Levels of mortality, education, and social conditions in the 107 local education authority areas of England

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Abstract

Study objective – To investigate the relationships between education, social conditions, and mortality.

Design – An ecological study relating several measures of mortality to local rates of educational attainment at age 15/16 years and scores on the Department of the Environment's index of local conditions.

Setting – England and its 107 local education authority areas in 1991.

Main results – Educational attainment was closely associated with all cause, coronary, and infant mortality and strongly associated with the index of local conditions. This social index was also closely associated with all the measures of mortality. In multiple regression, the social index was the stronger correlate of all cause mortality but for coronary and infant mortality, educational attainment remained highly statistically significant.

Conclusions – Area levels of both educational attainment and deprivation-affluence are strong correlates of local mortality rates in England. In these analyses educational attainment may be indexing the general cultural level of a community. Preliminary investigation with these ecological data suggests that deprivation-affluence has the stronger association but a surer assessment of their relative importance will require individual level information.

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Social class is an umbrella concept containing several dimensions, among the most important of which are education and the level of deprivation-affluence. Both of these are related to mortality. Education is the standard indicator of socioeconomic position in many countries and when used in this way it reveals an inverse and graded relationship with mortality[1] and morbidity.[2-4] The level of deprivation or affluence, measured on the Townsend index, at present accounts for nearly two thirds of the variation in premature mortality between the electoral wards of the northern region of England.[5] However, the precise nature of the relationship between education, deprivation-affluence, and mortality remains to be explored.

Some British studies have already examined the question. The 1946[6-8] and the 1958[9] British birth cohort studies have found that deprivation-affluence, measured in a variety of ways, and educational attainment are independently related to many aspects of health during early adulthood. The OPCS longitudinal study has shown that male adult mortality varies with both educational attainment and occupational social class.[10]

The presently reported study adds to these results because, unlike the birth cohorts, its outcome measure of health is mortality, and its measure of deprivation-affluence is more precisely targeted than the occupational social classes which were used in the longitudinal study analyses. It is an ecological study, which has the disadvantage of being hard to interpret but the advantage that it may identify factors that genuinely work at the ecological level.

Methods

All our data are recent government statistics, summarised for the 107 local education authority (LEA) areas of England. Those concerning education and social conditions refer to 1991, while the mortality data are for the period 1990–92. Our measure of educational attainment is the proportion of boys and girls in each LEA area who obtained grades A, B, or C, in at least five subjects in the General Certificate of Secondary Education (GCSE) examination at age 15/16 years.

For our measure of deprivation-affluence in each LEA area, we have used the Department of the Environment's summary index of local conditions.[11] This is a composite of the social conditions of local populations, constructed from seven items from the 1991 census and a further six items from various other sources. We have omitted the two items in the index which refer to adult mortality and educational attainment at age 16 years, because we wish to treat these as separate variables in our analysis. The index of local conditions, thus amended, consists of two measures of unemployment (total and long term), two household measures (crowding, basic amenities), car ownership, two measures of childhood conditions (low earning households and unsuitable accommodation), two neighbourhood characteristics (house contents insurance premiums and derelict land) and the proportions of adults receiving Income Support and of 17 year olds no longer in fulltime education. An index was constructed by summing these 11 measures, after first standardising each measure to a mean of zero and a standard deviation of one.

Table 1   Mean deprivation and mortality rates for local educational authorities of England ranked by GCSE pass rate

GCSE pass rate sextile (1991–92)	Mean social deprivation index (1991)*	Mean mortality (1990–92) per 1000				
		All causes, all ages		Coronary heart disease, ages 15–64 y		Infant
		Male	Female	Male	Female	
Least successful	12·59	11·5	6·8	1·42	0·43	8·3
2nd	5·26	11·2	6·8	1·40	0·42	8·1
3rd	−0·94	10·7	6·6	1·32	0·38	7·7
4th	−2·67	10·2	6·4	1·19	0·31	7·2
5th	−5·35	9·8	6·2	1·10	0·27	6·9
Most successful	−7·84	9·1	5·7	0·94	0·22	5·9
Correlation with GCSE pass rate	−0·89	−0·77	−0·64	−0·68	−0·69	−0·60

* Mean for England = 0; positive value = deprived, negative value = affluent.
GCSE = General Certificate of Secondary Education.

