

## RESEARCH NOTE

# Emotional and behavioural problems in childhood and risk of overall and cause-specific morbidity and mortality in middle-aged Finnish men

**Laura Kauhanen**

Institute of Public Health and Clinical Nutrition, University of Eastern Finland, Kuopio, Finland  
[laura.kauhanen@uef.fi](mailto:laura.kauhanen@uef.fi)

**Janne Leino**

Institute of Public Health and Clinical Nutrition, University of Eastern Finland, Kuopio, Finland

**Hanna-Maaria Lakka**

Institute of Public Health and Clinical Nutrition, University of Eastern Finland, Kuopio, Finland  
Kuopio National Institute of Health and Welfare, Helsinki

**John Lynch**

School of Population Health and Clinical Practice, University of Adelaide  
Department of Social Medicine, University of Bristol

**Jussi Kauhanen**

Institute of Public Health and Clinical Nutrition, University of Eastern Finland, Kuopio, Finland  
Prevention Research Center, Pacific Institute of Research and Evaluation, Berkeley, CA, USA

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## Introduction

Little is known of the overall and cause-specific morbidity and mortality of those having emotional and behavioural problems in childhood. In the study by Jokela, Ferrie, and Kivimäki (2008), childhood externalizing and internalizing behaviours were associated with increased risk of premature death. Externalizing problems are characterized by inattention, poor conduct, opposition and defiance. Internalizing problems, such as avoidant and withdrawn temperament, is manifested by low self-esteem, worry, fear, and shyness (Dick et al 2005; Roza et al 2003; Zahn-Waxler, Klimes-Dougan and Slattery 2000). Internalizing problems in childhood have been linked with adult depression and anxiety disorders (Clark et al 2007). In turn, externalizing problems have been related with later antisocial behaviour, delinquency (Simonoff et al 2004), and substance abuse (King, Iacono and McCue 2004). For example, Shepherd, Farrington and Potts (2004) found that antisocial lifestyle in childhood and adolescence increased the risk of injury and psychological illness. In addition, Laub and Vaillant (2000) found that alcohol abuse and poor self-care

were associated with subsequent death, in the study of 1,000 delinquent and non-delinquent boys.

It is suggested that psychological stressors may increase the vulnerability to cancer and autoimmune diseases through a deregulatory effect on the immune system (Irwin et al 1990; Stein, Keller and Schleifer 1985). For example, it has been reported that personality, emotional suppression, depression, and social isolation are risk factors for cancer (Edelman 2005; Grossarth-Maticek et al 1997; Penninx et al 1998; Persky Kempthorne-Rawson and Shekelle 1987; Shekelle et al 1981; Shaffer et al 1987) although some studies have found no evidence of such relationship (Price et al 2001; Bleiker et al 1996). In addition, it has been reported that depression, social isolation, and lack of social support are risk factors for coronary heart disease (CHD) (Peach et al 2003). Furthermore, there is some evidence that cynical hostility increases the risk of all-cause and cardiovascular mortality, and incident myocardial infarction (Everson et al 1997), and cancer-related mortality (Tindle et al 2009).

Emotional and behavioural problems among children and adolescents are perceived to be increasing in many countries, sometimes attributed to childhood poverty, increase in the proportion of single parent families, and substance abuse among families. (Kelleher et al 2000; Rimpelä et al 2006; Sweeting and West 1998). Studies report that approximately 7-20% of children and adolescents meet the criteria for a broadly-defined behavioural problem (Horwitz et al 1992; Kaltiala-Heino et al 2005; Kelleher et al 2000; Kumpulainen et al 1998). For example Rimpelä and colleagues (2006) found that, in a Finnish school health survey, 24% of children had psychosomatic symptoms, such as anxiety or physical manifestations (Rimpelä et al 2006).

The purpose of this study was to investigate reports, obtained from nurses, of emotional and behavioural problems during childhood, as predictors of overall and cause-specific mortality and morbidity in later life among participants of the Kuopio Ischemic Heart Disease Risk Factor Study (KIHD). Additionally in this study, we examined the effect of biological, behavioural, and socio-economic factors, on the associations between emotional and behavioural problems in childhood and all-cause, cancer and cardiovascular mortality, morbidity and alcohol-associated diseases.

