

Does childhood socioeconomic status influence adult health through behavioural factors?

H van de Mheen, K Stronks, CWN Looman and JP Mackenbach

- Background** The purpose of this study is to assess to what extent the effect of childhood socioeconomic status on adult health could be explained by a higher prevalence of unhealthy behaviour among those with lower childhood socioeconomic status.
- Methods** Data were obtained from the baseline of a prospective cohort study in the Netherlands (13 854 respondents, aged between 25 and 74). Childhood socioeconomic group was indicated by occupation of the father, and adult health was indicated by perceived general health, health complaints and mortality. Adult socioeconomic status was measured by current occupation. Behavioural factors were smoking, alcohol consumption, Body Mass Index and physical activity. Relations were analysed using logistic regression models.
- Results** A clear association between childhood socioeconomic circumstances and adult health was shown, as well as an association between childhood socioeconomic circumstances and health-related behaviour, even after adjustment for current socioeconomic status. Physical activity shows the strongest relation with childhood socioeconomic circumstances. Behavioural factors explain the relation between childhood socioeconomic status and adult health for approximately 10%.
- Conclusions** Childhood socioeconomic circumstances have an independent effect on adult health and health-related behaviour: the risk of health problems and health damaging behaviour is higher in lower childhood socioeconomic groups. The independent effect of childhood circumstances on adult health operates for a small part through unhealthy behaviour.
- Keywords** Childhood socioeconomic status (SES), behaviour, health
- Accepted** 16 September 1997

After publication of the Black Report¹ much attention was paid to the influence of current socioeconomic status (SES) on health. However, childhood socioeconomic circumstances may also play a role. Results of some studies on the direct effect (that is, irrespective of adult social class) of childhood socioeconomic environment on adult health suggest that growing up in poor socioeconomic circumstances leads to poor health or premature death in adulthood.²⁻⁷ Other studies however, did not find a clear effect of childhood SES on adult health or mortality.⁸⁻¹⁰ In summary, definite conclusions about the impact of childhood socioeconomic environment on later health cannot be drawn, but an independent influence may exist.

The process by which the impact of childhood environment on adult health is established is not clearly understood. Important pathways which can operate between early life and adult health status may run through biological risk factors, according to Barker and Forsdahl,¹¹⁻¹⁵ and through health-related behaviour.

In this study, we concentrate on health-related behaviour during (early) adult life as the pathway that links childhood circumstances to health. Since some of the backgrounds of health-related behaviour go back to childhood and early adulthood,¹⁶ it is very likely that the influence of childhood socioeconomic circumstances on later health operates through health-related behaviour. Some research on this pathway has been done, but this is surprisingly little.¹⁷ Behavioural factors like smoking, leisure time physical activity and alcohol consumption did not explain the relation between childhood poverty and heart disease.^{3,18} In some recent studies a substantial independent effect was not found of father's social class on adult smoking, heavy drinking and leisure time physical activity^{5,19} nor of father's education on adult smoking.²⁰ Leisure time physical activity, however, was related to education of the mother.²¹ Reviewing the scarce evidence, the influence of childhood social class on behavioural factors is not yet clearly understood.

In the Longitudinal Study of Socio-Economic Health Differences (LS-SEHD) in the Netherlands, data on childhood environment, adult health and adult health-related behaviour are available to investigate the mechanisms whereby

Department of Public Health, Erasmus University, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands.

health-related behaviour may relate childhood environment to adult health. The LS-SEHD offers the opportunity to study the effects of childhood environment in a population of men and women, aged 25–74 years.

The research questions to be answered in this paper are:

Does childhood SES have an independent effect (i.e. adjusted for adult SES) on adult health?

Does childhood SES have an independent effect on behavioural factors in adult life?

Does the influence of childhood SES on adult health operate through behavioural factors?

