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Are inequalities in height underestimated by adult social position? Effects of changing social structure and height selection in a cohort study

Chris Power, Orly Manor, Leah Li

Abstract

Objectives To investigate whether changing social structure and social mobility related to height generate (inflate) inequalities in height.

Design Longitudinal 1958 British birth cohort study. **Setting** England, Scotland, and Wales.

Participants 10 176 people born 3-9 March 1958 for whom data were available at age 33 years.

Main outcome measures Adult height and social class at age 33 years; class of origin (father's occupation when participant was 7 years old).

Results Adult height showed a social gradient with class at age 7 years and age 33 years. The difference in mean height between extreme groups was greater for class of origin than for adult class, reducing from 2.21 cm to 1.62 cm for men and from 2.18 cm to 1.74 cm for women. This narrowing inequality was due mainly to a decrease in mean height in classes I and II. This was because of the pattern of height related social mobility in which, for example, men moving into classes I and II were taller (mean 177.2 cm) than men remaining in class III manual (mean 176.1 cm) yet shorter than men with class I and II origins (mean 178.3 cm) and the relatively large number of individuals moving into classes I and II. Changes in the structure of society, seen here with the general trend of upward social mobility, have acted to diminish inequalities in adult height.

Conclusions The combination of changing social structure and height related mobility constrains, rather than inflates, inequalities in height and may lead to an underestimation of the role of childhood socioeconomic factors in the development of inequalities in adult disease.

Introduction

Inequalities in health are a key priority in public health, but there is controversy over the possible courses of action that might be taken to reduce them.^{1,2} Fundamental to the question of solutions is the question of causes, and opinion has changed over recent decades as to how inequalities develop. At the time of the Black report some argued that inequalities were created by health selection—that is, social sorting linked to health—whereby individuals with poorer health are more downwardly mobile and those with better health are more upwardly mobile.³ Alternatively, inequalities could be an artefact of social classification³: as class V declines in size it becomes a more extreme group and its mortality a less important social indicator. Hence, a rise in mortality relative to that of other classes might reflect a smaller group of individuals rather than greater social inequality. Both health selection and artefact of social classification were expected to inflate health differences.³

It is now accepted that selection and artefact are not primary explanations for inequalities in most health outcomes,^{4,5} although we still know little about the strength and direction of their effect. We assessed whether changes in the structure of society (artefact) and health related social mobility (selection) generate—that is, act to inflate—inequalities in health. We based our study on adult height, which has two advantages. Firstly, shorter adult stature is a well established predictor of cardiorespiratory disease later in life in men and women⁶⁻¹⁰ and is therefore a useful health indicator. Secondly, height has a particular value here because once adult stature is reached it changes little, at least in early adulthood, though from late middle age there is a

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Two figures illustrating the data in the tables can be found on bmj.com

Table 1 Mean (SD) adult height (cm) at 33 years by social class of origin (at 7 years) in 1965 and by adult class at age 33 in 1991

Social class	Social class at 7 years				Social class at 33 years			
	No (%)	Mean (SD) height	Slope	Difference* (95% CI)	No (%)	Mean (SD) height	Slope	Difference* (95% CI)
Men (n=5061)								
I and II	1086 (21.5)	178.2 (6.6)			2012 (39.8)	177.6 (6.7)		1.6
III non-manual	522 (10.3)	177.6 (6.8)	-0.76 (P<0.001)	2.2 (1.7 to 2.8)	551 (10.9)	177.9 (6.7)	-0.62 (P<0.001)	(1.1 to 2.2)
III manual	2272 (44.9)	176.6 (6.8)			1686 (33.3)	176.2 (6.7)		
IV and V	1181 (23.3)	176.0 (6.5)			812 (16.0)	176.0 (6.8)		
Women (n=5115)								
I and II	1042 (20.4)	164.3 (6.0)			1648 (32.2)	163.7 (6.5)		
III non-manual	544 (10.6)	164.0 (6.5)	-0.76 (P<0.001)	2.2 (1.7 to 2.7)	1875 (36.7)	163.1 (6.3)	-0.57 (P<0.001)	1.7 (1.3 to 2.2)
III manual	2355 (46.0)	162.7 (6.4)			379 (7.4)	162.8 (6.1)		
IV and V	1174 (23.0)	162.1 (6.4)			1213 (23.7)	162.0 (6.3)		

*Difference (cm) between two extreme groups.

trend of increasing “shrinkage.”¹¹ With a fixed health measure, the time sequence between health status and social position is more easily disentangled. We used data from the 1958 British birth cohort¹² with information on height and social position in childhood and adulthood to investigate inequalities in height.

