

RESEARCH

Impact on health inequalities of rising prosperity in England 1998-2007, and implications for performance incentives: longitudinal ecological study



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Abstract

Objective To investigate whether the uneven rise in prosperity between 1999 and 2008 accounted for differential increases in life expectancy in English local authorities.

Design Longitudinal ecological study.

Setting 324 local authorities in England, classified by their baseline level of deprivation.

Main outcome measures Multivariable regression was used to investigate the association between trends in prosperity between 1998 and 2007 and trends in life expectancy. Trends in health inequalities were assessed by comparing the experience of Spearhead local authorities (the 70 most deprived in 1998) with the average for all English local authorities.

Results Those local authorities that experienced the greatest improvement in prosperity experienced greater increases in life expectancy. With each 1% absolute decline in unemployment, life expectancy increased by 2.2 (95% confidence interval 0.5 to 3.8) months in men and by 1.7 (0.4 to 3.1) months in women. With each £1000 increase in average household income in a local authority, life expectancy increased by 1.4 (0.3 to 2.5) months in men and by 1.1 (0.2 to 1.9) months in women. The more deprived a local authority was in 1998, the lower the rate at which life expectancy improved.

Conclusion Decreases in unemployment and increases in average income in an area explained, to a large extent, why some local authorities “performed” better than others. Health inequalities between Spearhead and all local authorities widened during the period of rising prosperity, but they would have widened to an even greater extent had unemployment not fallen at a faster rate in more deprived areas. With worsening economic trends over the next 10 years, this research suggests that increases in life expectancy are likely to be smaller and health inequalities may widen at a faster rate than in the previous decade. Allocating resources to local authorities on the basis of their “performance” at increasing life expectancy is likely to reward more affluent areas rather than disadvantaged areas with greater needs, exacerbating the problem.

Introduction

The current economic crisis in the United Kingdom and the rest of Europe has raised concerns about the effects on health of economic decline and whether some sections of the population are hit harder than others. Several studies have shown that economic decline is associated with long term negative effects on health.¹⁻⁴ Rapid economic change can have a more extreme effect on unemployed people and those with low levels of education and fewer social supports.⁵ Although health risks may increase during economic downturns, evidence indicates that these risks can be mitigated by strong social support and employment programmes.²

Studies that have investigated the reverse context—the role of economic growth in health improvement—have generally focused on average population effects at the level of the country.^{6,7} These averages may mask diverse experiences of different groups within countries. Much less attention has been paid to the effect on health inequalities of improving economic conditions.

The 10 year period between 1998 and 2007 in England was characterised by sustained economic improvement. It was also the time during which the government pursued a systematic strategy to reduce inequalities in health in England.⁸ In particular, it set a target to reduce the gap in life expectancy between the fifth of local authorities with the worst health and deprivation indicators (the Spearhead group) and the population as a whole by 2010.

This target had not been met by 2010, and the gap in life expectancy between Spearhead local authorities and the average for England had widened.⁹ In 2008-10 life expectancy in Spearhead local authorities was three months lower in men and four months lower in women than would be required to meet the target (authors’ own calculations). Improvement in economic prosperity during this time was not shared equally. Employment

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and incomes, for example, improved at slower rates in some regions than in others. Understanding the differential effect on health of these changing socioeconomic conditions may shed light on the limited progress towards the health inequality targets, as well as the potential effect on health inequalities of future economic forecasts.

A new development in England is the recent announcement of a “health premium,” which will be awarded to local authorities depending on their rate of improvement on a set of health and risk factor indicators outlined in an “outcomes framework.”¹⁰ This performance incentive is part of the government’s strategy to “improve the health of the poorest fastest.” The overarching outcome in this framework is healthy life expectancy, which is derived from a combination of life expectancy and self reported health. The effect of historical socioeconomic conditions, and changes in those conditions over time, on the rate at which health improves in an area will influence the effect that this policy has on health equity. For instance, if rates of health improvement tend to be slower in places with a history of socioeconomic deprivation and lower levels of economic growth, this “health premium” will potentially be regressive, shifting resources from deprived areas with greater need to more advantaged areas.