Data and Methods

The design and objective of the LS-SEHD are described in detail elsewhere.²² The study is based on a cohort of 15–74-year-old, non-institutionalized Dutch nationals, living in the city of Eindhoven and surroundings (south-east Netherlands). At the time of the start of the survey a random sample of approximately 27 000 people was drawn from the population registries of the participating municipalities, which was stratified by age and post code (45–74-year-old people and people from the highest and lowest SES-groups, as indicated by post code, were overrepresented). People in the sample received a postal questionnaire in 1991. In this analysis, cross-sectional data obtained from the baseline measurement, as well as mortality follow-up data were used. The response rate was 70.1%, resulting in a study population of 18 973 respondents. The study population used in this analysis was restricted to people aged 25 and over, since the influence of childhood characteristics on behaviour and health, as well as on the SES finally attained, may not have worn off in younger adults. This resulted in a study population of 16 722.

In the LS-SEHD several indicators of adult and childhood SES were measured. Childhood socioeconomic circumstances were measured retrospectively by means of questions about the occupational level of the father of the respondent at the age of 12. Occupations were classified according to the Erikson, Goldthorpe and Portocarero (EGP)-scheme²³ into five categories: higher grade professionals, lower grade professionals/routine non-manual, self-employed, high and low skilled manual and unskilled manual. The occupational level of the respondent was used as indicator of adult SES. Housewives/-husbands were added as a sixth category. Health was indicated by three indicators: perceived general health, health complaints and mortality. Perceived general health was measured by the question 'how do you rate your health in general'. A dichotomous variable was constructed ('very good, good' versus 'fair, sometimes good and sometimes bad, bad'). Health complaints were measured by a 13-item questionnaire, divided into two categories: 0–3 and 4 or more complaints. Mortality follow-up was completed until 15 July 1996. Health-related behavioural factors are smoking, alcohol consumption, leisure time physical exercise and Body Mass Index (BMI). The demographic variables age (5-year categories), sex, marital status, religious affiliation and degree of urbanization were added as confounders. Respondents for whom information on occupation of the father or current occupation was missing were excluded from the analysis ($N = 2868$), leaving 13 854 respondents.

The first step in the analysis was to study the prevalence of health problems by current and childhood SES. Prevalences were standardized for age and sex using the direct method.

Health differences between father's occupational groups are expressed in odds ratios (OR) with 95% confidence intervals (CI), using logistic regression. The model included occupation of the father, respondent's occupation and confounders. The highest level was used as the reference category. We tested if the interaction between the respondent's own and father's occupation significantly changed the model (P -value < 0.05). If so, the independent effect of occupation of the father would be different in different classes of respondent's own occupation. This was not the case, so we used a model without interaction-terms.

The next step in our analysis was to study the association between childhood SES and health-related behaviour. Because we are interested in the independent effect of childhood socioeconomic circumstances we adjusted for current SES. The association between behavioural factors and childhood SES is expressed in OR, using logistic regression models. The highest occupational level of the father was used as the reference category. Also in this analysis, there was no interaction between childhood and adult SES. Again, we tested the significance of father's occupation with a test on trend (P -value < 0.05).

The last step was to estimate to what extent the effect of childhood SES on adult health could be explained by a higher prevalence of unhealthy behaviour. Behavioural factors were added both separately and simultaneously to a model that included father's occupational level, current occupation and confounders only. The contribution of behavioural factors was measured by the percentage reduction in the OR of the occupational level of the father compared to the first model. The reduction in deviance (likelihood ratio test) due to the inclusion of behavioural factors was used as an overall statistical test of their effect.

Only when results were significantly different for men and women analyses were done separately. In most cases however, no differences were found between the sexes.

Results

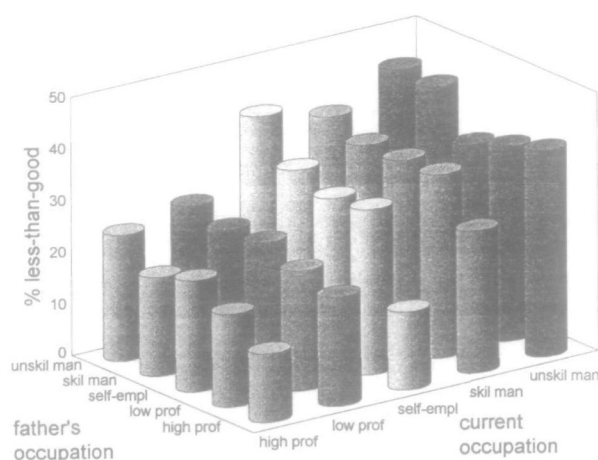
Results for the three health indicators were comparable. For ease of reference, figures will be presented for perceived general health. In addition, some figures of health complaints and mortality are presented. Table 1 shows the distribution of the population across classes of current occupation and occupation of the father.

