
Public health

Childhood and adult socioeconomic status as predictors of mortality in Finland

John W Lynch, George A Kaplan, Richard D Cohen, Jussi Kauhanen, Thomas W Wilson, Nicholas L Smith, Jukka T Salonen

Summary

Research has suggested that social-class differences in adult health may be at least partly determined by conditions earlier in life. In 2636 Finnish men, we assessed impact of childhood and adult socioeconomic conditions on adult mortality risk by examining whether differing socioeconomic lifecourses from early childhood to adulthood were associated with different risks of all-cause and cardiovascular mortality.

Compared with high-income adults, those with low income had increased relative risks of all-cause (2.54, 95% CI 1.83–3.53) and cardiovascular (2.37, 1.51–3.7) mortality, but these increased risks were not related in either adult group to childhood socioeconomic conditions. Men who went from low-income childhood to high-income adulthood had the same mortality risks as those whose socioeconomic circumstances were good in both childhood and adulthood (1.14, 0.56–2.31, all causes; 0.99, 0.39–2.51, cardiovascular). By contrast, men who experienced poor socioeconomic circumstances as both children and adults were about twice as likely to die as those whose position improved (2.39, 1.28–4.44, all causes; 2.02, 0.9–4.54, cardiovascular).

Our findings suggest that socioeconomic conditions in childhood are not important determinants of adult health. We caution against this interpretation—a lifecourse approach to socioeconomic differences in adult health requires understanding of the social and economic context in which individual lifecourses are determined.

Lancet 1994; **343**: 524–27

See *Commentary* page 496

Human Population Laboratory, California Department of Community Health Services, 2151 Berkeley Way, Annex 2, Suite 300, Berkeley, CA 94704, USA (J W Lynch MPH, G A Kaplan PhD, R D Cohen MPH, T W Wilson PhD, N L Smith MPH); **and Department of Health and General Practice, Research Institute of Public Health, University of Kuopio, Kuopio, Finland** (J Kauhanen MD, Prof J T Salonen MD)

Correspondence to: Dr George A Kaplan

Introduction

The positive relation between socioeconomic status and health has been consistently found throughout history, for different age groups, and in a variety of countries. Understanding differences in morbidity and mortality between socioeconomic strata of society may require an approach that sees socioeconomic inequality as operating throughout life. Mare¹ pointed out that risks of mortality and morbidity measured at any one time are weighted functions of all past activities and experiences. Dubos et al² used animal models to show how negative events early in life, such as maternal separation, inadequate nutrition, and infection, were linked to slower growth and smaller adult size. Since 1977, when Forsdahl³ reported that poverty during childhood followed by prosperity in adult life was associated with increased serum cholesterol and risk of arteriosclerotic disease, several studies have investigated the association between childhood socioeconomic conditions and adult health.^{4–8} Barker⁹ explored the hypothesis that important determinants of adult health may be established within uterine, infant, and childhood environments, and suggested that adverse health outcomes in adulthood are the long-term consequences of a sub-optimal environment in the uterus or during infancy that may retard fetal growth and early development. This process may be precipitated by inadequate maternal nutrition associated with poor socioeconomic status of the parents.¹⁰

Two mechanisms have been suggested to explain how poor socioeconomic conditions in childhood might be associated with negative adult health outcomes.¹¹ Barker¹² argues that an adverse uterine environment may biologically programme the fetus thus retarding its development and making it susceptible to later disease. Additionally, low socioeconomic status as a child might be associated with conditions and experiences that would predispose toward illness throughout the lifecourse and to premature mortality. Elford and colleagues^{13,14} have reviewed ecological, case-control, and longitudinal studies of association between early-life experiences and adult

cardiovascular disease. They concluded that evidence implicating poor childhood circumstances in adult cardiovascular disease was not wholly convincing. These studies also highlighted the difficulties of disentangling the effects of poor socioeconomic conditions in childhood from those in adulthood, and suggested that future research should include socially mobile groups where the transition from child to adulthood had involved change in socioeconomic status.

