

Occupation and mesothelioma in Sweden: updated incidence in men and women in the 27 years after the asbestos ban

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OBJECTIVES: We updated the Swedish component of the Nordic Occupational Cancer (NOCCA) Study through 2009 in order to investigate the incidence of mesothelioma of the peritoneum and pleura in both genders, and explored occupational exposures that may be associated with mesothelioma.

METHODS: The Swedish component of the NOCCA Study includes 6.78 million individuals. Data from this cohort were linked to the population-based Swedish Cancer Registry and Swedish Total Population Registry for three periods between 1961 and 2009, and then further linked to the Swedish NOCCA job-exposure matrix, which includes 25 carcinogenic substances and the corresponding exposure levels for 280 occupations. Multivariate analysis was used to calculate standardized incidence ratios (SIRs) for mesothelioma of the peritoneum and pleura by gender, occupational category, carcinogenic substance, and for multiple occupational exposures simultaneously.

RESULTS: A total of 3,716 incident mesotheliomas were recorded (21.1% in women). We found a significantly increased risk of mesothelioma in 24 occupations, as well as clear differences between the genders. Among men, increased risks of mesothelioma of the pleura were observed in male-dominated occupations, with the greatest elevation of risk among plumbers (SIR, 4.99; 95% confidence interval, 4.20 to 5.90). Among women, increased risks were observed in sewing workers, canning workers, packers, cleaners, and postal workers. In multivariate analysis controlling for multiple occupational exposures, significant associations were only observed between asbestos exposure and mesothelioma.

CONCLUSIONS: Asbestos exposure was associated with mesothelioma incidence in our study. The asbestos ban of 1982 has yet to show any clear effect on the occurrence of mesothelioma in this cohort. Among women, the occupations of canning workers and cleaners showed increased risks of mesothelioma of the pleura without evidence of asbestos exposure.

KEY WORDS: Epidemiology, Asbestos, Job-exposure matrix, Carcinogenic substances

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INTRODUCTION

Mesothelioma is a very aggressive malignancy that occurs in the peritoneum and pleura, and more rarely in the pericardium. It is most often linked to occupational asbestos exposure and was classified as an occupational disease in the 1950s [1]. Mesothelioma has a poor prognosis, with most patients dying within one year of diagnosis [2], and a long latency period of up to 40 years [3]. The incidence of mesothelioma varies; its incidence in developed countries such as Belgium, Britain, and Australia exceeds 30 cases per one million inhabitants [4], and in Swe-

den approximately 12 cases are diagnosed per one million inhabitants (approximately 120 cases per year) [5].

Mesothelioma development is most strongly associated with exposure to asbestos types from the amphibole family, of which crocidolite was the most prevalent type used in Sweden. Therefore, occupations in which crocidolite was used or manipulated constituted high-risk occupations. In some industries, such as asbestos-cement production, asbestos types from both the serpentine and amphibole families were used [6].

Asbestos was banned in Sweden in 1982 [7], and strict precautions and security requirements have been introduced for occupations that include the handling of or exposure to asbestos, such as asbestos removal. A sharp decline in the annual incidence rate of mesothelioma was observed in 2008 [8], but in the last two years its incidence has started to increase again. One of the reasons for this recent increase may be the long latency period of mesothelioma; however, since asbestos has been absent from the Swedish labor market for 35 years, one would expect the number of mesothelioma cases to be on the decline. Instead, at present more people in Sweden die from mesothelioma than from accidents in the workplace [9].

Only a limited number of occupations have been reported to confer a significant excess risk of mesothelioma [10], and no connection between mesothelioma and any occupational exposure besides asbestos, such as air pollution [11], has been scientifically proven. In the UK and Finland, it has been estimated that 97% [12] and 90% [13] of mesothelioma cases, respectively, are related to asbestos exposure, and most of these are caused by occupational exposure.

The most recent report on the Nordic Occupational Cancer (NOCCA) cohort covered the period from 1961 to 2005 and is the largest study of occupational cancer in the Nordic countries published so far. It included 2.8 million diagnosed cases of cancer in the five Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) and reported mesothelioma cases in occupations where asbestos exposure is not usually considered to be present [14]. A total of 40.6% of the mesothelioma cases in the NOCCA cohort were from Sweden (2,521 men and 548 women), and a statistically significant excess risk of mesothelioma among men in Sweden was found in 12 of the 53 occupational categories considered [14]. However, the proportion of women diagnosed with mesothelioma was also quite high.

Asbestos exposure alone probably cannot explain the relatively high proportion of women with mesothelioma in Sweden, since disease onset was found to occur at approximately 50 years of age, which is much earlier than the onset for men [5]. Moreover, asbestos exposure during the period covered by the NOCCA Study was most common in male-dominated occupations (e.g., insulators, ship builders, car mechanics, asbestos cement manufacturing, construction workers, etc.) [15]. How-

ever, since 17.8% of the mesothelioma cases in the latest Swedish NOCCA Study occurred in women [14], it is important to identify alternative direct or indirect causal factors.

Therefore, we updated the data in the Swedish component of the NOCCA Study through 2009 in order to investigate the incidence of mesothelioma of the peritoneum and pleura in both genders, and to explore occupational exposures other than asbestos that may be associated with mesothelioma. We also investigated whether mesothelioma incidence during the period from 1961 to 2009 differed among occupations and whether it was possible to see any effect of the Swedish asbestos ban of 1982.

MATERIALS AND METHODS

The Swedish Nordic Occupational Cancer Study

The NOCCA Study was started to investigate occupational exposures and their associations with cancer incidence. The Swedish component of the NOCCA Study consists of individuals who participated in one of the following Swedish population censuses: 1960, 1970, 1980, or 1990. The 1960, 1970, and 1990 censuses took place on November 1, while the 1980 census took place on September 15. The Swedish NOCCA Study included 6.78 million individuals aged 30 to 64 years who were still alive and living in Sweden on January 1 of the year following the census. Each individual's personal identification number, name, address, marital status, education, economic activity, occupation, and industry were recorded, and the occupations were then coded, as described previously by Pukkala et al. [14], according to a Swedish adaptation of the Nordic Occupational Classification [16], which is a Nordic adaptation of the International Standard Classification of Occupations from 1958 [17].

Update of cancer incidence through 2009

Cancer incidence was determined through record linkage between the Swedish NOCCA database and the population-based Swedish Cancer Registry. The present report updated information on cancer incidence in subjects included in the Swedish NOCCA Study through 2009, thus covering the period from 1961 to 2009. Follow-up was done over three time periods: 1961-1974, 1975-1989, and 1990-2009. Mesothelioma cases were classified into mesothelioma of the peritoneum (International Classification of Diseases, 7th revision [ICD-7] code 158) and of the pleura (ICD-7 code 162.2). Histological results were coded with three digits by the Swedish Cancer Registry (code 776), according to the official codes of the World Health Organization [18].

Study entry was set at January 1 of the year after the first available census in which an individual participated. Person-years

were accumulated until the date of emigration, death, or the end of the study period (December 31, 2009), whichever came first. Dates of death and emigration were retrieved from the Swedish Total Population Registry.

Standardized incidence ratio

The observed number of mesothelioma cases and person-years were stratified into 5-year age categories (30-34, 35-39, ..., ≥85 years) and 5-year calendar periods by gender and occupational category. Standardized incidence ratios (SIRs) were calculated using cancer incidence rates for the entire Swedish population by gender, age, and calendar time as reference rates. The exact 95% confidence interval (CI) was defined assuming a Poisson distribution of the observed number of cases.

The Nordic Occupational Cancer job-exposure matrix

The NOCCA job-exposure matrix (NOCCA-JEM) contains combined information from all the Nordic countries. It includes 25 carcinogenic substances with exposure levels for 280 occupations based on exposure data from national exposure databases and expert assessments available from 1945 to 1994 [19]. The NOCCA-JEM is quantitative; therefore, in principle it is possible to estimate the cumulative exposure (dose) of the 25 included carcinogenic substances for the entire NOCCA cohort.

The Finnish JEM (FINJEM) [20] was created by the Finnish Institute of Occupational Health in Helsinki, Finland. This is a generic quantitative JEM from 1945 onwards for 84 different outcomes, with exposures for almost 300 different occupations at 3-digit levels. This JEM is now used in many different countries. The FINJEM was used to construct national NOCCA JEMs for Denmark, Finland, Iceland, Norway, and Sweden. The exposure codes, definitions, and units of the carcinogenic substances included in the Swedish NOCCA-JEM can be found in Appendix 1. The Swedish NOCCA-JEM uses the 3-digit occupation codes used in the Swedish adaptation of the Nordic Occupational Classification. The data of the Swedish NOCCA Study were linked to the Swedish NOCCA-JEM to determine the exposures that occurred in the different occupations. Exposure information that went beyond the confines of the NOCCA-JEMs was obtained by an experienced occupational hygienist. Of the 280 occupational codes in the Swedish NOCCA Study, 96 were rated for occupational exposure to carcinogenic substances in the Swedish NOCCA-JEM.

Finally, mesothelioma incidence was linked with the Swedish NOCCA-JEM [19] and the observed number of cases was recorded by gender and by exposure to the carcinogenic substances included in the Swedish NOCCA-JEM.

The Swedish NOCCA Study received ethics committee/institutional review board approval from the Forskningsetikkommitteén at the Karolinska Institutet (Dnr 03-466).

RESULTS

A total of 3,716 cases of mesothelioma were diagnosed in the cohort of the Swedish NOCCA Study from 1961 to 2009, 785 (21.1%) of which occurred in women. The vast majority of cases (89.7%) had mesothelioma of the pleura, while a small proportion was diagnosed with mesothelioma of the peritoneum (10.3%). However, only 577 of the 3,334 cases of mesothelioma of the pleura occurred in women (17.3%), as opposed to 208 of the 382 (54.5%) cases of mesothelioma of the peritoneum. We found a significant excess risk of incident mesothelioma of both the peritoneum and pleura in 24 of the 280 occupations considered. Differences in risk between the genders were also found. Five occupations showed an excess risk in women, but no excess risk in men (Tables 1 and 2).

For men, the linkage of cancer incidence with the Swedish NOCCA-JEM resulted in the identification of 17 occupations with chemical exposure that conferred a significant excess risk of mesothelioma of the pleura, four of which also showed an excess risk of mesothelioma of the peritoneum: plumbers and pipe fitters (pleura: SIR, 4.99; 95% CI, 4.20 to 5.90; peritoneum: SIR, 3.56; 95% CI, 1.31 to 7.76), painters (pleura: SIR, 1.72; 95% CI, 1.35 to 2.16; peritoneum: SIR, 2.70; 95% CI, 1.08 to 5.56), bricklayers (pleura: SIR, 1.60; 95% CI, 1.07 to 2.30; peritoneum: SIR, 5.42; 95% CI, 1.99 to 11.80), and insulators (pleura: SIR, 10.9; 95% CI, 6.81 to 16.50; peritoneum: SIR, 64.70; 95% CI, 28.00 to 128.00) (Table 1, Appendix 2). Twelve of the 17 occupations with excess risk are rated for asbestos exposure in the Swedish NOCCA-JEM. However, most of these occupations are also rated for other exposures in the Swedish NOCCA-JEM. Moreover, the Swedish NOCCA-JEM indicates that the observed excess risk for mesothelioma of the pleura among mechanical engineers and technicians (SIR, 1.67; 95% CI, 1.42 to 1.95); toolmakers, machine-tool setters, and operators (SIR, 1.48; 95% CI, 1.22 to 1.77); chemical process workers (SIR, 2.15; 95% CI, 1.20 to 3.54); paper pulp workers (SIR, 2.10; 95% CI, 1.22 to 3.36); and stationary engine and related equipment operators (SIR, 1.77; 95% CI, 1.05 to 2.79) is not sufficiently high to classify them as occupations that include asbestos exposure (Table 1). An elevated risk of mesothelioma of the pleura was also observed in two occupations that are not rated for chemical exposure in the Swedish NOCCA-JEM: ships' engineers (SIR, 6.06; 95% CI, 3.65 to 9.46), and divers and pipe layers (SIR, 4.20; 95% CI, 1.14 to 10.7) (Table 1, Appendix 3). The highest risk of mesothelioma of the pleura was observed for insulators (SIR=10.9), and the largest number of cases was observed among machinery fitters and machinery assemblers (n=180).