Figure 1 shows the standardized prevalence of a less-than-good perceived general health for adult occupation by father's occupational class. Childhood SES seems to have an independent effect on perceived general health. Overall, the prevalence of a less-than-good perceived general health is higher in lower classes of adult occupation. Within each occupational group, the occupation of the father has an independent effect: the lower the father's occupational class, the higher the risk of less-than-good health. Only the risk for respondents whose father was self-employed is exceptional. (Housewives/-husbands are not included in the figure.)

The OR for all three health indicators are presented in Table 2. Father's occupation has an independent effect on adult

Table 1 Number of respondents by father's occupation and current occupation, men and women 25–74 years

Father's occupation	High professional	Low professional/routine non-manual	Self-employed	Skilled manual	Unskilled manual	Total
Current occupation						
High professional	208	410	281	277	158	1334
Low professional/routine non-manual	381	1217	749	1093	713	4153
Self-employed	25	74	252	104	109	564
Skilled manual	41	221	262	705	594	1823
Unskilled manual	39	185	321	660	669	1874
Housewife	223	707	909	1231	1036	4106
Total	917	2814	2774	4070	3279	13 854

**Figure 1** Perceived general health by father's and current occupation

health, even after adjustment for respondent's own occupation. Respondents with fathers in the lowest occupational class have a significantly higher risk of a less-than-good perceived general health.

Health complaints and mortality also showed an independent effect of father's occupation, the OR for e.g. unskilled manual workers was 1.35 and 1.25 respectively, although the latter was not statistically significant different from one.

Table 3 represents the relation between behavioural factors and father's occupation. The effect of adjustment for current occupational level is also shown. Only categories which are commonly known as risk factors for health are presented. For most behavioural factors the expected relation is found: the lower the occupation of the father the higher the risk of unhealthy behaviour in adulthood. The independent effect is statistically significant for almost all categories of unhealthy behaviour.

The risk of overweight (Quetelet's Index [QI] > 27) is higher and the risk of underweight (QI < 20) is lower in lower childhood socioeconomic groups. The risk of total abstinence is higher in lower occupational classes of the father. Among women this is only statistically significant after adjustment for current occupation. The risk of (very) excessive drinking seems

Table 2 Odds ratios for health problems by father's occupation, adjusted for current occupation, men and women, 25–74 years^a

		Father's occupation	High professional	Low professional/routine non-manual	Self-employed	Skilled manual	Unskilled manual	P-value test for overall effect ^b
Perceived general health	Less-than-good (N = 3892)	Father's occupation	1	1.46 [1.20–1.78]	1.62 [1.33–1.97]	2.00 [1.65–2.42]	2.24 [1.85–2.71]	**
		Father's occupation adjusted for current occupation	1	1.39 [1.14–1.70]	1.40 [1.15–1.71]	1.66 [1.37–2.01]	1.78 [1.47–2.17]	**
Health complaints	Four or more (N = 4555)	Father's occupation	1	1.19 [1.01–1.39]	1.18 [1.00–1.37]	1.39 [1.18–1.61]	1.58 [1.34–1.84]	**
		Father's occupation adjusted for current occupation	1	1.15 [0.98–1.35]	1.07 [0.91–1.24]	1.22 [1.03–1.42]	1.35 [1.14–1.56]	**
Mortality	Died (N = 544)	Father's occupation	1	1.47 [0.93–2.30]	1.33 [0.84–2.08]	1.33 [0.86–2.04]	1.42 [0.92–2.18]	ns
		Father's occupation adjusted for current occupation	1	1.41 [0.90–2.21]	1.19 [0.76–1.86]	1.19 [0.77–1.82]	1.25 [0.79–1.96]	ns

