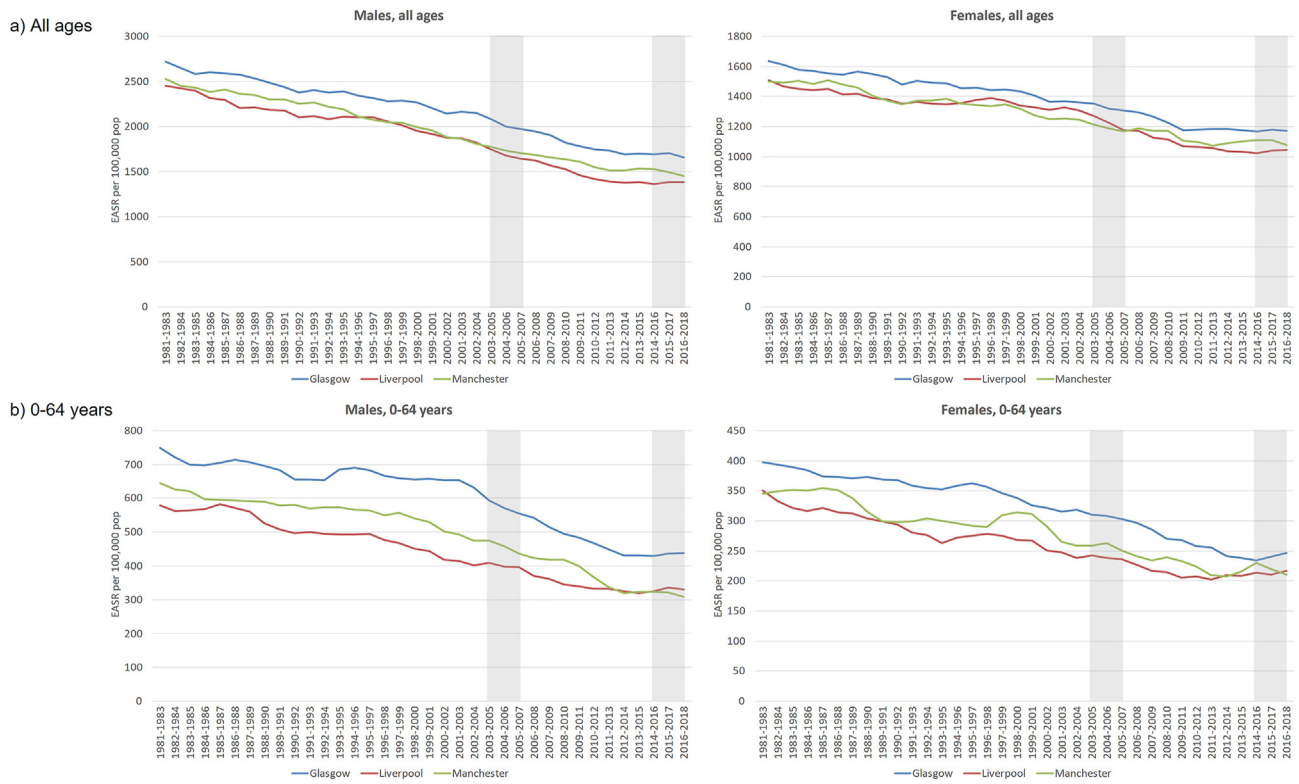

Fig. 2. European age-standardised mortality rates (EASRs) per 100,000 population, 3-year rolling averages, for all-cause deaths, Glasgow, Liverpool, Manchester, 1981–2018. Shaded areas denote periods covered by previous (2003–2007) and current (2014–2018) analyses. Note different y-axis scales on each chart.

Across different age groups, the excess in Glasgow was greatest among those of working age, principally among males: mortality was approximately 53% and 20% higher for males aged 15–44 years and 45–64 years, respectively. However, childhood mortality (age <15 years) was approximately 20% lower in Glasgow than in the English cities (with similar figures for males and females).

The online appendix (Table A3) presents data for males and females combined, showing overall excess figures of c.12% for all ages and c.17% for 0–64 years.

The results for 2014–18 are *broadly* similar to those for 2003–2007 (Table A3), with comparable all-age excess: 15% (2003–2007) and 12% (2014–2018). The major difference is a notable reduction in the excess for *premature* mortality (from 30% to 17% overall), especially for females (from 23% to 5%). This is partly explained by the narrower gap between the cities shown in Fig. 1 – but also by differences in deprivation: for the 2003–07 period, the cities' deprivation profiles were very similar, and thus, adjustment for deprivation made little difference to the results. In the most recent period, this was no longer the case: for example, for premature mortality, adjustment for deprivation reduces the excess for males from c.37% higher to 25%, and for females from c.13% to c.5%.