When women with mesothelioma were linked to the Swedish NOCCA-JEM, we observed an excess risk of mesothelioma of the pleura for one occupation rated for chemical exposure:

Table 1. Observed number of mesotheliomas in the peritoneum and pleura among men in Sweden and SIRs from 1961 to 2009

NYK	Occupational title, 1980	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
			Obs	SIR	95% CI	Obs	SIR	95% CI
Occupations exposed to carcinogenic substances								
003	Mechanical engineers and technicians	102,447	6	1.08	0.40, 2.36	158	1.67	1.42, 1.95
631	Railway engine drivers and assistants	9,605	1	1.71	0.04, 9.54	19	1.82	1.09, 2.84
750	Toolmakers, machine-tool setters, and operators	95,837	7	1.43	0.57, 2.94	120	1.48	1.22, 1.77
751	Machinery fitters and machine assemblers	127,226	6	0.96	0.35, 2.10	180	1.75	1.50, 2.02
753	Sheet metal workers	38,172	3	1.55	0.32, 4.52	140	4.38	3.68, 5.17
754	Plumbers and pipe fitters	31,515	6	3.56	1.31, 7.76	139	4.99	4.20, 5.90
755	Welders and flame cutters	41,203	3	1.45	0.30, 4.24	54	1.57	1.18, 2.04
761	Electrical fitters and wiremen	63,493	7	2.21	0.89, 4.55	119	2.28	1.89, 2.72
771	Construction carpenters and joiners	83,073	2	0.46	0.06, 1.67	98	1.40	1.14, 1.70
781	Painters	49,244	7	2.70	1.08, 5.56	73	1.72	1.35, 2.16
791	Bricklayers	18,956	6	5.42	1.99, 11.80	29	1.60	1.07, 2.30
794	Insulators	2,589	8	64.70	28.0, 128.00	22	10.90	6.81, 16.50
799	Non-specified other building and construction work	7,333	0	0.00	0.00, 7.42	22	2.75	1.72, 4.17
831	Chemical process workers	8,783	0	0.00	0.00, 8.44	15	2.15	1.20, 3.54
834	Paper pulp workers	9,431	0	0.00	0.00, 7.29	17	2.10	1.22, 3.36
871	Stationary engine and related equipment operators	11,851	2	3.14	0.38, 11.30	18	1.77	1.05, 2.79
873	Riggers and cable splicers	269	0	0.00	0.00, 252.00	2	8.64	1.05, 31.20
Occupations unexposed to carcinogenic substances agents								
603	Ships' engineers	3,895	1	5.32	0.13, 29.60	19	6.06	3.65, 9.46
797	Divers and pipe layers	2,983	0	0.00	0.00, 56.90	4	4.20	1.14, 10.70

SIR, standardized incidence ratio; NYK, Nordic Occupational Classification; N, number of persons in follow-up; ICD, International Classification of Diseases; Obs, observed; CI, confidence interval.

Table 2. Observed number of mesotheliomas in the peritoneum and pleura among women in Sweden and SIRs from 1961 to 2009

NYK	Occupational title, 1980	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
			Obs	SIR	95% CI	Obs	SIR	95% CI
Occupations exposed to carcinogenic substances								
718	Sewing work n.e.c.	33,031	2	0.75	0.09, 2.70	18	2.14	1.27, 3.39
Occupations unexposed to carcinogenic substances								
661	Sorting clerks and postal workers	6,028	2	9.27	1.12, 33.50	1	1.47	0.04, 8.21
825	Canning workers	3,882	0	0.00	0.00, 13.40	4	4.90	1.33, 12.50
881	Packers	15,318	4	4.49	1.22, 11.50	3	1.07	0.22, 3.13
932	Cleaners	103,538	7	1.21	0.49, 2.49	27	1.59	1.05, 2.31

SIR, standardized incidence ratio; NYK, Nordic Occupational Classification; N, number of persons in follow-up; ICD, International Classification of Diseases; Obs, observed; CI, confidence interval; n.e.c., not elsewhere classified.

sewing work (SIR, 2.14; 95% CI, 1.27 to 3.39) (Table 2, Appendix 4). We observed significant excess risks of mesothelioma of the pleura in two occupations not rated for chemical exposure in the Swedish NOCCA-JEM: canning workers (SIR, 4.90; 95% CI, 1.33 to 12.50) and cleaners (SIR, 1.59; 95% CI, 1.05 to 2.31). In total, 208 women had mesothelioma of the peritoneum, of whom 104 were economically inactive. The other 104 women were distributed among 280 occupations, of which only two had a significant excess risk: sorting clerks and postal workers (SIR, 9.27; 95% CI, 1.12 to 33.50) and packers (SIR, 4.49; 95% CI, 1.22 to 11.50) (Table 2, Appendix 5).

We examined the trends over the three follow-up periods:

1961-1974, 1975-1989, and 1990-2009. The significant excess risk of mesothelioma of the peritoneum was constant over time for plumbers and pipefitters as well as for electrical fitters and wiremen. For sheet metal workers and electrical fitters and wiremen, we observed an increased risk during all three follow-up periods, while we observed a decreased risk for stationary engine and related equipment operators, mechanical engineers and technicians, machinery fitters and machinery assemblers, welding and flame cutters, and ships' engineers among men, and sewing work among women (Table 3). For mesothelioma of the peritoneum, we observed a decreased risk for insulators but no consistent trends for any other occupation (Table 4).

Table 3. Observed number of mesotheliomas of the pleura among men and women in Sweden and SIRs for three time periods; 1961-1974, 1975-1989, and 1990-2009

NYK	Occupational title	1961-1974			1975-1989			1990-2009		
		Obs	SIR	95% CI	Obs	SIR	95% CI	Obs	SIR	95% CI
Exposed to chemical agents, men										
003	Mechanical engineers and technicians	4	1.31	0.36, 3.37	42	1.85	1.34, 2.51	112	1.62	1.34, 1.95
750	Toolmakers, machine-tool setters and operators	4	1.16	0.32, 2.97	40	1.83	1.31, 2.49	76	1.36	1.07, 1.70
751	Machinery fitters and machine assemblers	10	2.67	1.28, 4.91	52	2.03	1.51, 2.66	118	1.60	1.33, 1.92
753	Sheet metal workers	4	2.75	0.75, 7.04	38	4.27	3.02, 5.86	98	4.53	3.68, 5.52
754	Plumbers and pipe fitters	5	4.12	1.34, 9.62	44	5.80	4.22, 7.79	90	4.73	3.80, 5.81
755	Welders and flame cutters	4	3.90	1.06, 9.98	15	1.83	1.02, 3.01	35	1.39	0.97, 1.93
761	Electrical fitters and wiremen	4	2.09	0.57, 5.35	27	2.13	1.40, 3.10	88	2.34	1.87, 2.88
771	Construction carpenters and joiners	3	0.66	0.14, 1.92	34	1.45	1.01, 2.03	61	1.45	1.11, 1.86
781	Painters	4	1.57	0.43, 4.01	20	1.46	0.89, 2.25	49	1.88	1.39, 2.48
794	Insulators	0	0.00	0.00, 42.10	7	12.81	5.15, 26.40	15	10.79	6.04, 17.80
799	Non-specified other building and construction work	0	0.00	0.00, 7.91	7	2.70	1.09, 5.57	15	3.04	1.70, 5.01
831	Chemical process workers	2	3.70	0.45, 13.40	3	1.18	0.24, 3.46	10	2.55	1.22, 4.69
871	Stationary engine and related equipment operators	5	5.87	1.91, 13.70	5	1.32	0.43, 3.08	8	1.44	0.62, 2.84
873	Riggers and cable splicers	0	0.00	0.00, 178.00	0	0.00	0.00, 41.8	2	16.33	1.98, 59.00
Unexposed to chemical agents, men										
603	Ships' engineers	0	0.00	0.00, 23.60	7	7.88	3.17, 16.20	12	5.73	2.96, 10.00
797	Divers and pipelayers				0	0.00	0.00, 42.50	4	4.62	1.26, 11.80
Exposed to chemical agents, women										
718	Sewing work n.e.c.	4	5.65	1.54, 14.50	9	3.07	1.40, 5.83	5	1.05	0.34, 2.45

SIR, standardized incidence ratio; NYK, Nordic Occupational Classification; Obs, observed; CI, confidence interval; n.e.c., not elsewhere classified.

Table 4. Observed number of mesotheliomas of the peritoneum among men and women in Sweden and SIRs for three time periods; 1961-1974, 1975-1989, and 1990-2009

NYK	Occupational title	1961-1974			1975-1989			1990-2009		
		Obs	SIR	95% CI	Obs	SIR	95% CI	Obs	SIR	95% CI
Exposed to chemical agents, men										
754	Plumbers and pipe fitters	0	0.00	0.00, 30.60	2	3.11	0.38, 11.3	4	4.34	1.18, 11.10
761	Electrical fitters and wiremen	0	0.00	0.00, 19.70	1	0.93	0.02, 5.18	6	3.14	1.15, 6.85
791	Bricklayers	1	7.89	0.20, 43.90	3	5.85	1.21, 17.10	2	4.28	0.52, 15.50
794	Insulators	3	346.21	71.40, 1,012.00	3	65.27	13.50, 191.00	2	29.01	3.51, 105.00
Unexposed to chemical agents, women										
661	Sorting clerks and postal workers	0	0.00	0.00, 454.00	0	0.00	0.00, 85.20	2	12.16	1.47, 43.90

SIR, standardized incidence ratio; NYK, Nordic Occupational Classification; Obs, observed; CI, confidence interval; n.e.c., not elsewhere classified.

DISCUSSION

Mesothelioma is closely related to asbestos exposure [1,21]. Despite the ban on asbestos put in place in Sweden in 1982 [7], the incidence rate of mesothelioma increased in subsequent decades, flattened out in 2000, and started to decrease after 2005 [8]. A total of 3,716 individuals in the Swedish NOCCA Study were diagnosed with mesothelioma from 1961 to 2009. The predominant type of mesothelioma in both genders was mesothelioma of the pleura, which was also much more common in men than in women. The proportion of women with mesothelioma of the pleura was 17.8%, but when mesothelioma of the

peritoneum was included, the proportion of women with mesothelioma increased to 21.1%. Only 0.7% of all cases of mesothelioma are pericardial mesothelioma [22].

Men in traditionally male-dominated occupations, such as sheet metal workers, plumbers, welders, and others, had a significantly increased risk, while we did not observe any cases of mesothelioma among women in those occupations. This is probably due to the fact that there are few women in these occupations, and that job activities and exposure patterns can differ between genders. In occupations dominated by women, significantly increased risks were found among packers, sewing workers, cleaners, canning workers, and sorting clerks and postal workers. Sew-

ing work showed the highest increased risk of mesothelioma of the pleura in the first period (1961-1974) (SIR, 5.65; 95% CI, 1.54 to 14.50), the second period (1975-1989) (SIR, 3.07; 95% CI, 1.40 to 5.83), and the full period (1961-2009) (SIR, 2.14; 95% CI, 1.27 to 3.39). Sewing workers are exposed to fibers, but not to asbestos fibers. However, exposure to asbestos fibers in the textile industry did occur in two small workshops in Sweden after the Second World War (Professor S. Krantz, personal communication). It may be that the asbestos-containing brake shoes in the textile machines caused a background level of airborne asbestos fibers in the machine halls, as was shown in an Italian non-asbestos textile industry [23]. Male textile workers showed no increase in risk, but their work activities and exposure may have been different.

It is well known that textile workers have an increased risk of mesothelioma, as was seen in the US [24] and several other countries where asbestos fibers have been a part of the production process. However, no studies have confirmed that exposure to textile fibers alone is carcinogenic. The traditional understanding of mesothelioma incidence in women holds that they are exposed via their husbands; that is, men exposed to asbestos bring home asbestos fibers on their clothes, and their wives are then subjected to secondary asbestos exposure when they handle or wash the clothes. However, we did not find any evidence of such a pattern in the present analysis.

Linkage to the Swedish NOCCA-JEM led to some interesting results. Twelve of the 17 occupations with excess mesothelioma risk were rated for asbestos exposure in the Swedish NOCCA-JEM. Five occupations (mechanical engineers and technicians; toolmakers, machine tool setters and operators; chemical process workers; paper pulp workers; and stationary engine and related equipment operators) were rated for chemical exposure in the Swedish NOCCA-JEM, but not for asbestos exposure. It is possible that asbestos exposure occurred in all of these occupations, but that the Swedish NOCCA-JEM is not sensitive enough to rate them as such due to low asbestos prevalence (e.g., a total of 102,447 men had the occupational code of mechanical engineers and technicians in 1980). Moreover, these occupations contain many different activities and tasks that include low asbestos exposure. We excluded all occupations in the Swedish NOCCA-JEM with an exposure prevalence (proportion of exposed individuals in a defined occupation) of less than 5% for all agents.

Asbestos use was highest in Sweden from 1965 to 1975. Due to a latency period of 30 to 40 years, we should not expect to observe many changes until the last of our three follow-up periods, during which we found an increased risk for sheet metal workers and electrical fitters.

The excess risk for women sewing workers in the first follow-up period may have been due to exposure during the 1930s

and 1940s, for which we do not have information. The same point can also be made for the other occupations that showed decreasing trends.

An important observation is that the following occupations rated for asbestos exposure in the Swedish NOCCA-JEM showed no elevated risk in our data: chemical and cellulose processing work and store and warehouse workers. Furnace men, non-specific electrical and electronics workers, concrete and construction workers, glass formers and cutters, paper and paperboard workers, and chimney sweeps are all exposed to asbestos in the course of their work. Although they all showed an elevated risk of mesothelioma in our analysis, it was not statistically significant. An increased risk of mesothelioma has been observed in other studies among furnace men and chimney sweeps [13,25].