^a Adjusted for age (5-year categories), sex, marital status, religious affiliation and degree of urbanization.^b * <0.05, ** <0.01

Table 3 Odds ratios for behavioural factors by father's occupation, adjusted for current occupation, men and women, 25–74 years^a

		Father's occupation	High professional	Low professional/routine non-manual	Self-employed	Skilled manual	Unskilled manual	P-value test for overall effect ^b
BMI	QI ^c < 20 (N = 874)	Father's occupation	1	0.90	0.66 ^d	0.68 ^d	0.63 ^d	**
		Father's occupation adjusted for current occupation	1	0.90	0.67 ^d	0.71 ^d	0.65 ^d	**
	QI > 27 (N = 2695)	Father's occupation	1	1.39 ^d	1.70 ^d	1.88 ^d	2.03 ^d	**
		Father's occupation adjusted for current occupation	1	1.36 ^d	1.52 ^d	1.68 ^d	1.76 ^d	**
Alcohol consumption	Abstainer (N = 2925)	Father's occupation	1	1.12	1.47 ^d	1.56 ^d	1.91 ^d	**
		Father's occupation adjusted for current occupation	1	1.05	1.27 ^d	1.28 ^d	1.49 ^d	** ^c
	(Very) excessive (N = 1142)	Father's occupation	1	1.24	0.90	1.09	1.26	**
		Father's occupation adjusted for current occupation	1	1.25	0.86	1.09	1.25	**
Smoking	Once smoker (N = 9666)	Father's occupation	1	1.12	0.90	1.19	1.09	**
		Father's occupation adjusted for current occupation	1	1.09	0.86	1.10	1.09	**
	Current smoker (N = 4877)	Father's occupation	1	0.96	0.94	1.06	1.23 ^d	**
		Father's occupation adjusted for current occupation	1	0.94	0.86	0.94	1.06	**
Leisure time physical activity	No physical activity (N = 644)	Father's occupation	1	1.62 ^d	2.03 ^d	1.73 ^d	1.82 ^d	*
		Father's occupation adjusted for current occupation	1	1.61 ^d	1.72 ^d	1.58 ^d	1.62 ^d	ns
	Frequent physical activity (N = 4301)	Father's occupation	1	0.78 ^d	0.66 ^d	0.66 ^d	0.59 ^d	**
		Father's occupation adjusted for current occupation	1	0.80 ^d	0.74 ^d	0.73 ^d	0.68 ^d	** ^c

^a Adjusted for age (5-year categories), sex, marital status, religious affiliation and degree of urbanization.^b * <0.05, ** <0.01^c Difference between men and women ($P < 0.05$): significant for women, not for men.^d CI does not include one.^e QI = Quetelet's Index.

somewhat higher in lower occupational classes of the father, with the exception of the self-employed, but the relationship is not very clear. There is no clear relationship between smoking and occupation of the father. The risk of no physical exercise is much higher in lower childhood socioeconomic groups. After adjustment for current occupation the P -value for trend is not significant, although all classes differ significantly from the highest occupational group (CI do not include one). The risk of heavy exercise is lower in higher childhood socioeconomic groups. After adjustment for current occupation this is only statistically significant for women.

Table 4 shows that the relation between childhood SES and adult health decreases when behavioural factors are added to the model. After adjustment for behavioural factors the effect of occupational level of the father is still statistically significant. This means that childhood socioeconomic differences in adult health can only be partly explained by behavioural factors. For example, the OR of the lowest occupational group of the father (adjusted for current occupational status and confounders) for a less-than-good perceived general health is 1.78. When physical activity is added to the model the OR decreases to 1.69. This means that an estimated 11.5% of the increased risk of a

Table 4 Odds ratios for less-than-good perceived general health by father's occupation, adjusted for current occupation and behavioural factors, men and women, 25–74 years^a

