Are childhood socio-economic circumstances related to coronary heart disease risk? Findings from a population-based study of older men

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Background The independent influence of childhood social circumstances on health in later life remains uncertain. We examined the extent to which childhood socio-economic circumstances are related to the risk of coronary heart disease (CHD) in older British men, taking account of adult social class and behavioural risk factors.

Methods A socio-economically representative sample of 5552 British men (52–74 years) with retrospective assessment of childhood socio-economic circumstances (father’s occupation and childhood household amenities) who were followed up for CHD (fatal and non-fatal) for 12 years.

Results Men whose childhood social class was manual had an increased hazard ratio (HR) 1.34 (95% CI 1.11–1.63)—this effect was diminished when adjusted for adult social class and adult behavioural risk factors (cigarette smoking, alcohol, physical activity and body weight) (HR 1.19; 95% CI 0.97–1.46). Men whose family did not own a car in their childhood were at increased CHD risk even after adjustments for adult social class and behaviours (HR 1.35, 95% CI 1.04–1.75). Men with combined exposure to both childhood and adult manual social class had the highest risk of CHD (HR 1.51; 95% CI 1.19–1.91); this was substantially reduced by adjustment for adult behavioural risk factors (adjusted HR 1.28; 95% CI 0.99–1.65).

Conclusions Less affluent socio-economic conditions in childhood may have a modest persisting influence on risk of CHD in later life.

Keywords Childhood social circumstances, adult social class, behavioural risk factors, CHD, old age

Introduction The growing burden of chronic diseases in addition to the current increase of an ageing population is a public health problem faced by many parts of the developed and developing world. Therefore, researching pathways to ill health in the elderly will help improve our understanding of ways in which the burden of chronic diseases in older people may be lessened. One of the possible pathways is through the environment in early life which affects the development of chronic diseases such as coronary heart disease (CHD).1 There is evidence supporting the association of childhood social class with CHD independent of adult social class.2–4 But many of these (7 of the 10 studies in a systematic review)2–3 have not additionally taken into account the role of adult behavioural risk factors, which could be important influences on the relationship between childhood social class and CHD. Some studies, which have done so, have shown mixed results with the association of childhood social class and CHD either diminishing or having a weak positive effect when controlling for adult behavioural...
risk factors. We have previously shown that in middle-age childhood social class was related to CHD prevalence, independent of adult social class and behavioural risk factors. Here we report on the relation of childhood social circumstances to the incidence of CHD in older men studied from 52–74 years over a 12-year period, using both father’s occupation and childhood household amenities as markers. We also investigate the contribution of adult social class and adult behavioural risk factors to the associations observed, and examine the combined effect of childhood and adult social class on CHD.

Methods
The British Regional Heart Study (BRHS) is a prospective study of cardiovascular disease comprising a socially and geographically representative sample of men aged 40–59 years drawn from one general practice in each of 24 towns representing all major British regions in 1978–80. Baseline assessment included standard cardiovascular risk factors measured at study entry in 1978–80. Details of the BRHS are reported elsewhere. In 1992, information on childhood social circumstances in addition to information on lifestyle factors was collected by postal questionnaires. For this article, we use follow-up data on morbidity and mortality from 31 October 1992 to 1 June 2004 and our main outcome of interest was fatal and non-fatal CHD. Information on morbidity and mortality has been routinely collected during the follow-up through general practice records and the National Health Service Central Register, respectively. Non-fatal myocardial infarction was defined by the presence of at least two of—severe prolonged chest pain, ECG evidence of myocardial infarction and cardiac-enzymes changes consistent with myocardial infarction. This was ascertained by reviews of general practitioner records. Information from death certificates using the International Classification of Diseases, 9th revision (ICD-9) was used to identify fatal myocardial infarction cases as deaths with code 410–414 (equivalent to ICD 10th revision codes I20–I25).

Childhood social class
Subjects were asked in the questionnaire about the kind of job their father had done for the longest period of his (father’s) life. This information was used to classify subjects into manual [3752 (71%)] and non-manual [1436 (27%)] childhood social class groups using the Office of Population Censuses and Surveys Classification of Occupations (1980) social class coding index manual. Two hundred and sixty-eight (5%) men who did not report their father’s social class and 115 (2%) men whose fathers’ longest-held occupation was the Armed Forces were excluded from the analyses.

Childhood social circumstances
Besides father’s occupation, information was also collected on childhood household amenities as a proxy for childhood social circumstances and to enable a better assessment of early-life socio-economic position. Subjects were asked if till they were 10 years old their home had a bathroom, hot water supply and family car ownership.