Male ships' engineers, as well as divers and pipe layers, showed a significant excess risk of mesothelioma of the pleura, but in the Swedish NOCCA-JEM these occupations were not rated for any chemical exposure. Male ships' engineers are more likely to be exposed to asbestos [26].

Among women, canning workers, sorting clerks and postal workers, and packers are not exposed to asbestos, but we found a significant excess risk of mesothelioma of the pleura and peritoneum in these occupations. We have no explanation for these observations. Women working as sewing workers and cleaners also showed a significant excess risk of mesothelioma of the pleura. These occupations do include exposure to textile fibers, but no specific textile fiber has been correlated to mesothelioma in the literature.

A total of 25.5% of the women with mesothelioma in the present study had mesothelioma of the peritoneum, compared to just 5.9% of the men. A change in the diagnostic procedures for peritoneal tumors in 1999 may indicate a possibility for misclassification before the year 2000 [27]. Several studies have shown that ovarian and gastrointestinal tumors may be misdiagnosed as mesothelioma of the peritoneum and vice versa [28-30]. The distinction between ovarian cancer and mesothelioma of the peritoneum may also be difficult to detect. A significant excess risk of ovarian cancer has been found among textile workers, graphic workers, packing workers, and workers in the telegraph and telephone industry (a subgroup of postal workers) in Sweden [31], corresponding to employment in both 1960 and 1970. This is in agreement with our observations of excess risk in this study, but no reports have described potential asbestos exposure within these occupations.

Asbestos is known to cause cancer in the wives and children of workers who are heavily exposed to asbestos [32,33]. This association may indicate that even household exposure may play a role in the development of asbestos-related cancers [34]. However, we have no indication as to why the women in the

high-risk occupations observed in this study would have had higher levels of household exposure than women in other occupations.

Asbestos may have been a contaminant in talc, particularly before the mid-1970s [35]. Talc may be used for hygienic purposes or may be introduced to the women peritoneum through powder-coated gloves used in surgical operations [36]. Heller et al. [37] found asbestos fibers in the ovarian tissue of 69% of women with household asbestos exposure and in 35% of those with a history of asbestos exposure. No associations were found between ovarian cancer and occupational exposure to talc in a Norwegian study of pulp and paper employees [38]. In a review of occupational risk factors and ovarian cancer, Shen et al. [39] observed an excess risk of ovarian cancer associated with talc exposure.

Exposure assessment is a weakness in most epidemiological studies. The NOCCA data lack information on smoking habits, but smoking is not expected to affect the risk of mesothelioma [40]. The Swedish NOCCA cohort was analyzed in conjunction with the Swedish NOCCA-JEM, which contains quantitative exposure levels for 25 carcinogenic agents for each year between 1945 and 1994 for 96 different occupations. Never before has any linkage been made using such large and advanced materials.

We have chosen to present the results as they are, in an exploratory manner, and acknowledge that some of the SIRs may have been significant by chance.

We were not able to determine which time scale (age, period, or cohort) influenced the observed trends. This is a weakness in this study and similar studies using SIRs as risk estimates.

Until recently, mesothelioma incidence has increased each year in Sweden, and it is therefore important to investigate the context of this increase, as we do not currently have a full understanding of the situation. There is no reason to believe that asbestos is the only causative agent of mesothelioma, or that the disease will disappear over time due to reduced asbestos exposure. Therefore, it is important to identify other potential airborne risk factors that may be liabilities to the working population. The follow-up time after the asbestos ban in Sweden is too short (9-17 years in the latest follow-up period) to illustrate that effect.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare for this study.

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Appendix 1. Exposure codes, exposures, and units used in the Swedish job-exposure matrix

Exposure code	Exposure	Unit
ALHC	Aliphatic and alicyclic hydrocarbon solvents	ppm
ANIM	Animal-borne dust	mg/m ³
ARHC	Aromatic hydrocarbon solvents	ppm
ASB	Asbestos	f/cm ³
BAP	Benzo(a)pyrene	µg/m ³
BITU	Bitumen fumes	mg/m ³
CHC	Chlorinated hydrocarbon solvents	ppm
CR	Chromium	µg/m ³
DEEX	Diesel engine exhaust	mg/m ³
FE	Iron	mg/m ³
FORM	Formaldehyde	ppm
GASO	Gasoline	ppm
NI	Nickel	µg/m ³
OSOL	Other organic solvents	ppm
PB	Lead	µmol/L
QUAR	Quartz dust	mg/m ³
SO ₂	Sulfur dioxide	ppm
WOOD	Wood dust	mg/m ³
WELD	Welding fumes	mg/m ³
BENZ	Benzene	ppm
MCH	Methylene chloride	ppm
TOLU	Toluene	ppm
PER	Perchloroethylene	ppm
TCE	1, 1, 1-trichloroethane	ppm
TRI	Trichloroethylene	ppm
UV	Ultraviolet radiation	J/m ²
IRAD	Ionizing radiation	mSv
PPWL	Perceived physical work load	score
NIGH	Night work	none
NOEXP	No exposure to any known carcinogens	none

Appendix 2. Observed number of mesotheliomas in the peritoneum and pleura among men in Sweden in occupations exposed to chemical agents with SIRs from 1961 to 2009

NYK	Occupational title, 1980	Exposure code ¹	N			Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
			Obs	SIR	95% CI	Obs	SIR	95% CI	Obs	SIR	95% CI
003	Mechanical engineers and technicians	DEEX	102,447	6	1.08	0.40, 2.36	158	1.67	1.42, 1.95		
011	Chemists and physicists	BENZ, NIGW	8,340	0	0.00	0.00, 9.14	2	0.30	0.04, 1.08		
014	Laboratory technicians and assistants	BENZ	2,091	0	0.00	0.00, 78.60	1	1.34	0.03, 7.48		
021	Veterinarians	ANIM, PPWL, UV	1,256	0	0.00	0.00, 53.10	0	0.00	0.00, 3.09		
045	Medical technicians	FORM, NIGW	2,108	0	0.00	0.00, 29.40	4	2.01	0.55, 5.13		
338	Filling station attendants and demonstrators	BENZ, DEEX, GASO, NIGW, PPWL, TOLU	8,248	2	3.89	0.47, 14.10	3	0.35	0.07, 1.03		
401	Working proprietors: agricultural, horticultural, and forestry enterprises	ANIM, PPWL, UV	202,251	9	0.71	0.32, 1.34	49	0.23	0.17, 0.31		
405	Livestock breeders	ANIM, FORM	1,194	0	0.00	0.00, 51.80	2	1.72	0.21, 6.21		
406	Breeders of fur-bearing animals	ANIM, PPWL, UV	967	0	0.00	0.00, 59.00	0	0.00	0.00, 3.55		
411	Agricultural and livestock workers	ANIM, PPWL, UV	52,282	1	0.31	0.01, 1.71	5	0.09	0.03, 0.22		
414	Fur-bearing animal farm workers	ANIM, PPWL, UV	488	0	0.00	0.00, 113.00	0	0.00	0.00, 6.71		
418	Agricultural, horticultural, and livestock work n.e.c.	ANIM, PPWL, UV	905	0	0.00	0.00, 93.20	1	1.54	0.04, 8.58		
419	Non-specified agricultural, horticultural, and livestock work	ANIM, PPWL, UV	7	0	0.00	0.00, 8,212.00	0	0.00	0.00, 441.00		
441	Forest workers and log-drivers	FORM, PPWL, UV	65,024	1	0.26	0.01, 1.46	14	0.22	0.12, 0.38		
501	Miners and quarrymen	BAP, DEEX, IRAD, PPWL, QUAR	12,178	0	0.00	0.00, 5.57	5	0.47	0.15, 1.11		
502	Well drillers and diamond drillers	PPWL, QUAR, UV	1,829	0	0.00	0.00, 36.10	2	1.20	0.15, 4.35		
503	Ore dressers	NI, PPWL, QUAR	1,065	0	0.00	0.00, 64.40	1	1.11	0.03, 6.18		
504	Mining and quarrying work n.e.c.	DEEX, QUAR	3,674	0	0.00	0.00, 19.20	2	0.65	0.08, 2.34		
509	Non-specified mining and quarrying work	DEEX, QUAR	37	0	0.00	0.00, 1,710.00	0	0.00	0.00, 105.00		
631	Railway engine drivers and assistants	ASB, DEEX, NIGW	9,605	1	1.71	0.04, 9.54	19	1.82	1.09, 2.84		
633	Motor-vehicle drivers and tram drivers	DEEX, NIGW	155,917	7	0.87	0.35, 1.79	76	0.57	0.45, 0.71		
635	Deliverymen	DEEX, NIGW, PPWL, UV	2,214	0	0.00	0.00, 46.70	0	0.00	0.00, 3.16		
636	Bus and tram conductors, traffic assistants	DEEX, NIGW, UV	1,439	0	0.00	0.00, 48.00	0	0.00	0.00, 2.79		
639	Non-specified rail and road transport work	DEEX, NIGW, UV	1,417	0	0.00	0.00, 53.40	4	3.61	0.98, 9.25		
641	Harbormasters	DEEX, NIGW	958	0	0.00	0.00, 75.30	0	0.00	0.00, 4.63		
644	Road traffic supervisors	DEEX, NIGW	6,829	0	0.00	0.00, 11.20	2	0.37	0.04, 1.34		
649	Non-specified traffic supervision	DEEX, NIGW	5	0	0.00	0.00, 11,844.00	0	0.00	0.00, 589.00		
712	Fur tailors	ANIM	1,074	0	0.00	0.00, 54.50	1	0.86	0.02, 4.80		
714	Upholsterers	BENZ, MCH, PPWL, TCE, TOLU, WOOD	6,569	1	2.62	0.07, 14.60	5	0.78	0.25, 1.82		
715	Patternmakers and cutters	FORM	2,294	0	0.00	0.00, 24.00	2	0.76	0.09, 2.75		
718	Sewing work n.e.c.	FORM	1,563	0	0.00	0.00, 42.00	3	2.06	0.43, 6.03		
722	Shoe cutters, lasters, and sewers	BENZ, TOLU	3,642	0	0.00	0.00, 17.30	1	0.28	0.01, 1.58		
729	Non-specified shoe and leather goods work	BENZ, TOLU	10	0	0.00	0.00, 6,035.00	0	0.00	0.00, 323.00		
731	Furnacemen	ASB, BAP, CR, FE, NI, NIGW, PB, PPWL, QUAR, SO2	11,199	1	1.74	0.04, 9.72	6	0.65	0.24, 1.42		
732	Metal annealers, temperers, and case-hardeners	BAP, CR, FE, NI, NIGW, PB, PPWL, WELD	2,586	0	0.00	0.00, 26.40	2	0.89	0.11, 3.22		
733	Rolling mill workers	CR, CR, FE, NI, NIGW, PPWL, SO2, WELD	5,788	0	0.00	0.00, 11.50	4	0.76	0.21, 1.96		