Increasing prosperity may influence health through multiple pathways and over various timeframes. Some effects may be rapid, such as the relation between job loss and suicide.¹¹ Several authors have found that economic growth is associated with short term increases in some deaths, such as road traffic accidents.¹²⁻¹⁴ In the medium term, increased prosperity may improve health through increased social investment and reduced exposure to adverse physical and psychosocial environments,¹⁵⁻¹⁷ as well as through improvements in health behaviours resulting from improved access to information, services, and resources.¹⁸ Life course and intergenerational models imply that the full effect of increased prosperity would be realised over decades.¹⁹⁻²¹ The effect of these mechanisms on health inequalities will in part depend on the extent to which prosperity increases differentially across social groups and areas.

In this study, we explore the cumulative effects of changes in socioeconomic conditions (employment, income, and education) over 10 years on changes in life expectancy in local authorities in England, during a period of rising national prosperity. We asked whether those local authorities that saw the greatest improvement in socioeconomic conditions experienced the greatest rises in life expectancy; whether baseline deprivation in a local authority influenced the rate at which life expectancy increased; and the extent to which changes in prosperity and baseline deprivation influenced inequalities in health between Spearhead local authorities and all local authorities. We then examine the implications of these effects for the English health inequalities targets and proposed financial incentives to local authorities for health improvement.

Methods

Setting

We used aggregate data on 324 lower tier local authorities in England based on 2009 boundaries (we excluded the City of London and the Isles of Scilly because of their small population size). In line with the English inequalities targets, the analysis compared all local authorities combined and the fifth of local authorities designated by the government as having the worst deprivation and health indicators in 1998—the “Spearhead” group.

Data sources

The main outcome variable in our analysis was change in life expectancy. Data on life expectancy for each lower tier local authority came from the NHS Information Centre.²² We measured trends in prosperity (explanatory variables) as changes in unemployment, household income, and educational achievement. Each of these socioeconomic indicators came from the Office for National Statistics.²³ We measured unemployment within each local authority by using the claimant rate. This is the proportion of the working age (16-64 years) population claiming unemployment benefits (jobseekers allowance). We measured household income by using the average gross disposable household income per head of population. The Office for National Statistics calculates this as the average amount of income that people within an area have after taxes, social contributions, income from property ownership, and pension provision.^{24 25} This information is published only for county council areas and groups of contiguous unitary authorities. However, as changes in household income at this level probably reflect changes at lower geographical levels, we assigned lower tier local authorities the average value of the county council or unitary authority group in which they were located. We measured high educational achievement as the proportion of working age people in each local authority with advanced educational qualifications (NVQ level 4 or equivalent and above). To reduce the effect of short term random fluctuations in these measures, we calculated each year’s level as a three year moving average of the current, previous, and subsequent years.

The analysis assessed the association between the 10 year change in each of the three socioeconomic indicators of prosperity between 1998 and 2007 and the 10 year change in life expectancy between 1999 and 2008 in each local authority. We took the 1998-2007 period for the socioeconomic indicators, rather than 1999-2008, to exclude the effects of the recession, which resulted in increases in unemployment in 2008. We included this one year time lag between the socioeconomic indicators and the outcome to take into account the delay between socioeconomic change and improvements in health and to exclude very short term in-year effects of socioeconomic change on mortality. As a sensitivity analysis, we also included models with no time lag and with two and three year time lags. We calculated change in life expectancy and change in each of the socioeconomic indicators in each area as the 10 year difference. To check whether our estimates were overly dependent on values at either end of these time points, which may not be representative of the overall trend, we also did the analysis using the average annual change in these indicators over this 10 year period (see web appendix 3). We used the Indices of Multiple Deprivation 2000 to measure the baseline level of deprivation in each local authority at the start of this time period in 1998.²⁶

Web appendix 1 gives further details of these variables and data sources. All data are available from the authors on request.