Comparisons between Glasgow and Liverpool and Manchester separately (rather than combined) showed similar results, although the excess tended to be lower in comparison with Manchester (online appendix Table A4).

Fig. 4 shows the SMRs for Glasgow by three-city deprivation decile for all ages and 0–64 years. The results for 2014–18 are compared with 2003–2007. For all-age deaths, the higher mortality in Glasgow is observed fairly evenly across deciles – especially in the most recent period. Note that the higher mortality in Decile 2 in the first period was not seen in the original study (i.e. based on income deprivation rather than employment deprivation); otherwise, the results are very similar. For 0–64 years, the excess is higher among more, rather than less, deprived deciles. Again, this pattern is clearer in the most recent period. The higher excess in deciles 2 and 3 in the early period was again not observed in the original study based on income deprivation.

Finally, Fig. 5 presents – for all ages and both sexes – age-, sex- and deprivation-adjusted mortality (2014–2018) for Glasgow, relative to Liverpool and Manchester combined, for the different causes of death examined. The excess was lowest for all cancers (c.12%), including lung cancer (c.16%), and diseases of the circulatory system (c. 18%). However, in absolute terms, these causes obviously account for most deaths. In relative terms, however, the excess in Glasgow was greatest for drug-related poisonings (approximately 2.3 times higher), alcohol-related causes and suicide, both of which are approximately 50% higher. Comparing males and females (online appendix Figure A1), with the exception of suicide, the excess was higher for male deaths for each cause, especially for alcohol-related causes and drug-related poisonings. The levels of excess are broadly similar to those shown in the 2010 study; the main exception is alcohol-related causes, where the excess has fallen considerably.[9] This is discussed further below.

Discussion

Summary of main results and implications

These analyses of mortality and deprivation in three UK post-industrial cities update previous, impactful, research. They provide further evidence of worrying recent mortality trends, not just in Glasgow, but in the English comparator cities as well. The overall level of 'excess mortality' in Glasgow in 2014–18 was, at c.12%, broadly similar to that shown by previous analyses. However, the excess for premature mortality (<65 years) reduced from c.30% to 17%, partly influenced by changes in the employment deprivation profiles of the

