CHILDHOOD SOCIAL CLASS AND CANCER INCIDENCE: RESULTS FROM THE GLOBE STUDY

Inge M.C.M. de Kok, MSc; Frank J van Lenthe, PhD; Mauricio Avendano, PhD; Marieke Louwman, PhD; Jan-Willem W Coebergh, PhD; Johan P Mackenbach, PhD

ABSTRACT

Despite increased recognition of the importance of investigating socio-economic inequalities in health from a life course perspective, little is known about the influence of childhood socio-economic position (SEP) on cancer incidence. The authors studied the association between father's occupation and adult cancer incidence by linking information from the longitudinal GLOBE study with the regional population-based Eindhoven Cancer Registry over a period of 14 years. In 1991, 18 973 participants (response rate 70.1 %) of this study responded to a postal questionnaire, including questions on SEP in youth and adulthood. Respondents above the age of 24 were included (N=12 978). Cox regression was used to calculate hazard ratios (HR) for all cancers together as well as for the five most frequently occurring cancers by respondent's educational level or occupational class and by father's occupational class (adjusted for respondent's education and occupation). Respondents with a low educational level showed an increased risk of all cancers (HR 1.21 (95% CI 1.02-1.43)), lung (HR 3.68 (95% CI 2.12-6.39)) and breast cancer (HR 2.52 (95% CI 1.12-5.65) in women). Respondents with a low adult occupational level showed an increased risk of lung cancer (HR 2.90 (95% CI 1.63-5.15)) and a reduced risk of basal cell carcinoma (BCC) (HR 0.52 (95% CI 0.35-0.78)). After adjustment for adult education and occupation, respondents whose father was in a lower occupational class showed an increased risk of colorectal cancer (HR 3.38 (95% CI 1.21-9.46)) as compared to this with a father in the highest social class. In contrast, respondents whose father was in a lower occupational class, showed a decreased risk of BCC (HR 0.62 (95% CI 0.39-0.99)) as compared to those with a father in the highest occupational class. The association between childhood SEP and cancer incidence is less consistent than the association between adult SEP and cancer incidence, but may exist for colorectal cancer and BCC.

INTRODUCTION

There is convincing evidence that socio-economic conditions at different stages of the life course influence adult health outcomes (Davey Smith & Lynch, 2004; Kuh & Ben-Shlomo, 2004; Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003). Although investigations of early socio economic origins of cardiovascular disease (CVD) have proceeded rapidly since the late 1980's (Galobardes, Smith, & Lynch, 2006), such investigations have only recently emerged for cancers (Frankel, Gunnell, Peters, Maynard, & Davey Smith, 1998; Pensola & Martikainen, 2003; Potischman, Troisi, & Vatten, 2004). These studies yielded contradictory results on the association between childhood socio-economic position (SEP) and cancer mortality; they were limited by using mortality as an outcome and did not investigate the association between cancer type and childhood SEP.

Previous studies indicate that SEP in adulthood is associated with cancer incidence and mortality rates, although associations vary by cancer type and geographic region (Faggiano, Partanen, Kogevinas, & Boffetta, 1997; van Loon, Brug, Goldbohm, van den Brandt, & Burg, 1995). For example, mainly in the western societies, people with a high SEP have an increased risk of melanoma, while those with a low SEP have an increased risk of lung cancer (Faggiano *et al.*, 1997; van Loon, Brug *et al.*, 1995). Several mechanisms have been proposed to explain these differences, including factors in childhood and adulthood. A higher prevalence of smoking, poor diet and physical inactivity in lower socio-economic groups seem to explain part of the socio-economic inequalities in lung cancer (Louwman, van Lenthe, Coebergh, & Mackenbach, 2004; Lynch, Kaplan, & Salonen, 1997). Furthermore, higher exposure to infectious agents such as Helicobacter Pylori in childhood resulting from overcrowding may explain some of the impact of low SEP in childhood on stomach cancer (Davey Smith, Hart, Blane, & Hole, 1998).