Statistical analysis

We used linear regression to investigate the association between the 10 year change in life expectancy in an area and the 10 year change in each of the three socioeconomic indicators of rising prosperity. We further adjusted for the level of deprivation in 1998 and regional effects, because the historical level of deprivation in an area before 1998 and regional factors that are not explained by socioeconomic change may also influence health improvement during this time period. This resulted in

the following model (equation 1): $\Delta\text{Life expectancy} = \beta_1 \Delta\text{Unemp}_i + \beta_2 \Delta\text{GDHI}_i + \beta_3 \Delta\text{EDUC}_i + \beta_4 \text{IMD}_i + \beta_5 \text{Region}_i + \epsilon_i$, where i is the English local authority; Δ is the 10 year difference in life expectancy, unemployment (Unemp), household income (GDHI), and educational achievement (EDUC); IMD is the level of deprivation in 1998; and Region_{*i*} is the government office region to which local authority i belongs. The regression model was weighted by the 2008 mid-year population estimate for each local authority.

To test the robustness of the model to outliers, we re-estimated the model after removing observations with standardised residuals of an absolute value greater than 2. We also tested all two way interactions between the main variables in the final model and replicated models without adjustment for regional effects (see web appendix 3).

We then used the resulting model to estimate the increase in life expectancy over this time period that was attributable to the change in the socioeconomic indicators of prosperity, expressed as a percentage of the actual increase. We also estimated the additional increase in life expectancy that would have resulted from “levelling up” the socioeconomic indicators over this time period in the Spearhead areas to the average level in 2007 (see web appendix 2 for details).

Results

Trends in life expectancy and prosperity

The average increase in life expectancy in a local authority over the 10 year period was 34 (11-85) months for men and 26 (range 4-80) months for women (table 1). Health inequalities between Spearhead and all local authorities widened, with the Spearhead authorities experiencing smaller increases in life expectancy than the country as a whole.

The unemployment rate declined over the period, and inequalities in unemployment between the Spearhead authorities and the country as a whole narrowed. The proportion of people with higher qualifications increased across the country at a similar rate (6 percentage points), so the gap between the Spearhead and all local authorities remained constant. The average household income by local authority increased by £2815, but slightly less in the Spearhead authorities, so income inequalities increased (table 1).

Association between baseline deprivation, rising prosperity, and increasing life expectancy

Figure 1 shows the correlation between the change in indicators of prosperity and the change in life expectancy within local authorities, unadjusted for baseline deprivation. Life expectancy increased more in areas that experienced the greatest decline in unemployment and in those that experienced the greatest increase in household incomes, except for women’s life expectancy, for which we found no unadjusted association with decreasing unemployment, when we included all local authorities in the analysis.

This unadjusted correlation, however, cannot determine the independent effect of these trends in prosperity. Our regression model indicated that both decreasing unemployment and increasing household income were significantly and independently associated with increasing life expectancy in men and women, when we also controlled for baseline deprivation. We found no association between the increase in educational achievement in an area and improvement in life expectancy, so we dropped this from the final model. In the final model, a 1%

decline in the unemployment rate was associated with an additional 2.2 (95% confidence interval 0.5 to 3.8) months of life expectancy in men and 1.7 (0.4 to 3.1) months of life expectancy in women. An average increase of £1000 in household income in a local authority was associated with an additional 1.4 (0.3 to 2.5) months of life expectancy in men and 1.1 (0.2 to 1.9) months in women (table 2). Local authorities that were more deprived at the beginning of this time period had significantly smaller improvements in life expectancy even when we took into account the changes over time in unemployment and household income.

None of the results was substantially changed when outliers were removed or when models were not stratified by region. We saw no significant interaction between any of the main variables in the final model, and plots of model residuals indicated that these associations were approximately linear. We replicated models by using average annual change over 10 years, rather than the difference between two time points, and found similar results. We found that results were not substantially changed if we used zero, two, or three year lags rather than a one year lag between our outcome and explanatory variables. (See web appendix 3 for residual plots and additional model specifications.)

Unemployment declined by 1.3 percentage points between 1998 and 2007, and household income increased by £2815. On the basis of our model, these figures correspond to an increase in average life expectancy of seven months in men and six months in women. These results suggest that 21% (95% confidence interval 8% to 34%) of the increase in women’s life expectancy and 20% (8% to 32%) of the increase in men’s life expectancy over this time period was attributable to these improvements in unemployment and income (table 3). In Spearhead local authorities, we estimated a slightly higher proportion of the increase in men’s and women’s life expectancy to have been attributable to the improvements in unemployment and income.