We examined the impact on adult mortality of different socioeconomic lifecourses. The purpose of the study was to examine whether different lifecourses were associated with risk of all-cause and cardiovascular mortality in middle-aged men. Information was collected as part of a population-based study of eastern Finnish men.¹⁵ In an effort to overcome some of the deficiencies in previous studies related to the confounding effects of adult socioeconomic status and childhood socioeconomic status, we modelled mortality as a function of an individual's socioeconomic lifecourses from child to adulthood. By grouping individuals in this way, comparisons could be made between adult socioeconomic status and different childhood origins.¹⁶

Methods

Subjects were participants in the Kuopio Ischaemic Heart Disease Risk Factor Study, which was designed to investigate previously unestablished risk factors for ischaemic heart disease and carotid atherosclerosis in a population-based sample of eastern Finnish men.¹⁵ Of 3433 eligible men aged 42, 48, 54, or 60 who resided in the town of Kuopio or its surrounding rural communities, 198 were excluded because of death, serious disease, or migration away from the area; of the remainder, 2682 (82.9%) agreed to participate. Baseline examinations were done between March, 1984, and December, 1989. No striking sociodemographic differences have been found between participants and non-participants.¹⁷ Information on socioeconomic status in both childhood and adulthood was available for 2636 men. The numbers of participants in each age cohort were 330 (12.5%), 353 (13.4%), 1564 (59.3%), and 389 (14.8%).

At baseline examination, individuals reported aspects of their childhood at age 10 such as parents' sociodemographic characteristics, home environment, and childhood experiences. An index of childhood socioeconomic conditions was based on seven items—father's education and occupation, mother's education and occupation, whether or not the family lived on a farm and the size of that farm, and the degree to which their family was perceived as wealthy. These items were scored dichotomously and the scores summed.⁵ Subjects were classified according to approximate index tertiles as either high, medium, or low childhood socioeconomic status.

A variety of indicators of adult socioeconomic status were available, including current income, current and previous occupations, highest level of education, perception of financial security, and housing tenure. In addition, an index of material living conditions was created by summing the number of material possessions from a list of twelve (colour television, dishwasher, car, telephone, &c).¹⁸ The results reported here use current income as the measure of adult status. Analyses of other adult socioeconomic variables showed that income was the strongest predictor of mortality in this group of men. Furthermore, similar findings were obtained when other indicators of socioeconomic status such as education and occupation were used. The measure of current income was divided into low (bottom 40% of income earners) and high (top 60%) categories. Other analyses modelling income continuously, in quintiles, and in tertiles did not change the conclusions of the study.

Socioeconomic lifecourses were created by cross-classifying the index of childhood conditions with those of adult income. Pairing the three levels of childhood conditions with two levels of income as

Socioeconomic status			All-cause mortality		Cardiovascular mortality	
Child	Adult	n (%)	Deaths	Rate (95% CI)	Deaths	Rate (95% CI)
High	High	404 (15.3)	13	34 (15-52)	8	20 (6-35)
Mid	High	709 (26.9)	22	33 (19-46)	12	18 (8-28)
Low	High	478 (18.1)	19	48 (25-66)	10	27 (10-43)
High	Low	140 (5.3)	16	105 (56-154)	5	35 (5-65)
Mid	Low	464 (17.6)	50	97 (71-123)	27	51 (32-70)
Low	Low	441 (16.7)	46	94 (67-121)	23	47 (28-66)
Total		2636 (100)	166	..	85	..

Table 1: Age-adjusted all-cause and cardiovascular mortality rates per 1000 (95% CI) lifecourses in 42-60-year-old Finnish men

an adult produced six lifecourses. Table 1 shows the numbers of men in each. Participants were followed until the end of 1992, with a mean follow-up of 6 years. All-cause and cardiovascular mortality were ascertained by linkage to the National Death Registry, which is maintained for all Finnish citizens. Classification of death was based on the primary cause, reviewed at the National Centre of Statistics of Finland. Cardiovascular deaths were classified according to the 9th revision of the International Classification of Diseases (ICD) for ICD codes 390-459.

Statistical methods

Associations between socioeconomic lifecourses and mortality were assessed with the Cox proportional hazards model,¹⁹ a regression method that explicitly models the relation between a set of risk factors and an outcome, taking into account the times from entry into the study and the outcome, withdrawal from, or termination of the study. Age-adjusted models containing five dummy variables that represented the socioeconomic lifecourses were fitted to the data. The group whose lifecourse was from high childhood socioeconomic status to high adult status was used as the reference.

