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Mortality in adults aged 26-54 years related to socioeconomic conditions in childhood and adulthood: post war birth cohort study

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Abstract

Objective To examine premature mortality in adults in relation to socioeconomic conditions in childhood and adulthood.

Design Nationally representative birth cohort study with prospective information on socioeconomic conditions.

Setting England, Scotland, and Wales.

Study members 2132 women and 2322 men born in March 1946 and followed until age 55 years.

Main outcome measures Deaths between 26 and 54 years of age notified by the NHS central register.

Results Study members whose father's occupation was manual at age 4, or who lived in the worst housing, or who received the poorest care in childhood had double the death rate during adulthood of those living in the best socioeconomic conditions. All indicators of socioeconomic disadvantage at age 26 years, particularly lack of home ownership, were associated with a higher death rate. Manual origins and poor care in childhood remained associated with mortality even after adjusting for social class in adulthood or home ownership. The hazard ratio was 2.6 (95% confidence interval 1.5 to 4.4) for those living in manual households as children and as adults compared with those living in non-manual households at both life stages. The hazard ratio for those from manual origins who did not own their own home at age 26 years was 4.9 (2.3 to 10.5) compared with those from non-manual origins who were home owners.

Conclusions Socioeconomic conditions in childhood as well as early adulthood have strongly influenced the survival of British people born in the immediate post war era.

Introduction

Risks to long term survival may begin early in life. Modest associations between socioeconomic conditions in childhood and mortality in adulthood have been found in some,¹⁻¹¹ but not all,¹²⁻¹⁴ studies after taking account of socioeconomic circumstances in adulthood. The associations are generally stronger for mortality from cardiovascular disease.^{2 4-6 9 10 14-16} With few exceptions,^{8 11} most previous studies have been retrospective,^{1 3-5 13 16} unrepresentative of the general population,^{3-6 10 15 16} not included women,^{2-4 10 14 16} examined only one indicator of socioeconomic conditions in childhood,^{1-4 9 10 14 16} or controlled inadequately for socioeconomic conditions in adulthood.^{5 6} Few studies have covered post war generations that may have had a healthier and more equitable start to life than earlier generations.^{2 8 14 17} We examined premature mortality in adults in a nationally representative British birth cohort in relation to prospective measures

of socioeconomic conditions in childhood and adulthood.

Methods

The Medical Research Council's national survey of health and development comprises a prospective national cohort of 2547 women and 2815 men; a socially stratified sample of all births that took place in England, Scotland, and Wales during 3-9 March 1946.¹⁸ Sufficient adult deaths have now accrued to provide 90% power at the 5% significance level to detect a doubling of the adult all cause mortality at any age in those from a household in which the father's occupation was manual when the study member was aged 4 compared with non-manual family of origin.

Age 26 years was taken as the start of follow up for our analysis because at that age study members were flagged for death on the NHS central register, and a home visit provided information on socioeconomic conditions in adulthood. The sample available for analysis was thus cohort members who were alive and resident in Britain in 1971. By then 881 of the original 5362 had already died or emigrated, and we excluded a further 27 because they were not flagged on the central register, leaving 4454 available for analysis. Ethical approval for our study came from the North Thames Multicentre Research Ethics Committee.

Indicators of socioeconomic conditions

Indicators in childhood

Indicators of socioeconomic conditions in childhood, based on information from interviews of the mother at home by health visitors, included father's social class when the study member was aged 4 years (manual or non-manual) and parental education (more than primary level or not). A score for housing quality allocated one point for each of dwelling in very good repair, dwelling built since 1919, and no overcrowding (no more than 1.5 people per room). A score by the health visitor for care of the house and child allocated one point for each of very clean house, very clean child, at least adequate shoes, at least adequate clothes, and mother coped well. Three comparable sized groups were defined for each score.

Indicators in adulthood

Indicators of socioeconomic conditions at age 26 years were two measures of household social class (one based on the study member's occupation (if male) or the occupation of the study member's partner (if female) and a sex neutral measure based on the occupation given the highest social class), net income (distinguishing the bottom two fifths (equivalent to less than £30 per week or £120 per month in 1972) from the top three fifths), home ownership (yes or no), and educational qualifications (yes or no).

