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PAPERS

Socioeconomic conditions in childhood and ischaemic heart disease during middle age

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Abstract

Objective—To examine the association between socioeconomic conditions in childhood and ischaemic heart disease in middle aged men, including the role of physiological and behavioural risk factors.

Design—Prevalence study with extensive examination and testing and with recall of childhood conditions.

Setting—Population based study in Kuopio, Finland.

Subjects—Representative sample of 2679 men aged 42, 48, 54, and 60.

Main outcome measures—Ischaemic findings on progressive maximal exercise test.

Results—Low socioeconomic ~~state~~ status in childhood was associated with significantly higher prevalence of findings indicating ischaemias. Compared with those in the highest tertile of childhood socioeconomic conditions, the age adjusted odds ratio for subjects in the lowest tertile was 1·44 and for those in the middle tertile 1·35. Adjustment for years of cigarette smoking times the average number of cigarettes smoked, ratio of high density lipoprotein to low density lipoprotein cholesterol, fibrinogen and serum selenium concentrations, and adult height did not appreciably weaken the association. Adjustment for adult socioeconomic state resulted in a 16% decline in the association. The association was reduced to non-significance by adjustment for measures of prevalent cardiovascular illness.

Conclusions—Socioeconomic state in childhood was significantly associated with ischaemic heart disease in middle aged men. Levels of risk factors measured at middle age did not account for this association, nor did adult height. Because childhood socioeconomic conditions precede the development of ischaemic heart disease the substantial impact of prevalent illness on the observed association suggests that ischaemic heart disease develops earlier in those with lower socioeconomic state during childhood.

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Introduction

Low socioeconomic state has been shown to be associated with increased risk for a large number of health outcomes.[1-4] The reasons for these associations, however, are not fully understood. For example, although low socioeconomic state was found to be related to higher risk of ischaemic heart disease in several prospective studies,[5-8] this increased risk persisted when risk factors for ischaemic heart disease were taken into account simultaneously. Most recently, several studies have indicated that low socioeconomic state in childhood may also be related to mortality from ischaemic heart disease.[9-13] Although these studies, based on both cohort and ecologic analyses, found such a relation, it is not clear whether the increased risks can be attributed to pathways involving conventional cardiovascular risk factors. For example, Forsdahl suggested that a change from poverty in childhood and adolescence to prosperity in adult life would lead to raised cholesterol concentrations, thereby increasing ischaemic heart disease risk.[10] Though Forsdahl[10] and Arnesen and Forsdahl[14] found evidence to support such a suggestion, Notkola *et al*[11] in their analyses of the Finnish cohort of the seven countries study,[15] found no evidence that raised serum cholesterol concentrations provided the pathway linking childhood socioeconomic conditions and ischaemic heart disease risk in adulthood.

The notion that the risk of ischaemic heart disease in adulthood is set in place during childhood is intriguing and needs further confirmation. Likewise, the role of behavioural and biological pathways in explaining this excess risk needs to be clarified. The purpose of the present study was to examine further the association between socioeconomic conditions during childhood and the risk of ischaemic heart disease using data collected as part of the baseline examination of the Kuopio ischaemic heart disease risk factor study, a population study of a random sample of middle aged men in eastern Finland. The availability of information on adult and childhood economic states, as well as a wide variety of behavioural and physiological measures, allowed us to examine in some detail the association of socioeconomic conditions in childhood with the risk of ischaemic heart disease and the reasons for this association.

Methods

Subjects were drawn from two population based samples of men residing in Kuopio, Finland, and the surrounding rural communities and who participated in cohort 1 or cohort 2 of the Kuopio ischaemic heart disease risk factor study. The target population for cohort 1 consisted of all men born in 1930 or 1931 permanently residing in this area. Eighty five per cent of all eligible men (n=1166) were enrolled in cohort 1 between March 1984 and August 1986, with enrolment in reverse chronological order such that all men were aged 54 at the time of examination. Cohort 2, with enrolment beginning in August 1986 and ending December 1989, consisted of a sample of one third of all men in the same area who were aged 42, 48, 54, and 60 at the time of the examination. The participation rate in cohort 2 was 84% (n=1513). The Kuopio study is an epidemiological investigation of established and unestablished but potentially important risk factors for ischaemic heart disease and of carotid atherosclerosis and the biological pathways that mediate these risk factors.