## Methods

### Study population

The subjects were participants in the KIHD which is a prospective population-based study designed to investigate risk factors for cardiovascular diseases, including psychosocial and socio-economic factors, in middle-aged and ageing men from Eastern Finland. The original study population consisted of a random age-stratified sample of 2,682 men, who were 42, 48, 54, or 60 years of age at baseline in 1984 (Kaplan et al 1994). The Research Ethics Committee of the University of Kuopio approved the study. The school health records were available for 952 (35.5%) men, because some of the archives, where school health records were stored, were destroyed during World War II and others by fires. There were 72 men who were excluded from the analyses because of the missing data on some of the covariates. The final study sample was therefore 880. A comparison of the historical study sample with the rest of the KIHD cohort revealed that the study participants were on average somewhat younger, their education, occupational, and income levels were higher, they were physically more active and they have smoked cigarettes less than the rest of the KIHD cohort (Table 1).

**Table 1. Comparison of the historical study sample (n=880) with the rest of the KIHD cohort (n=1603)**

	Mean (SD) or proportion (%)		p-values for the difference between groups
	Study sample (n=880)	The rest of the KIHD cohort (n=1603)	
<b>Covariates</b>			
Age group (%)			
1 (42 years)	24.0	5.9	<0.001
2 (48 years)	18.6	9.4	
3 (54 years)	46.3	68.4	
4 (60 years)	11.1	16.3	
Educational level (%)			
1 (low)	7.7	11.1	<0.001
2	43.8	50.5	
3	41.9	31.8	
4 (high)	6.6	6.6	
Occupational level (%)			
1 (farmer)	12.5	20.2	<0.001
2 (blue collar)	46.4	41.6	
3 (white collar)	41.1	38.2	
Smoking history (pack/years)	148.4 (286.9)	180.9 (360.7)	0.014
BMI (kg/m <sup>2</sup> )	26.4 (3.7)	26.9 (3.5)	0.681
LDL cholesterol (mmol/l)	4.0 (1.0)	4.1 (1.0)	0.006
HDL cholesterol (mmol/l)	1.3 (0.3)	1.3 (0.3)	0.570
SBP (mm Hg)	133.9 (16.8)	134.4 (17.3)	0.395
Leisure time physical activity (h/year)	123.5 (153.1)	105.8 (130.9)	0.003
Alcohol consumption (g/week)	82.2 (148.3)	73.8 (134.2)	0.150
Income (marks/year)	82,222.5 (52467.6)	74,785.8 (49352.3)	<0.001

### **Emotional and behavioural problems in childhood**

Childhood information was obtained from elementary school health records which were filled out by the school health nurses and doctors in the 1930s to 1950s. The school health records contained data on health status, school attendance, behaviour of the child at school, general hygiene/cleanliness of the child, and socio-economic circumstances at home, based on the personal observations of school health nurses, and doctors at school and during home visits until the children were 13 years of age.

A man was defined as having emotional/behavioural problems in childhood if a school health nurse had reported one or both of the following:

1. Emotional problems
2. Behavioural problems

1. "Emotional problems" was defined as school health nurses reporting a child having withdrawal problems such as nervousness, shyness, fearfulness, and anxiety. 2. "Behavioural problems" was defined as a school health nurse reporting aggressive, antisocial, or delinquent behaviour of the child. These items were scored dichotomously and the scores summed. A summary variable of emotional and behavioural problems variables was made to represent the total emotional/behavioural problems score in childhood. If there was no mention of items 1 or 2, a man was defined as not having emotional/behavioural problems in childhood.

### **Covariates**

**Age and examination year** Age was categorized into four groups: 42 years, 48 years, 54 years, and 60 years. Examination year was categorized from 1984 to 1989.

**Biological factors** The gathering of blood specimens (Salonen et al 1992) and the measurement of serum lipids (Salonen et al 1991) have been explained elsewhere.

The ratio of low density lipoprotein (LDL) to high density lipoprotein (HDL) cholesterol and systolic blood pressure (SBP) were included in the analysis.

**Adulthood behavioural factors** The assessment of alcohol consumption in grams per week with a structured quantity and frequency method using the Nordic alcohol consumption inventory has been described previously (Kauhanen et al 1997). Leisure-time physical activity in hours per year was assessed from a 12-month history questionnaire (Lakka et al

1994). Cigarette smoking was estimated by self-reporting and converted to pack-years (the average number of cigarettes per day times the number of years smoked). Body mass index (BMI) was calculated as the ratio of weight in kilograms to the square of height in metres ( $\text{kg}/\text{m}^2$ ).