Figure 2 shows the predicted effect on the change in life expectancy if the unemployment rate in the Spearhead local authorities reduced and household incomes increased during the 10 year period to the average level for all local authorities in 2007. These improvements would have meant an additional decrease in unemployment of 1.25% and an additional £762 increase in the average annual household income in Spearhead authorities. The model predicts that this “levelling up” of socioeconomic conditions would have reduced the inequalities in life expectancy between Spearhead and all local authorities, resulting in an additional four months of life expectancy in men and an additional three months in women on average in each Spearhead local authority.

Discussion

Our study has shown that rising prosperity is associated with increases in life expectancy at the local authority level in England, over a 10 year period of favourable macroeconomic conditions. Greater declines in unemployment and increases in household incomes in local authorities were associated with greater increases in life expectancy. An estimated 20% of the increase in men’s life expectancy and 21% of the increase in women’s life expectancy between 1999 and 2008 was explained by the improvement in these two prosperity indicators over this 10 year period. Increasing income inequality across the country over 10 years had the effect of widening inequalities in life expectancy, whereas the decreasing unemployment gap was associated with reduced health inequalities. Our analysis shows that, even after control for the change in unemployment and

income, the more deprived an area was at the baseline the smaller the increase in life expectancy. The combined effect of increasing prosperity (measured by both unemployment and income) and baseline deprivation was an overall widening of inequalities in life expectancy between Spearhead local authorities and all local authorities.

Limitations

Although investigating change over time provides more robust evidence than does a simple cross sectional analysis,²⁷ this type of ecological analysis has several limitations. Firstly, we cannot rule out reverse causality, in which those local authorities with better health improvement have greater potential for improving their productivity, which leads to lower unemployment and higher wages. Secondly, our results might be explained by other confounding factors that are associated with improvements in unemployment and household income, which have a direct influence on mortality in an area. Plausible factors, such as environmental or neighbourhood improvements, are, however, still likely to be related to overall improvements in prosperity. Thirdly, the composition of local authority populations may have changed over time, and improvements in unemployment, household income, and life expectancy may reflect the movement of employed, wealthier, or healthier people into an area or, conversely, the movement of unemployed, poorer, or less healthy people out of an area. Other studies have shown, however, that migration does not fully explain the association between improvements in area based measures of prosperity and improvements in health.²⁸⁻³⁰ Fourthly, as our analysis is based on aggregate data, we cannot determine whether it reflects associations at an individual level. The association between decreasing unemployment and improved health, for example, may reflect decreasing risks among both employed and unemployed people as prosperity increases. However, the strength of the effect size and the large body of other evidence from longitudinal studies,³¹⁻³⁴ showing the effect of unemployment and household income on health, support the conclusion that the association between increased prosperity and improved health is causal.

Policy implications

The English health inequalities strategy did not specifically target income inequality or unemployment, yet these two factors explain, to a large extent, why some local authorities “performed” better than others. In 2010 the National Audit Office identified that only 12 (17%) Spearhead local authorities were on track to meet the national health inequalities target. The best performing local authorities were in London and northeast England. The explanation given by the National Audit Office and others as to why some Spearhead local authorities performed better than others has not taken into account the effect of differential changes in socioeconomic circumstances. Previous explanations have focused on the management, partnership structures, and processes within each local authority, as well as the level of investment and implementation of medical and lifestyle interventions (such as prescribing of drugs to control blood pressure and reduce cholesterol and increasing the capacity of smoking cessation services).³⁵⁻³⁶ The analysis presented here indicates that important factors influencing this pattern of performance are trends in unemployment and household income, resulting in a differential rise in prosperity across different local authorities. Spearhead local authorities in London and northeast England experienced the greatest declines in unemployment, and those in London also experienced the greatest rise in household incomes.

On the basis of our findings, we speculate that reducing inequalities in household income across the country and achieving further reductions in unemployment in deprived areas would have made a significant contribution to achieving the English health inequalities target. We estimated the effect of levelling up these two socioeconomic factors in the Spearhead areas to the average level for all local authorities and found that this had the potential to increase men’s life expectancy in the Spearhead areas sufficiently to achieve the government’s 2010 target.