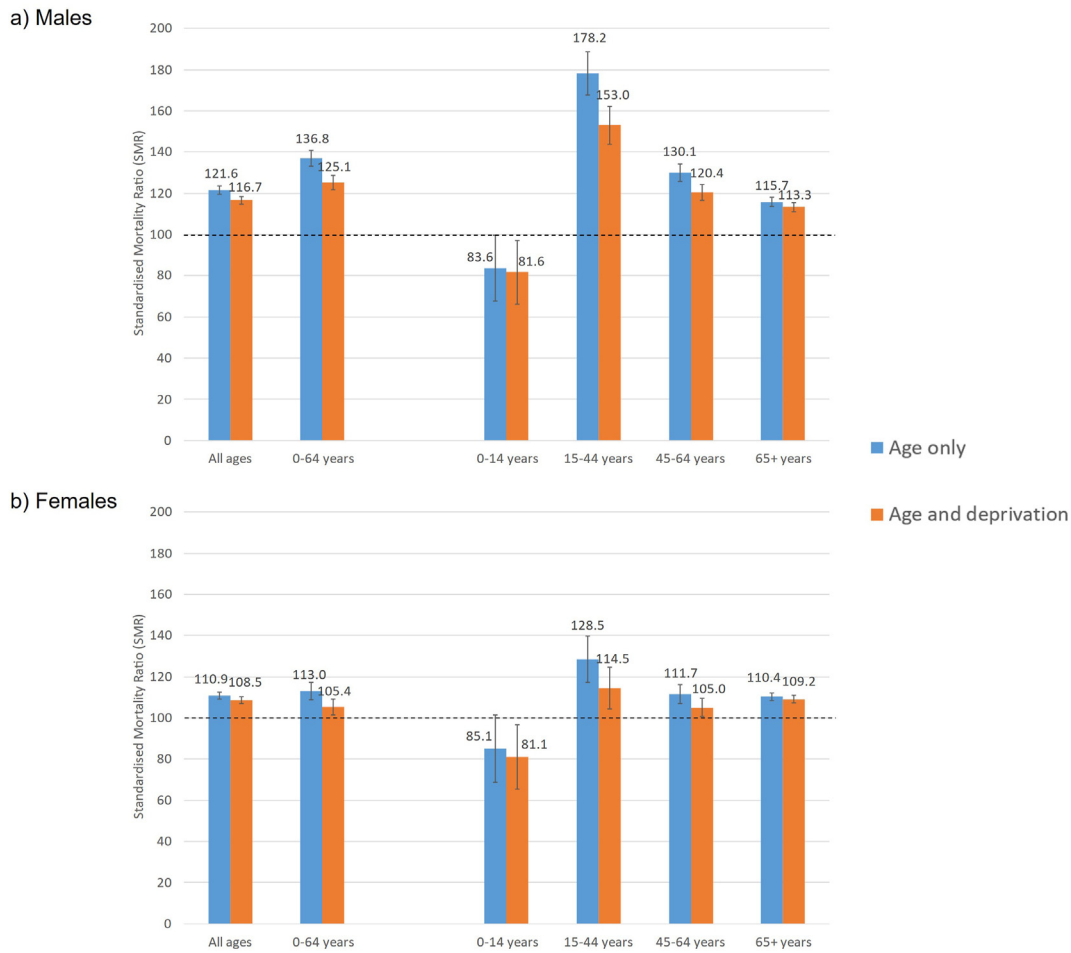

Fig. 3. All-cause standardised mortality ratios (SMRs), Glasgow relative to Liverpool and Manchester, standardised by (1) five-year age group and (2) 5-year age group and three-city deprivation decile, for (a) males and (b) females, 2014–2018.

cities: the latter is particularly true of Manchester, where the overall population size has also increased to a much greater extent.

The implications of this work are multiple. The overall 'stalling' of improvement in mortality rates in the cities is known to mask *increasing* death rates among the more deprived populations across the United Kingdom.[36] These have been linked to UK Government austerity measures, which have had a particularly detrimental effect on the poorest in society and therefore signal an urgent need for appropriate policy responses, including reversing previous cuts to social security payments for those most in need.[31–36]

The study suggests Manchester has, on average, become much less socioeconomically disadvantaged recently (potentially linked to population increases primarily in the city centre[44]); therefore, it is perhaps a less valid comparator city for these analyses than before. However, we should be cautious in this interpretation, for the work also highlights important limitations in how area deprivation is currently measured in the United Kingdom. The previously used measure of income deprivation has been criticised for several reasons, including a 'ceiling effect' (whether social security payments match the level of need).[9,12] Employment deprivation is similarly limited; in addition, it does not reflect levels of *in-work* poverty, which has risen in recent years,[45] and also fails to account for income reductions caused by UK Government austerity measures: indeed, those no longer eligible to claim particular benefits following these reforms are excluded from this definition of deprivation. More fundamentally, however, indicators derived from such administrative sources fail to capture the multifaceted experiences of living in poverty in the United Kingdom: there is a clear need, therefore, to better understand such 'unmeasured' differences between populations.

Strength and weaknesses

This study has several strengths. The analyses are based on the total populations of the cities, rather than survey samples. We have updated previous influential research. The analyses are based on the creation of similar-sized spatial units of analysis and have used an identical measure of deprivation – thus overcoming the problem of different measures of deprivation being used at different geographical scales in the different UK countries. That said, for reasons articulated previously, the use of employment deprivation is also one of the study's key limitations. In focussing on Glasgow's excess levels of mortality, we have also not analysed rates by deprivation decile *within* each city: this would be an important area for future research, given that we know the overall 'stalling' of improvement in mortality masks increasing death rates among the most deprived. This has been shown for UK nations and for Scottish (but not yet English) cities.[36] The analyses also predate the COVID-19 pandemic: further research would be required to explore whether impacts differed across the cities.