Father's occupation	Father's occupation adjusted for current occupation (model A)	Model A, adjusted for BMI		Model A, adjusted for alcohol consumption		Model A, adjusted for smoking		Model A, adjusted for physical activity		Model A, adjusted for all behavioural factors ^c	
		Odds ratio	% reduction	Odds ratio	% reduction	Odds ratio	% reduction	Odds ratio	% reduction	Odds ratio	% reduction
High professional	1	1		1		1		1		1	
Low professional/routine non-manual	1.39 ^f	1.37 ^f	5.1	1.40 ^f	–	1.39 ^f	–	1.33 ^f	15.4	1.36 ^f	7.7
Self-employed	1.40 ^f	1.41 ^f	–	1.38 ^f	5.0	1.41 ^f	–	1.29 ^f	27.5	1.32 ^f	20.0
Skilled manual	1.66 ^f	1.65 ^f	1.5	1.62 ^f	6.1	1.67 ^f	–	1.59 ^f	10.6	1.58 ^f	12.1
Unskilled manual	1.78 ^f	1.75 ^f	3.8	1.74 ^f	5.1	1.79 ^f	–	1.69 ^f	11.5	1.67 ^f	14.1
Deviance/reduction deviance ^b	1055.690 (df 29)	86.339 ^b (df 2)		232.771 ^b (df 4)		62.057 ^b (df 4)		324.279 ^b (df 3)		523.519 ^b (df 9)	
P-value reduction deviance ^c	–	**		**		**		**		**	

^a Adjusted for age (5-year categories), sex, marital status, religious affiliation and degree of urbanization^b Reduction in deviance due to inclusion of behavioural factor to model A.^c * <0.05, ** <0.01.^d Only reduction in odds ratio was calculated: (OR model A – OR model B) / (OR model A – 1)^e BMI, alcohol consumption and physical activity.^f CI does not include one.

less-than-good perceived general health for the lowest father's occupational group, as expressed by the OR, can be attributed to physical activity. When all behavioural factors (except smoking, because this factor did not contribute at all) are added to the model simultaneously, the reduction in OR is approximately 14% for the lowest group. Also with respect to health complaints and mortality, physical activity was the most important factor. As for health complaints, the OR for unskilled manual workers decreased from 1.35 to 1.29 (17%) and for mortality from 1.25 to 1.06 (76%). As for mortality, however, the CI include one (results not shown).

Discussion

The results show an independent effect of childhood socioeconomic group on adult health. This means that the risk of health problems is higher among respondents who grew up in unfavourable socioeconomic circumstances, irrespective of their current SES.

Childhood socioeconomic circumstances also seem to have an independent effect on health-related behaviour. With respect to almost all behavioural factors, the relation points in the same direction: there is more unhealthy behaviour among respondents from lower childhood socioeconomic groups, independent of their current SES. Behavioural factors contribute a small part (approximately 10%) to the explanation of differences in adult health between childhood socioeconomic groups. Physical activity seems to be the most important behavioural factor in this process. The relation between childhood SES and health, however, is still largely unexplained, which is not in conflict with the scarce evidence from other studies.

When interpreting the data, there are a few limitations to the study design that need consideration. Firstly, non-response may have influenced the results. Non-response to the postal survey did not appear to be related to demographic variables. In addition, a short oral interview was held among a sample of the non-respondents to the postal survey; 30% of them participated. This group was representative of the total group of non-respondents with respect to demographic variables, and health differences were not found compared to respondents to the postal survey. This confirms the view that non-respondents do not differ significantly from respondents.

Secondly, the influence of childhood socioeconomic circumstances could be underestimated due to a reporting bias. This would occur if lower socioeconomic groups report unfavourable childhood conditions less accurately than higher groups. Omitting to report (or forgetting) events from childhood appears to be related to education among those aged 55 years and older.²⁴ Other retrospective measurements in the GLOBE-study with respect to events in childhood (like serious illness and hospital admissions) showed that the level of underestimation was higher in lower educated groups.²⁵ Compared to childhood events, however, occupation of the father is less likely to be completely forgotten. Therefore, we expect a possible underestimation to be less serious.