Adult socio-economic status
Subjects’ own adult social class was based on the longest-held occupation of each man recorded at the study entry and classified using the Registrar Generals’ Social Class Classification. In this analysis, we excluded men with longest-held occupation in the Armed Forces, and categorized social classes I, II, III non-manual into ‘non-manual social class’ and III manual, IV and V as ‘manual social class’.

Adult behavioural risk factors
Detailed questions were asked about smoking (number of cigarettes smoked and changes in smoking habits), alcohol consumption (frequency and number of alcoholic drinks), physical activity (frequency and type of activity) and body weight. Body mass index (BMI) was calculated as body weight/(height)^2 using measures of body weight (in kilograms) and height (in metres) measured at the baseline examination. The men were classified into groups based on their alcohol intake—none, occasional, light, moderate and heavy. Heavy drinking was defined as drinking more than six units (1 UK unit = 10 g) of alcohol daily or on most days in the week. In the questionnaire, subjects were also asked to report their pattern of physical activity such as walking, cycling and other sporting activities. Physical activity scores were assigned on the basis of frequency and type of activity and the men were divided into six groups: none, occasional, light, moderate, moderately vigorous and vigorous. Subjects who reported none or occasional activity were classified as ‘inactive’.

Statistical analyses
Cox proportional hazards model was used to calculate age-adjusted hazard ratios (HRs) with 95% confidence intervals (CI) for CHD for those of manual childhood social class compared with those of non-manual childhood social class. We assessed the proportionality assumption for the Cox models by carrying out a test on the Schoenfeld residuals. The assumption was found to be valid for the main explanatory variables—childhood social class and childhood household amenities. The model was then separately adjusted first for adult social class (all six social groups), second for adult behavioural risk factors and finally both for adult social class and behavioural risk factors. Similar hazards ratios were calculated according to childhood household amenities. HRs were also calculated according to adult social class adjusted for childhood social class and then behavioural risk factors. To assess the combined effect of social class and to explore any interaction between childhood and adult social class we categorized subjects into four sub-groups according to both childhood and adult social class—both childhood and adult non-manual social class; childhood non-manual and adult manual social class; childhood manual and adult non-manual; and childhood and adult manual social class. We calculated HRs for CHD for these groups with those of childhood and adult non-manual social class as the reference category. We also carried out a formal test of interaction between childhood and adult social class. To further explore the relationship of behavioural risk factors with childhood and adult social class we calculated the percentage of men who were current smokers, heavy drinkers, inactive and obese (BMI ≥ 30 kg/m^2) according to the
sub-groups of childhood and adult social class. For the adjustments, age and BMI were fitted as continuous variables. Childhood social class (two levels), adult social class (six levels), smoking (six levels), physical activity (five levels) and alcohol intake (five levels) were fitted as ordinal variables. Analyses were carried out using SAS version 8 and STATA version 7.

Results

Among 5552 men aged 64–83 by the end of the follow-up period (55, 380 person-years), there were 645 (1.2% per annum) cases of CHD (372 non-fatal cases, 244 fatal cases and 29 had both a non-fatal and fatal event). Table 1 describes the demographic characteristics of the subjects according to childhood and adult social class. Eighty-five per cent of men of adult manual social class had a manual childhood social class. The proportion of men lacking childhood amenities and with adverse behavioural risk factors was higher in those of manual childhood social class and among those of manual adult social class.

Table 2 shows the number of CHD events and the relative risk of CHD according to childhood and adult social class groups. Those of manual childhood social class had a greater risk of CHD compared with those of non-manual childhood social class. This effect, though modest in size, was statistically significant when adjusted for adult social class. In an age-stratified analysis, the association appeared to be present both