Many years of epidemiological research into the aetiology of cancers have focused on host or environmental factors in adulthood. With much of cancer aetiology yet to be explained, new research incorporates earlier periods in life (Colditz & Frazier, 1995; Oliveria, Saraiya, Geller, Heneghan, & Jorgensen, 2006). An exposure acting during a specific time window could have long-lasting effects on the structure or the function of the body, resulting in the development of cancer. Alternatively, there could be cumulative effects of a set of independent risk factors over the life course that culminate in disease development in adulthood (Galobardes, Lynch, & Davey Smith, 2004; Potischman *et al.*, 2004). An increased emphasis on factors that act during childhood and adolescence, along with evaluations of the interplay among such factors, may improve our understanding of how early life exposures influence adulthood cancer risk.

This population-based study aimed to address: 1) Is there an association between childhood social class and cancer incidence? 2) Do adult educational level and occupational class influence cancer incidence? 3) To what extent is the association between childhood SEP and cancer incidence mediated by adulthood education and occupational class?

MATERIALS AND METHODS

The prospective GLOBE study started in 1991 with the aim to investigate the explanation of socio-economic inequalities in health. GLOBE is the Dutch acronym for 'Health and Living Conditions of the Population of Eindhoven and Surroundings'. A detailed description of the purpose and design of the GLOBE study is presented elsewhere (Mackenbach, van de Mheen, & Stronks, 1994). At baseline, a sample of 27 020 non-institutionalised Dutch persons, between 15 and 74 years of age, living in or near the city of Eindhoven (in the south-east of the Netherlands) was approached to fill out a postal questionnaire in 1991. The population registers of the municipalities were used as a sampling frame, and a random sample was drawn, stratified by age, municipality and zip code. The response rate was 70.1%, so information was available from 18 973 persons; there appeared to be no selective non-response according to age, sex, socio-economic position (based on zip code) or marital status (Mackenbach *et al.*, 1994). The extensive questionnaire included measures of socio-economic position and childhood circumstances.

Information on change of address and vital status of the study population was routinely sought from the population registers of the municipalities in the study area, and of other municipalities if sample members had moved from the study area.

Cancer incidence

The population-based Eindhoven Cancer Registry has collected data on new cancer patients since 1955 according to international guidelines (Parkin, Whelan, Ferlay, Raymond, & Young, 1997). Since 1988 the registry has covered an area in the southeast Netherlands with a population of over 2 million inhabitants, including the area of the GLOBE population.

Data from the GLOBE baseline measurements were linked with cancer registry records in a two-step procedure. First, a combination of the respondent's sex, date of birth and the first two characters of his or her last name at birth were used as a linking key. In a second step, double matches were manually checked, using identifiable data (such as initials, full last names, date of death and postal codes).

Three respondents were excluded, because no linking key could be constructed (N = 18 970). After linkage, there were 19 403 records in the database, as one person could have more then one tumour. As we were interested in the incidence, respondents who were registered with several tumours at the same location were only included with the first tumour diagnosed at that specific location. So, recurrences of first tumours at specific locations were not included, nevertheless, for people who developed several tumours at different locations, all first tumours at a specific location were included.

Socio-economic position

Childhood social class was measured retrospectively by father's occupational class when the respondent was 12 years old or, if the father didn't work then or had died, according to his last occupation. Adult occupational class was measured by the current or last occupational level of the main breadwinner in the respondent's family. Occupations were classified according to the scheme of Erikson, Goldthorpe, and Portocarero (1983) in five different groups: (1) Higher grade professionals; (2) Lower grade professionals; (3) Self employed; (4) Higher grade manuals; and (5) Lower grade manuals. SEP in early adulthood was measured by the highest attained level of education of the respondent, with students classified according to their current training, and using a closed question in the baseline questionnaire. Four different groups were created: (1) primary school only; (2) lower vocational school and lower secondary school; (3) intermediate vocational school and intermediate/higher secondary school; and (4) higher vocational school and university. In The Netherlands, educational level is recognized as a good indicator of SEP (van Berkel-van Schaik & Tax, 1990).

If data were missing on one or more of the three indicators of SEP across the life course, respondents were excluded from the study (N = 5291); 2338 respondents did not fill out their father's occupation; 583 respondents did not fill out their education; 3361 respondents did not fill out the occupation of the main breadwinner, as they were unemployed or still studying. Respondents below the age of 25 at the start of the study (April 1st 1991), were also excluded (N = 2250). The resulting analytical sample comprised of 12 978 respondents.