Results

During the follow-up period there were 166 deaths, 85 due to cardiovascular disease. Table 1 shows the numbers of all-cause and cardiovascular deaths and the associated age-adjusted mortality rates for each of the lifecourses. Table 2 shows the age-adjusted relative risks of all-cause and cardiovascular mortality for each lifecourse, based on the Cox proportional hazards model. Within adult-income groups there were no significant differences in risk for all-cause or cardiovascular death across childhood socioeconomic categories. Compared with the high-adult-income group, those with low adult income had a 2.54 (95% confidence interval [CI] 1.83-3.53) times higher all-cause mortality and 2.37 (1.51-3.70) times higher cardiovascular mortality.

The figure shows proportional-hazards modelling of socioeconomic lifecourses and all-cause mortality. For the groups whose lifecourses resulted in low adult income, high, medium, and low childhood statuses were associated with all-cause mortality risk ratios of 2.93 (1.39-6.17), 2.55

Socioeconomic status		All-cause mortality		Cardiovascular mortality	
Child	Adult	Relative risk	95% CI	Relative risk	95% CI
High	High	1.00	..	1.00	..
Mid	High	0.88	0.44-1.74	0.78	0.32-1.92
Low	High	1.14	0.56-2.31	0.99	0.39-2.51
High	Low	2.93	1.39-6.17	1.59	0.52-4.88
Mid	Low	2.55	1.38-4.70	2.26	1.02-4.99
Low	Low	2.39	1.28-4.44	2.02	0.90-4.54

Derived from proportional hazards modelling and 95% confidence intervals for each lifecourse.

Table 2: Age-adjusted relative risks of all-cause and cardiovascular mortality in 42-60-year-old Finnish men

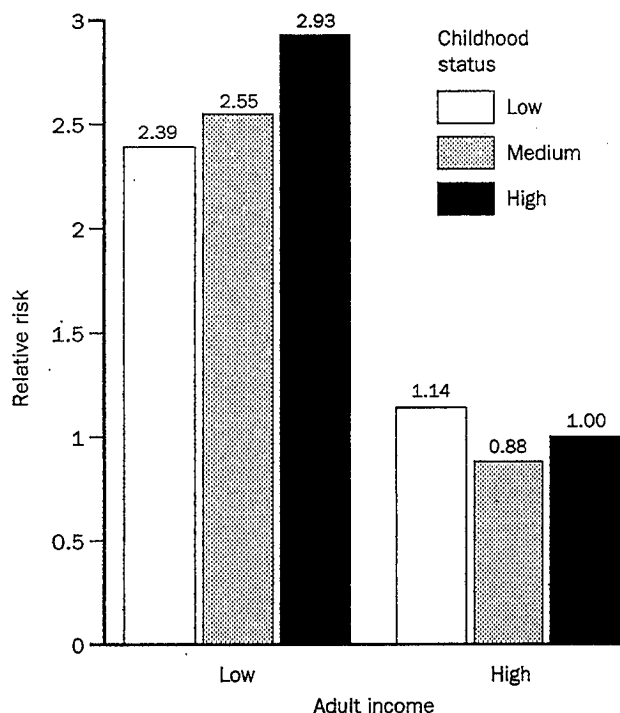


Figure: Proportional hazards age-adjusted relative risks for all-cause mortality by childhood socioeconomic status and adult income levels in 42–60-year-old Finnish men

(1.38–4.70), and 2.39 (1.28–4.44), respectively. For those whose adult income was high, high, medium, and low childhood statuses were associated with all-cause mortality risk ratios of 1.0 (reference category), 0.88 (0.44–1.74), and 1.14 (0.56–2.31), respectively. The highest mortality risk ratio of 2.93 was in the group whose lifecourse was from high childhood status to low adult income. Although the risk ratio for this group was not significantly different from others whose adult income was low, it is noteworthy that men in this group (5%) were more likely to have lost a parent during the 1939–45 war and to report a history of minor mental problems.

A variety of child to adult socioeconomic lifecourses were constructed from the individual items that formed the index of childhood conditions and the available measures of adult socioeconomic status. These analyses showed the same patterns of mortality to those that used the full childhood index of socioeconomic conditions and adult income. In addition, other analyses showed similar findings when urban and rural dwellers or adult occupational subgroups were considered separately.