<table>
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<tr>
<th>Table 1 Demographic characteristics of subjects in the BRHS aged 52–73 in 1992 according to childhood and adult social class</th>
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<td>Childhood social class</td>
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<tr>
<td>Age—mean in years (SD)</td>
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<tr>
<td>Adult manual social class—n (%)</td>
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<tr>
<td>No bathroom in childhood home—n (%)</td>
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<tr>
<td>No hot water supply in childhood home—n (%)</td>
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<tr>
<td>No family access to car in childhood—n (%)</td>
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<tr>
<td>Current smokers—n (%)</td>
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<tr>
<td>Heavy drinkers—n (%)</td>
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<td>Physically inactive—n (%)</td>
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<td>Overweight (BMI ≥ 25 kg/m²)—n (%)</td>
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<th>Table 2 Hazard ratios (HR) with 95% confidence intervals (CI) for coronary heart disease (CHD) according to childhood and adult social class and childhood household amenities in a prospective study of British men aged 52–73 years followed up from 1992 to 2004</th>
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<td>Childhood social class</td>
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<td>Childhood social class</td>
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<td>Non-manual</td>
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<td>Manual</td>
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<td>Adult social class</td>
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<td>Non-manual</td>
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<td>Manual</td>
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<tr>
<td>Bathroom in childhood home</td>
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<tr>
<td>Yes</td>
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<td>No</td>
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<td>Hot water supply in childhood home</td>
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<td>Yes</td>
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<tr>
<td>No</td>
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<tr>
<td>Family access to car in childhood</td>
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<td>Yes</td>
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<td>No</td>
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aAdjusted for childhood social class.

bAdult behavioural risk factors included smoking, alcohol, physical activity and BMI.
Table 3  Coronary heart disease (CHD) rate per 1000 person-years and HR with 95% CI for CHD according to childhood and adult social classes in a prospective study of British men aged 52–73 years followed-up from 1992 to 2004

<table>
<thead>
<tr>
<th>Groups according to childhood and adult social class</th>
<th>CHD rate per 1000 person-years</th>
<th>Hazard ratio (HR) (95%CI)</th>
<th>Hazard ratio (HR) (95%CI)</th>
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<tbody>
<tr>
<td>n</td>
<td>Childhood</td>
<td>Adult</td>
<td>Age-adjusted</td>
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<td>-------------</td>
</tr>
<tr>
<td>1</td>
<td>985</td>
<td>Non-manual</td>
<td>Non-manual</td>
</tr>
<tr>
<td>2</td>
<td>404</td>
<td>Non-manual</td>
<td>Manual</td>
</tr>
<tr>
<td>3</td>
<td>1298</td>
<td>Manual</td>
<td>Non-manual</td>
</tr>
<tr>
<td>4</td>
<td>2341</td>
<td>Manual</td>
<td>Manual</td>
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</table>

*Adult behavioural risk factors included smoking, alcohol, physical activity and BMI.

Table 4  Adult behavioural risk factors according to childhood and adult social classes in a prospective study of British men aged 52–73 years followed-up from 1992 to 2004

<table>
<thead>
<tr>
<th>Groups according to childhood and adult social class</th>
<th>Current smokers (n = 931)</th>
<th>Heavy drinking (n = 199)</th>
<th>Inactive (n = 1589)</th>
<th>Obese (BMI ≥ 30 kg/m²) (n = 533)</th>
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<tbody>
<tr>
<td>Group</td>
<td>Childhood</td>
<td>Adult</td>
<td>n (%)</td>
<td>n (%)</td>
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</tr>
<tr>
<td>1</td>
<td>Non-manual</td>
<td>Non-manual</td>
<td>122 (12)</td>
<td>46 (5)</td>
</tr>
<tr>
<td>2</td>
<td>Non-manual</td>
<td>Manual</td>
<td>65 (16)</td>
<td>13 (3)</td>
</tr>
<tr>
<td>3</td>
<td>Manual</td>
<td>Non-manual</td>
<td>172 (13)</td>
<td>44 (3)</td>
</tr>
<tr>
<td>4</td>
<td>Manual</td>
<td>Manual</td>
<td>577 (24)</td>
<td>98 (4)</td>
</tr>
</tbody>
</table>

in the older (>63 years) and younger subjects (<63 years) in the cohort (data not shown). Including additional measures of adult socio-economic position (car and house ownership) made little difference to these estimates (data not shown). The effect of childhood social class was diminished when adjusted for adult behavioural risk factors (Table 2). Adjustment for both adult social class and behavioural risk factors did not substantially alter the effect estimates after adjustment for behavioural risk factors alone (Table 2). Further adjustment for town of birth or region of residence in adult life (at the time of recruitment in the study) made very little difference to the reported effect of childhood social class on CHD risk. Adjustment for other cardiovascular risk factors measured at baseline screening including blood cholesterol, blood pressure and blood glucose also did not materially affect these results. Men of manual adult social class had a greater risk of CHD compared with non-manual, but the strength of this association was weaker than that seen for childhood social class. The effect of adult social class was diminished when adjusted for childhood social class.