MEASURES

Childhood socioeconomic conditions—Based on a factor analysis of a large number of variables reflecting

socioeconomic conditions and state during childhood and adult life, a set of six items was identified that reflected socioeconomic conditions during childhood. These items measured father's education and occupational prestige, mother's occupational prestige, whether or not the family lived on a farm and the size of the farm, and whether the family was perceived as being "wealthy." The factor analysis was used only to identify a cluster of items that referred to childhood socioeconomic conditions; factor weights were not used. For each continuous variable the distribution was dichotomised and scores of 1 were assigned for values above the median and 0 for values below the median. The scale of childhood socioeconomic conditions was generated by summing the scores for these six items. The mean for this scale was 2·5 with a median of 3·0. The Chrombach's α, a measure derived from the average inter-item correlation between items on the scale,[16] was 0·60.

Ischaemic heart disease—A small increment, progressive, maximal exercise tolerance test was performed on an electrically braked ergometer. After a warm up of three minutes at 50 watts, the load was raised by 20 watts per minute. Testing was discontinued on exhaustion, symptoms, if there were severe findings on electrocardiography, or if the respiratory gas exchange ratio exceeded 1·2. Electrocardiograms were recorded with the Kone 620 system, which plots the heart rate and ST_{60} deviation from the isoelectric level. ST_{60} deviation was recorded every 30 seconds, based on an average of intervals of five seconds. Ischaemia was defined as horizontal or downward sloping ST segment depression of 0·5 mm or more, typical angina leading to discontinuation of exercise, or maximal heart rate during exercise of less than 130 beats per minute. Of the 2679 men with no missing data, 940 (35·1%) manifested such changes during the exercise test.

Adjustment variables—Information on smoking (years of smoking cigarettes times average number of cigarettes per day), leisure time physical activity (based on a seven day report)[17], alcohol consumption (grams per week), and coffee consumption (grams per day based on a four day record)[18] was collected. Investigations of fasting (12 hour) venous blood samples[19] included determination of platelet aggregability, fibrinogen concentration, ratio of high density lipoprotein to low density lipoprotein cholesterol, insulin sensitivity (based on plasma insulin×blood glucose concentrations), and serum concentration of selenium. Participants were asked for an extensive medical history, including hypertensive state and history, drugs taken, and previous diagnoses of cardiovascular and other conditions. Adult socioeconomic state was measured with a summary index that combined measures of income, education, occupation, occupational prestige, material standard of living, and housing conditions.

Statistical methods—The scale of childhood socioeconomic conditions was divided into tertiles, with all multivariate analyses using two indicator variables to represent the contrast between each of the two lowest tertiles and the highest to avoid assumptions of linearity. Multiple logistic analyses were performed using the CATMOD procedure of SAS.[20] Only covariates that were biologically plausible or significantly associated with ischaemia on exercise were entered into multivariate models.

Relation of childhood socioeconomic state and ischaemia on exercise as adult in 42-60 year old men in eastern Finland. Figures are odds ratios (95% confidence intervals)

Model	Adjustments	Scale of childhood socioeconomic conditions		
		High	Medium	Low
1	Age	1·00	1·35 (1·12 to 1·64)	1·44 (1·17 to 1·78)
2	Age, cigarette years, HDL:LDL cholesterol, fibrinogen, serum selenium	1·00	1·34 (1·11 to 1·62)	1·38 (1·12 to 1·72)
3	Age, adult socioeconomic state	1·00	1·20 (0·98 to 1·45)	1·21 (0·97 to 1·51)
4	Age, height	1·00	1·32 (1·09 to 1·60)	1·38 (1·12 to 1·72)
5	Age, diagnosis of ischaemic heart disease, CVD medications, hypertension years	1·00	1·12 (0·87 to 1·43)	1·17 (0·89 to 1·55)

Results

Ischaemia on exercise was found in 35·1% of the men in the two cohorts. The prevalence of ischaemic changes during exercise as a function of the third of the scale of childhood socioeconomic conditions was 30% in the highest third, 38% in the middle third, and 39% in the lowest third; a prevalence ratio, comparing low with high, of 1·30.