**Childhood socio-economic variables** Socio-economic position (SEP) in childhood was a summary variable including poor social conditions at home, poor hygiene, attending a special summer camp for poor children, and attending a school meal programme meant for children in need (Kauhanen et al 2006). Education was also included in the analysis of childhood SEP. It was categorized into four groups: less than elementary, elementary, full or some secondary, and high school or above.

**Adulthood socio-economic variables** Adult SEP was assessed by the self-report of annual personal income and occupation. Occupation was categorized into three groups: 1=farmer, 2=blue collar, 3=white collar.

### **Outcomes**

**Mortality** Deaths were ascertained by computer linkage to the national death registry using the Finnish social security number. All deaths occurring between study entry (March 1984 to December 1989) and 31 December 2007 were included. Deaths coded with the Ninth International Classification of Diseases (ICD-9) codes 140-239 and the tenth revision (ICD-10) codes C00-D48 were included in the analysis of cancer deaths. Deaths coded with ICD-9 codes 390-459 and ICD-10 by codes I00-I99, were considered cardiovascular (CVD) deaths. Deaths were coded with ICD-9 codes 410-414, and ICD-10 codes I20-I25 were included in the analysis of coronary heart disease (CHD) deaths. The median follow-up time was 20.7 years (range 0.2 to 24.8 years). There were 72 cancer deaths, 130 CVD deaths and 89 CHD deaths during the follow-up period. Death codes were all validated according to the international criteria adopted by the WHO MONICA (Monitoring of Trends and Determinants of Cardiovascular Disease) Project (Bothig 1989).

**Acute coronary events** Data on fatal or non-fatal acute coronary events between the study entry and 2004, were collected prospectively and diagnostic classification was made by the FINMONICA coronary registry group (Tuomilehto et al 1992). Since 1 January 2004, the events were

obtained by computer linkage to the national computerized hospital discharge registry. Diagnostic information was collected from hospitals and events were classified by one internist using the same diagnostic criteria as in the FINMONICA project. The median follow-up time to the first coronary event was 17.6 years (range 0.1 to 21.8 years). If the subject had multiple non-fatal events during the follow-up, the first one was considered as the endpoint. Data were available up to 31 December 2004, during which period, 209 acute coronary events occurred.

**Alcohol-associated diseases** All alcohol-associated diseases that occurred between study entry and 31 December 2007 were included. Data on alcohol-associated diseases were obtained by record linkage from the national computerized hospitalization registry, which covers every hospitalization in Finland. Alcohol diseases were coded with the Eighth International Classification of Diseases (ICD-8) or the Ninth revision (ICD-9) or the 10th revision (ICD-10). The median follow-up time to the first alcohol-associated disease was 20.7 years (range 0.04 to 24.8 years). If the subject had multiple non-fatal events during the follow-up, the first one was considered as the endpoint. During the follow-up period, 69 alcohol-associated diseases occurred.

### Statistical analysis

The association between emotional and behavioural problems in childhood and the risk of all-cause, cancer, CVD, and CHD deaths, and the risk of acute coronary events and alcohol-associated diseases in later life, were analysed with Cox proportional hazards models<sup>1</sup>. The analysis sample was 880. Emotional problems were reported for 9.5% of men and behavioural problems for 2.3% of men. Men with any emotional/behavioural problems in childhood formed the index group (11.8%) and men without emotional/behavioural

problems in childhood were a reference group in the summary problems score analyses.

A sequence of models was carried out to examine the relationship between childhood emotional and behavioural problems and mortality and morbidity in adulthood. Model 1 included age and examination year. Model 2 was the same as model 1 and additionally adjusted for SEP in childhood (poor social conditions at home, poor hygiene, attending a special summer camp for poor children, and attending a school meal programme meant for children in need, education). Model 3 was the same as model 1 and additionally adjusted for adulthood SEP (occupation, income). Model 4 was the same as model 1 and additionally adjusted for the biological factors (systolic blood pressure, LDL/HDL), and behavioural characteristics (alcohol consumption, smoking, BMI, physical activity). All analyses were performed using SPSS for Windows 17.0.