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Appendix 2. Continued

NYK	Occupational title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
735	Smiths and forgers	BAP, FE, NIGW, PB, PPWL, WELD	10,725	1	1.68	0.04, 9.37	13	1.34	0.72, 2.30
736	Metal casters and moulders	BAP, CR, FE, FORM, NI, NIGW, PB, PPWL, QUAR, WELD	11,315	0	0.00	0.00, 5.73	10	0.96	0.46, 1.76
737	Wire and tube drawers	CR, FE, NI, NIGW, PPWL, WELD	2,594	0	0.00	0.00, 25.90	1	0.43	0.01, 2.40
738	Metal processing work n.e.c.	CR, FE, NI, PB, PPWL, QUAR, SO2, TCE, TRI, WELD	6,940	1	2.78	0.07, 15.50	10	1.73	0.83, 3.19
739	Non-specified metal processing work	CR, FE, NI, PB, PPWL, QUAR, SO2, TCE, TRI, WELD	503	0	0.00	0.00, 187.00	1	2.76	0.07, 15.40
750	Toolmakers, machine-tool setters, and operators	BAP, CR, FE, NI, PB, PPWL, TCE, TRI, WELD	95,837	7	1.43	0.57, 2.94	120	1.48	1.22, 1.77
751	Machinery fitters and machine assemblers	ASB, BAP, BENZ, CR, DEEX, FE, GASO, MCH, NI, PB, PPWL, TCE, TOLU, WELD	127,226	6	0.96	0.35, 2.10	180	1.75	1.50, 2.02
753	Sheet metal workers	ASB, CR, FE, NI, PB, PPWL, TRI, UV, WELD	38,172	3	1.55	0.32, 4.52	140	4.38	3.68, 5.17
754	Plumbers and pipe fitters	ASB, CR, FE, NI, PB, PPWL, WELD	31,515	6	3.56	1.31, 7.76	139	4.99	4.20, 5.90
755	Welders and flame cutters	ASB, BAP, CR, FE, FORM, NI, PB, PPWL, UV, WELD	41,203	3	1.45	0.30, 4.24	54	1.57	1.18, 2.04
757	Metal platers and coaters	CR, FE, FORM, NI, PB, PER, PPWL, TCE, TRI, WELD	3,090	0	0.00	0.00, 23.00	6	2.32	0.85, 5.05
759	Non-specified engineering and building metal work	CR, FE, NI, PB, PPWL, TCE, TRI, WELD	21,302	0	0.00	0.00, 2.66	20	0.87	0.53, 1.34
761	Electrical fitters and wiremen	ASB, PPWL	63,493	7	2.21	0.89, 4.55	119	2.28	1.89, 2.72
764	Radio and television assemblers and repairmen	MCH, PB, PER, TCE, TRI	15,557	1	1.39	0.04, 7.73	12	1.00	0.52, 1.75
766	Telephone and telegraph installers and repairmen	PB, PPWL, UV	21,069	0	0.00	0.00, 3.43	8	0.44	0.19, 0.86
769	Non-specified electrical and electronics work	ASB, FORM, MCH, PB, PER, TCE, TRI	4,649	1	3.35	0.08, 18.60	6	1.21	0.44, 2.63
771	Construction carpenters and joiners	ASB, PPWL, QUAR, UV, WOOD	83,073	2	0.46	0.06, 1.67	98	1.40	1.14, 1.70
772	Bench carpenters and cabinet makers	FORM, PPWL, WOOD	47,242	2	0.76	0.09, 2.75	54	1.25	0.94, 1.63
773	Laminated wood and fiberboard workers	CR, FORM, PPWL, WOOD	543	0	0.00	0.00, 334.00	1	6.26	0.16, 34.90
774	Frame and circular sawyers and planers	CR, NIGW, PPWL, WOOD	11,368	0	0.00	0.00, 6.57	3	0.33	0.07, 0.98
778	Woodwork n.e.c.	PPWL, WOOD	9,787	1	1.72	0.04, 9.58	8	0.85	0.37, 1.67
779	Non-specified woodwork	PPWL, WOOD	8,632	0	0.00	0.00, 6.72	4	0.45	0.12, 1.16
781	Painters	ASB, BENZ, CR, FORM, MCH, PB, PPWL, TCE, TOLU, UV	49,244	7	2.70	1.08, 5.56	73	1.72	1.35, 2.16
791	Bricklayers	ASB, PPWL, QUAR, UV	18,956	6	5.42	1.99, 11.80	29	1.60	1.07, 2.30
792	Masons	PPWL, QUAR, UV	252	0	0.00	0.00, 267.00	1	4.52	0.11, 25.20
793	Concrete and construction workers	ASB, PPWL, QUAR, UV	72,332	5	1.29	0.42, 3.01	76	1.23	0.97, 1.54
794	Insulators	ASB, BAP, BITU, PPWL, UV	2,589	8	64.70	28.0, 128.00	22	10.90	6.81, 16.50
799	Non-specified other building and construction work	ASB, PB, PPWL, QUAR, UV	7,333	0	0.00	0.00, 7.42	22	2.75	1.72, 4.17
801	Typographers and lithographers	PB	27,145	1	0.72	0.02, 4.00	13	0.56	0.30, 0.97
806	Bookbinders	MCH, PPWL	2,842	0	0.00	0.00, 25.00	0	0.00	0.00, 1.54
808	Printing work n.e.c.	BENZ, GASO, MCH, PB, PPWL, TCE, TOLU	652	0	0.00	0.00, 150.00	1	2.72	0.07, 15.10
809	Non-specified printing work	BENZ, GASO, PB, TOLU, TRI	15	0	0.00	0.00, 4.343.00	0	0.00	0.00, 247.00
811	Glass formers and cutters	ASB, NI, NIGW, PB, PPWL, QUAR	2,083	0	0.00	0.00, 30.00	3	1.47	0.30, 4.30
812	Potters	NI, NIGW, PB, PPWL, QUAR	1,758	0	0.00	0.00, 36.40	0	0.00	0.00, 2.22

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Appendix 2. Continued

NYK	Occupational title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
813	Glass and ceramics kilnmen	NI, NIGW, PB, PPWL, QUAR, SO2	1,313	0	0.00	0.00, 48.10	2	1.66	0.20, 6.00
814	Glass, china, and ceramics painters and decorators	NI, NIGW, PB, QUAR	348	0	0.00	0.00, 188.00	0	0.00	0.00, 11.30
818	Glass, pottery, and tile work n.e.c.	NIGW, QUAR	1,691	0	0.00	0.00, 47.60	2	1.61	0.19, 5.80
819	Non-specified glass, pottery, and tile work	NIGW, QUAR	3,007	0	0.00	0.00, 20.40	4	1.38	0.38, 3.54
831	Chemical process workers	BENZ, MCH, NIGW, PER, PPWL, TOLLU, TRI	8,783	0	0.00	0.00, 8.44	15	2.15	1.20, 3.54
834	Paper pulp workers	NIGW, SO2	9,431	0	0.00	0.00, 7.29	17	2.10	1.22, 3.36
836	Paper and paperboard workers	ASB, FORM, NIGW, PPWL	15,354	1	1.29	0.03, 7.17	13	1.04	0.56, 1.79
838	Chemical and cellulose processing work n.e.c.	ASB, BENZ, BITU, FORM, MCH, NIGW, PB, PPWL, QUAR, TOLU	2,050	0	0.00	0.00, 34.9	1	0.59	0.01, 3.29
839	Non-specified chemical and cellulose processing work	NIGW, SO2	4,724	0	0.00	0.00, 14.90	3	0.77	0.16, 2.24
851	Rubber products workers	BENZ, NIGW, PPWL, TCE, TOLLU, TRI	7,891	1	2.46	0.06, 13.70	9	1.36	0.62, 2.59
852	Plastic products workers	FORM, MCH, NIGW, PB, PPWL, TCE	7,628	0	0.00	0.00, 10.70	8	1.47	0.63, 2.89
853	Tanners and fur dressers	CR, NIGW, PPWL	1,545	0	0.00	0.00, 39.80	1	0.65	0.02, 3.62
856	Stone cutters and carvers	NIGW, PPWL, QUAR	3,223	0	0.00	0.00, 20.70	2	0.72	0.09, 2.60
857	Paper and paperboard products workers	FORM, NIGW, PPWL	3,920	1	5.42	0.14, 30.20	2	0.66	0.08, 2.39
871	Stationary engine and related equipment operators	DEEX, NIGW, SO2	11,851	2	3.14	0.38, 11.30	18	1.77	1.05, 2.79
872	Crane and hoist operators	ASB, NIGW	9,881	0	0.00	0.00, 6.56	14	1.51	0.83, 2.54
873	Riggers and cable splicers	ASB, NI, PPWL	269	0	0.00	0.00, 252.00	2	8.64	1.05, 31.2
874	Construction machine operators	BITU, DEEX, PPWL	24,172	1	0.77	0.02, 4.27	8	0.37	0.16, 0.72
875	Truck and conveyor operators	DEEX, NIGW, PPWL	27,549	2	1.54	0.19, 5.56	14	0.67	0.37, 1.13
876	Greasers	DEEX, PPWL, TOLU	3,077	0	0.00	0.00, 22.90	3	1.16	0.24, 3.40
879	Non-specified operations monitoring and material handling work	DEEX, PPWL, TOLU	60	0	0.00	0.00, 1,562.00	0	0.00	0.00, 110.00
882	Dockers and freight handlers	DEEX, PPWL, UV	13,522	1	1.39	0.04, 7.77	9	0.79	0.36, 1.51
883	Store and warehouse workers	ASB, PPWL	59,447	0	0.00	0.00, 1.25	45	0.96	0.70, 1.29
902	Policemen	DEEX, NIGW, PB, PPWL	20,783	1	0.92	0.02, 5.12	17	0.92	0.54, 1.47
933	Chimney sweeps	ASB, BAP, PPWL	2,656	0	0.00	0.00, 27.70	5	2.29	0.74, 5.34
943	Laundryers and dry-cleaners	BENZ, PER, PPWL, TCE, TRI	3,130	0	0.00	0.00, 21.90	3	1.09	0.22, 3.18

SIR, standardized incidence ratio; NYK, Nordic Occupational Classification; N, number of persons in follow-up; ICD, International Classification of Diseases; Obs, observed; CI, confidence interval; n.e.c., not elsewhere classified.

¹See Appendix 1 for exposure codes.

Appendix 3. Observed number of mesotheliomas in the peritoneum and pleura among men in Sweden in occupations not exposed to chemical agents with SIRs from 1961 to 2009

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
001	Architects, building and construction engineers and technicians	NOEXP	70,114	5	1.30	0.42, 3.03	41	0.62	0.45, 0.84
002	Electrical, electronics, and telecommunications engineers and technicians	NOEXP	58,669	1	0.37	0.01, 2.05	54	1.19	0.89, 1.55
004	Chemical engineers and technicians	NOEXP	20,932	1	0.93	0.02, 5.18	24	1.33	0.85, 1.99
005	Metalurgists and mining engineers and technicians	NOEXP	9,376	1	1.97	0.05, 11.00	6	0.70	0.26, 1.51
006	Engineers and technicians n.e.c.	NOEXP	28,910	0	0.00	0.00, 2.36	27	1.03	0.68, 1.50
007	Surveyors, measurers, and cartographers	UV	5,085	0	0.00	0.00, 15.30	1	0.24	0.01, 1.33
008	Technical assistants	NOEXP	4,115	0	0.00	0.00, 14.00	5	1.09	0.35, 2.55
009	Non-specified engineering work	NOEXP	4,919	0	0.00	0.00, 30.80	0	0.00	0.00, 2.17
013	Geologists and meteorologists	UV	1,722	0	0.00	0.00, 46.70	1	0.73	0.02, 4.04
019	Non-specified chemical and physical work	NOEXP	2,109	0	0.00	0.00, 22.90	3	1.06	0.22, 3.11
022	Biologists	UV	813	0	0.00	0.00, 137.00	0	0.00	0.00, 8.98
023	Agricultural and horticultural researchers/advisors	UV	3,363	1	5.48	0.14, 30.50	1	0.32	0.01, 1.80
024	Forestry researchers/advisors	PPWL, UV	1,865	0	0.00	0.00, 35.40	0	0.00	0.00, 2.15
029	Non-specified biological work	UV	3	0	0.00	0.00, 21,907.00	0	0.00	0.00, 1,096.00
031	Physicians and surgeons	NOEXP	19,366	0	0.00	0.00, 4.51	5	0.37	0.12, 0.86
032	Dentists	NOEXP	7,386	0	0.00	0.00, 9.73	1	0.16	0.00, 0.87
039	Non-specified medical work	NIGW, PPWL	2	0	0.00	0.00, 19,278.00	0	0.00	0.00, 1,044.00
040	Registered nurses	NIGW, PPWL	3,526	0	0.00	0.00, 49.00	1	1.12	0.03, 6.22
041	Midwives	NIGW, PPWL	24	0	0.00	0.00, 6,856.00	0	0.00	0.00, 458.00
042	Attendants in psychiatric care	NIGW	8,595	2	5.14	0.62, 18.60	1	0.16	0.00, 0.87
043	Practical nurses and hospital orderlies	NIGW, PPWL	7,382	0	0.00	0.00, 20.20	2	0.82	0.10, 2.97
044	Dental nurses	NOEXP	29	0	0.00	0.00, 5,239.00	0	0.00	0.00, 375.00
046	Pharmacists	NIGW	1,204	0	0.00	0.00, 53.40	0	0.00	0.00, 3.11
047	Physiotherapists and occupational therapists	PPWL	2,874	0	0.00	0.00, 37.40	1	0.67	0.02, 3.76
048	Health and nursing work n.e.c.	NIGW, PPWL	1,939	0	0.00	0.00, 46.80	4	3.24	0.88, 8.31
049	Non-specified health and nursing work	NIGW, PPWL	12	0	0.00	0.00, 14,649.00	0	0.00	0.00, 667.00
050	Principals and headmasters	NOEXP	4,649	0	0.00	0.00, 12.70	5	1.00	0.32, 2.33
051	University and higher education teachers	NOEXP	11,588	0	0.00	0.00, 7.61	6	0.73	0.27, 1.59
052	Teachers of theoretical subjects	PPWL	26,139	0	0.00	0.00, 2.68	7	0.30	0.12, 0.61
053	Schoolmasters	PPWL	19,143	2	1.98	0.24, 7.17	4	0.23	0.06, 0.58
054	Teachers of painting, music, and physical education	PPWL	11,770	1	1.80	0.05, 10.00	5	0.54	0.18, 1.26
055	Teachers of vocational subjects	PPWL	10,747	0	0.00	0.00, 5.90	13	1.21	0.65, 2.08
056	Pre-primary education teachers	PPWL, UV	1,788	0	0.00	0.00, 101.00	0	0.00	0.00, 8.63
057	Educational methods advisors	NOEXP	3,650	0	0.00	0.00, 17.80	0	0.00	0.00, 1.05
058	Educational work n.e.c.	NOEXP	1,849	0	0.00	0.00, 65.00	2	2.14	0.26, 7.72
059	Non-specified educational work	NOEXP	388	0	0.00	0.00, 398.00	0	0.00	0.00, 29.80
061	Ministers and priests	NOEXP	8,843	0	0.00	0.00, 7.41	3	0.36	0.07, 1.05
068	Religious work n.e.c.	NOEXP	575	0	0.00	0.00, 168.00	0	0.00	0.00, 10.40