Table 2 also shows the HRs for CHD in relation to different childhood household amenities. Those whose family did not own a car had a higher CHD risk and this remained statistically significant even after adjusting for adult social class and behavioural risk factors. When we combined these childhood social amenities and father’s social class in a score, this showed no consistent evidence of a higher CHD risk with increasing number of these adverse childhood social circumstances (P = 0.19).

We examined the combined effect of social class in childhood and adulthood on risk of CHD. Table 3 shows CHD rates per 1000 person-years and age-adjusted relative risk of CHD according to childhood and adult social class with non-manual childhood and adult social class group as the reference group (group 1). CHD risks were lowest in this reference group and highest in those with both childhood and adult manual social class (group 4). Exposure to manual social class either in childhood or as adults (groups 2 and 3) was also associated with increased CHD risk. However, higher levels of current smoking, physical activity and obesity were found in these groups (Table 4) with the highest levels in those exposed to both childhood and adult manual social class (group 4). Adult manual workers had higher levels of smoking and physical activity than all non-manual workers irrespective of childhood social class (groups 2 and 4 vs groups 1 and 3); childhood social class had an influence on obesity irrespective of adult manual social class.

Table 3 also shows the relative risk for CHD adjusted for these behavioural risk factors according to childhood and adult social class. Adjustment for adult behavioural risk factors substantially reduced the increased relative risk seen in those of both childhood and adult manual social class (group 4); the increased risk was of borderline significance (HR 1.28; 95% CI 0.99–1.65). The greater relative risks of CHD in those of manual social class either in childhood or as adults (groups 2 and 3) were also attenuated when adjusted for adult behavioural risk factors. A test for interaction between childhood and adult social class showed no evidence that the effect of childhood social class was different in those of adult non-manual and manual groups (P = 0.48). There was no evidence that the relation of adult behavioural risk factors with CHD incidence differed according to childhood social class (P-value for tests of interaction for smoking = 0.27, alcohol = 0.17, physical activity = 0.21, BMI = 0.25). There was no association between...
any of the childhood socio-economic measures and stroke (data not shown).

Discussion
We have previously shown that in middle-aged men (52–74 years) childhood social class was related to prevalent CHD independent of adult social class and behavioural risk factors.23 In this report we extend our observations to incident CHD in this population of older men, examine other measures of socio-economic position in childhood as well as investigate the combined effect of social class in early life and adulthood with incident CHD. We observed that the relation of childhood social class with subsequent CHD risk was diminished when adult behavioural risk factors were taken into account. The combination of manual childhood and adult social class appeared to increase CHD risk further but this was attenuated by adult behavioural risk factors. Lack of family car ownership in childhood had an independent relationship with increased CHD risk.

Our findings are consistent with previous studies of the relationship between childhood social circumstances and CHD.16 Previous studies have indicated that less favourable childhood socio-economic conditions were associated with increased CHD risk; the size of the associations were also mostly weak as seen in our study.2,16 A small number of earlier studies have taken into account the additional role of adult behavioural risk factors (which can be important influences on the relation between childhood social class and CHD), showing that adjustment reduces the influence of childhood social circumstances on CHD.5,6,8 Previous studies have also shown that social circumstances in childhood were associated with increased accumulation of adult risk factors17–19 and some have reflected a similar difference in the influence of childhood and adult social class on adult risk factors.20–22 The absence of any relation between most childhood household amenities (access to bathroom, hot water and overcrowding) with CHD risk is consistent with recent findings from the British Women's Heart and Health Study, which suggested that childhood infections as a result of poor household conditions are unlikely to be an important pathway to increased CHD risk in adulthood.27

Our results are based on a population-based socioeconomically representative sample of men from across Britain, with high rates of follow-up for morbidity and mortality. The childhood social class measure was based on the longest-held occupation of the father, which is likely to be a stable measure of childhood social status, with social mobility in the father's generation probably less marked than among men in the generation of our study, who were more influenced by widened educational opportunities. A limitation of our study is that the measures of childhood social class are based on retrospective collection of information, raising the possibility both of random error and recall bias. Recall bias, particularly a tendency to overestimate social status, has been previously demonstrated for father's occupation, when compared with information collected in early life.23 However, the validity of the father's social class measurement is suggested by its strong relationship with educational attainment of the subjects; a markedly lower proportion of subjects with fathers in manual occupations were educated after 18 years of age and a higher proportion left education at 14 years. Recall bias is less likely to affect recall of family amenities in childhood, particularly car ownership. The accuracy of adult social class (based on occupation and used in adjusted analyses) is also important. Our measure was based on longest-held occupation recorded at study entry in 1978–80 when the subjects were aged 40–59 years. We have already established that this measure was stable over a 20-year period, changing in only a small proportion (<10%) of subjects.24 Moreover, the addition of other measures of adult social status (including car ownership and housing tenure) had little effect on the results. Our measures of social status after retirement are however limited, allowing the possibility of some residual social confounding.