Statistical analysis

Chi-square tests were used for comparing baseline categorical variables (sex, age and marital status) between respondents with different SEP levels.

Cox proportional hazard models were used to analyse the differences in overall and tumour-specific incidence by the three socio-economic indicators. Persons were considered to be at risk for developing cancer until they died, moved from the cancer registration area, or the end of follow-up (October 1st 2004 or January 1st 2005, depending on the place of residence of the respondent), whichever occurred first.

In the first model, the association between father's occupational class and cancer incidence was explored. Subsequently, associations between respondent's education and occupational level were explored. Finally, all three SEP-indicators were put into a model together. All models were fitted with adjustment for age, gender and marital status. Also, the models were fitted by age group, birth cohort and gender. However, these results are not shown, because they did not differ between age groups or birth cohorts, and associations were similar across the entire age range.

Analyses were performed using the statistical package SPSS 11.0. All tests were two-sided and significance was defined as $p<0.05$ or when the confidence interval of the hazard ratio (HR) did not contain 1.

RESULTS

Between 1991 and 2005 a total of 1542 first tumours were diagnosed within the GLOBE population. The most frequent tumours were BCC (19.6% of all tumours), tumours of the breast (31.5% of all tumours among the female population), lung (12.3% of all tumours), colorectal (11.7% of all tumours) and prostate (16.1% of all tumours among the male population).

At baseline, respondents with lower SEP in childhood were more often male (52.8% versus 49.8%; P=0.009), they were older (50.5 versus 48.1 years; p<0.001) and a higher proportion were married (82.8% versus 72.4%; P<0.001) than respondents with higher childhood SEP. Respondents with lower education were more often female (52.3% versus 29.9%; P<0.001), were older (56.7 versus 46.5 years; p<0.001) and a greater proportion were married (81.6% versus 72.5%; P<0.001) than respondents with higher education. Respondents with a lower occupational level in adulthood were more often female (50.4% versus 36.9%; P<0.001), less were married and a greater proportion were divorced (married: 75.6% versus 85.5%; divorced: 7.8% versus 4.1%; P<0.001) than respondents with higher occupational level in adulthood (Table 1).

For father's occupation, the risk of colorectal cancer was higher among the lower occupational classes, compared to the highest occupational class. The highest risk was observed among those in the high manual classes (HR 3.28, 95% CI: 1.19-9.03) (Table 2). In contrast, it seemed that the risk of BCC was lower among those with the lower father's occupational classes as compared to the highest father's occupational category. The lowest, but also the only significant, risk of BCC was observed among participants who father was self employed (HR 0.57, 95% CI 0.36-0.90) (Table 2). Father's occupation was not significantly associated with total cancer or with other types of cancer.

A lower adult educational level was associated with higher risk of total cancer (lowest vs. highest level, HR 1.21, 95% CI: 1.02-1.43) (Table 3). Compared to the highest education category, all other educational levels were significantly associated with an increased risk. The association between adult education and total cancer appeared to be largely driven by an effect of adult education on lung (men and women) and breast cancer (women), whereas other cancer types included in the study did not contribute to this pattern. The highest lung cancer risk was observed among those with the lowest level of adult education (HR 3.68, 95% CI: 2.12-6.39). The highest breast cancer risk was found among respondents with intermediate vocational school and intermediate/higher secondary school (HR 3.72, 95% CI: 1.66-8.34). Also, there was a significant trend in association between respondent's educational level and lung cancer risk (P=0.000); for the other cancers there wasn't a significant trend in association. Respondent's education was not associated with other cancer types. With respect to adult occupational class, the highest lung cancer risk was observed among those in the lower grade manual occupations (HR 2.90, 95% CI: 1.63-5.15) (Table 3). People with lower occupational class were at lower risk of BCC (lowest HR 0.45, 95% CI: 0.24-0.83). Adult occupational class was not associated with other cancer types. After adjusting for father's occupational level, the associations between respondent's educational level, as well as occupational level, and cancer incidence remained.