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Appendix 3. Continued

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
069	Non-specified religious work	NOEXP	5	0	0.00	0.00, 14,349.00	0	0.00	0.00, 729.00
071	Judges and other lawyers in courts of law	NOEXP	2,674	0	0.00	0.00, 25.50	1	0.39	0.01, 2.17
072	Prosecutors and senior police officers	NOEXP	1,609	0	0.00	0.00, 39.60	1	0.63	0.02, 3.51
073	Lawyers in private practice	NOEXP	3,163	0	0.00	0.00, 27.10	1	0.43	0.01, 2.42
074	Corporation and organization lawyers	NOEXP	2,489	0	0.00	0.00, 36.50	0	0.00	0.00, 2.23
078	Legal work n.e.c.	NOEXP	72	0	0.00	0.00, 803.00	0	0.00	0.00, 44.10
079	Non-specified legal work	NOEXP	33	0	0.00	0.00, 1,702.00	0	0.00	0.00, 93.30
081	Sculptors, painters, photographers, and commercial artists	NOEXP	7,264	0	0.00	0.00, 10.30	5	0.83	0.27, 1.94
082	Designers	NOEXP	2,152	0	0.00	0.00, 33.00	3	1.57	0.32, 4.58
083	Display artists	NOEXP	1,773	0	0.00	0.00, 35.10	1	0.55	0.01, 3.08
084	Authors	NOEXP	717	0	0.00	0.00, 112.00	1	1.89	0.05, 10.50
085	Journalists and editors	NOEXP	10,784	1	2.08	0.05, 11.60	1	0.13	0.00, 0.71
086	Performing artists	NOEXP	1,785	0	0.00	0.00, 49.80	1	0.82	0.02, 4.58
087	Composers and musicians	NOEXP	5,853	0	0.00	0.00, 14.70	2	0.50	0.06, 1.80
088	Literary and artistic work n.e.c.	NOEXP	2,119	0	0.00	0.00, 41.20	0	0.00	0.00, 2.47
089	Non-specified literary and artistic work	NOEXP	112	0	0.00	0.00, 550.00	0	0.00	0.00, 32.40
091	Accountants and auditors	NIGW	7,763	0	0.00	0.00, 10.50	1	0.17	0.00, 0.96
092	Social workers	NIGW	11,545	0	0.00	0.00, 9.27	6	0.99	0.36, 2.15
093	Librarians, archivists, and curators	NOEXP	3,809	0	0.00	0.00, 21.90	0	0.00	0.00, 1.37
094	Economists and statisticians	NOEXP	9,809	1	3.69	0.09, 20.50	2	0.50	0.06, 1.80
095	Psychologists	NIGW	6,734	0	0.00	0.00, 9.40	6	0.89	0.33, 1.94
096	Staff officers	NOEXP	10,495	0	0.00	0.00, 9.26	1	0.15	0.00, 0.85
097	Systems analysts and programmers	NIGW	20,684	2	3.58	0.43, 12.90	6	0.75	0.27, 1.62
098	Other related work	NOEXP	2,464	0	0.00	0.00, 39.40	0	0.00	0.00, 2.44
099	Non-specified other professional, technical, and related work	NOEXP	105	0	0.00	0.00, 1,186.00	0	0.00	0.00, 55.80
101	Government legislative and administrative work	NOEXP	20,680	1	1.00	0.03, 5.57	10	0.57	0.27, 1.05
111	General managers	NOEXP	43,157	3	1.23	0.25, 3.59	28	0.69	0.46, 0.99
118	Other business managers, including managers with specific functions	NOEXP	42,128	0	0.00	0.00, 1.62	18	0.47	0.28, 0.74
119	Non-specified business administrative and other technical and economic administrative work	NOEXP	9	0	0.00	0.00, 6,826.00	0	0.00	0.00, 427.00
201	Bookkeepers and office cashiers	NOEXP	20,197	0	0.00	0.00, 3.12	11	0.55	0.27, 0.98
203	Bank tellers	NOEXP	551	0	0.00	0.00, 113.00	0	0.00	0.00, 6.86
204	Cashiers in retail stores and restaurants	PPWL	405	0	0.00	0.00, 206.00	0	0.00	0.00, 12.10
208	Debt collectors	NOEXP	908	1	23.77	0.60, 132.00	0	0.00	0.00, 5.19
209	Non-specified bookkeeping and clerical work	NOEXP	30	0	0.00	0.00, 2,087.00	0	0.00	0.00, 112.00
290	Secretaries, typists and related workers	NOEXP	13,491	1	2.26	0.06, 12.60	7	0.92	0.37, 1.90
291	Computer operators	NIGW	4,220	0	0.00	0.00, 23.00	2	0.78	0.09, 2.82
292	Bank employees (general bank work)	NOEXP	8,744	1	2.80	0.07, 15.60	3	0.51	0.11, 1.50
293	Travel agency employees	NOEXP	1,765	0	0.00	0.00, 44.50	1	0.71	0.02, 3.97

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Appendix 3. Continued

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
294	Forwarding and shipping agents.	NOEXP	7,092	0	0.00	0.00, 10.40	5	0.85	0.28, 1.98
295	Property managers and store managers	NOEXP	26,687	1	0.68	0.02, 3.77	23	0.95	0.60, 1.42
296	Insurance raters and claims adjusters	NOEXP	4,618	0	0.00	0.00, 15.70	2	0.51	0.06, 1.85
297	Employees in national insurance offices	NOEXP	2,571	0	0.00	0.00, 35.30	0	0.00	0.00, 2.26
298	Cost accountants and estimating clerks	NOEXP	18,612	0	0.00	0.00, 3.15	17	0.84	0.49, 1.35
299	Non-specified clerical work	NOEXP	10,738	2	2.58	0.31, 9.33	3	0.23	0.05, 0.68
301	Working proprietors, wholesale trade	NOEXP	10,565	1	1.97	0.05, 11.00	4	0.50	0.14, 1.28
302	Working proprietors, retail trade	NOEXP	44,588	2	0.82	0.10, 2.95	18	0.45	0.27, 0.71
309	Non-specified working proprietors	NOEXP	261	0	0.00	0.00, 448.00	1	9.44	0.24, 52.60
311	Insurance representatives and agents	NOEXP	4,736	0	0.00	0.00, 14.40	2	0.47	0.06, 1.69
312	Brokers and valuers	NOEXP	3,414	0	0.00	0.00, 28.20	1	0.49	0.01, 2.74
313	Advertising salesmen	NOEXP	11,279	0	0.00	0.00, 8.30	1	0.14	0.00, 0.77
319	Non-specified sales of insurance, real estate, securities, and business services	NOEXP	3	0	0.00	0.00, 215,113.00	0	0.00	0.00, 12,553.00
331	Commercial travelers, buyers, and dealers	NOEXP	106,733	6	1.16	0.42, 2.52	52	0.60	0.45, 0.78
332	Shop managers	PPWL	21,663	0	0.00	0.00, 2.87	13	0.60	0.32, 1.02
333	Shop assistants	PPWL	35,320	0	0.00	0.00, 1.98	22	0.71	0.45, 1.08
339	Non-specified other sales work	NOEXP	127	0	0.00	0.00, 604.00	0	0.00	0.00, 36.40
402	Farm managers and supervisors	PPWL, UV	2,381	0	0.00	0.00, 26.80	0	0.00	0.00, 1.55
403	Forestry managers and supervisors	UV	10,523	0	0.00	0.00, 5.38	1	0.09	0.00, 0.48
404	Horticultural managers and supervisors	NIGW, UV	3,170	0	0.00	0.00, 20.40	1	0.33	0.01, 1.85
407	Reindeer owners	PPWL, UV	807	0	0.00	0.00, 75.50	1	1.25	0.03, 6.94
409	Non-specified agricultural, horticultural, and forestry management work	PPWL, UV	13	0	0.00	0.00, 5,746.00	0	0.00	0.00, 306.00
412	Horticultural workers	PPWL, UV	17,272	0	0.00	0.00, 4.18	9	0.64	0.29, 1.22
415	Reindeer herdsmen	UV	253	0	0.00	0.00, 295.00	0	0.00	0.00, 17.20
421	Game-keepers and hunters	UV	208	0	0.00	0.00, 313.00	0	0.00	0.00, 17.70
431	Fishermen	PPWL, UV	9,029	0	0.00	0.00, 6.92	3	0.34	0.07, 1.01
432	Fish-breeders	PPWL, UV	231	0	0.00	0.00, 400.00	0	0.00	0.00, 28.00
601	Ships' deck officers	NIGW, UV	6,790	1	2.88	0.07, 16.10	8	1.38	0.60, 2.73
602	Ships' pilots	NIGW, UV	861	0	0.00	0.00, 67.70	1	1.04	0.03, 5.77
603	Ships' engineers	NIGW, UV	3,895	1	5.32	0.13, 29.60	19	6.06	3.65, 9.46
609	Non-specified ships' officers	NIGW, UV	6	0	0.00	0.00, 17,936.00	0	0.00	0.00, 1,012.00
611	Ships' deck and engine-room crew	NIGW, PPWL, UV	7,036	1	3.14	0.08, 17.50	10	1.96	0.94, 3.61
621	Aircraft pilots, navigators, and flight engineers	IRAD, NIGW	2,050	0	0.00	0.00, 38.90	0	0.00	0.00, 2.23
632	Railway guards	NIGW, UV	15,904	3	2.92	0.60, 8.53	11	0.60	0.30, 1.08
642	Air traffic controllers and flight dispatchers	NIGW	1,607	0	0.00	0.00, 59.20	0	0.00	0.00, 3.52
643	Railway station masters and train dispatchers	NIGW	4,799	1	3.30	0.08, 18.40	3	0.59	0.12, 1.74
651	Post-office clerks	NOEXP	5,220	0	0.00	0.00, 13.00	4	0.83	0.23, 2.12
652	Telecommunications traffic officers	NOEXP	362	0	0.00	0.00, 149.00	0	0.00	0.00, 8.49