Contemporary mortality data for each LEA area have kindly been provided by the OPCS: specifically, (i) age standardised all cause mortality per 1000 at all ages, for males and females separately; (ii) age standardised coronary heart disease mortality per 1000 at ages 15–64, males and females separately; and (iii) infant mortality per 1000 live births, males and females combined. (i) and (ii) may be regarded as "adult" mortality.

Several methods have been used to examine these data. The 107 LEAs of England have been ranked according to their pass rates in the GCSE examination and divided into sextiles; lowest sextile to 25·1%, 29·7%, 35·1%, 37·6%, 41·4%, highest sextile to 47%. The mean rate of social deprivation-affluence for each sextile group of LEAs has been calculated, as have the mean rates for the various measures of mortality. The strength of the relationship between the examination pass rate and (a) the index of social conditions and (b) each measure of mortality was measured by rank correlation of the 107 LEA areas.

The sextile analysis and the rank correlations have been repeated using the social index scores instead of the GCSE pass rates as the independent variable. The mean for the social index score for England equals zero, positive values indicate deprivation, negative values affluence. The highest social index scores in the sextiles were −7·5 (most affluent), −5·5, −2·2, 1·9, 7·7, 23·1 (most deprived).

Finally, to investigate the hypothesis that local mortality is related to deprivation-affluence mainly through local standards of education, a multiple regression[12] of each mortality index on the sextile of deprivation score (entered as a continuous variable in order to assess the trend) was performed, adjusted for sextile of GCSE pass rate (entered as a categorical variable to give the fullest possible adjustment). These results are presented as the fitted mortality values at the lowest and highest sextiles of deprivation. The corresponding analysis was performed on GCSE pass rate, adjusted for sextile of social deprivation.

Results

Table 1 displays characteristics of the LEA areas grouped into sextiles by their GCSE pass rates. The second column shows the average rate of social deprivation; positive figures indicate relative deprivation, negative figures relative affluence. The succeeding columns record the corresponding mean mortality rates. The bottom row presents the correlations between examination pass rate and each of the other variables in the 107 *individual* LEA areas. The sextile group of LEAs with the most successful examination pass rate has the most affluent social index score and the lowest rates on all five measures of mortality. Mean deprivation-affluence scores and mortality rates increase in a stepwise manner from the highest to the lowest sextile of educational attainment.

The strongest association is between the examination results and the social index, a rank correlation for the 107 individual LEAs of 0·89, social deprivation thus "explaining" four fifths of the variance in educational attainment. The mortality rates show similar if weaker trends, with correlations which range from 0·60 for infant mortality to 0·77 for male all cause mortality. All the rank correlations in the bottom row significantly differ from zero at the 0·0001 level.

Table 2 displays the characteristics of the LEA areas grouped into sextiles by their social index. The most affluent sextile of areas has the highest GCSE pass rate and the lowest rates on all five mortality measures. Examination pass rates tend to fall and mortality rates to rise from the most affluent to the most deprived sextile. For the individual areas the rank correlation of the social index is highest with male all cause mortality, lower with the other measures of adult mortality, and lowest with infant mortality. All the rank correlations in the bottom row significantly differ from zero at the 0·0001 level. In several cases the mortality rates in the most deprived sextile are lower than an incremental gradient would predict. An examination of the LEAs concerned shows that most of these are London boroughs.