### Results

Table 2 shows the mean  $\pm$  standard deviation or prevalence for the covariates: age, the biological and behavioural factors (systolic blood pressure, HDL and LDL cholesterol, leisure time physical activity, BMI, alcohol consumption, and smoking), and education and occupation, for men with emotional problems (n=84), behavioural problems (n=20), and without emotional/behavioural problems (n=776) in childhood. The educational and income levels were lower, and LDL levels higher in men with behavioural problems in childhood compared to men with emotional problems and without emotional/behavioural problems in childhood. Men with emotional problems in childhood were somewhat younger than others. Table 2 also shows crude mortality rates of all-cause, cancer, CVD and CHD deaths, and incidence density of acute coronary events, and alcohol-associated diseases in men with and without emotional/behavioural problems in childhood.

**Table 2. Baseline characteristics of men with emotional and behavioural problems and without emotional/behavioural problems in childhood**

Covariates	Mean (SD) or proportion (%)			p-values for the difference between groups
	Men with emotional problems in childhood (n=84)	Men with behavioural problems in childhood (n=20)	Men without emotional/behavioural problems in childhood (n=776)	
Age group (%)				
1 (42 years)	33.3	0.0	23.6	0.009
2 (48 years)	15.5	10.0	19.2	
3 (54 years)	41.7	85.5	45.7	
4 (60 years)	9.5	5.0	11.5	
Educational level (%)				
1 (low)	8.3	35.5	6.9	< 0.001
2	31.0	50.0	45.0	
3	53.6	15.0	41.4	
4 (high)	7.1	0.0	6.7	
Occupational level (%)				
1 (farmer)	6.0	0.0	13.5	0.002
2 (blue collar)	39.3	85.0	46.1	
3 (white collar)	54.8	15.0	40.3	
Smoking history (pack/years)	167.9 (296.1)	273.6 (340.4)	143.1 (284.0)	0.107
0 (never)	29.8	5.0	26.8	0.076
1 (former)	36.9	40.0	42.9	
2 (current)	33.3	55.0	30.3	
BMI (kg/m <sup>2</sup> )	26.9 (3.6)	28.3 (4.4)	26.8 (3.7)	0.191
LDL cholesterol (mmol/l)	3.8 (0.8)	4.7 (1.5)	4.0 (1.0)	0.004
HDL cholesterol (mmol/l)	1.3 (0.3)	1.2 (0.2)	1.3 (0.3)	0.527
SBP (mm Hg)	133.1 (15.7)	140.0 (18.7)	133.8 (16.9)	0.237
Leisure time physical activity (h/year)	136.4 (203.2)	169.6 (178.9)	120.9 (145.9)	0.269
Alcohol consumption (g/week)	76.5 (113.8)	54.2 (70.0)	82.9 (150.0)	0.711
Median	25.3	19.0	39.9	
Range	0-512.5	0-220.8	0 - 2853.0	
0 (abstainers)	13.1	20.0	11.1	0.587
1 (0.1-279.9 g/week)	82.1	80.0	83.2	
2 (280.0-2853.0g/week)	4.8	0.0	5.7	
Income (marks/year)	83,535.7 (46 890.7)	48,800.0 (21 338.4)	82,941.7 (53,348.8)	0.015

Median	72,500	43,500	74,000
Range	5,000-234,000	15,000-90,000	0 – 550,000

(Table 2 cont'd)

Mortality/incidence/100 000 person-years

All-cause death	1,405	4,289	1,452
Cancer death	550	2,144	355
CVD death	550	1,787	696
CHD death	428	1,072	475
Acute coronary events	1,109	2,946	1,399
Alcohol-associated diseases	318	1,121	365

BMI, body mass index; LDL, low density lipoprotein; HDL, high density lipoprotein; SBP, systolic blood pressure; CVD, cardiovascular disease; CHD, coronary heart disease

**Table 3. Relative hazards (RH) of all-cause death, cancer death, CVD death, CHD death, acute coronary events and alcohol-associated diseases in men with emotional, behavioural, and emotional/behavioural problems in childhood, compared with men without emotional, behavioural and emotional/behavioural problems in childhood as a reference group.**

	RH (95%CI)					
	All-cause death	Cancer death	CVD death	CHD death	Acute coronary events	Alcohol-associated diseases
Events /Total n in the model	252/880	68/880	118/880	81/880	193/880	61/880
No emotional problems in childhood	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
Emotional problems in childhood						
Model 1	0.94 (0.61-1.44)	1.44 (0.71-2.90)	0.78 (0.39-1.53)	0.88 (0.41-1.92)	0.82 (0.49-1.36)	0.83 (0.33-2.06)
Model 2	0.82 (0.53-1.27)	1.44 (0.70-2.99)	0.63 (0.31-1.26)	0.70 (0.42-1.55)	0.70 (0.42-1.18)	0.79 (0.32-2.00)
Model 3	0.90 (0.58-1.38)	1.41(0.69-2.88)	0.73 (0.37-1.44)	0.85 (0.39-1.84)	0.81 (0.48-1.35)	0.86 (0.34-2.16)