Analysis

We used survival curves, obtained from the Kaplan-Meier method, to compare the cumulative death rate between 26 and 54 years for those in the disadvantaged groups with those in the most advantaged group. We used Cox's proportional hazards models to investigate the relations between socioeconomic conditions and adult mortality. We checked the proportional hazards assumption. Follow up time (in months) was from the cohort's 26th birthday until the first of death, emigration, or the end of February 2001, just before the cohort's 55th birthday. If death had not occurred, follow up was treated as censored. Firstly, we considered each indicator of socioeconomic conditions in childhood separately and checked whether any of the alternative measures were associated with mortality once the father's social class was taken into account. Secondly, we repeated this strategy for the indicators of socioeconomic conditions in adulthood. Thirdly, we investigated the effect of social class in

childhood on adult mortality adjusted for adult social class for those with complete information (3117 study members). We modelled other pair combinations to investigate if they exhibited similar patterns. Finally, we tested whether our findings changed when we included cigarette smoking at 26 years. We present weighted hazard ratios that account for the initial sampling procedure, with correctly adjusted confidence intervals and P values, using Software for the Statistical Analysis of Correlated Data (SUDAAN, Research Triangle Institute, NC).

Results

Table 1 lists the characteristics of the sample. The increase in educational level and non-manual occupations of study members compared with their parents reflects the changing social and economic structure of British society.¹⁹

Table 1 Characteristics of sample

	No of study members (unweighted)			Unweighted%	Weighted%
	Women	Men	Total		
Childhood socioeconomic conditions					
Father's social class:					
Non-manual	823	892	1715	40.2	24.2
Manual	1222	1334	2556	59.8	75.8
No (deaths) in sample	2045 (89)	2226 (112)	4271 (201)		
Father's education:					
Secondary level	535	588	1123	28.5	18.5
Primary level only	1367	1455	2822	71.5	81.5
No (deaths) in sample	1902 (87)	2043 (103)	3945 (190)		
Mother's education:					
Secondary level	414	476	890	22.3	15.3
Primary level only	1504	1599	3103	77.7	84.7
No (deaths) in sample	1918 (86)	2075 (106)	3993 (192)		
Housing quality (at age 4 years):					
Good or intermediate	1078	1081	2159	52.4	46.8
Intermediate	507	575	1082	26.3	27.5
Worst	395	484	879	21.3	25.6
No (deaths) in sample	1980 (90)	2140 (106)	4120 (196)		
Care of house and child (at age 4 years):					
Best	774	794	1568	40.8	34.9
Intermediate	478	521	999	26.0	26.1
Worst	594	679	1273	33.2	39.1
No (deaths) in sample	1846 (83)	1994 (102)	3840 (185)		
Adult socioeconomic conditions (26 years)					
Household social class:					
Non-manual	974	946	1920	50.9	43.2
Manual	883	968	1851	49.1	56.8
No (deaths) in sample	1857 (79)	1914 (90)	3771 (169)		
Highest social class:					
Non-manual	1412	1363	2775	73.6	68.3
Manual	445	551	996	26.4	31.7
No (deaths) in sample	1857 (79)	1914 (90)	3771 (169)		
Own educational qualifications:					
Any qualifications	1198	1290	2488	60.0	52.7
No qualifications	792	868	1660	40.0	47.3
No (deaths) in sample	1990 (84)	2158 (110)	4148 (194)		
Household income:					
Top three fifths	933	1019	1952	57.0	56.8
Bottom two fifths	745	729	1474	43.0	43.2
No (deaths) in sample	1678 (76)	1748 (89)	3426 (194)		
Housing tenure:					
Owner occupier	886	776	1662	45.5	45.6
Other	910	1084	1994	54.5	54.4
No (deaths) in sample	1796 (79)	1860 (92)	3656 (171)		

Table 2 Hazard ratios (95% confidence intervals) for mortality between ages 26 and 54 years for indicators of socioeconomic conditions in childhood