Discussion

Our analyses show a higher mortality in low-adult-income groups compared with high-adult-income groups. This higher relative risk in the low-adult-income group did not differ by childhood socioeconomic conditions. Misclassification of either childhood or adult socioeconomic status could mask their relation to mortality. If childhood socioeconomic index was a bad measure of the true childhood status then the resulting misclassification could account for the absence of an association in these analyses. Although there is undoubtedly some misclassification in any measure of life circumstances from previous decades, in two studies this same measure

was related to prevalent adult coronary heart disease and fibrinogen concentrations.^{5,18} In addition, multiple measures of both child and adult status were available. Although items such as farm size and perception of family wealth might have been subject to biased recall, parental occupation and education seem less likely to be biased.²⁰ Analyses were done with each individual indicator of childhood socioeconomic status as well as with the items combined to form the index of childhood conditions. These analyses produced the same conclusions regardless of how childhood socioeconomic conditions were measured.

Our findings could be interpreted as a rejection of the idea that socioeconomic conditions in childhood are important factors in adult health. We caution against this interpretation. Firstly, these results largely reflect the mortality experience of study cohorts aged 54 and 60 years; with the relatively short follow-up, only 13 of the 166 deaths occurred in the cohorts aged 42 or 48. Furthermore, as the 54-year-old cohort accounted for almost 60% of the sample, it is worth noting that this group of men was born during the 1930s and so lived most of their first 10 years under war conditions. The 1939–45 war and the ensuing reparations to the allies produced economic devastation for Finland, food shortages, loss of land, and relocation of more than 10% of the population. Although assessment of the impact of the 1939–45 war can only be speculative, it is possible that it may have been so socially, politically, and economically devastating as to distort the impact of childhood socioeconomic conditions. For example, the general socioeconomic context may have been uniformly poor so that there would be no differential long-term effect of childhood circumstances, or the behavioural, social, and psychological disruption during the period may have diluted the general impact of childhood socioeconomic situation.

Secondly, this analysis is limited to assessing the impact of childhood status on adult mortality. There may well be other adult health outcomes for which childhood socioeconomic conditions are an important factor.^{5,7,12,21} Furthermore, there are consistent findings that infant mortality, neonatal health, and infant health are related to socioeconomic conditions and that detrimental impacts on health early in life may be carried over into adulthood.^{22–28}

Finally, the importance of childhood conditions on adult-health outcomes should not be dismissed because destinations may depend on origins.¹⁶ We show here that adult socioeconomic destinations were a better predictor of mortality than childhood origins, but the distribution of adult socioeconomic status in part reflects socioeconomic level when adults were children: social mobility is limited, so that being born into poor circumstances is usually a good predictor of being poor as an adult. Elo and Preston²⁹ argued that even if childhood environments only affect mortality through their connection with adult socioeconomic position they should still be viewed as influencing adult mortality.

We found a lower mortality risk for the 1187 (45%) men who experienced inter-generational upward mobility. These men had the same mortality risk as those whose socioeconomic circumstances were high in both childhood and adulthood. In other words, this group of men were able to overcome a poor start in life, at least in terms of their later mortality. By contrast, the 905 (34%) men who experienced poor childhood circumstances and did not improve their socioeconomic position as adults, were about twice as likely

to die as those who were upwardly mobile. Our findings should be viewed in the context of post-war economic developments in Finland. Singleton³⁰ pointed out that at the end of the 1939–45 was the largely agrarian Finnish economy was exhausted, but by the late 1960s the per-capita gross domestic product had surpassed UK's and continued to increase at twice the UK rate at least until 1985. The results presented here suggest that those who did not materially benefit during a period of economic expansion may be at increased risk of ill health. It is unlikely that a full understanding of the impact of socioeconomic factors in childhood and adulthood can be reached without considering the factors that determine lifecourses and the economic, political, and social contexts in which those lifecourses occur.

Supported in part by grant HL44199 from the National Heart, Lung, and Blood Institute and by grants from the Academy of Finland and the Finnish Ministry of Education.