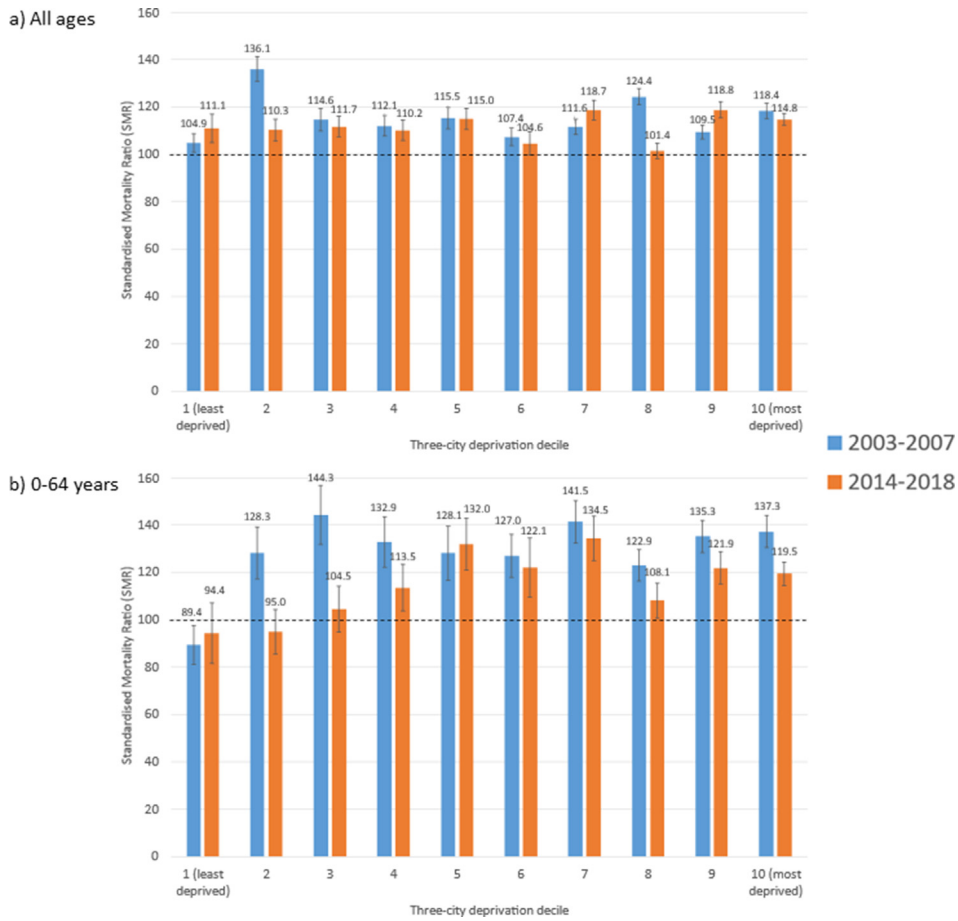

Fig. 4. All-cause age/sex standardised mortality ratios (SMRs), Glasgow relative to Liverpool and Manchester, by three-city deprivation decile for (a) all ages and (b) 0–64 years, 2003–2007 and 2014–2018.

Relevance to other studies

Stalling improvement in mortality rates in all three cities has been demonstrated recently. For example, male mortality rates in Manchester reduced by approximately −5% in the 1980s, −8% in the 1990s and 2000s, but only by −1% in the 2010s (up to 2017). Similar slowdowns were observed in the majority of UK cities.[36]

For all-age deaths, the level of excess mortality shown here for Glasgow is similar to previous studies, but lower for deaths under 65 years.[9,12,13,46–48] The higher excess for suicide and alcohol- and drug-related mortality is consistent with the previous research into the causes of Glasgow's excess mortality, with evidence of a greater vulnerability in Glasgow's population caused by a series of adverse historical and political events.[11,12] In addition, all three causes of death were recently explored in a study of birth cohorts in UK countries and cities: for drug-related deaths and suicide, particular cohorts in all three cities were at greater risk of death – but these 'cohort effects' were much more pronounced in Glasgow. Period effects were shown to be important in the analysis of deaths from alcohol-related causes; however, birth cohorts in Glasgow also had the highest mortality rates from these causes.[49] Despite that, the present study has shown that Glasgow's excess mortality for this cause of death has reduced considerably: from approximately 2.3 times higher in 2003–07 to less than 50% higher in 2014–2018. This reflects changing trends in alcohol-related deaths across the cities. Rates among males increased dramatically in Glasgow from the early 1990s, peaking in the early to mid-2000s (the period covered by the original analyses), before falling sharply in subsequent years; in contrast, rates in Liverpool and Manchester increased steadily over three decades until the early 2010s. A similar picture was observed for females, although rates in all three cities were much lower.[36]

The notably higher drug-related death rate in Glasgow (and Scotland) has been much discussed, including within two recent UK Government Parliamentary enquiries;[50,51] unfortunately, key policy recommendations to address the issue have been rejected by the UK Government.[52]

Although deaths from suicide have been shown here to be considerably higher in Glasgow, the rates of death from this cause have fallen notably in all three cities over the last three decades.[36] It has previously been suggested that lower rates of suicide in Liverpool may be influenced by the religious profile of its population, potentially conferring a protective effect.[53,54] Other such protective effects for population health in both the English cities were included as part of the 2016 explanation of the causes of Glasgow's excess mortality: in Liverpool's case, this related primarily to higher social connectedness, and in Manchester's case, this related primarily to its greater levels of ethnic diversity (linked to so-called 'healthy migrant' effects).[11,12] The influence of the latter has since been quantified with one study showing that in the years 2001–2010, excess mortality among 35- to 74-year-olds in Glasgow (relative to Manchester) reduced by one-fifth after adjustment for ethnicity and country of birth.[46] The effect may be plausibly greater now, given that a large proportion of the recent population increase