The strength and statistical significance of the association of childhood social class with CHD risk in our study was strongly dependent on whether adjustment was made for adult social class and, particularly adult behavioural risk factors. The interpretation of these adjusted analyses depends on whether adult social class and adult behavioural risk factors are regarded as confounders of the childhood social class–CHD association, or mediators of it. Childhood social status is strongly related to adult social position,17 and the adult behavioural risk factors are themselves affected both by early life and adult social conditions.17,21 In the present study, obesity in particular was strongly related to childhood social class, while the other behavioural risk factors were more strongly influenced by adult social class. While we have to an extent explored the different effects of childhood and adult social class on risk factors, it was not possible in our study to fully disentangle the issue of whether these risk factors are mediators or confounders, though the former remains a strong possibility, suggesting that unadjusted analyses may provide a truer indicator of the association. In the case of family car ownership in childhood, the association with CHD risk was however substantially independent of adjustment, though (like that for childhood social class) limited in strength. The persistence of this effect of childhood circumstances in our older population is noteworthy. There are possible reasons why lack of family car ownership retained an independent relationship with CHD. First, the question on family car ownership may have been less prone to recall bias or misclassification compared with other questions on father's occupation or other childhood amenities. Second, family car ownership during the childhood of our subjects (approximately in the 1930s and 1940s) may be a better or stronger marker of material wealth or social affluence. Thus, owning a car probably discriminated the very affluent from the rest, something that was not fully captured using the father's occupation-based social class distinction. It has been previously shown in our study that in adults material wealth such as car ownership discriminates mortality even within occupational social class groups.25 A higher CHD risk in those lacking family car access, not necessarily indicating poverty as such, probably reflects the relative difference in wealth when compared with those who had a family car. It is possible that the effect of adverse childhood social circumstances would be more apparent using more precise markers of resource income. This also highlights that the strength of the association of childhood social
circumstances with CHD in later life in observational studies can differ according to the measures used to assess social class in early life as was pointed out in a recent report.26

Different mechanisms have been postulated to understand how childhood or early life factors affect health in later life.27,28 Exposures acting during a specific period which influence the development of chronic diseases forms the basis of the ‘critical period model’ or ‘critical period with later effect modifiers’ if modified by exposures in later life. The other pathway to chronic diseases is the ‘accumulation of risk model’. According to this model, adverse exposures accumulate over the lifecourse gradually increasing the risk to worse adult health outcomes.16,28 This accumulation of risk can either occur in a dose-response fashion or through clustering of exposures such as low birthweight, poor diet, lower educational attainment which are all associated with poorer childhood social conditions.28 Adverse exposures can also accumulate by forming chains of risk where one exposure increases the risk of another.

Although the present study does not allow discrimination between these models, the results (particularly the combined influence of childhood and adult social class) would be consistent with a cumulative model of risk with social circumstances at different stages of the lifecourse contributing to overall risk. However, it remains possible that social exposures, particularly early in life, are critical in their timing. Cohorts with more measures at different stages of the lifecourse are needed to fully substantiate the accumulation of risk model.

**Implications of our findings and conclusions**

Our results show that the effect of less affluent childhood social circumstances on CHD risk persists in an older population. Combined exposure to both adverse childhood and adult social circumstances is associated with the most unfavourable lifestyle behaviour. The findings add to the current literature since we have shown that the influence of social conditions in childhood, though modest, persists in old age. Moreover, by this age behavioural risk factors, which can have their origins in childhood and adulthood, play an important role in developing risk of CHD. Thus, as regards to public health policy, a dual approach to improve childhood socio-economic circumstances as well as to target social disparities in behavioural risk factors in adult life will not only help reduce the burden from CHD in older people but also narrow health inequalities.

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**Conflict of Interest:** None declared.

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**KEY MESSAGES**

- Less affluent childhood socioeconomic conditions may have a persistent effect on CHD risk in old age.
- Combined exposure to adverse childhood and adult social circumstances is associated with the most unfavourable lifestyle behaviour and CHD risk.
- Adult behavioural risk factors play an important role in influencing the relation of childhood social factors with CHD risk in later life.

**References**


This research demonstrates that adults who lived in deprived life-course epidemiology during childhood and during adulthood. BMJ 1996;313:1434–38.