Methods

Study sample—The 1958 birth cohort includes all children born in England, Wales, and Scotland from 3-9 March 1958.¹³ We obtained information on 98% (about 17 000) from a target of 17 733 births enrolled in the perinatal mortality survey. Participants have been followed from birth through to age 41 years. With 11 405 (73% of the target population in 1991) responding at age 33 years, the sample size has reduced over the period of the study, although biases are regarded as small.¹² We examined the representativeness of the samples used here, which rely on data for age 7 and 33 years, and found that 23.3% (men) and 23.0% (women) were from classes IV and V at age 7 compared with 24.3% of the full sample. Individuals included in our analyses are therefore representative of the original national study with respect to social class.

Measures—Interviewers measured participants' height at 33 years. All measurements were done with participants in erect standing posture to obtain maximum standing height. We measured height once using a stadiometer and reading to the nearest centimetre. Social class when the participant was aged 7 years was based on father's occupation in 1965 and at age 33 on the participant's own current or most recent occupation in 1991, categorised as I and II

(professional/managerial), III non-manual (skilled non-manual), III manual (skilled manual), and IV and V (semiskilled or unskilled manual).

Data analysis—We calculated mean adult height according to class at age 7 and 33 for men and women separately. Differences between the extreme social classes are indicated with 95% confidence intervals. We estimated a slope of inequality using simple linear regression with height and social class as continuous variables, assuming equal spacing between the four social classes. We calculated mean adult height for socially mobile groups, distinguishing between groups moving in and out of each class (that is, inflow and outflow mobility) separately for each sex. We used a linear model to estimate differences in mean height between stable and socially mobile groups.

Results

There were social gradients in adult height for class of origin and class at age 33 (table 1). There were changes in social structure between 1965 and 1991 for parents and offspring at a comparable age in the life span: the proportions in classes I and II increased from 22% to 40% for men and 20% to 32% for women. Correspondingly, the proportion of men, though not women, in semiskilled or unskilled occupations declined from 23% to 16%. Differences in mean height between the extreme social classes were greater for class of origin than for class of destination, with differences of 2.21 cm versus 1.62 cm respectively for men and 2.18 cm versus 1.74 cm for women. Consistent with this, the slope of inequality was steeper for age 7 years.

Table 2 Mean height (cm) at 33 years and inflow social mobility (moving into destination class (adult class at age 33) from class of origin at 7 years (father's class) either from all lower classes or all higher classes with combined groups of upward and downward mobility). Figures in parentheses are numbers of participants

Class of origin	Adult class of destination			
	I and II	III non-manual	III manual	IV and V
Men				
I and II	178.3 (729)	178.6 (115)	177.0 (285)	176.2 (515)
III non-manual	177.2 (1283)	177.7 (91)		
III manual		177.8 (345)	176.1 (926)	
IV and V			176.0 (475)	175.6 (297)
Women				
I and II	164.6 (542)	164.1 (330)	163.2 (83)	162.3 (813)
III non-manual	163.24 (1106)	163.9 (227)		
III manual		162.8 (1318)	163.0 (193)	
IV and V			162.1 (103)	161.3 (400)

Table 3 Mean height (cm) at 33 years and outflow social mobility (moving out from class of origin at 7 years (father's class) to destination class (adult class at age 33) with combined groups of upward and downward mobility). Figures in parentheses are numbers of participants

Adult class of destination	Social class of origin			
	I and II	III non-manual	III manual	IV and V
Men				
I and II	178.3 (729)	178.4 (271)	177.5 (948)	176.1 (884)
III non-manual	178.0 (357)	177.7 (91)		
III manual		176.3 (160)	176.0 (926)	
IV and V			175.8 (398)	175.6 (297)
Women				
I and II	164.6 (542)	164.0 (199)	163.0 (1554)	162.5 (774)
III non-manual	163.9 (500)	163.9 (227)		
III manual		164.1 (118)	163.0 (193)	
IV and V			161.7 (608)	161.3 (400)

The narrowing of inequality was due mainly to a decrease in mean height in classes I and II, whereas for classes IV and V mean height was similar for both class of origin and adult class (table 1). This reduction in height for classes I and II can be explained by patterns of social mobility linked to height. One general pattern to emerge is that those moving to a higher class are taller on average than the class they leave and shorter than the class they join (tables 2 and 3, also see graphs of data on bmj.com). To illustrate, men moving into classes I and II from all other classes were taller (177.2 cm) than men with similar class origins (for example, 176.1 cm for those remaining in class III manual), yet they were shorter than men staying in class I and II (178.3 cm) (table 2). After we adjusted for class of destination, men moving into a higher class (inflow mobility) were on average 0.7 cm (95% confidence interval 0.2 to 1.2 cm) shorter than those who were stable in that class, whereas men moving into a lower class were on average 0.8 cm (0.2 to 1.4) taller than the stable group. The respective figures for women were 1.3 cm (0.8 to 1.8) and 0.6 cm (0.0 to 1.2). For outflow mobility (table 3) we found that, after adjustment for class of origin, men moving out to a higher class were 0.4 cm (-0.2 to 0.9) taller than those stable in their class of origin, while men moving out to a lower class were 1.1 cm (0.7 to 1.6) shorter. Similarly for women, the respective figures were 0.7 cm (0.2 to 1.3) and 0.6 cm (0.1 to 1.2).