After adjusting for respondent's educational level and occupational class, the associations between childhood SEP and colorectal cancer, and BCC incidence remained. The highest colorectal cancer risk was observed for those in the high manual classes (HR 3.38, 95% CI: 1.21-9.46) (Table 4). The lowest BCC risk was observed among the self employed group (HR 0.62, 95% CI: 0.39-0.99) (Table 4).

DISCUSSION

A lower childhood SEP, as compared to the highest SEP in childhood, was associated with an increased risk of colorectal cancer and, although there was weaker evidence, with a reduced risk of BCC. Both associations remained significant after adjustment for respondent's educational level or occupational class. Childhood SEP was not associated with total cancer, lung, breast, and prostate cancers. Given associations between respondent's education and total cancer incidence, lung cancer incidence and breast cancer incidence, as well as associations between respondent's occupation and lung cancer and BCC incidence, our study suggests that exposure to low SEP at different stages of the life-course is related to risk of different cancers.

Previous studies have shown contradictory results on the association between SEP and colorectal cancer: Both higher and lower social class in adulthood have been associated with higher risk of colorectal cancer (Faggiano *et al.*, 1997; Krieger *et al.*, 1999; Palmer & Schneider, 2005; van Loon, Brug *et al.*, 1995; van Loon, van den Brandt, & Golbohm, 1995). To our knowledge, this is the first study showing an increased risk of colorectal cancer in the lower as compared to the highest childhood SEP group. A first explanation for this association could be a methodological artefact. For example, those in the highest childhood social class could be a highly selective group in terms of health. However, if this would be the case, the same patterns of association would be expected for other tumours. As this was not the case, a methodological artefact seems an unlikely explanation. The association between father's occupation and colorectal cancer could be due to the low number of cases in the highest SEP group (four cases). On the other hand, the low number of cases in this after a long period of follow-up can be an indication of the low risk of colorectal cancer in this SEP group. We also analysed the association between childhood SEP and colorectal cancer with the 'higher manuals' as reference-group (the largest group) and found that the risk of colorectal cancer was significantly lower among those with the highest father's occupational classes (0.31 (95% CI 0.11-0.84). Thereby, the mean time lag between age 12 (when childhood SEP was measured) and the age at diagnoses for people whose father was 'a higher professional' is higher than for other groups (63 versus 58 years). A social causation mechanism may be an explanation for the associations found. For adults, it is known that colorectal cancer risk is influenced by poor dietary habits, physical inactivity and smoking, and these factors are more prevalent in lower SEP groups (Potter, 1997). Protective factors of high childhood SEP against the risk of colorectal cancer, such as higher intake of fruits and vegetables (Potter & Hunter, 2002) and better living conditions (reduced exposure to infectious agents or better hygienic conditions) may explain the reduced risk. Further research, including longer follow up in our study, needs to be done to gain better insight in the relationship between social class in childhood and colorectal cancer risk.

The finding that persons in higher social classes seem to have an increased risk of BCC has been reported previously (Lear *et al.*, 1997). However, because this cancer is generally not included in population registries, there are very few good incidence studies of socio-economic-related risk factors. BCC of the skin is associated with intense exposures to ultraviolet (UV) radiation, particularly in childhood (Goldberg, 1996). A few decades ago, tanning became more socially favoured and a suntan was regarded as a symbol of success and well-being (Woodward & Boffetta, 1997). Additionally, more leisure time became available for outdoor activities and for holidays in the sun, whereby since the 1980's holidays to the (sub) tropics became affordable for many in the Netherlands. As a result, exposure to sunlight outside work (recreational exposure) became increasingly important as a source of UV radiation.

Thus, the increased risk of BCC found in higher social class, mainly in adulthood, could be attributable to differences in the quality and timing of exposures to intense sunlight. Another possible explanation is that people in higher social classes might be more aware of the risk of BCC, which leads in turn to an increased reporting of BCC. This hypothesis is supported by the finding that low SEP and infrequent physician visits are associated with very large lesions (Robinson, Altman, & Rademaker, 1995). Since we found an association of both childhood and adulthood SEP with BCC incidence, we analysed the cumulative effect of SEP on BCC incidence. Compared to respondents who had a high SEP for all three SEP indicators (occupational levels 1 and 2 or educational levels 1 and 2), the risk of BCC for respondents who had a low SEP level for all three SEP indicators (occupational levels 3, 4 and 5 or educational levels 3 and 4) was lower (HR 0.67, 95% CI: 0.47-0.93). For respondents who had a low father's and adult occupational level and a high educational level the BCC risk was lower (HR 0.47, 95% CI: 0.23-0.94). Surprisingly, for respondents who had a high father's and adult occupational level, but a low educational level, the BCC risk was also lower (HR 0.47, 95% CI: 0.25-0.90). No significant lower risk was found for respondents who had a low father's and a high adult occupational level, or who had a high father's and low adult occupational level. So, associations between SEP and BCC incidence were found only if occupational level in both childhood and adulthood were the same.