Model 4	0.88 (0.57-1.36)	1.39 (0.67-2.88)	0.74 (0.38-1.47)	0.84 (0.39-1.83)	0.85 (0.51-1.43)	0.77 (0.31-1.94)
<i>(Table 3 cont'd)</i>						
No behavioural problems in childhood	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
Behavioural problems in childhood						
Model 1	2.80 (1.57-5.02)	5.31 (2.29-12.36)	2.50 (1.01-6.14)	2.15 (0.68-6.85)	1.96 (0.92-4.20)	2.54 (0.79-8.20)
Model 2	1.88 (1.01-3.50)	5.09 (1.89-13.76)	1.46 (0.56-3.76)	1.23 (0.37-4.12)	1.37 (0.62-3.03)	1.93 (0.54-6.86)
Model 3	2.34 (1.31-4.20)	4.39 (1.89-10.19)	2.08 (0.85-5.13)	1.85 (0.58-5.90)	1.79 (0.84-3.83)	2.09 (0.65-6.77)
Model 4	2.23 (1.24-4.02)	3.85 (1.63-9.10)	1.92 (0.77-4.77)	1.56 (0.48-5.02)	1.40 (0.65-3.01)	2.18 (0.66-7.14)
No emotional/behavioural problems	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
Emotional/behavioural problems in childhood						
Model 1	1.31 (0.91-1.87)	2.29 (1.29-4.01)	1.10 (0.63-1.92)	1.14 (0.59-2.22)	1.00 (0.64-1.56)	1.17 (0.56-2.46)
Model 2	1.11 (0.76-1.62)	2.41 (1.29-4.50)	0.85 (0.47-1.52)	0.86 (0.43-1.72)	0.82 (0.52-1.30)	1.07 (0.49-2.32)
Model 3	1.23 (0.86-1.77)	2.22 (1.24-3.98)	1.01 (0.58-1.78)	1.08 (0.56-2.10)	0.98 (0.63-1.53)	1.17 (0.55-2.49)
Model 4	1.21 (0.85-1.73)	2.07 (1.16-3.67)	1.03 (0.58-1.80)	1.05 (0.54-2.04)	0.98 (0.63-1.53)	1.09 (0.51-2.30)

**Notes.**

*Model 1 Adjusted for age and examination year*

*Model 2 The same as model 1 and childhood SEP, educational level*

*Model 3 The same as model 1 and occupation, income level*

*Model 4 The same as model 1 and biological and behavioural factors (systolic blood pressure, ratio of low density lipoprotein to high density lipoprotein cholesterol, body mass index, leisure time physical activity, smoking, alcohol consumption)*

*CVD, cardiovascular disease; CHD, coronary heart disease*



Table 3 shows that men who had emotional/behavioural problems in childhood had a 2.29-fold (95% confidence interval (CI) 1.29 to 4.01) age- and examination-year adjusted risk of cancer death. After adjustment for the SEP in childhood and adulthood and for the biological and behavioural factors in adulthood, the association remained unchanged. All-cause, CVD, and CHD death, risk of acute coronary events, and alcohol-associated morbidity showed no associations with emotional/behavioural problems in childhood.

Table 3 also shows that there were no statistically significant relationships between emotional problems in childhood and adult all-cause, cancer, CVD, CHD mortality, acute myocardial infarctions and alcohol-associated morbidity.

Men who had behavioural problems in childhood had a 2.80-fold (1.57 to 5.02) age- and examination-year adjusted risk of all-cause death, a 5.31-fold (2.29 to 12.36) risk of cancer death, and a 2.50-fold (1.01 to 6.14) risk of CVD death. The association between behavioural problems and all-cause and cancer deaths was somewhat attenuated after adjusting for SEP in childhood and adulthood, and biological, and behavioural factors in adulthood, whereas CVD mortality risk was no longer significant after further adjustments. The risk of CHD mortality, acute myocardial infarctions, and alcohol-associated morbidity was also elevated, but the results were not statistically significant.