Thirdly, the attitude towards health may affect the association between self-reported (subjective) health and health behaviour, since it may influence both adult health behaviour and subjective health. In that case the contribution of health behaviour to the relation between childhood SES and subjective health might be overestimated. On the contrary, one might assume that the attitude towards health is indeed formed by adverse

childhood circumstances, in which case the attitudes are causally related to the behaviours. Thus, the contribution is not overestimated because it is part of the causal chain that interests us.²⁶

To increase the effectiveness of interventions with respect to behavioural factors, it is important to understand the mechanisms by which adult behaviour is influenced by childhood socioeconomic circumstances. Since this relation has not been described extensively before, however, further research is needed to clarify these mechanisms. For example, parents' (un)healthy behaviour may play a role, as well as personality characteristics and cultural factors. These latter factors, most of which develop in youth, may influence adult lifestyles. For example, it has been demonstrated that in the Netherlands less effective coping-styles are more common among adolescents from lower school levels.²⁷ In addition, material circumstances may link childhood socioeconomic circumstances to health behaviour. Lower SES in childhood may cause financial deprivation, making it e.g. impossible to join a sports club, which results in less physical activity. In this and other studies, childhood economic problems (like financial deprivation) show independent associations with adult health.^{6,28}

In this study we found that the effect of childhood socioeconomic circumstances on behaviour is most apparent for physical activity. It has been shown that long-term maintenance of health-related physical activity is possible.²⁹ It may be that the effect of e.g. cultural factors in early life is stronger with respect to physical activity than to other behavioural factors, since physical activity may often be started at an earlier age than e.g. smoking and alcohol consumption. The minor contribution of smoking might also be explained by the fact that smoking behaviour was adopted later in life than other behavioural factors and may be more sensitive to occupational environment and workplace culture.²⁶

The relation between childhood socioeconomic circumstances and physical activity may also partly reflect selection on health: childhood socioeconomic circumstances are related to health, and health problems (in childhood and adulthood) may lead to less physical activity. Little research has been done on the influence of health in childhood on adult behaviour. In adult life however, it has been shown that physical activity is still related to mortality even when initial (adult) health status is taken into account.^{30,31} This means that selection on adult health cannot explain the relation between physical activity and health in adult life. Therefore selection on childhood health cannot be expected to explain the whole phenomenon. We need to explore this relation in more detail, however, to understand the underlying mechanisms.

The finding that only 10% of differences in adult health could be explained by behavioural factors prompts us to search for other explanations. In the literature, some other perspectives are explored in view of the influence of childhood circumstances on adult health. First of all, social disadvantage may exist throughout the course of life. Davey Smith *et al.*⁷ showed that the risk of mortality was higher in those who had experienced cumulative socioeconomic disadvantage. An accumulation of disadvantage may increase the effect of childhood socioeconomic circumstances. Our results show that people who grew up in unfavourable circumstances, and who are still in unfavourable circumstances at adult age, have the highest risk of mortality.

We found no interaction, however, between childhood and current socioeconomic status: the influence of childhood circumstances is the same in all adult socioeconomic groups.

Secondly, as described in the introduction, the independent effect of childhood social class on adult health may also point to biological determinants of health that operate in the early years. This perspective emphasizes the early living conditions, which are not influenced by later socioeconomic circumstances.^{10,12-15} Blane¹⁹ found a significant relation between childhood SES and biological factors, including BMI. Although BMI reflects genetic factors associated with inherited class or material deprivation in early life, it is also considered to be the outcome of behavioural factors.³² Therefore, in this analysis it is regarded as an (indirect) indicator of health behaviour. Because other measurements of biological risk factors are not available in our study, the biological pathway could not be explored further.

Thirdly, childhood circumstances can act, in a process of indirect selection, as a common background factor, influencing both social mobility and later health. In this mechanism, cultural factors^{17,33} and personality characteristics³⁴ play a role: they may influence adult lifestyles and therefore later health, and, they may also influence social mobility. A next step in our study will be to explore this mechanism.