Our finding that lower education and occupational class in adulthood increases the risk of lung cancer is consistent with previous epidemiological studies (Ekberg-Aronsson, Nilsson, Nilsson, Pehrsson, & Lofdahl, 2006; Faggiano *et al.*, 1997; Mao, Hu, Ugnat, Semenciw, & Fincham, 2001; van Loon, Brug *et al.*, 1995). The impact of SEP on lung cancer is likely manifest through lifestyle risk factors, such as smoking, dietary factors or physical activity (Louwman *et al.*, 2004; Marmot & Feeney, 1997; J. D. Potter, 1997; Stellman & Resnicow, 1997). Indeed, Louwman et al.(2004) showed that smoking explained 39% of the effect of education on lung cancer, an additional 22% being explained by alcohol intake and physical activity. In this study, smoking explained 14.7% of the effect of respondent's education and 12.8% of respondent's occupational inequalities on lung cancer.

For breast cancer, lifestyle factors, such as alcohol consumption, poor diet (Hamajima *et al.*, 2002; Hankinson & Hunter, 2002), and obesity resulting from unfavourable lifestyle may also explain part of the association found with adult education (Gerber, Muller, Reimer, Krause, & Friese, 2003; Moller & Tonnesen, 1997; J. D. Potter, 1997). Other studies have also shown that the risk of breast cancer was higher for women with lower SEP (Gorey & Vena, 1995; Krieger *et al.*, 1999; Lawson, 1999; van Loon, Brug *et al.*, 1995). In contrast, some studies reported higher rates of breast cancer among more affluent women (Faggiano *et al.*, 1997). The latter was explained by the fact that breast cancer incidence is largely influenced by childbearing, and women with higher education have lower fertility, later age at first birth and a greater prevalence of childlessness (dos Santos Silva & Beral, 1997; Hankinson & Hunter, 2002). Women in the higher classes are also more likely to attend screening (Bradley, Given, & Roberts, 2001; Schrijvers, Stronks, van de Mheen, Coebergh, & Mackenbach, 1994), which could contribute to an increased breast cancer incidence. We did not find an association between adult occupational class and breast cancer incidence. This may perhaps be due to the fact that adult occupational class was measured by the current or last occupational level of the main breadwinner in the respondent's family, in our population mainly the man.

Strengths and weaknesses

A strength of this study is that it examines social class in childhood and cancer incidence over a period of 14 years. The follow-up of the original sample on vital status has been nearly complete (Louwman *et al.*, 2004), and the two-step linkage procedure ascertained the appropriate identification of cancer patients within the GLOBE cohort. Also, the use of data from the cancer registry is preferred over self-reported questionnaires for estimating the prevalence of cancer (Schrijvers *et al.*, 1994). This makes it unlikely that the results have been biased by incompleteness of data on cancer incidence. Moreover, BCC inclusion is a strength of the study, because these tumours are generally not included in disease registries (de Vries, Louwman, Bastiaens, de Gruijl, & Coebergh, 2004). We were able to examine the influence of SEP on BCC, because BCC's are included in the population-based Eindhoven Cancer Registry. It is known that registrations of BCC's are not without error. In the Netherlands, however, underreporting of BCC is unlikely to be related to SEP. In the rare case that dermatologists do not send tissue to the pathologist (only if something is confirmed by a pathologist the case is included in the cancer registry) it is because the dermatologist already knows for sure that this is a BCC and that treatment is needed immediately. This is not related to SEP. Thereby, medical care is available equally to all because it is a national health insurance system in the Netherlands. So, patients from all socio-economic groups have access to the same care.