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Appendix 3. Continued

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
653	Telephone operators	NOEXP	415	0	0.00	0.00, 221.00	0	0.00	0.00, 15.40
655	Telegraph and radio operators	NOEXP	1,358	0	0.00	0.00, 50.60	0	0.00	0.00, 2.89
659	Non-specified post and telecommunications work	NOEXP	4	0	0.00	0.00, 11,832.00	0	0.00	0.00, 613.00
661	Sorting clerks and postal workers	NIGW, PPWL, UV	19,489	1	1.10	0.03, 6.15	6	0.40	0.15, 0.88
662	Messengers	NIGW, PPWL, UV	9,941	1	2.45	0.06, 13.60	1	0.16	0.00, 0.90
669	Non-specified mail distribution and other messenger work	NIGW, PPWL, UV	9	0	0.00	0.00, 6,102.00	0	0.00	0.00, 509.00
671	Lighthouse and lock operators, ferry and harbor service assistants	NIGW, UV	1,406	0	0.00	0.00, 46.50	1	0.78	0.02, 4.33
678	Railway linemen	NIGW, UV	4,137	0	0.00	0.00, 17.50	1	0.30	0.01, 1.66
699	Non-specified transport and communications work	NIGW, UV	926	0	0.00	0.00, 58.20	1	0.92	0.02, 5.15
701	Spinners, weavers, knitters, and dyers	NIGW	12,935	2	2.76	0.33, 9.97	14	1.18	0.65, 1.98
711	Tailors and dressmakers	NOEXP	3,848	0	0.00	0.00, 16.80	1	0.29	0.01, 1.61
713	Milliners and hat makers	NOEXP	222	0	0.00	0.00, 273.00	0	0.00	0.00, 15.70
719	Non-specified sewing work	NIGW	280	0	0.00	0.00, 221.00	0	0.00	0.00, 13.40
721	Shoemakers and shoe repairers	NOEXP	4,100	0	0.00	0.00, 18.20	1	0.32	0.01, 1.80
726	Leather goods makers	NOEXP	1,506	0	0.00	0.00, 40.60	0	0.00	0.00, 2.43
741	Precision-tool makers	NIGW	8,077	0	0.00	0.00, 9.48	5	0.78	0.25, 1.81
742	Watchmakers	NOEXP	2,376	0	0.00	0.00, 26.00	0	0.00	0.00, 1.56
743	Opticians	NOEXP	1,570	0	0.00	0.00, 49.30	0	0.00	0.00, 2.98
744	Dental technicians	NOEXP	2,535	0	0.00	0.00, 29.00	2	0.94	0.11, 3.41
745	Goldsmiths and silversmiths	NOEXP	2,206	0	0.00	0.00, 29.60	3	1.41	0.29, 4.13
749	Non-specified precision-tool manufacturing work	NOEXP	30	0	0.00	0.00, 2012.00	0	0.00	0.00, 112.00
765	Recording, sound, and light equipment operators	NOEXP	1,515	0	0.00	0.00, 113.00	0	0.00	0.00, 7.71
795	Glaziers	PPWL, UV	3,693	0	0.00	0.00, 19.90	6	1.97	0.72, 4.29
797	Divers and pipe layers	PPWL	2,983	0	0.00	0.00, 56.90	4	4.20	1.14, 10.70
821	Grain mill and oil press workers	PPWL	2,668	0	0.00	0.00, 24.40	0	0.00	0.00, 1.51
822	Bakers and pastry cooks	PPWL	15,529	0	0.00	0.00, 4.08	9	0.59	0.27, 1.13
823	Chocolate and confectionary workers	PPWL	958	0	0.00	0.00, 82.20	0	0.00	0.00, 5.18
824	Brewery, distillery, and other beverage plant workers	PPWL	2,361	0	0.00	0.00, 31.40	2	1.10	0.13, 3.97
825	Canning workers	PPWL	1,746	0	0.00	0.00, 39.70	1	0.67	0.02, 3.75
826	Butchers and meat preparers	PPWL	11,550	0	0.00	0.00, 6.11	2	0.20	0.02, 0.74
827	Dairy workers	PPWL	5,108	0	0.00	0.00, 12.50	1	0.20	0.01, 1.13
828	Food processing work n.e.c.	PPWL	1,677	0	0.00	0.00, 49.20	2	1.65	0.20, 5.97
829	Non-specified food processing work	PPWL	30	0	0.00	0.00, 2,155.00	0	0.00	0.00, 134.00
841	Tobacco workers	NIGW, PPWL	219	0	0.00	0.00, 358.00	0	0.00	0.00, 21.90
850	Basketry weavers	NIGW	331	0	0.00	0.00, 186.00	0	0.00	0.00, 11.70
854	Photographic laboratory workers	PPWL	704	0	0.00	0.00, 122.00	0	0.00	0.00, 7.71
855	Musical instrument makers and tuners	NIGW	812	0	0.00	0.00, 81.80	1	1.32	0.03, 7.36
858	Other production and related work n.e.c.	PPWL	12,425	1	1.51	0.04, 8.43	18	1.67	0.99, 2.64
859	Non-specified other production and related work	PPWL	6	0	0.00	0.00, 34,047.00	0	0.00	0.00, 1,939.00
861	Unskilled manual workers	PPWL	61,982	1	0.29	0.01, 1.64.00	45	0.83	0.60, 1.11

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Appendix 3. Continued

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
881	Packers	NIGW, PPWL	9,086	2	4.50	0.55, 16.30	8	1.14	0.49, 2.25
888	Furniture removers and porters	PPWL	312	0	0.00	0.00, 281.00	1	5.17	0.13, 28.80
889	Non-specified packing, freight handling, and storage work	PPWL	263	0	0.00	0.00, 233.00	1	3.81	0.10, 21.20
901	Firefighters	PPWL	8,126	0	0.00	0.00, 10.30	7	1.16	0.47, 2.39
903	Customs officials	NIGW, PPWL	4,024	0	0.00	0.00, 17.10	4	1.10	0.30, 2.81
904	Prison and reformatory officials	NIGW, PPWL	3,973	0	0.00	0.00, 18.70	4	1.21	0.33, 3.10
908	Civilian protective service work n.e.c.	NIGW, PPWL	12,117	0	0.00	0.00, 7.18	7	0.89	0.36, 1.83
909	Non-specified civilian protective service work	NIGW, PPWL	2	0	0.00	0.00, 18,129.00	0	0.00	0.00, 1,017.00
911	Catering supervisors	PPWL	7,067	0	0.00	0.00, 13.10	5	1.12	0.36, 2.60
912	Cooks	PPWL	5,888	0	0.00	0.00, 19.50	1	0.35	0.01, 1.97
913	Kitchen maids	PPWL	3,356	0	0.00	0.00, 38.60	2	1.49	0.18, 5.37
914	Nursemaids	NIGW, PPWL	1,427	0	0.00	0.00, 130.00	0	0.00	0.00, 10.90
915	Housekeeping service workers	PPWL, PPWL	1,306	0	0.00	0.00, 142.00	0	0.00	0.00, 13.10
916	Hotel receptionists	PPWL	1,018	0	0.00	0.00, 73.60	1	1.24	0.03, 6.89
917	Pursers, stewards, and stewardesses	IRAD, NIGW, PPWL	1,332	0	0.00	0.00, 61.40	1	1.03	0.03, 5.73
918	Housekeeping and related service work n.e.c.	PPWL	75	0	0.00	0.00, 1,914.00	0	0.00	0.00, 164.00
919	Non-specified housekeeping and related service work	PPWL	21	0	0.00	0.00, 5,590.00	0	0.00	0.00, 339.00
921	Waiters and waitresses	NIGW, PPWL	6,138	0	0.00	0.00, 15.60	3	0.80	0.17, 2.34
931	Building caretakers	PPWL	29,755	1	0.75	0.02, 4.18	25	1.22	0.79, 1.79
932	Cleaners	PPWL	11,668	0	0.00	0.00, 9.80	3	0.55	0.11, 1.62
939	Non-specified caretaking and cleaning work	PPWL	3	0	0.00	0.00, 26,846.00	0	0.00	0.00, 1,513.00
941	Hairdressers and beauticians	PPWL	7,056	0	0.00	0.00, 9.01	2	0.29	0.04, 1.06
942	Bath attendants	PPWL	625	0	0.00	0.00, 135.00	0	0.00	0.00, 8.34
944	Pressers	NOEXP	2,000	0	0.00	0.00, 29.80	2	0.95	0.12, 3.43
945	Coaches and horse trainers	PPWL, UV	2,275	0	0.00	0.00, 48.00	1	0.85	0.02, 4.72
946	Photographers	NIGW, UV	5,405	0	0.00	0.00, 14.00	3	0.68	0.14, 1.98
947	Undertakers	NIGW	587	0	0.00	0.00, 133.00	0	0.00	0.00, 8.50
948	Other service work n.e.c.	NIGW	2,047	0	0.00	0.00, 38.30	1	0.67	0.02, 3.72
949	Non-specified other service work	NIGW	3	0	0.00	0.00, 16,088.00	0	0.00	0.00, 937.00
981	Members of the armed forces	PPWL	25,245	2	1.48	0.18, 5.34	18	0.76	0.45, 1.21

SIR, standardized incidence ratio; NYK, Nordic Occupational Classification; N, number of persons in follow-up; ICD, International Classification of Diseases; Obs, observed; CI, confidence interval; n.e.c., not elsewhere classified.

¹See Appendix 1 for exposure codes.

Appendix 4. Observed number of mesotheliomas in the peritoneum and pleura among women in Sweden in occupations exposed to chemical agents with SIRs from 1961 to 2009

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
003	Mechanical engineers and technicians	DEEX	2,032	1	16.27	0.41, 90.70	0	0.00	0.00, 20.10
011	Chemists and physicists	BENZ, NIGW	3,438	0	0.00	0.00, 28.80	1	2.28	0.06, 12.70
014	Laboratory technicians and assistants	BENZ	11,149	2	7.28	0.88, 26.30	1	1.33	0.03, 7.44
021	Veterinarians	ANIM, PPWL, UV	443	0	0.00	0.00, 328.00	0	0.00	0.00, 126.00
045	Medical technicians	FORM, NIGW	5,133	1	4.42	0.11, 24.60	0	0.00	0.00, 4.90
338	Filling station attendants and demonstrators	BENZ, DEEX, GASO, NIGW, PPWL, TOLU	1,984	0	0.00	0.00, 38.60	0	0.00	0.00, 11.00
401	Working proprietors; agricultural, horticultural, and forestry enterprises	ANIM, ANIM, PPWL, UV	17,126	0	0.00	0.00, 3.89	3	1.25	0.26, 3.65
405	Livestock breeders	ANIM, FORM	367	0	0.00	0.00, 195.00	0	0.00	0.00, 74.50
406	Breeders of fur-bearing animals	ANIM, PPWL, UV	70	0	0.00	0.00, 1,053.00	0	0.00	0.00, 325.00
411	Agricultural and livestock workers	ANIM, ANIM, PPWL, UV	24,598	2	1.08	0.13, 3.90	1	0.17	0.00, 0.93
414	Fur-bearing animal farm workers	ANIM, PPWL, UV	80	0	0.00	0.00, 712.00	0	0.00	0.00, 214.00
418	Agricultural, horticultural and livestock work n.e.c.	ANIM, PPWL, UV	953	0	0.00	0.00, 130.00	0	0.00	0.00, 46.20
419	Non-specified agricultural, horticultural and livestock work	ANIM, PPWL, UV	2	0	0.00	0.00, 18,734.00	0	0.00	0.00, 10,479.00
441	Forest workers and log-drivers	FORM, PPWL, UV	939	0	0.00	0.00, 70.70	0	0.00	0.00, 22.10
501	Miners and quarrymen	BAP, DEEX, IRAD, PPWL, QUAR	65	0	0.00	0.00, 2,204.00	0	0.00	0.00, 753.00
502	Well drillers and diamond drillers	PPWL, QUAR, UV	5	0	0.00	0.00, 18,648.00	0	0.00	0.00, 6,483.00
503	Ore dressers	NI, PPWL, QUAR	126	0	0.00	0.00, 470.00	0	0.00	0.00, 139.00
504	Mining and quarrying work n.e.c.	DEEX, QUAR	66	0	0.00	0.00, 1,305.00	0	0.00	0.00, 358.00
509	Non-specified mining and quarrying work	DEEX, QUAR	2	0	0.00	0.00, 37,328.00	0	0.00	0.00, 7,804.00
631	Railway engine drivers and assistants	ASB, DEEX, NIGW	158	0	0.00	0.00, 1,106.00	0	0.00	0.00, 462.00
633	Motor-vehicle drivers and tram drivers	DEEX, NIGW	5,575	0	0.00	0.00, 19.20	1	1.63	0.04, 9.07
635	Deliverymen	DEEX, NIGW, PPWL, UV	3,810	0	0.00	0.00, 18.90	0	0.00	0.00, 5.92
636	Bus and tram conductors, traffic assistants	DEEX, NIGW, UV	892	0	0.00	0.00, 63.20	0	0.00	0.00, 17.50
639	Non-specified rail and road transport work	DEEX, NIGW, UV	6	0	0.00	0.00, 15,024.00	0	0.00	0.00, 4,794.00
641	Harbormasters	DEEX, NIGW	18	0	0.00	0.00, 8,744.00	0	0.00	0.00, 3,367.00
644	Road traffic supervisors	DEEX, NIGW	320	0	0.00	0.00, 436.00	0	0.00	0.00, 172.00
649	Non-specified traffic supervision	DEEX, NIGW	1	0	0.00	0.00, 145,405.00	0	0.00	0.00, 44,745.00
712	Fur tailors	ANIM	168	0	0.00	0.00, 307.00	0	0.00	0.00, 108.00
714	Upholsterers	BENZ, MCH, PPWL, TCE, TOLU, WOOD	748	0	0.00	0.00, 97.20	0	0.00	0.00, 30.20
715	Patternmakers and cutters	FORM	3,286	0	0.00	0.00, 14.50	1	1.21	0.03, 6.73
718	Sewing work n.e.c.	FORM	33,031	2	0.75	0.09, 2.70	18	2.14	1.27, 3.39
722	Shoe cutters, lasters, and sewers	BENZ, TOLU	3,662	0	0.00	0.00, 13.00	0	0.00	0.00, 4.21
729	Non-specified shoe and leather goods work	BENZ, TOLU	10	0	0.00	0.00, 5.613.00	0	0.00	0.00, 1,676.00
731	Furnacemen	ASB, BAP, CR, FE, NI, NIGW, PB, PPWL, QUAR, SO ₂ , WELD	385	0	0.00	0.00, 361.00	0	0.00	0.00, 124.00
732	Metal annealers, temperers, and case-hardeners	BAP, CR, FE, NI, NIGW, PB, PPWL, WELD	68	0	0.00	0.00, 1,414.00	0	0.00	0.00, 436.00
733	Rolling mill workers	CR, CR, FE, NI, NIGW, PPWL, SO ₂ , WELD	214	0	0.00	0.00, 434.00	0	0.00	0.00, 121.00