The risk of health problems is significantly higher for those respondents whose fathers came from the lowest socioeconomic groups. This means that children growing up in the most unfavourable circumstances may be especially at risk. These are e.g. children from broken families, who live on social security. In the Netherlands, almost two thirds of broken families with children under 18 live on social security.³⁵ In other countries, where benefits are less, the situation for these children may be even worse. Interventions that are aimed at reducing inequalities in later health, e.g. with respect to (knowledge of) health-related behaviour, are particularly needed among those groups that live in deprived circumstances.

Acknowledgements

The LS-SEHD is financially supported by the Ministry of Public Health, Welfare and Sports and the Prevention Fund. It forms part of the GLOBE-study ('Gezondheid en Levensomstandigheden Bevolking Eindhoven en omstreken'). The GLOBE-study is performed by the Department of Public Health of Erasmus University, Rotterdam in collaboration with the Public Health Services of the city of Eindhoven and the region of South-East Brabant.

The authors wish to thank Michel Provoost and Xandra Savelkoul for carefully constructing the data base and collecting mortality data.

References

- 1 Townsend P, Davidson N. *Inequalities in Health. The Black Report* Harmondsworth: Penguin Books, 1982
- 2 Kiernan KE, Colley JRT, Douglas JWB, Reid DD. Chronic cough in young adults in relation to smoking habits, childhood environment and chest illness. *Respiration* 1976;**33**:236-44
- 3 Kaplan GA, Salonen JT. Socioeconomic conditions in childhood and ischaemic heart disease during middle age. *Br Med J* 1990;**301**: 1121-23.