Weaknesses of the study are that we have few cases for many cancer types. We were unable to look at associations between SEP and other specific cancers, as well as the effect of SEP on cancers in different stages. Finally, our measurement of childhood SEP is rather general, retrospectively measured and does not refer to SEP during the very early stages of life.

Implications of findings

This study has demonstrated that SEP is associated with cancer incidence and that SEP at different stages of the life-course may be associated with different types of cancer. This may be due to the fact that different cancer types have other risk factors; some risk factors act across the entire life course (such as diet and UV radiation) while other factors only act during adulthood (such as smoking and alcohol). It should be noted that the associations found between childhood SEP and cancer incidence are not conclusive. Interventions to reduce cancer risk throughout the life course – that is, starting in youth – may be more important for colorectal cancer and BCC. On the other hand, interventions to reduce socio-economic inequalities in lung cancer should probably focus on smoking in adulthood, as this is the main cancer that is associated with adult SEP.

The exact nature of the relationship among the SEP factors and the different period in life is unknown; it may concern interactive or cumulative effects of exposure. However, most studies contain exposure information from one time only. Hence, longitudinal information is important. Further research needs to be done to get a better insight in the influence of SEP in childhood on cancer incidence, and to use this information to improve our understanding of how early influences may contribute to risk of adult cancers.

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Tabel 1: Baseline characteristics of the population, by SEP indicators, per stage of life course (N = 12 978)

Father's occupation*		1 (high) N	1 (high) %	2 N	2 %	3 N	3 %	4 N	4 %	5 (low) N	5 (low) %	P-value
Gender	Male	443	(49.8)	1442	(53.7)	1261	(49.2)	1964	(51.6)	1603	(52.8)	0.009
	Female	446	(50.2)	1242	(46.3)	1302	(50.8)	1841	(48.4)	1434	(47.2)	
Age	Mean	48.1		47.2		52.3		49.7		50.5		<0.001
Marital status	Married	644	(72.4)	2002	(74.6)	2065	(80.6)	3103	(81.6)	2515	(82.8)	<0.001
	Not-Married	165	(18.6)	434	(16.2)	247	(9.6)	354	(9.3)	272	(9.0)	
	Divorced	52	(5.8)	169	(6.3)	142	(5.5)	210	(5.5)	145	(4.8)	
	widowed	24	(2.7)	63	(2.3)	79	(3.1)	104	(2.7)	76	(2.5)	
	missing	4	(0.4)	17	(0.6)	30	(1.2)	34	(0.9)	29	(1.0)	

Education†		1 (high) N	1 (high) %	2 N	2 %	3 N	3 %	4 (low) N	4 (low) %	P-value
Gender	Male	1793	(70.1)	1537	(56.1)	2218	(42.3)	1165	(47.7)	<0.001
	Female	766	(29.9)	1202	(43.9)	3021	(57.7)	1276	(52.3)	
Age	Mean	46.5		46.6		49.8		56.7		<0.001
Marital status	Married	1855	(72.5)	2088	(76.2)	4394	(83.9)	1992	(81.6)	<0.001
	Not-Married	499	(19.5)	414	(15.1)	377	(7.2)	182	(7.5)	
	Divorced	149	(5.8)	151	(5.5)	281	(5.4)	137	(5.6)	
	widowed	43	(1.7)	63	(2.3)	142	(2.7)	97	(4.0)	
	missing	13	(0.5)	23	(0.8)	45	(0.9)	33	(1.4)	

Adult occupation*		1 (high) N	1 (high) %	2 N	2 %	3 N	3 %	4 N	4 %	5 (low) N	5 (low) %	P-value
Gender	Male	1131	(63.1)	2540	(47.6)	393	(53.0)	1619	(53.4)	1030	(49.6)	<0.001
	Female	660	(36.9)	2796	(52.4)	349	(47.0)	1412	(46.6)	1048	(50.4)	
Age	Mean	50.8		48.6		51.6		50.3		50.3		<0.001
Marital status	Married	1531	(85.5)	4011	(75.2)	589	(79.4)	2628	(86.7)	1570	(75.6)	<0.001
	Not-Married	153	(8.5)	818	(15.3)	63	(8.5)	204	(6.7)	234	(11.3)	
	Divorced	73	(4.1)	313	(5.9)	43	(5.8)	127	(4.2)	162	(7.8)	
	widowed	28	(1.6)	138	(2.6)	39	(5.3)	50	(1.6)	90	(4.3)	
	missing	6	(0.3)	56	(1.0)	8	(1.1)	22	(0.7)	22	(1.1)	