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Appendix 4. Continued

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
735	Smiths and forgers	BAP, FE, NIGW, PB, PPWL, WELD	112	0	0.00	0.00, 1,117.00	0	0.00	0.00, 371.00
736	Metal casters and molders	BAP, CR, FE, FORM, NI, NIGW, PB, PPWL, QUAR, WELD	422	0	0.00	0.00, 227.00	0	0.00	0.00, 71.40
737	Wire and tube drawers	CR, FE, NI, NIGW, PPWL, WELD	200	0	0.00	0.00, 446.00	0	0.00	0.00, 131.00
738	Metal processing work n.e.c.	CR, FE, NI, PB, PPWL, QUAR, SO2, TCE, TRI, WELD	1,061	0	0.00	0.00, 63.10	0	0.00	0.00, 18.80
739	Non-specified metal processing work	CR, FE, NI, PB, PPWL, QUAR, SO2, TCE, TRI, WELD	133	0	0.00	0.00, 570.00	0	0.00	0.00, 158.00
750	Toolmakers, machine-tool setters, and operators	BAP, CR, FE, NI, PB, PPWL, TCE, TRI, WELD	10,824	1	2.47	0.06, 13.70	0	0.00	0.00, 2.85
751	Machinery fitters and machine assemblers	ASB, BAP, BENZ, CR, DEEX, FE, GASO, MCH, NI, PB, PPWL, TCE, TOLU, WELD	5,685	0	0.00	0.00, 25.10	1	2.38	0.06, 13.30
753	Sheet metal workers	ASB, CR, FE, NI, PB, PPWL, TRI, UV, WELD	381	0	0.00	0.00, 389.00	0	0.00	0.00, 142.00
754	Plumbers and pipe fitters	ASB, CR, FE, NI, PB, PPWL, WELD	76	0	0.00	0.00, 1,781.00	0	0.00	0.00, 617.00
755	Welders and flame cutters	ASB, BAP, CR, FE, FORM, NI, PB, PPWL, UV, WELD	1,464	0	0.00	0.00, 76.40	0	0.00	0.00, 24.40
757	Metal platers and coaters	CR, FE, FORM, NI, PB, PER, PPWL, TCE, TRI, WELD	351	0	0.00	0.00, 223.00	0	0.00	0.00, 72.10
759	Non-specified engineering and building metal work	CR, FE, NI, PB, PPWL, TCE, TRI, WELD	7,898	2	3.58	0.43, 12.90	1	0.53	0.01, 2.98
761	Electrical fitters and wiremen	ASB, PPWL	1,754	0	0.00	0.00, 86.80	0	0.00	0.00, 31.70
764	Radio and television assemblers and repairmen	MCH, PB, PER, TCE, TRI	4,994	0	0.00	0.00, 30.60	0	0.00	0.00, 11.40
766	Telephone and telegraph installers and repairmen	PB, PPWL, UV	1,247	0	0.00	0.00, 122.00	1	12.31	0.31, 68.60
769	Non-specified electrical and electronics work	ASB, FORM, MCH, PB, PER, TCE, TRI	6,396	0	0.00	0.00, 8.31	3	1.95	0.40, 5.71
771	Construction carpenters and joiners	ASB, PPWL, QUAR, UV, WOOD	122	0	0.00	0.00, 1,036.00	0	0.00	0.00, 333.00
772	Bench carpenters and cabinet makers	FORM, PPWL, WOOD	2,884	0	0.00	0.00, 34.60	0	0.00	0.00, 11.00
773	Laminated wood and fiberboard workers	CR, FORM, PPWL, WOOD	219	0	0.00	0.00, 808.00	0	0.00	0.00, 341.00
774	Frame and circular sawyers and planers	CR, NIGW, PPWL, WOOD	333	0	0.00	0.00, 357.00	0	0.00	0.00, 118.00
778	Wood work n.e.c.	PPWL, WOOD	889	0	0.00	0.00, 70.90	0	0.00	0.00, 21.30
779	Non-specified wood work	PPWL, WOOD	272	0	0.00	0.00, 204.00	0	0.00	0.00, 61.30
781	Painters	ASB, BENZ, CR, FORM, MCH, PB, PPWL, TCE, TOLU, UV	1,173	0	0.00	0.00, 70.60	0	0.00	0.00, 22.90
791	Bricklayers	ASB, PPWL, QUAR, UV	12	0	0.00	0.00, 13,562.00	0	0.00	0.00, 5,361.00
793	Concrete and construction workers	ASB, PPWL, QUAR, UV	121	0	0.00	0.00, 1,007.00	0	0.00	0.00, 361.00
794	Insulators	ASB, BAP, BITU, PPWL, UV	23	0	0.00	0.00, 5,568.00	0	0.00	0.00, 1,619.00
801	Typographers and lithographers	PB	4,036	0	0.00	0.00, 26.10	0	0.00	0.00, 8.92
806	Bookbinders	MCH, PPWL	4,544	1	3.38	0.09, 18.90	2	2.17	0.26, 7.84
808	Printing work n.e.c.	BENZ, GASO, MCH, PB, PPWL, TCE, TOLU	872	0	0.00	0.00, 87.00	1	7.15	0.18, 39.80
809	Non-specified printing work	BENZ, GASO, PB, TOLU, TRI	30	0	0.00	0.00, 1,643.00	0	0.00	0.00, 516.00
811	Glass formers and cutters	ASB, NI, NIGW, PB, PPWL, QUAR	312	0	0.00	0.00, 188.00	0	0.00	0.00, 56.60
812	Potters	NI, NIGW, PB, PPWL, QUAR	524	0	0.00	0.00, 121.00	1	10.10	0.26, 56.30
813	Glass and ceramics kilnmen	NI, NIGW, PB, PPWL, QUAR, SO2	45	0	0.00	0.00, 1,044.00	0	0.00	0.00, 341.00
814	Glass, china, and ceramics painters and decorators	NI, NIGW, PB, QUAR	465	0	0.00	0.00, 120.00	0	0.00	0.00, 38.80

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Appendix 4. Continued

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
818	Glass, pottery, and tile work n.e.c.	NIGW, QUAR	889	0	0.00	0.00, 71.10	0	0.00	0.00, 23.70
819	Non-specified glass, pottery, and tile work	NIGW, QUAR	699	0	0.00	0.00, 79.40	0	0.00	0.00, 24.50
831	Chemical process workers	BENZ, MCH, NIGW, PER, PPWL, TOLU, TRI	753	0	0.00	0.00, 107.00	0	0.00	0.00, 32.50
834	Paper pulp workers	NIGW, SO2	258	0	0.00	0.00, 376.00	0	0.00	0.00, 117.00
836	Paper and paperboard workers	ASB, FORM, NIGW, PPWL	3,266	0	0.00	0.00, 18.20	1	1.58	0.04, 8.78
838	Chemical and cellulose processing work n.e.c.	ASB, BENZ, BITU, FORM, MCH, NIGW, PB, PPWL, QUAR, TOLU	680	0	0.00	0.00, 116.00	0	0.00	0.00, 38.40
839	Non-specified chemical and cellulose processing work	NIGW, SO2	1,532	1	11.48	0.29, 64.00	0	0.00	0.00, 12.90
851	Rubber products workers	BENZ, NIGW, PPWL, TCE, TOLU, TRI	2,596	0	0.00	0.00, 25.90	0	0.00	0.00, 7.96
852	Plastic products workers	FORM, MCH, NIGW, PB, PPWL, TCE	4,531	1	4.88	0.12, 27.20	2	2.94	0.36, 10.60
853	Tanners and fur dressers	CR, NIGW, PPWL	172	0	0.00	0.00, 341.00	0	0.00	0.00, 112.00
856	Stone cutters and carvers	NIGW, PPWL, QUAR	19	0	0.00	0.00, 6,740.00	0	0.00	0.00, 2,075.00
857	Paper and paperboard products workers	FORM, NIGW, PPWL	2,872	0	0.00	0.00, 20.80	1	1.77	0.04, 9.86
871	Stationary engine and related equipment operators	DEEX, NIGW, SO2	33	0	0.00	0.00, 4,541.00	0	0.00	0.00, 1,525.00
872	Crane and hoist operators	ASB, NIGW	1,483	0	0.00	0.00, 57.40	1	4.40	0.11, 24.50
873	Riggers and cable spicers	ASB, NI, PPWL	2	0	0.00	0.00, 55,230.00	0	0.00	0.00, 17,711.00
874	Construction machine operators	BITU, DEEX, PPWL	55	0	0.00	0.00, 2,367.00	0	0.00	0.00, 778.00
875	Truck and conveyor operators	DEEX, NIGW, PPWL	1,105	0	0.00	0.00, 114.00	0	0.00	0.00, 36.90
876	Greasers	DEEX, PPWL, TOLU	93	0	0.00	0.00, 1,469.00	0	0.00	0.00, 508.00
882	Dockers and freight handlers	DEEX, PPWL, UV	84	0	0.00	0.00, 1,229.00	0	0.00	0.00, 413.00
883	Store and warehouse workers	ASB, PPWL	10,051	1	1.75	0.04, 9.77	1	0.57	0.01, 3.15
902	Policemen	DEEX, NIGW, PB, PPWL	1,631	0	0.00	0.00, 96.30	0	0.00	0.00, 36.40
933	Chimney sweeps	ASB, BAP, PPWL	7	0	0.00	0.00, 20,338.00	0	0.00	0.00, 6,611.00
943	Launderers and dry-cleaners	BENZ, PER, PPWL, TCE, TRI	10,307	0	0.00	0.00, 4.87	0	0.00	0.00, 1.64

SIR, standardized incidence ratio; NYK, Nordic Occupational Classification; N, number of persons in follow-up; ICD, International Classification of Diseases; Obs, observed; CI, confidence interval; n.e.c., not elsewhere classified.

¹See Appendix 1 for exposure codes.

Appendix 5. Observed number of mesotheliomas in the peritoneum and pleura among women in Sweden in occupations not exposed to chemical agents with SIRs from 1961 to 2009

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
001	Architects, building and construction engineers and technicians	NOEXP	3,025	0	0.00	0.00, 39.90	0	0.00	0.00, 12.80
002	Electrical, electronics, and telecommunications engineers and technicians	NOEXP	2,207	0	0.00	0.00, 61.40	0	0.00	0.00, 22.20
004	Chemical engineers and technicians	NOEXP	1,649	0	0.00	0.00, 70.30	0	0.00	0.00, 24.40
005	Metallurgists and mining engineers and technicians	NOEXP	141	0	0.00	0.00, 969.00	0	0.00	0.00, 336.00
006	Engineers and technicians n.e.c.	NOEXP	1,805	0	0.00	0.00, 43.80	0	0.00	0.00, 14.70
007	Surveyors, measurers, and cartographers	UV	268	0	0.00	0.00, 548.00	0	0.00	0.00, 206.00
008	Technical assistants	NOEXP	8,140	0	0.00	0.00, 8.29	1	0.67	0.02, 3.76
009	Non-specified engineering work	NOEXP	638	0	0.00	0.00, 271.00	0	0.00	0.00, 118.00
013	Geologists and meteorologists	UV	288	0	0.00	0.00, 328.00	0	0.00	0.00, 97.90
019	Non-specified chemical and physical work	NOEXP	49	0	0.00	0.00, 1,131.00	0	0.00	0.00, 285.00
022	Biologists	UV	617	0	0.00	0.00, 228.00	0	0.00	0.00, 89.30
023	Agricultural and horticultural researchers/advisors	UV	940	0	0.00	0.00, 114.00	0	0.00	0.00, 41.30
024	Forestry researchers/advisors	PPWL, UV	49	0	0.00	0.00, 3,416.00	0	0.00	0.00, 1,394.00
031	Physicians and surgeons	NOEXP	7,265	0	0.00	0.00, 15.50	2	2.76	0.33, 9.96
032	Dentists	NOEXP	3,984	1	5.89	0.15, 32.80	0	0.00	0.00, 7.02
040	Registered nurses	NIGW, PPWL	61,685	3	1.12	0.23, 3.28	8	0.95	0.41, 1.87
041	Midwives	NIGW, PPWL	4,565	0	0.00	0.00, 19.40	0	0.00	0.00, 6.71
042	Attendants in psychiatric care	NIGW	13,596	0	0.00	0.00, 6.18	0	0.00	0.00, 1.91
043	Practical nurses and hospital orderlies	NIGW, PPWL	125,497	5	1.02	0.33, 2.38	16	1.04	0.60, 1.69
044	Dental nurses	NOEXP	14,563	0	0.00	0.00, 7.47	2	1.31	0.16, 4.75
046	Pharmacists	NIGW	4,083	0	0.00	0.00, 19.00	0	0.00	0.00, 5.77
047	Physiotherapists and occupational therapists	PPWL	13,419	0	0.00	0.00, 8.27	3	2.32	0.48, 6.77
048	Health and nursing work n.e.c.	PPWL	1,085	0	0.00	0.00, 134.00	0	0.00	0.00, 52.50
049	Non-specified health and nursing work	NIGW, PPWL	31	0	0.00	0.00, 2,249.00	0	0.00	0.00, 750.00
050	Principals and headmasters	NOEXP	905	0	0.00	0.00, 75.50	0	0.00	0.00, 26.00
051	University and higher education teachers	NOEXP	3,650	0	0.00	0.00, 32.50	0	0.00	0.00, 10.20
052	Teachers of theoretical subjects	PPWL	27,148	3	2.56	0.53, 7.48	1	0.26	0.01, 1.45
053	Schoolmasters	PPWL	56,890	5	1.59	0.52, 3.71	11	1.20	0.60, 2.14
054	Teachers of painting, music, and physical education	PPWL	17,479	2	2.13	0.26, 7.68	5	1.73	0.56, 4.04
055	Teachers of vocational subjects	PPWL	3,938	1	4.53	0.11, 25.20	0	0.00	0.00, 4.87
056	Pre-primary education teachers	PPWL, UV	33,027	2	2.32	0.28, 8.37	2	0.85	0.10, 3.06
057	Educational methods advisors	NOEXP	2,739	0	0.00	0.00, 35.30	0	0.00	0.00, 11.20
058	Educational work n.e.c.	NOEXP	5,177	0	0.00	0.00, 25.00	0	0.00	0.00, 8.52
059	Non-specified educational work	NOEXP	443	0	0.00	0.00, 235.00	0	0.00	0.00, 79.10
061	Ministers and priests	NOEXP	1,880	0	0.00	0.00, 32.90	0	0.00	0.00, 10.50
068	Religious work n.e.c.	NOEXP	2,097	0	0.00	0.00, 45.00	0	0.00	0.00, 15.20
069	Non-specified religious work	NOEXP	5	0	0.00	0.00, 12,218.00	0	0.00	0.00, 3,253.00
071	Judges and other lawyers in courts of law	NOEXP	676	0	0.00	0.00, 183.00	0	0.00	0.00, 60.00