## Discussion

Our findings suggest that behavioural problems in childhood are associated with increased risk of all-cause and cancer mortality in adulthood, even after adjustment for the socio-economic position in childhood and adulthood, and biological and behavioural factors in adulthood. There was also an elevated risk of CVD, CHD death, acute myocardial infarctions, and alcohol-associated diseases, but the results were not statistically significant. Combined emotional/behavioural problems score showed also a relationship with cancer death. This effect is likely to be driven by behaviour problems in childhood, because emotional problems did not show any effect when analysed on its own.

It is hypothesized that risky and self-harmful behaviour, exposure to dangerous environments, and low socio-economic status would explain the increased mortality risk with those having problem

behaviours in childhood. The findings by Jokela, Ferrie and Kivimäki (2008) suggested that externalizing behaviours, and possible co-morbidity between internalizing and externalizing behaviours, in addition to adverse family environment in childhood, would cause the increased mortality risk in adulthood. Our results give some support to the hypothesis that behavioural problems in childhood could be manifested in the life course, through long-term risky lifestyle factors, such as smoking, which in turn increase the mortality risk in later life. It is possible, that shy and fearsome children do not engage themselves so easily to risk-taking or self-harmful behaviour, compared to aggressive personality types who may act more recklessly, causing damage to their health.

It is also possible that negative personality type can act as an independent risk factor for all-cause, cancer and CVD mortality. Cynical hostility is known to be associated with perceived stress, coping ability, and social support. Hostility may impair the positive effects of social support on stress, which may in turn produce greater neural, endocrine, or inflammatory physiological responses that facilitate greater disease burden (Tindle et al 2009). For example, Weidner et al (1987) found that Type A behaviour and hostility were linked with elevated levels of plasma and LDL cholesterol. They concluded that Type A and hostile individuals spend a lot of time in a high arousal/attentional state, which could be associated with increased sympathetic nervous system activity, that may affect to the atherosclerotic process. In the present study, men with behavioural problems in childhood had an unfavourable profile of baseline characteristics, including age, socio-economic status, smoking, and LDL cholesterol levels. Nevertheless, the relationship between behavioural problems in childhood and all-cause and cancer mortality, remained after adjustment for the potential confounding factors.

The present study had some noteworthy strengths, such as long follow-up time, the use of several confounding factors, and reliable mortality and morbidity data in the analyses, and the use of historical records in assessing childhood problem behaviours. In the retrospective study design, recall bias can cause underestimation of the true impact of childhood factors, as people may not remember all the details of the past. Limitations of the study are that the sample size is relatively small due to

missing data, which leads to imprecise estimates. Another limitation is that although the use of external raters may be more objective than self-report for childhood factors, rater variability may contribute to random or systematic misclassification of the data. For example the prevalence for behavioural problems is low by contemporary standards. It is difficult to know how nurses interpreted these problem behaviours in Eastern Finland in the first half of the 20<sup>th</sup> century or what the true period prevalence was for behavioural problems, as there is no representative data. In addition, it is a significant limitation to have no information on the period between the childhood behavioural ratings and the adult outcomes. Adult behavioural factors, taken into account in the analyses, were not necessarily sufficient to determine the full lifetime risk of

unhealthy behaviour and its changes during the life-course.

Although this study has insufficient statistical power, there is some suggestion that reported behavioural problems in childhood increase the risk of all-cause and cancer deaths in adulthood. The long-term effects of problem behaviours highlight the importance of early intervention of such problems in young children. The developmental route of behavioural problems into cancer remains still unclear, although adult lifestyle behaviour seems to play an important role in the risk association. It is also possible that different emotional and behavioural characteristics may act as risk factors for different kinds of diseases. More long-term epidemiological studies are needed to clarify the relationship between emotional and behavioural problems in early life and subsequent morbidity and mortality.