* 1 = High professional , 2 = Lower grade professional , 3 = Self employed , 4 = High manual, 5 = Low manual

† 1 = higher vocational school and university , 2 = intermediate vocational school and intermediate/higher secondary school, 3 = lower vocational school and lower secondary school , 4 = primary school only

Table 2: Effects of father's occupation (Number of cases, odds ratio's (95% CI)) by tumour site, adjusted for sex, age, and marital status.

Tumour site	Father's occupation*									
	1 (High) (n = 890)		**2** (n = 2684)		**3** (n = 2564)		**4** (n = 3806)		**5 (Low)** (n = 3037)	
All sites combined (n = 1542)	96	1.00	276	1.01 (0.80-1.28)	335	1.00 (0.80-1.26)	455	1.03 (0.83-1.29)	380	1.07 (0.85-1.34)
Lung (n = 189)	9	1.00	27	1.02 (0.48-2.16)	38	1.19 (0.58-2.46)	59	1.37 (0.68-2.77)	56	1.59 (0.79-3.22)
Breast (n = 209)	14	1.00	39	1.04 (0.56-1.92)	40	0.83 (0.45-1.53)	62	0.99 (0.55-1.77)	54	1.09 (0.60-1.97)
Colon/rectum (n = 180)	4	1.00	34	3.01 (1.07-8.49)	41	2.88 (1.03-8.05)	61	3.28 (1.19-9.03)	40	2.65 (0.95-7.40)
Prostate (n = 141)	8	1.00	29	1.21 (0.55-2.66)	34	1.21 (0.56-2.61)	39	1.02 (0.48-2.18)	31	0.99 (0.46-2.16)
Skin, basal cell carcinoma (n = 302)	28	1.00	55	0.69 (0.44-1.09)	54	0.57 (0.36-0.90)	88	0.69 (0.45-1.06)	77	0.75 (0.49-1.16)

* 1 = High professional , 2 = Lower grade professional , 3 = Self employed , 4 = High manual, 5 = Low manual

Table 3: Effects of education and adult occupation (Number of cases, odds ratio's (95% CI)) by tumour site, adjusted for sex, age, and marital status.

Tumour site	Education†							
	1 (High) (n = 2559)		**2** (n = 2741)		**3** (n = 5240)		**4 (Low)** (n = 2441)	
All sites combined (n = 1542)	224	1.00	313	1.35 (1.14-1.60)	625	1.24 (1.06-1.45)	380	1.21 (1.02-1.43)
Lung (n = 189)	16	1.00	38	2.54 (1.41-4.56)	70	2.49 (1.44-4.30)	65	3.68 (2.12-6.39)
Breast (n = 209)	7	1.00	39	3.72 (1.66-8.34)	119	3.54 (1.64-7.64)	44	2.52 (1.12-5.65)
Colon/rectum (n = 180)	29	1.00	44	1.51 (0.94-2.42)	67	1.11 (0.71-1.74)	40	0.98 (0.60-1.60)
Prostate (n = 141)	36	1.00	36	1.13 (0.71-1.79)	41	0.80 (0.51-1.25)	28	0.78 (0.47-1.28)
Skin, basal cell carcinoma (n = 302)	55	1.00	58	1.02 (0.70-1.47)	118	0.93 (0.67-1.30)	71	0.97 (0.68-1.39)