Indicator	Total sample*	P value	Women†	Men†
Father's social class:				
Non-manual	1.0	<0.001	1.0	1.0
Manual	1.9 (1.3 to 2.6)		2.5 (1.4 to 4.5)	1.5 (0.93 to 2.3)
Father's education:				
Secondary level	1.0	0.134	1.0	1.0
Primary level only	1.4 (0.91 to 2.0)		1.7 (0.92 to 3.3)	1.1 (0.67 to 1.9)
Mother's education:				
Secondary level	1.0	0.254	1.0	1.0
Primary level only	1.3 (0.84 to 1.9)		2.2 (1.1 to 4.5)	0.92 (0.55 to 1.6)
Housing quality (at age 4 years):				
Good or intermediate	1.0	0.008	1.0	1.0
Intermediate	1.2 (0.78 to 1.8)		1.0 (0.77 to 1.4)	1.3 (0.96 to 1.8)
Worst	1.7 (1.2 to 2.5)		2.2 (1.2 to 3.8)	1.3 (0.76 to 2.4)
Care of house and child (at age 4 years):				
Best	1.0	<0.001	1.0	1.0
Intermediate	1.2 (0.7 to 1.9)		1.8 (0.88 to 3.5)	0.77 (0.39 to 1.5)
Worst	2.1 (1.4 to 3.2)		2.4 (1.3 to 4.3)	1.9 (1.1 to 3.3)

Hazard ratios obtained from Cox's proportional hazards models.
 *Adjusted for sex only.
 †Unadjusted.

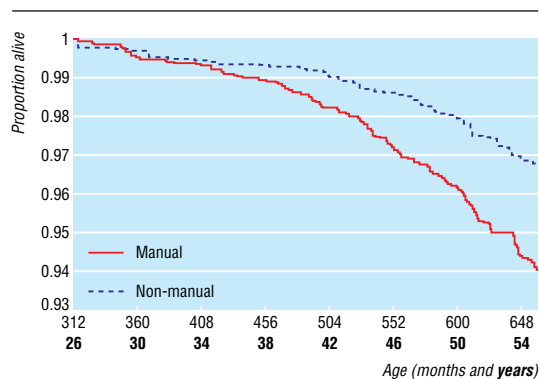
Table 3 Hazard ratios (95% confidence intervals) for mortality at between ages 26 and 54 years for father's social class and care of house and child based on 3773 study members and 180 deaths

	Adjusted*	P value	Adjusted†	P value
Father's social class:				
Non-manual	1.0	<0.001	1.0	0.001
Manual	2.2 (1.5 to 3.2)		1.9 (1.3 to 2.7)	
Care of house and child (at age 4 years):				
Best	1.0	0.001	1.0	0.007
Intermediate	1.2 (0.76 to 2.0)		1.1 (0.70 to 1.9)	
Worst	2.1 (1.4 to 3.1)		1.8 (1.2 to 2.8)	

Hazard ratios obtained from Cox's proportional hazards model.
 *Adjusted for sex only.
 †Adjusted for both socioeconomic indicators and sex.

Socioeconomic conditions in childhood and adult mortality

Overall, 120 men and 93 women died between 26 and 54 years of age. Both sexes had similar death rates (hazard ratio 0.95, 95% confidence interval 0.69 to 1.3). By 54 years study members from manual origins were twice as likely as those from non-manual origins to have died (6% *v* 3%; figure). Sex adjusted estimates from a Cox's proportional hazards model confirmed that the rate was almost double across all ages (table 2). The difference was less for men (1.5, 0.93 to 2.3) than



Cumulative death rates age 26 to 54 years by father's social class in 4271 (201 deaths) men and women born in March 1946

for women (2.5, 1.7 to 3.8), although a test for interaction between father's social class and sex was not significant.

The hazard ratios (worst versus best) for the scores for housing quality and care of house and child were similar to the ratio associated with social class of origin (table 2). The increase in rates associated with low levels of paternal or maternal education was smaller. For each indicator the difference in death rate between advantaged and disadvantaged groups was larger for women than it was for men, in particular for maternal education. The score for care of the house and child was the only indicator with an additional effect on mortality once father's social class was taken into account (table 3).