A further implication of our analysis is that a financial incentive, such as the proposed English “health premium,” paid to those local authorities experiencing the greatest improvement in life expectancy or a similar indicator derived from it (for example, health expectancy) would reward the more affluent local authorities rather than the most disadvantaged areas with the greatest need. A fairer system to reward performance by local authorities and their partners would recognise that gaining the same level of health improvement is harder in a deprived population than in a more affluent population. Our analysis shows that even adjusting for the level of deprivation at baseline would not eliminate the bias in the incentive towards more affluent areas, as the rates at which household incomes increase and unemployment falls in an area will also be major determinants of how local authorities perform. The extent to which local authorities and their partners can influence income and unemployment independent of national policy is debatable. A health premium may therefore penalise or reward local authorities for factors that are out of their control and are largely the result of the broader macroeconomic climate and national policy.

National policy, including that directed at regional development, has a major influence on economic growth and whether that is experienced differentially across the country. Forecasts for economic growth over the next 10 years, however, have prompted some commentators to refer to it as “the lost decade,” with median household incomes forecast to be no higher in 2015-16 than they were in 2002-03.³⁷ Nationally determined social transfers and tax credits are an important component of household income, particularly in deprived areas. A recent report found that cash transfers in countries in the Organisation for Economic Co-operation and Development have become less effective at reducing income inequality since the 1990s.³⁸ The Institute for Fiscal Studies estimates that the overall effect of tax and benefit reforms announced by the UK government in 2010 would be regressive, with low income households of working age losing the most.³⁹ Government cuts to local authority budgets in England have been greatest in more disadvantaged areas,⁴⁰ and recent increases in unemployment between 2010 and 2011 are also highly correlated with local authority budget cuts (correlation coefficient between reduction in spend per head of population and increase in male claimant rate: $r=-0.21$, $P=0.0026$; authors’ calculations). Our analysis indicates that slower economic growth may result in a smaller increase in life expectancy over the next decade compared with the previous 10 years. Action by national government to reduce socioeconomic inequalities between local authorities in England could reduce health inequalities, whereas policies that increase the gap in incomes and unemployment between areas are likely to exacerbate health inequalities.

Contributors: BB was responsible for the concept and design of the study. MW and DT-R developed the performance incentives analysis. BB did the analysis with support from DT-R. All authors contributed to

What is already known on this topic

Rising national prosperity in England over the decade from 1998 to 2007 was associated with increasing average life expectancy for the country as a whole

However, not all areas shared in the rising prosperity

The effect on health inequalities of this uneven rise in prosperity is not clear, and nor are the implications of the proposal to offer local authorities financial incentives based on their "performance" in further improving health

What this study adds

English local authorities with the greatest improvement in prosperity between 1998 and 2007 saw greater increases in life expectancy; the more deprived an authority was in 1998, the lower the rate at which life expectancy improved

These two findings help to explain why health inequalities between the most deprived local authorities (the Spearheads) and all local authorities widened over this prosperous period

Allocating resources to local authorities on the basis of their "performance" at increasing life expectancy is likely to reward more affluent areas, rather than disadvantaged areas with greater needs

the interpretation of the data, drafting the article, and final approval of the version to be published. BB is the guarantor.

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Ethical approval: Not needed.

Data sharing: Statistical code and dataset available from corresponding author at benbarr@liverpool.ac.uk.

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Tables

Table 1 | Level and change in life expectancy and socioeconomic indicators between 1998/99 and 2007/08, for all local authorities (LAs) and Spearhead LAs

Variable	Local authority groups	Mean* in 1998/99†	Mean* in 2007/08‡	Mean difference over time
Women's life expectancy (years)	Spearhead LAs	78.8	80.8	24 months
	All LAs	80.2	82.3	26 months
Men's life expectancy (years)	Spearhead LAs	73.4	76.1	32 months
	All LAs	75.3	78.2	34 months
Unemployment rate (%)	Spearhead LAs	5.4	3.5	-1.9
	All LAs	3.6	2.2	-1.3
Proportion of working age population with NVQ4+ qualifications (%)	Spearhead LAs	18	24	6
	All LAs	22	28	6
Annual disposable household income per head at 2005 prices (£)	Spearhead LAs	8672	11 392	2720
	All LAs	9340	12 154	2815

*Mean values weighted by LA population.