The table shows the results of logistic analyses. With adjustment for age, subjects who reported low socioeconomic state in childhood were at 1·44 times the risk (95% confidence interval 1·17 to 1·78) of ischaemia on exercise than were those who reported high socioeconomic state during childhood (model 1). Those in the middle third were at almost the same level of increased risk as those in the lowest third (1·35 (1·12 to 1·64)). Simultaneous adjustment for years of cigarette smoking times average number of cigarettes per day, ratio of high density lipoprotein to low density lipoprotein cholesterol, and fibrinogen and serum selenium concentrations did not appreciably alter the strength of this association (model 2). Other behavioural and biological covariates were not associated with ischaemia on exercise and were not included in the model. In model 3 adjustment for adult socioeconomic state resulted in a 16% reduction in the association between low socioeconomic conditions in childhood and ischaemia on exercise (odds ratio=1·21 (0·97 to 1·51)). The results of analyses not shown did not indicate any interaction between socioeconomic conditions in childhood and in adulthood on the risk of ischaemia on exercise. These factors were independent predictors. Model 4 indicated that height, a factor thought to be related to childhood socioeconomic state and nutrition, did not confound the association. A final model examined the confounding effect of prevalent illness by including variables that indicated a previous diagnosis of ischaemic heart disease, use of drugs to treat cardiovascular disease, and years since first diagnosis of hypertension. In this model there was a reduction in the magnitude of the association between socioeconomic conditions in childhood and risk of ischaemia on exercise. Those in the lowest third of socioeconomic conditions in childhood had 1·17 times the risk of those in the highest third, with confidence intervals extending below 1·00 (0·89 to 1·55). This reduction in the strength of the association was attributable to the impact of a previous diagnosis of ischaemic heart disease. With adjustment for previous diagnosis of ischaemic heart disease and age those in the lowest third of childhood socioeconomic conditions were at 1·15 (0·88 to 1·52) times the risk of showing ischaemia on exercise as those in the highest third.

Conclusions

As do previous studies these analyses show an association between a measure of economic conditions during childhood and presence of ischaemic heart disease in middle age. There is no evidence that this association is due to any of a variety of behavioural or biological pathways. It should be remembered, however, that ischaemic heart disease develops over years, and the most relevant risk factors may be those that occur substantially before the onset of clinical or even subclinical disease. Although the association between socioeconomic conditions in childhood and ischaemia on exercise was not due to behavioural and

biological risk factors in the lowest third of childhood socioeconomic conditions, examination of these factors in adulthood alone may obscure the earlier effects of such risk factors. For example, earlier development of adverse concentrations of low density lipoprotein cholesterol in subjects in the lowest third of childhood socioeconomic conditions than in subjects in the highest third might put those in the lowest third at higher risk as adults. Thus to understand the mechanisms that underlie the association seen in this study it will be necessary to have information on differences in the course of risk factors, from childhood to adulthood, in subjects in different socioeconomic strata.

The impact of prevalent disease on this association also requires some comment. Although it is true that adjustment for a previous diagnosis of ischaemic heart disease substantially weakens the association between socioeconomic conditions in childhood and the risk of ischaemia on exercise, this should not be interpreted as an indication that prevalent disease is responsible for the association. Because the report of socioeconomic conditions in childhood is an account of events that happened before ischaemic heart disease developed, socioeconomic conditions in childhood may be a causal variable, one of the consequences of which is the development of ischaemic heart disease. One hypothesis is that ischaemic heart disease develops earlier in those with low socioeconomic state during childhood.

Thus possible explanations of the observed results are that, in the cohorts of men studied, risk factors for ischaemic heart disease developed earlier in those with low socioeconomic state in childhood or that clinical and subclinical disease presented earlier, or both. Barker *et al* found that systolic blood pressure in 10 year olds was inversely related to birth weight, suggesting that hypertension and its complication may have developed earlier in subjects from the lower socioeconomic strata, which have higher rates of low birth weight.[21] The Kuopio ischaemic heart disease study is examining the prevalence and progression of carotid atherosclerosis as a function of, among other things, socioeconomic conditions in childhood, and it will consider earlier development and faster progression of disease in subjects with low socioeconomic state during childhood.

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