The results of the regression analyses are presented in table 3. The mortality rates which are presented are the means for the two extreme sextiles *after* adjustment for the designated variable (the corresponding unadjusted values appear in tables 1 and 2). For male and female all cause mortality, adjusting for social deprivation-affluence largely eliminates the association with education, while adjusting for education leaves the association with deprivation-affluence little changed. The opposite

Table 2   Mean GCSE pass rate and mortality rates of local educational authorities of England ranked by social deprivation index

Social deprivation sextile (1991)	Mean GCSE pass rate (1991–92)	Mean mortality (1990–92) per 1000				
		All causes, all ages		Coronary heart disease, ages 15–64 y		Infant
		Male	Female	Male	Female	
Most deprived	22·3%	11·4	6·7	1·33	0·38	8·1
2nd	28·4%	11·3	7·0	1·47	0·44	8·4
3rd	32·5%	10·9	6·8	1·37	0·42	7·5
4th	37·8%	10·0	6·3	1·19	0·30	7·1
5th	38·6%	9·5	6·0	1·05	0·25	6·8
Most affluent	42·3%	9·1	5·8	0·92	0·22	6·1
Correlation with social deprivation index	−0·89	0·81	0·65	0·71	0·67	0·55

Table 3 *Mortality indices by deprivation adjusted for GCSE pass rate, and by GCSE pass rate adjusted for deprivation*

Mortality index	Mortality by deprivation adjusted for GCSE*			Mortality by GCSE adjusted for social deprivation*		
	Most deprived sextile	Most affluent sextile	p (trend)	Least successful sextile	Most successful sextile	p (trend)
Male all cause	11·7	9·8	0·0001	10·7	9·8	0·03
Female all cause	7·0	6·2	0·005	6·6	6·0	0·03
Male CHD	1·44	1·13	0·005	1·31	1·02	0·006
Female CHD	0·39	0·31	0·09	0·39	0·22	0·0001
Infant	7·7	7·2	0·40	7·9	6·0	0·002

* Fitted values from regression analysis.
CHD = coronary heart disease.

picture is seen for female coronary heart disease and infant mortality, which remain, after adjustment, strongly associated with education and not social deprivation-affluence. Male coronary heart disease mortality is intermediate, remaining significantly though more weakly associated with both education and deprivation-affluence.

Discussion

The study reported in the present paper used data available in government departments to describe the relationships between education, deprivation, and mortality, and to suggest new insights for further investigation.

Our results provide strong evidence of the continuing importance of social deprivation for health. They also show that education is a strong correlate of mortality at the area level; indeed its association is broadly comparable with that of our deprivation measure. The regression analyses are an indication of the relative strength of these associations. The results for all cause mortality suggest that the social index is the stronger correlate, with education having only a marginal residual association. The results for coronary and infant mortality indicate, in contrast, that educational attainment remains highly statistically significant.

When interpreting these results, it is important to bear in mind that education and deprivation-affluence are highly correlated and therefore that our results about their relative importance are highly sensitive to mis-specification of the predictor variables.[13] If a better measure of deprivation could be made available, it might explain part or all of the education effect. Conversely, educational attainment may be a better measure of deprivation than the social index, although if this were so it would cast serious doubt on the current methodology for constructing deprivation indices.

Our data refer to areas, not to individuals, and the interpretation of such ecological data must be cautious.[14] It is relevant that a recent study has found that the ecological association between deprivation and mortality is attribu-

table to a pattern of individual level associations.[15] Nevertheless, ecological relationships should be taken only as pointers to possible individual level relationships.

Since our measures of educational attainment and mortality refer to different generations, a simple individual level analogue of our ecological results is unlikely. Indeed, our education measure may be indexing a fundamentally ecological variable,[16] namely the general cultural level of a community. This general cultural level could influence the educational attainment of the community's adolescents through normative expectations of its schools and the cultural resources of its parents.[17] It could also influence the health, and hence the mortality, of the community's infants and adults through normative behaviour concerning infant care and adult cigarette smoking, diet, and physical exercise.

These results regarding the relative weight of the material and cultural dimensions of social class need to be investigated with individual level data, but on the basis of the present analyses we hypothesise that an area's educational level is a predictor of individual mortality.

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