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## References

- Bothig S. (1989) WHO MONICA Project: objectives and design. *International Journal of Epidemiology*, 18, 29-37.
- Bleiker EM, VanderPloeg HM, Hendriks JH and Ader HJ. (1996) Personality factors and breast cancer development: a prospective longitudinal study. *Journal of the National Cancer Institute*, 88, 1478-1482.
- Clark C, Rodgers B, Caldwell T, Power C and Stansfeld S. (2007) Childhood and adulthood psychological ill health as predictors of midlife affective and anxiety disorders: The 1958 British Birth Cohort. *Archives of General Psychiatry*, 64, 668-687.
- Dick D, Viken R, Kaprio J, Pulkkinen L and Rose R. (2005) Understanding the covariation among childhood externalizing symptoms: genetic and environmental influences on Conduct Disorder, Attention Deficit Hyperactivity Disorder, and Oppositional Defiant Disorder Symptoms. *Journal of Abnormal Child Psychology*, 33, 219-229.
- Edelman S. (2005) Relationship between psychological factors and cancer: an update of the evidence. *Clinical Psychology*, 9, 45-53.
- Everson S, Kauhanen J, Kaplan G, Goldberg D, Julkunen J, Tuomilehto J and Salonen JT. (1997) Hostility and increased risk of mortality and acute myocardial infarction: the mediating role of behavioral risk factors. *American Journal of Epidemiology*, 146, 142-152.
- Grossarth-Maticke R, Eysenck H, Pfeifer A, Schmidt P and Koppel G. (1997) The specific action of different personality risk factors on cancer of the breast, cervix, corpus uteri and other types of cancer: a prospective investigation. *Personality and Individual Differences*, 33, 949-960.

- Horwitz S, Leaf P, Leventhal J, Forsyth B and Speechley K. (1992) Identification and management of psychosocial and developmental problems in community-based, primary care pediatric practices. *Pediatrics*, 89, 480-485.
- Irwin M, Patterson T, Smith T, Caldwell C, Brown S, Gillin J, and Grant I. (1990) Reduction of immune function in life stress and depression. *Biological Psychiatry*, 27, 22-30.
- Jokela M, Ferrie J and Kivimäki M. (2009) Childhood problem behaviors and death by midlife: the British National Child Development Study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 48, 19-24.
- Kaltiala-Heino R, Rimpelä M, Marttunen M, Rimpelä A and Rantanen P. (2005) Bullying, depression, and suicidal ideation in Finnish adolescents: school survey. *British Medical Journal*, 319, 348-351.
- Kaplan G, Wilson T, Cohen R, Kauhanen J, Wu M and Salonen J. (1994) Social functioning and overall mortality: prospective evidence from the Kuopio Ischemic Heart Disease Risk Factor Study *Epidemiology*, 5, 495-500.
- Kauhanen J, Kaplan G, Goldberg D and Salonen J. (1997) Beer bingeing and mortality: results from the Kuopio ischaemic heart disease risk factor study, a prospective population based study. *British Medical Journal*, 315, 846-851.
- Kauhanen L, Lakka H, Lynch J and Kauhanen J. (2006) Social disadvantages in childhood and risk of all-cause death and cardiovascular disease in later life: a comparison of historical and retrospective childhood information. *International Journal of Epidemiology*, 35, 962-968.
- Kelleher K, McInerney T, Gardner W, Childs G and Wasserman R. (2000) Increasing identification of psychosocial problems: 1979-1996. *Pediatrics*, 105, 1313-1321.
- King SM, Iacono WG, McCue M. (2004) Childhood externalizing and internalizing psychopathology in the prediction of early substance use. *Addiction*, 99, 1548-1559.
- Kumpulainen K, Räsänen E, Henttonen I, Almqvist F, Kresanov K, Linna S-L, Moilanen I, Piha J, Puura K and Tamminen T. (1998) Bullying and psychiatric symptoms among elementary school-age children. *Child Abuse and Neglect*, 22, 705-717.
- Lakka T, Venäläinen J, Rauramaa R, Salonen R, Tuomilehto J and Salonen J. (1994) Relation of leisure-time physical activity and cardiorespiratory fitness to the risk of acute myocardial infarction in men. *New England Journal of Medicine*, 330, 1549-1554.
- Laub JH and Vaillant GE. (2000) Delinquency and mortality: a 50-year follow-up study of 1,000 delinquent and non-delinquent boys. *American Journal of Psychiatry*, 157, 96-102.
- Neeleman J, Wessely S and Wadsworth M. (1998) Predictors of suicide, accidental death, and premature natural death in a general-population birth cohort. *The Lancet*, 351, 93-97.
- Peach B, Ruth D, Tennan, C and Tonkin A. (2003) Stress and coronary heart disease: psychosocial risk factors. *Medical Journal of Australia*, 178, 272-276.
- Penninx B, Guralnik J, Pahor M, Ferrucci L, Cerhan J, Wallace R and Havlik R. (1998) Chronically depressed mood and cancer risk in older persons. *Journal of the National Cancer Institute*, 90, 1888-1893.
- Persky V, Kempthorne-Rawson J and Shekelle, R. (1987) Personality and risk of cancer: 20-year follow-up of the Western Electric Study. *Psychosomatic Medicine*, 49, 435-449.
- Price MA, Tennant CC, Smith RC, Butow PN, Kennedy SJ, Kossof MB and Dunn SM. (2001) The role of psychosocial factors in the development of breast carcinoma: Part I. The cancer-prone personality. *Cancer*, 91, 679-685.
- Regier D, Kessler L, Burns B and Goldberg I. (1979) The need for a psychosocial classification in primary-care settings. *International Journal of Mental Health*, 8, 16-29.
- Rimpelä M, Luopa P, Räsänen M and Jokela J. (2006) Nuorten hyvinvointi 1996-2005 - Eriytyvätkö hyvinvoinnin ja pahoinvoinnin kehityssuunnat [Welfare trends among the youth 1996-2005]. In M. Kautto. ed. *Suomalaisten hyvinvointi 2006 [Welfare trends in Finland 2006]* Pp. 57-77. Stakes, Helsinki.
- Roza SJ, Hofstra MB, Van der Ende J and Verhulst FC. (2003) Stable prediction of mood and anxiety disorders based on behavioral and emotional problems in childhood: a 14-year follow-up during childhood, adolescence, and young adulthood. *American Journal of Psychiatry*, 160, 2116-2121.