However, an important influence on average height in a particular class is the number of individuals moving or staying in the same class. Adult height in classes I and II fell because a substantial number of men (1283) with shorter average stature moved into this class to join a smaller group of taller men (729) originally from this class (table 2). Fewer men (357) moved out of class I and II (table 3), and they too were taller than men moving into this class. This pattern of inward and outward social mobility led to a reduction in average height in the highest social groups. Similar trends were seen for women.

Discussion

Contrary to expectation, we found that changing social structure and height related selection have acted to reduce rather than amplify inequalities in height. In other words, inequalities would have been greater in the absence of these social processes. Adult height is uniquely able to demonstrate this because, in contrast

with other health measures, it varies little until late middle age.¹¹ Height was constant throughout this study and it was only social position that varied from class of origin (father's class) to destination class. Comparison of these two social measures shows the effect of social mobility and height selection. Our results show that socioeconomic conditions in childhood generate wider inequalities that are then offset, in part, by social forces acting to diminish inequalities in adult height. Macro social trends therefore influence the pattern of inequality in this population, and it is the level of mobility over time—in this instance the general trend of upward social mobility between generations—that is important here, in combination with height selection.

We do not argue that social mobility has a major impact on inequalities. From a difference in mean height between the extreme social groups of 2.2 cm, the estimated reduction in inequality is only modest. However, it is the lessening of inequality that is of interest as we had expected inequalities to increase as a result of social mobility. For other health measures, effects of social mobility are less readily established because of changes in health status. However, previous studies suggest that social mobility may have a constraining effect on inequalities in health ("gradient constraint"), but effects are likely to vary, as found in the 1958 cohort (O Manor, unpublished data) and elsewhere.^{14 15} Even so, narrowing inequality for adult

What is already known on this topic

Changes in the structure of society (artefact) and health related social mobility (selection) are thought to generate inequalities in health, but the strength and direction of effects are not fully appreciated

Adult height is a risk marker for cardiorespiratory disease and a useful index with which to assess effects of social mobility

What this study adds

Inequalities in height were not inflated as a result of social mobility and changes in social structure

These social forces acted to obscure an effect of childhood socioeconomic circumstances

Inequalities would have been greater in the absence of the general trend of upward social mobility between generations and the tendency for taller people to be upwardly mobile

height is noteworthy because of its potential to influence the pattern of inequality in some chronic diseases, including coronary heart disease, in later life.⁶⁻¹⁰

Inequalities in height based on adult social position seem to underestimate the effects of socioeconomic differences originating in childhood. This has implications for the perceived scale and causes of inequalities in adult disease, and therefore for policies aimed at reducing inequalities. The involvement of macro level trends linked to structural factors (changing social structures and social mobility) will need to be appreciated. Such trends may be neglected by current evidence based approaches to inequalities,² which tend to emphasise easily measured factors, often at an individual level and usually on a short time scale. Our results show that an unfavourable impact of childhood circumstances on adult height is partly obscured by changing social structures and that an understanding of such effects is needed to tackle current patterns of health inequality.

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Impact of upward social mobility on population mortality: analysis with routine data

Richard F Heller, Patrick McElduff, Richard Edwards

Abstract

Objective To examine the contribution of changes in the distribution of social class to the mortality of the whole population between 1970-2 and 1991-3.

Design Examination of routine data at two time points: 1970-2 and 1991-3.

Data source Data provided by the Office for National Statistics.

Main outcome measures Difference for the total population in the number of deaths between 1971 and 1991. Proportion of difference accounted for by change in population size, change in risk of death within each social class, or change in distribution of population across social classes.

Results Reductions in mortality between 1970-2 and 1991-3 among men in England and Wales were partially (16% of all deaths) attributable to increases in the proportion of men in higher social classes, representing 3943 fewer deaths per year or one less death for every 3056 men in 1991-3 compared with 1970-2.

Conclusion Some of the observed reduction in mortality seen between 1970-2 and 1991-3 can be accounted for by improved overall socioeconomic status of the population.

Introduction

In recent years the topic of health inequality has developed increasing social and political importance, and one of the spurs to this has been the demonstration of a large and widening gap in death rates between the extremes of the social distribution.¹⁻⁴ However, this may give a distorted view of the overall level of health inequality due to social class differentials as it does not take into account the changing distribution of social class within the whole population.

Between 1970-2 and 1991-3 mortality in the higher and lower social classes diverged in England and Wales, but there was also a reduction in the proportion of people in the lower social classes.

We assessed the potential impact of changes in the composition of social class on population mortality. To do so, we measured the contribution of changes in the risk of death within social classes and changes in the distribution of the population between social classes to the change in total deaths between 1970-2 and 1991-3.

Methods

The data for this analysis were provided by the Office for National Statistics and were analysed only for men aged 25-64 years. Social class, defined by the registrar