†1999 for life expectancy; 1998 for socioeconomic indicators.

‡2008 for life expectancy; 2007 for socioeconomic indicators.

Table 2| Effect of baseline deprivation, decrease in unemployment, and increase in average household income on increase in life expectancy

Factor influencing life expectancy	Increase in life expectancy—months (95% CI)*	P value
Men (R²=0.27)		
Additional increase in life expectancy with each 1% decline in unemployment rate	2.2 (0.5 to 3.8)	0.009
Additional increase in life expectancy with each £1000 increase in disposable household income per head	1.4 (0.3 to 2.5)	0.01
Additional increase in life expectancy for each point that LA's initial level of deprivation (IMD2000) is lower than average	0.2 (0.1 to 0.3)	<0.001
Women (R²=0.28)		
Additional increase in life expectancy with each 1% decline in unemployment rate	1.7 (0.4 to 3.1)	0.013
Additional increase in life expectancy with each £1000 increase in disposable household income per head	1.1 (0.2 to 1.9)	0.016
Additional increase in life expectancy for each point that LA's initial level of deprivation (IMD2000) is lower than average	0.3 (0.2 to 0.4)	<0.001

IMD2000=Indices of Multiple Deprivation 2000; LA=local authority.

*95% CI based on robust standard errors; model based on equation 1 (see text); model also adjusted for nine government office regions (No of local authorities=324).

Table 3| Predicted increase in life expectancy attributable to decrease in unemployment and increase in average household income per head between 1998 and 2007

	Attributable increase in life expectancy—months (95% CI)	Proportion of total increase in life expectancy—% (95% CI)
Spearhead local authorities:		
Women's life expectancy	6 (2 to 10)	26 (10 to 42)
Men's life expectancy	8 (3 to 13)	25 (10 to 40)
All local authorities:		
Women's life expectancy	5 (2 to 9)	21 (8 to 34)
Men's life expectancy	7 (3 to 11)	20 (8 to 32)