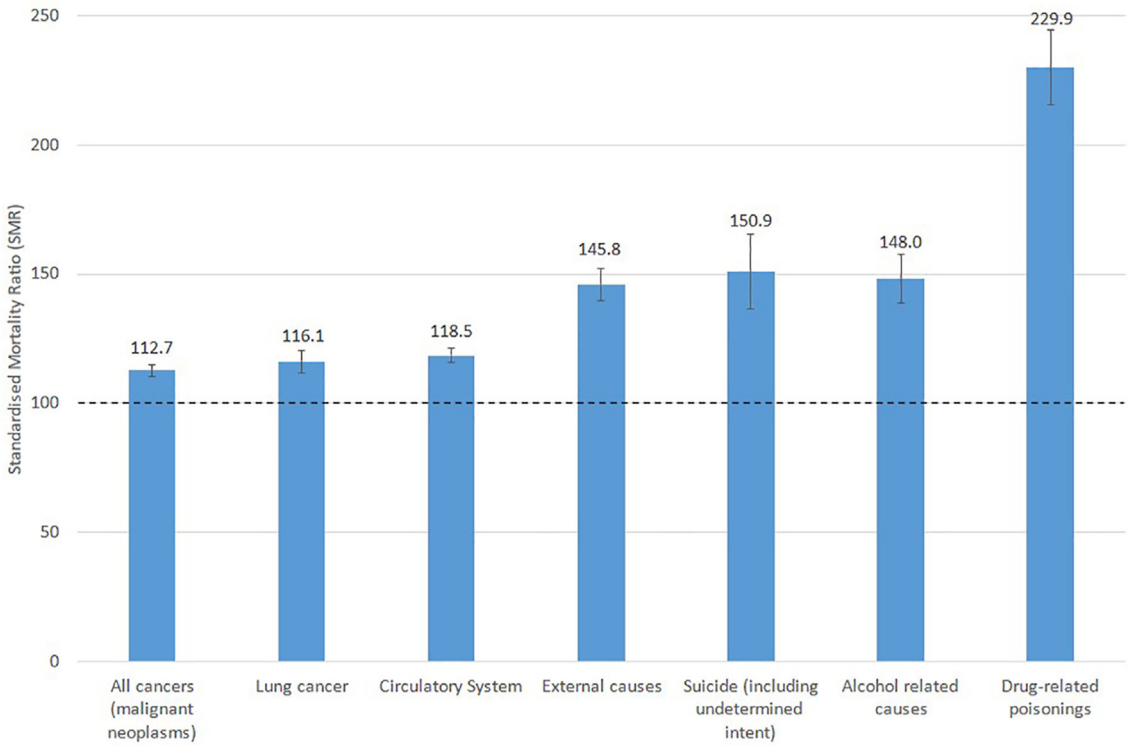

Fig. 5. Age, sex and three-city deprivation decile standardised mortality ratios (SMRs), Glasgow relative to Liverpool and Manchester, by cause of death, all ages, 2014–2018.

in Manchester is attributable to international immigration.[55] That greater population change in Manchester (compared with the other two cities) may be relevant more generally, given the previously demonstrated association between population change and mortality trends: linked to the aforementioned healthy migrant effect, mortality can decline in areas experiencing population increase, and rise in places experiencing population loss.[56–60] The increasing size of the student population – and younger residents more generally – in Manchester[44] may be relevant, although further comparative research across all three cities would be required to try to quantify its potential impact.

Conclusion

Taken in its entirety, all the evidence of excess levels of, and changing trends in, mortality in Glasgow emphasises that there is no such thing as a 'Glasgow effect': rather it is a political effect and therefore requires a political response. As the present study still demonstrates pronounced levels of excess mortality in Glasgow, previously published policy recommendations to address poverty, inequality and vulnerability in the city remain highly relevant.[12] However, given evidence of the impact of UK Government austerity measures affecting all UK cities, additional measures at UK Government level to protect, and restore, the income of the poorest in society are also urgently needed.

Author statements

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Ethical approval

Not required.

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Competing interests

None declared.

Authors' contributions

D.W. originally conceived the study. The research questions and analysis plan were agreed by all authors. Data were extracted by D.W., N.B. and R.P. L.S. undertook the analyses. D.W. drafted the article. All authors provided substantial critical input to improve the article, and all authors approved the final draft.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2021.10.004.

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