References

- Mare RD. Socioeconomic careers and differential mortality among older men in the United States. In: Vallin J, D'Souza S, Palloni A, eds. *Measurement and analysis of mortality*. Oxford: Clarendon Press, 1990: 362–87.
- Dubos R, Savage D, Schaedler R. Biological freudianism. Lasting effects of early environmental influences. *Pediatrics* 1966; 38: 789–800.
- Forsdahl A. Are poor living conditions in childhood and adolescence an important risk factor for arteriosclerotic heart disease? *Pediatrics* 1966; 38: 789–800.
- Notkola V, Punsar S, Karvonen MJ, Haapakoski J. Socioeconomic conditions in childhood and mortality and morbidity caused by coronary heart disease in rural Finland. *Soc Sci Med* 1985; 21: 517–23.
- Kaplan GA, Salonen JT. Socioeconomic conditions in childhood and ischaemic heart disease during middle age. *BMJ* 1990; 301: 1121–23.
- Hasle H. Association between living conditions in childhood and myocardial infarction. *BMJ* 1990; 300: 512–13.
- Nyström Peck AM. Childhood environment, intergenerational mobility, and adult health—evidence from Swedish data. *J Epidemiol Community Health* 1992; 46: 71–74.
- Ben-Shlomo Y, Davey Smith G. Deprivation in infancy or in adult life: which is more important for mortality risk? *Lancet* 1991; 337: 530–34.
- Barker DJP, ed. *Fetal and infant origins of adult disease*. London: British Medical Journal, 1992.
- Barker DJP, Osmond CC. The maternal and fetal origins of cardiovascular disease. In: Marmot M, Elliott P, eds. *Coronary heart disease epidemiology*. Oxford: Oxford University Press, 1992: 83–90.
- Lundberg O. The impact of childhood living conditions on illness and mortality in adulthood. *Soc Sci Med* 1993; 36: 1047–52.
- Barker DJP, Gluckman PD, Godfrey KM, Harding JE, Owens JA, Robinson JS. Fetal nutrition and cardiovascular disease in adult life. *Lancet* 1993; 341: 938–41.
- Elford J, Whincup P, Shaper AG. Early life experience and adult cardiovascular disease: longitudinal and case-control studies. *Int J Epidemiol* 1991; 20: 833–44.
- Elford J, Shaper AG, Whincup P. Early life experience and cardiovascular disease—ecological studies. *J Epidemiol Community Health* 1992; 46: 1–11.
- Salonen JT. Is there a continuing need for longitudinal epidemiologic research? The Kuopio Ischaemic Heart Disease Risk Factor study. *Am Clin Research* 1988; 20: 46–50.
- Duncan OD. How destination depends on origin in the occupational mobility table. *Am J Sociol* 1979; 84: 793–803.
- Lakka TA, Salonen JT. Physical activity and serum lipids: a cross-sectional population study in eastern Finnish men. *Am J Epidemiol* 1992; 136: 806–18.
- Wilson TW, Kaplan GA, Kauhanen J, et al. The association between plasma fibrinogen concentration and five socioeconomic indices in the Kuopio Ischaemic Heart Disease Risk Factor Study. *Am J Epidemiol* 1993; 137: 292–300.
- Cox DR, Oakes D. *Analysis of survival data*. New York: Chapman and Hall, 1984.
- Lundberg O. Causal explanations for class inequality in health—an empirical analysis. *Soc Sci Med* 1991; 32: 385–93.
- Lichtenstein P, Harris JR, Pedersen NL, McClearn GE. Socioeconomic status and physical health, how are they related? An empirical study based on twins reared apart and twins reared together. *Soc Sci Med* 1992; 36: 441–50.
- Vägerö D, Östberg V. Mortality among children and young persons in Sweden in relation to childhood socioeconomic group. *J Epidemiol Community Health* 1989; 43: 280–84.
- Östberg V, Vägerö D. Socioeconomic differences in mortality among children. Do they persist into adulthood? *Soc Sci Med* 1991; 32: 403–10.
- Nelson MD. Socioeconomic status and childhood mortality in North Carolina. *Am J Public Health* 1992; 82: 1131–33.
- Nordström M, Cnattingius S, Haglund B. Social differences in Swedish infant mortality by cause of death, 1983 to 1986. *Am J Public Health* 1993; 83: 26–30.
- Hogue CR, Hargraves MA. Class, race and infant mortality in the United States. *Am J Public Health* 1993; 83: 9–12.
- Kent G. *The politics of children's survival*. New York: Praeger, 1992.
- Najman JM, Morrison WB, Andersen M, Williams G. Child development delay and socio-economic disadvantage in Australia: a longitudinal study. *Soc Sci Med* 1992; 34: 829–35.
- Elo IT, Preston SH. Effects of early-life conditions on adult mortality: a review. *Popul Index* 1992; 58: 186–212.
- Singleton F. *The economy of Finland in the twentieth century*. Bradford: University of Bradford, 1986.