- Salonen J, Nyyssönen K, Korpela H, Tuomilehto J, Seppänen R and Salonen R. (1992) High stored iron levels are associated with excess risk of myocardial infarction in eastern Finnish men. *Circulation*, 86, 803-811.
- Salonen J, Salonen R, Seppänen K, Rauramaa R and Tuomilehto J. (1991) HDL, HDL2 and HDL3 subfractions and the risk of acute myocardial infarction. A prospective population study in eastern Finnish men. *Circulation*, 84, 129-139.
- Shaffer J, Graves P, Swank R and Pearson T. (1987) Clustering of personality traits in youth and the subsequent development of cancer among physicians. *Journal of Behavioral Medicine*, 10, 441-447.
- Shekelle R, Raynor WJ, Ostfeld A, Bieliauskas L, Lui S and Oglesby P. (1981) Psychological depression and 17-year risk of death from cancer. *Psychosomatic Medicine*, 43, 117-125.
- Shepherd J, Farrington D and Potts J. (2004) Impact of antisocial lifestyle on health. *Journal of Public Health*, 26, 347-352.
- Simonoff E, Elander J, Holmshaw J, Pickles A, Murray R and Rutter M. (2004) Predictors of antisocial personality. *British Journal of Psychiatry*, 184, 118-127.
- Stein M, Keller S and Schleifer S. (1985) Stress and immunomodulation: the role of depression and neuroendocrine function. *Journal of Immunology*, 135, 827-833.
- Sweeting H and West P. (1998) Health at age 11: reports from schoolchildren and their parents. *Archives of Disabled Child*, 78, 427-434.
- Tindle HA, Chang Y-F, Kuller LH, Manson JE, Robinson JG, Rosal MC, Siegle GJ and Matthews KA. (2009) Optimism, cynical hostility, and incident coronary heart disease and mortality in the Women's Health Initiative. *Circulation*, 120, 656-662.
- Tuomilehto J, Arstila M, Kaarsalo E, Kankaanpää J, Ketonen M, Kuulasmaa K, Lehto S, Miettinen H, Mustaniemi H and Palomäki P. (1992) Acute myocardial infarction (AMI) in Finland-baseline data from the FINMONICA AMI register in 1983-1985. *European Heart Journal*, 13, 577-587.
- Weidner G, Sexton G, McLellarn R, Connor S and Matarazzo J. (1987) The role of type A behavior and hostility in an elevation of plasma lipids in adult women and men. *Psychosomatic Medicine*, 49, 136-145.
- Zahn-Waxler C, Klimes-Dougan B and Slattery M. (2000) Internalizing problems of childhood and adolescence: prospects, pitfalls, and progress in understanding the development of anxiety and depression. *Developmental Psychopathology*, 12, 443-466.

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## Endnotes

<sup>i</sup> Chi-squared tests and independent samples T-tests were used to assess differences in the study sample and the rest of the KIHD cohort. The differences in baseline characteristics between the three groups were analysed by chi-squared tests and analysis of variance (ANOVA).