Socioeconomic conditions in young adult life and subsequent mortality

Study members living in manual households at age 26 years had almost double the death rate of those in non-manual households (1.9, 1.3 to 2.7) (table 4). The effect for women increased slightly and the effect for men decreased slightly when the sex neutral measure was used. Mortality was also higher for the disadvantaged group on all the other indicators of socioeconomic conditions in adulthood. Home ownership but not net income or education had an additional effect on mortality when each was added separately to a model including household social class.

Combined effects of socioeconomic conditions in childhood and adulthood on mortality

Father's social class and the score for care of house and child remained significant when each was adjusted separately for adult social class, then home ownership (table 5). Estimates from a model including father's social class and adult social class and their non-significant interaction indicate that those in manual households in childhood and young adulthood had almost a threefold increase in mortality compared with those in non-manual households at each time (2.6, 1.5 to 4.4). Study members who experienced upward social mobility (1.9, 1.0 to 3.5) or downward social mobility (1.3, 0.59 to 2.8) had intermediate rates. The contrast using home ownership was even more noticeable: those from manual origins who did not own their home as young adults had an almost fivefold increase in mortality compared with those from non-manual origins who became owner occupiers (4.9, 2.3 to 10.5). When smoking was included in the model (not shown) the effects weakened slightly but remained significant.

The death rate for those 167 study members with no information about social class in childhood or adulthood was similar to the rest of the cohort. The death rate for those for whom childhood but not adult social class was known (616 study members) was higher than the rate for those who also had a social class measure at both ages (1.7, 1.2 to 2.6). They were more likely to have lived in households with the lowest score for care of house and child at 4 years and were more disadvantaged on all the other socioeconomic indicators in childhood.

Discussion

Men and women from manual social classes in childhood and adulthood were almost three times more likely to die between 26 and 54 years compared with those from non-manual classes at both life stages in a British national cohort born immediately after the second world war. Factors at both life stages had a cumulative effect on the risk of premature mortality in adulthood. The similar effects on mortality of other pairs of social indicators at both life stages reinforced this interpretation. Home ownership probably reflected future as well as current wealth and wealth of the family of origin given the relatively young age at which it was measured (26 years) and the rapidly rising British house prices since the 1970s.¹⁹ In contrast, neither social class at this age nor a single measure of income was likely to reflect accurately socioeconomic position throughout adult life or exposure to persistent poverty.

Loss to follow up was more common among those with a chronic or serious illness in childhood.²⁰ These differences, together with the greater likelihood of socioeconomic disadvantage, probably explain the higher death rate in those without a known social class in adulthood.

The main limitation of our study was the small number of deaths, which restricted investigations of cause of death for about another five years. Around a third of deaths in men between 26 and 54 years were due to circulatory diseases, a third to cancers, and a third to other causes. In women, almost half was due to cancers.

The size of the relation between socioeconomic conditions in childhood and mortality in adulthood in our study is larger than that observed in previous studies. This may be due to the use in most other studies of retrospective recall of conditions in childhood, with more measurement error, which could lead to an underestimate of effect size. Alternatively, the effect of socioeconomic conditions in childhood on mortality in adulthood may be stronger at younger ages, as suggested by time series analyses of Italian mortality data.²¹ Our cohort is still relatively young, and continued follow up will allow us to see if the effects observed before 55 years weaken, remain the same, or strengthen as the cohort ages.

Table 4 Hazard ratios (95% confidence intervals) for mortality at between ages 26 and 54 years for indicators of socioeconomic conditions at age 26 years

Indicator	Total sample*	P value	Women†	Men†
Household social class:				
Non-manual	1.0	<0.001	1.0	1.0
Manual	1.9 (1.3 to 2.7)		1.7 (1.0 to 2.9)	2.1 (1.2 to 3.5)
Highest social class:				
Non-manual	1.0	<0.001	1.0	1.0
Manual	1.9 (1.3 to 2.6)		2.0 (1.2 to 3.3)	1.8 (1.1 to 2.9)
Own educational qualifications:				
Any qualifications	1.00	0.002	1.00	1.00
No qualifications	1.7 (1.2 to 2.4)		1.5 (0.92 to 2.5)	1.9 (1.2 to 2.9)
Household income:				
Top three fifths	1.00	0.013	1.0	1.00
Bottom two fifths	1.6 (1.1 to 2.3)		1.7 (1.0 to 2.9)	1.5 (0.89 to 2.4)
Housing tenure:				
Owner occupier	1.0	<0.001	1.0	1.0
Other	2.6 (1.7 to 4.0)		2.8 (1.6 to 5.0)	2.4 (1.4 to 4.3)

Hazard ratios obtained from Cox's proportional hazards models.