Figures

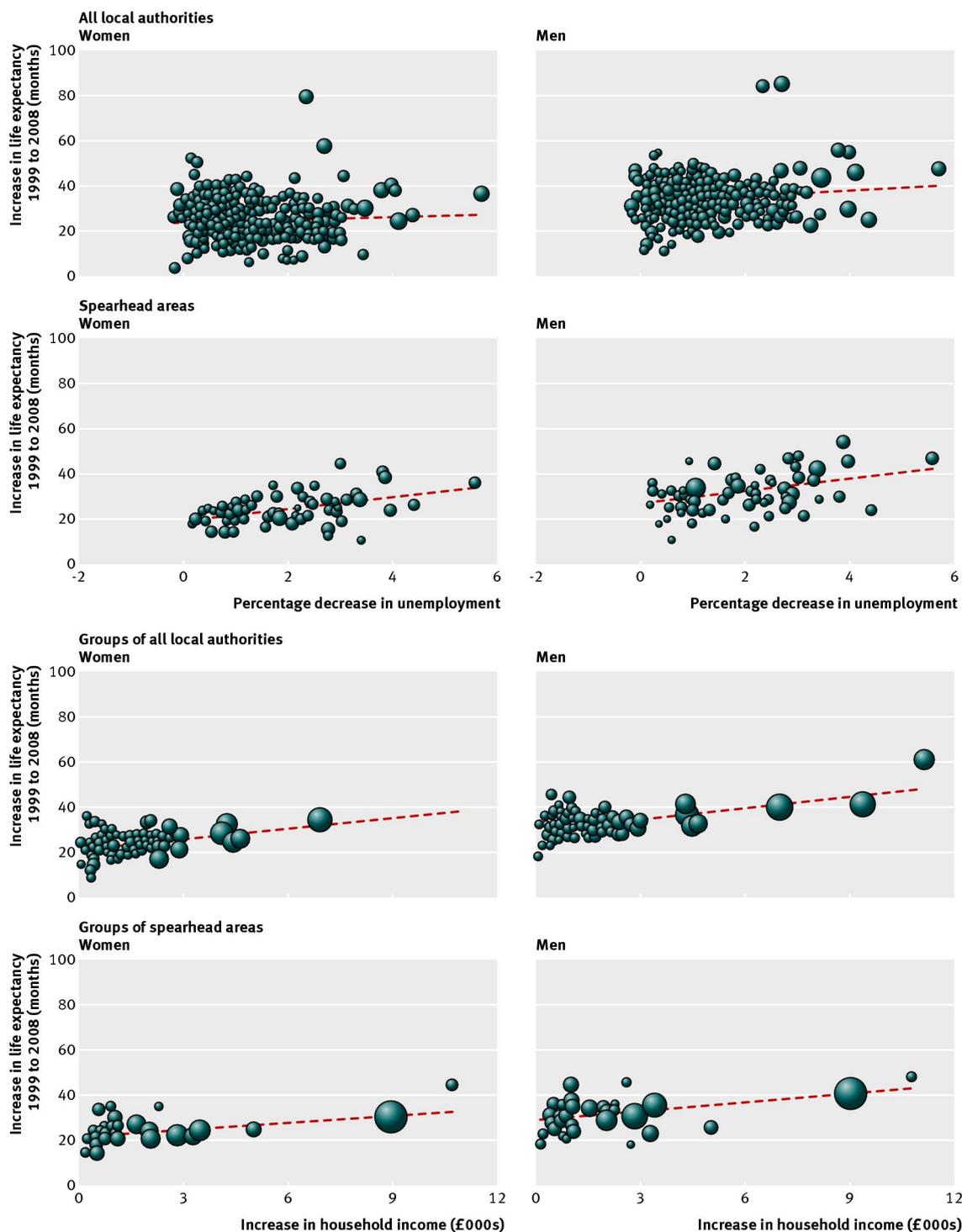


Fig 1 Unadjusted association between increase in life expectancy (1999-2008) and decrease in unemployment rate (top four graphs) or increase in average household income (gross disposable household income (GDHI); bottom four graphs) for all local authorities and Spearhead local authorities (dashed line shows fitted values). For household income, as GDHI is available only for county councils and contiguous groups of unitary local authorities, graphs show mean increase in GDHI and life expectancy of all local authorities and Spearhead local authorities in these groups

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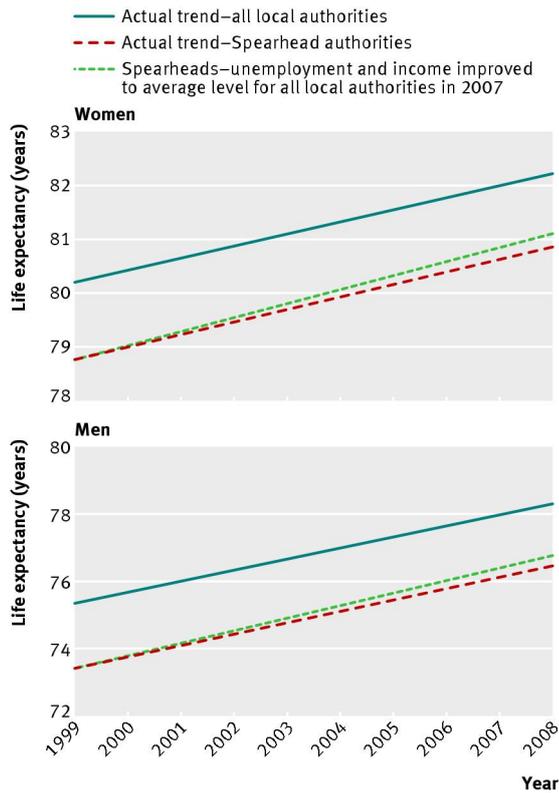


Fig 2 Model estimates of effect on increase in life expectancy if between 1998 and 2007 unemployment rate and average household income “levelled up” in Spearhead local authorities to average level for all local authorities in 2007

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