- ⁴ Vågerö D, Leon D. Effect of social class in childhood and adulthood on adult mortality [letter]. *Lancet* 1994;**343**:1224–25.
- ⁵ Wannamethee SG, Whincup PH, Shaper G, Walker M. Influence of father's social class on cardiovascular disease in middle-aged men. *Lancet* 1996;**348**:1259–63.
- ⁶ Rahkonen O, Lahelma E, Huuhka M. Past or present? Childhood living conditions and current socioeconomic status as determinants of adult health. *Soc Sci Med* 1997;**44**:327–36.
- ⁷ Davey Smith G, Hart C, Blane D, Gillis C, Hawthorne V. Lifetime socioeconomic position and mortality: prospective observational study. *Br Med J* 1997;**314**:547–52.
- ⁸ Colley JRT, Douglas JWB, Reid DD. Respiratory disease in young adults: influence of early childhood lower respiratory tract illness, social class, air pollution, and smoking. *Br Med J* 1973;**III**:195–98.
- ⁹ Lynch JW, Kaplan GA, Cohen RD *et al.* Childhood and adult socioeconomic status as predictors of mortality in Finland. *Lancet* 1994;**343**:524–27.
- ¹⁰ Kuh DJL, Wadsworth MEJ. Physical health status at 36 years in a British national birth cohort. *Soc Sci Med* 1993;**37**:905–16.
- ¹¹ Barker DJP, Osmond C. Infant mortality, childhood nutrition, and ischaemic heart disease in England and Wales. *Lancet* 1986;**I**:1077–81.
- ¹² Barker DJP, Osmond C, Golding J, Kuh D, Wadsworth MEJ. Growth in utero, blood pressure in childhood and adult life, and mortality from cardiovascular disease. *Br Med J* 1989;**298**:564–67.
- ¹³ Barker DJP, Osmond C, Winter PD, Margetts B. Weight in infancy and death from ischaemic heart disease. *Lancet* 1989;**I**:577–80.
- ¹⁴ Forsdahl A. Are poor living conditions in childhood and adolescence an important risk factor for arteriosclerotic heart disease? *Br J Prev Med* 1977;**31**:91–95.
- ¹⁵ Forsdahl A. Living conditions in childhood and subsequent development of risk factors for arteriosclerotic heart disease. *J Epidemiol Community Health* 1978;**32**:34–37.
- ¹⁶ Taylor SE. *Health Psychology*. New York: McGraw-Hill, 1991, pp.51–75.
- ¹⁷ Davey Smith G, Blane D, Bartley M. Explanations for socio-economic differentials in mortality. *Eur J Public Health* 1994;**4**:132–44.
- ¹⁸ Notkola V, Punsar S, Karvonen MJ, Haapakoski J. Socio-economic conditions in childhood and mortality and morbidity caused by coronary heart disease in adulthood in rural Finland. *Soc Sci Med* 1985;**21**:517–23.
- ¹⁹ Blane D, Hart CL, Davey Smith G, Gillis CR, Hole DJ, Hawthorne VM. Association of cardiovascular disease risk factors with socioeconomic position during childhood and during adulthood. *Br Med J* 1996; **313**: 1434–38.
- ²⁰ Greenlund KJ, Liu K, Kiefe CI, Yunis C, Dyer AR, Burke GL. Impact of father's education and parental smoking status on smoking behavior in young adults. *Am J Epidemiol* 1995;**142**:1029–33.
- ²¹ Kuh DJH, Cooper C. Physical activity at 36 years: patterns and childhood predictors in a longitudinal study. *J Epidemiol Community Health* 1992;**46**:114–19.
- ²² Mackenbach JP, Mheen H van de, Stronks K. A prospective cohort study investigating the explanation of socio-economic inequalities in health in the Netherlands. *Soc Sci Med* 1994;**38**:299–308.
- ²³ Enkson R, Goldthorpe JH, Portocarero L. Intergenerational class mobility and the convergence thesis: England, France and Sweden. *Br J Sociol* 1983;**34**:303–42.
- ²⁴ Borini G, Dall'ora P, Della Sala S, Marinelli L, Spinnler H. Autobiographical memory: Sensitivity to age and education of a standardized enquiry. *Psychological Medicine* 1989;**19**:215–24.
- ²⁵ Mheen H van de, Stronks K, Looman CWN, Mackenbach JP. The role of childhood health in the explanation of socio-economic health inequalities in early adult life. *J Epidemiol Community Health*, In press, 1998.
- ²⁶ Lynch JW, Kaplan GA, Salonen JT. Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic lifecourse. *Soc Sci Med* 1997;**44**:809–19.
- ²⁷ Tuinstra J, Hoekstra E, Groothoff JW, Post D. Differences in coping-style among adolescents. The influence of sex and school-level. *Tijdsch voor Jeugdgezondheidszorg* 1997;**29**:1–4 [in Dutch].
- ²⁸ Mheen H van de, Stronks K, Bos van den J, Mackenbach JP. The contribution of childhood environment to the explanation of socio-economic inequalities in health in adult life: a retrospective study. *Soc Sci Med* 1997;**44**:13–24.
- ²⁹ Laitakari J, Vuori I, Oja P. Is long-term maintenance of health related physical activity possible? An analysis of concepts and evidence. *Health Education Research* 1996;**11**:463–77.
- ³⁰ Paffenbarger RS, Hyde RT, Wing AL, Hsieh C. Physical activity, all cause mortality and longevity of college alumni. *N Engl J Med* 1986;**314**:605–13.
- ³¹ Blair SN, Kohl HW, Barlow CE, Paffenbarger RS, Gibbons LW, Macera CA. Changes in physical fitness and all-cause mortality. *JAMA* 1995;**273**:1093–98.
- ³² Bouchard C. Current understanding of the etiology of obesity: genetic and nongenetic factors. *Am J Clin Nutr* 1991;**53**:156S–156SS.
- ³³ Sweeting H, West P. Family life and health in adolescence: a role for culture in the health inequalities debate? *Soc Sci Med* 1995;**40**:163–75.
- ³⁴ Ranchor AV. Social class, psychosocial factors and disease: from description towards explanation. Groningen: Rijksuniversiteit Groningen, 1994 [dissertation].
- ³⁵ Ministry of Social Affairs and Employment. *The other side of The Netherlands About prevention and fight against hidden poverty and social exclusion*. Den Haag, 1996 [in Dutch].