*Adjusted for sex only.

†Unadjusted.

The effect of socioeconomic conditions in childhood on mortality in adulthood may also vary by cohort. For example, no effect of socioeconomic conditions in childhood on all cause or cardiovascular mortality was seen in a Finnish cohort of men who spent the early years of their life under war conditions.¹³ The authors argued that the impact of the second world war may have distorted the effect. In a follow up study of a cohort of children who grew up during the depressed 1930s in Britain those with unemployed fathers had the highest death rate.⁶ Our early post war cohort was exposed to food rationing, and welfare and educational reforms intended to provide a more equitable start to life than that experienced by earlier born British cohorts. We might have expected that inequalities in death would have been reduced, but we found no evidence of this.

Despite variations in the size of the effect, the general conclusion from this and other studies is that not all the effects of socioeconomic conditions in childhood on mortality in adulthood are mediated through differential exposure to socioeconomic conditions in adulthood. Nor is there much evidence that behavioural risk factors in adults mediate these effects.^{3 5 10 15 16} Alternatively, socioeconomic conditions

Table 5 Hazard ratios (95% confidence intervals) for mortality at between ages 26 and 54 years for different pairs of socioeconomic indicators in childhood and adulthood based on 3117 study members and 137 deaths

	Adjusted*	P value	Adjusted†	P value	Adjusted†	P value	Adjusted†	P value	Adjusted†	P value
Father's social class:										
Non-manual	1.0	<0.001	1.0	0.005			1.0	0.002		
Manual	2.1 (1.4 to 3.3)		1.9 (1.2 to 3.0)				2.1 (1.3 to 3.1)			
Care of house and child:										
0.012										
Best or intermediate	1.0	0.004			1.0				1.0	0.014
Worst	1.8 (1.2 to 2.6)				1.7 (1.1 to 2.5)				1.6 (1.1 to 3.6)	
Household social class:										
Non-manual	1.0	0.030	1.0	0.140	1.0	0.114				
Manual	1.6 (1.0 to 2.4)		1.4 (0.90 to 2.1)		1.4 (0.92 to 2.1)					
Home ownership:										
<0.001										
Yes	1.0	<0.001					1.0	<0.001	1.0	
No	2.4 (1.5 to 3.8)						2.3 (1.5 to 3.6)		2.3 (1.5 to 3.6)	

Hazard ratios obtained from Cox's proportional hazard models.

*Adjusted for sex only.

†Adjusted for both socioeconomic indicators and sex.

What is already known on this topic

Associations between socioeconomic conditions in childhood and mortality in adulthood suggest that risks to survival begin in early life

Studies have been generally retrospective, been unrepresentative, used only one marker of childhood conditions, controlled inadequately for adult conditions, or not included women

What this study adds

The death rate for women and men between 26 and 54 years living in poor socioeconomic conditions in childhood was double that of those living in the best conditions

Those for whom socioeconomic disadvantage continued into early adulthood were between three and five times more likely to die than those in the most advantageous conditions

in childhood may be markers of causal factors for specific diseases operating in childhood or fetal life. These include poor nutrition and growth, illness, and stress.^{20 22-24} Research should focus on the extent to which these factors account for the observed relation between socioeconomic conditions early in life and adult disease and mortality to identify possible underlying risk processes.

Contributors: DK conceived and designed the study, conducted the analyses, and drafted and revised the paper; she will act as guarantor for the paper. RH provided statistical advice and help with interpreting and writing up the methods and results. All contributors discussed the design of the analyses and helped to revise the paper.

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