Tumour site	Adult occupation*									
	1 (High) (n = 1791)		**2** (n = 5337)		**3** (n = 743)		**4** (n = 3032)		**5 (Low)** (n = 2078)	
All sites combined (n = 1542)	239	1.00	591	0.92 (0.79-1.07)	91	0.88 (0.69-1.13)	387	0.97 (0.83-1.14)	234	0.85 (0.71-1.02)
Lung (n = 189)	16	1.00	62	1.77 (1.02-3.06)	12	2.00 (0.95-4.24)	55	2.28 (1.31-3.99)	44	2.90 (1.63-5.15)
Breast (n = 209)	23	1.00	98	1.02 (0.65-1.61)	9	0.69 (0.32-1.49)	44	0.86 (0.52-1.42)	35	0.92 (0.54-1.57)
Colon/rectum (n = 180)	29	1.00	62	0.86 (0.55-1.34)	8	0.66 (0.30-1.45)	51	1.11 (0.70-1.76)	30	0.96 (0.57-1.60)
Prostate (n = 141)	30	1.00	54	0.93 (0.60-1.46)	8	0.77 (0.35-1.68)	32	0.76 (0.46-1.25)	17	0.66 (0.37-1.21)
Skin, basal cell carcinoma (n = 302)	62	1.00	117	0.68 (0.49-0.92)	12	0.45 (0.24-0.83)	73	0.70 (0.50-0.98)	38	0.52 (0.35-0.78)

* 1 = High professional , 2 = Lower grade professional , 3 = Self employed , 4 = High manual, 5 = Low manual

† 1 = higher vocational school and university , 2 = intermediate vocational school and intermediate/higher secondary school, 3 = lower vocational school and lower secondary school , 4 = primary school only

Table 4: Effects of father's occupation on the incidence of cancer (odds ratio's (95% CI)) by tumour site, adjusted for age, sex, marital status, educational level and adult occupation

Tumour site	Father's occupation* adjusted by education				
	1 (High) (n = 890)	**2** (n = 2684)	**3** (n = 2564)	**4** (n = 3806)	**5 (Low)** (n =3037)
All sites combined (n = 1542)	1.00	0.98 (0.78-1.24)	0.95 (0.76-1.20)	0.97 (0.77-1.22)	1.00 (0.79-1.27)
Lung (n = 189)	1.00	0.87 (0.41-1.85)	0.85 (0.40-1.78)	0.92 (0.45-1.89)	0.99 (0.48-2.06)
Breast (n = 209)	1.00	0.91 (0.49-1.68)	0.71 (0.38-1.32)	0.84 (0.46-1.52)	0.93 (0.51-1.71)
Colon/rectum (n = 180)	1.00	3.01 (1.07-8.51)	3.02 (1.07-8.51)	3.48 (1.25-9.70)	2.89 (1.01-8.23)
Prostate (n = 141)	1.00	1.25 (0.57-2.75)	1.32 (0.60-2.90)	1.13 (0.52-2.48)	1.13 (0.50-2.56)
Skin, basal cell carcinoma (n = 302)	1.00	0.69 (0.44-1.09)	0.57 (0.36-0.92)	0.70 (0.45-1.09)	0.75 (0.48-1.19)

Tumour site	Father's occupation* adjusted by education and adult occupation				
	1 (High) (n = 890)	**2** (n = 2684)	**3** (n = 2564)	**4** (n = 3806)	**5 (Low)** (n =3037)
All sites combined (n = 1542)	1.00	0.99 (0.78-1.25)	0.98 (0.77-1.23)	0.99 (0.79-1.25)	1.03 (0.81-1.31)
Lung (n = 189)	1.00	0.84 (0.39-1.80)	0.81 (0.39-1.72)	0.86 (0.42-1.79)	0.92 (0.44-1.93)
Breast (n = 209)	1.00	0.92 (0.50-1.69)	0.75 (0.40-1.39)	0.88 (0.48-1.60)	0.99 (0.53-1.82)
Colon/rectum (n = 180)	1.00	3.02 (1.07-8.54)	3.06 (1.09-8.65)	3.38 (1.21-9.46)	2.78 (0.97-7.94)
Prostate (n = 141)	1.00	1.26 (0.57-2.77)	1.37 (0.62-3.01)	1.16 (0.53-2.55)	1.17 (0.52-2.65)
Skin, basal cell carcinoma (n = 302)	1.00	0.71 (0.45-1.13)	0.62 (0.39-0.99)	0.75 (0.48-1.17)	0.83 (0.52-1.31)

* 1 = High professional , 2 = Lower grade professional , 3 = Self employed , 4 = High manual, 5 = Low manual