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Appendix 5. Continued

NYK	Occupation title, 1980	Exposure code ¹	N			Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
			Obs	SIR	95% CI	Obs	SIR	95% CI	Obs	SIR	95% CI
072	Prosecutors and senior police officers	NOEXP	311	0	0.00	0.00, 444.00	0	0.00	0.00, 163.00		
073	Lawyers in private practice	NOEXP	404	0	0.00	0.00, 258.00	0	0.00	0.00, 83.80		
074	Corporation and organization lawyers	NOEXP	748	0	0.00	0.00, 208.00	0	0.00	0.00, 81.70		
078	Legal work n.e.c.	NOEXP	36	0	0.00	0.00, 2,687.00	0	0.00	0.00, 752.00		
079	Non-specified legal work	NOEXP	8	0	0.00	0.00, 5,157.00	0	0.00	0.00, 1,603.00		
081	Sculptors, painters, photographers, and commercial artists	NOEXP	3,164	0	0.00	0.00, 30.20	0	0.00	0.00, 9.98		
082	Designers	NOEXP	2,175	0	0.00	0.00, 44.30	0	0.00	0.00, 14.00		
083	Display artists	NOEXP	912	0	0.00	0.00, 112.00	0	0.00	0.00, 36.10		
084	Authors	NOEXP	253	0	0.00	0.00, 251.00	0	0.00	0.00, 89.50		
085	Journalists and editors	NOEXP	5,321	1	5.04	0.13, 28.10	0	0.00	0.00, 6.00		
086	Performing artists	NOEXP	2,052	0	0.00	0.00, 45.80	1	3.95	0.10, 22.00		
087	Composers and musicians	NOEXP	1,299	0	0.00	0.00, 75.40	1	7.15	0.18, 39.80		
088	Literary and artistic work n.e.c.	NOEXP	1,157	0	0.00	0.00, 94.00	1	7.89	0.20, 44.00		
089	Non-specified literary and artistic work	NOEXP	28	0	0.00	0.00, 2,183.00	0	0.00	0.00, 697.00		
091	Accountants and auditors	NIGW	2,415	0	0.00	0.00, 52.80	0	0.00	0.00, 19.20		
092	Social workers	NIGW	28,010	1	1.06	0.03, 5.92	3	1.09	0.23, 3.20		
093	Librarians, archivists, and curators	NOEXP	7,906	0	0.00	0.00, 10.50	2	1.83	0.22, 6.61		
094	Economists and statisticians	NOEXP	5,125	0	0.00	0.00, 34.60	0	0.00	0.00, 15.20		
095	Psychologists	NIGW	3,882	0	0.00	0.00, 21.30	1	1.78	0.05, 9.94		
096	Staff officers	NOEXP	9,685	0	0.00	0.00, 14.60	1	1.40	0.04, 7.78		
097	Systems analysts and programmers	NIGW	4,806	0	0.00	0.00, 35.40	0	0.00	0.00, 14.10		
098	Other related work	NOEXP	2,389	1	11.81	0.30, 65.80	0	0.00	0.00, 14.20		
099	Non-specified other professional, technical, and related work	NOEXP	16	0	0.00	0.00, 6,989.00	0	0.00	0.00, 2,067.00		
101	Government legislative and administrative work	NOEXP	10,921	0	0.00	0.00, 10.00	0	0.00	0.00, 3.35		
111	General managers	NOEXP	2,404	0	0.00	0.00, 23.20	0	0.00	0.00, 8.73		
118	Other business managers, including managers with specific functions	NOEXP	11,359	0	0.00	0.00, 8.10	0	0.00	0.00, 2.74		
119	Non-specified business administrative and other technical and economical administrative work	NOEXP	1	0	0.00	0.00, 80,140.00	0	0.00	0.00, 14,685.00		
201	Bookkeepers and office cashiers	NOEXP	55,066	3	1.00	0.21, 2.93	9	0.92	0.42, 1.75		
203	Bank tellers	NOEXP	3,891	0	0.00	0.00, 17.70	0	0.00	0.00, 5.16		
204	Cashiers in retail stores and restaurants	PPWL	17,049	0	0.00	0.00, 4.17	1	0.35	0.01, 1.95		
208	Debt collectors	NOEXP	311	0	0.00	0.00, 344.00	0	0.00	0.00, 111.00		
209	Non-specified bookkeeping and clerical work	NOEXP	44	0	0.00	0.00, 872.00	0	0.00	0.00, 333.00		
230	Secretaries, typists, and related workers	NOEXP	156,010	6	1.07	0.39, 2.33	23	1.30	0.82, 1.95		
291	Computer operators	NIGW	10,485	1	2.42	0.06, 13.50	2	1.43	0.17, 5.16		
292	Bank employees (general bank work)	NOEXP	13,696	2	4.04	0.49, 14.60	0	0.00	0.00, 2.39		
293	Travel agency employees	NOEXP	2,524	0	0.00	0.00, 49.50	1	4.57	0.12, 25.50		
294	Forwarding and shipping agents	NOEXP	1,296	0	0.00	0.00, 85.20	0	0.00	0.00, 30.90		
295	Property managers and store managers	NOEXP	1,879	0	0.00	0.00, 38.40	0	0.00	0.00, 13.70		

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Appendix 5. Continued

NYK	Occupation title, 1980	Exposure code ¹	N			Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
			Obs	SIR	95% CI	Obs	SIR	95% CI	Obs	SIR	95% CI
296	Insurance raters and claims adjusters	NOEXP	5,757	0	0.00	0.00, 12.30	1	1.04	0.03, 5.78		
297	Employees in national insurance offices	NOEXP	8,271	1	3.65	0.09, 20.40	2	2.39	0.29, 8.63		
298	Cost accountants and estimating clerks	NOEXP	18,173	2	1.27	0.15, 4.57	9	1.79	0.82, 3.40		
299	Non-specified clerical work	NOEXP	36,587	5	1.98	0.64, 4.63	5	0.56	0.18, 1.30		
301	Working proprietors, wholesale trade	NOEXP	818	0	0.00	0.00, 94.80	0	0.00	0.00, 36.00		
302	Working proprietors, retail trade	NOEXP	19,665	1	0.72	0.02, 4.00	2	0.53	0.06, 1.91		
309	Non-specified working proprietors	NOEXP	71	0	0.00	0.00, 2,296.00	0	0.00	0.00, 1,210.00		
311	Insurance representatives and agents	NOEXP	468	0	0.00	0.00, 190.00	0	0.00	0.00, 67.30		
312	Brokers and valuers	NOEXP	759	0	0.00	0.00, 159.00	0	0.00	0.00, 61.50		
313	Advertising salesmen	NOEXP	3,442	0	0.00	0.00, 40.70	1	3.98	0.10, 22.20		
331	Commercial travelers, buyers, and dealers	NOEXP	16,425	0	0.00	0.00, 6.20	2	1.12	0.14, 4.04		
332	Shop managers	PPWL	10,619	0	0.00	0.00, 4.83	5	2.19	0.71, 5.12		
333	Shop assistants	PPWL	127,312	12	1.49	0.77, 2.59	30	1.13	0.76, 1.61		
339	Non-specified other sales work	NOEXP	14	0	0.00	0.00, 5,845.00	0	0.00	0.00, 1,695.00		
402	Farm managers and supervisors	PPWL, UV	89	0	0.00	0.00, 1,237.00	0	0.00	0.00, 458.00		
403	Forestry managers and supervisors	UV	104	0	0.00	0.00, 1,129.00	0	0.00	0.00, 358.00		
404	Horticultural managers and supervisors	NIGW, UV	190	0	0.00	0.00, 574.00	0	0.00	0.00, 221.00		
407	Reindeer owners	PPWL, UV	35	0	0.00	0.00, 2,135.00	0	0.00	0.00, 921.00		
409	Non-specified agricultural, horticultural, and forestry management work	PPWL, UV	1	0	0.00	0.00, 38,198.00	0	0.00	0.00, 10,007.00		
412	Horticultural workers	PPWL, UV	6,005	0	0.00	0.00, 8.90	1	0.79	0.02, 4.40		
415	Reindeer herdsman	UV	29	0	0.00	0.00, 1,762.00	0	0.00	0.00, 648.00		
421	Game-keepers and hunters	UV	7	0	0.00	0.00, 23,437.00	0	0.00	0.00, 7,829.00		
431	Fishermen	PPWL, UV	105	0	0.00	0.00, 613.00	0	0.00	0.00, 208.00		
432	Fish-breeders	PPWL, UV	37	0	0.00	0.00, 1,925.00	0	0.00	0.00, 649.00		
601	Ships' deck officers	NIGW, UV	9	0	0.00	0.00, 8,850.00	0	0.00	0.00, 3,018.00		
602	Ship pilots	NIGW, UV	1	0	0.00	0.00, 109,892.00	0	0.00	0.00, 32,275.00		
603	Ships' engineers	NIGW, UV	5	0	0.00	0.00, 35,765.00	0	0.00	0.00, 15,712.00		
609	Non-specified ships' officers	NIGW, UV	1	0	0.00	0.00, 349,361.00	0	0.00	0.00, 162,002.00		
611	Ships' deck and engine-room crew	NIGW, PPWL, UV	76	0	0.00	0.00, 2,508.00	0	0.00	0.00, 1,012.00		
621	Aircraft pilots, navigators, and flight engineers	IRAD, NIGW	20	0	0.00	0.00, 8,083.00	0	0.00	0.00, 2,823.00		
632	Railway guards	NIGW, UV	592	0	0.00	0.00, 277.00	0	0.00	0.00, 110.00		
642	Air traffic controllers and flight dispatchers	NIGW	1,186	0	0.00	0.00, 140.00	0	0.00	0.00, 54.80		
643	Railway station masters and train dispatchers	NIGW	452	0	0.00	0.00, 170.00	0	0.00	0.00, 56.90		
651	Post-office clerks	NOEXP	13,510	1	1.39	0.04, 7.77	2	0.88	0.11, 3.16		
652	Telecommunications traffic officers	NOEXP	192	0	0.00	0.00, 351.00	0	0.00	0.00, 120.00		
653	Telephone operators	NOEXP	23,067	3	1.96	0.40, 5.74	7	1.40	0.56, 2.88		
655	Telegraph and radio operators	NOEXP	1,994	0	0.00	0.00, 31.90	1	2.90	0.07, 16.10		
659	Non-specified post and telecommunications work	NOEXP	6	0	0.00	0.00, 5,772.00	0	0.00	0.00, 2,440.00		
661	Sorting clerks and postal workers	NIGW, PPWL, UV	6,028	2	9.27	1.12, 33.50	1	1.47	0.04, 8.21		
662	Messengers	NIGW, PPWL, UV	1,300	0	0.00	0.00, 71.90	0	0.00	0.00, 24.30		

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Appendix 5. Continued

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
671	Lighthouse and lock operators, ferry and harbor service assistants	NIGW, UV	53	0	0.00	0.00, 1,484.00	0	0.00	0.00, 488.00
678	Railway linemen	NIGW, UV	248	0	0.00	0.00, 205.00	0	0.00	0.00, 68.20
699	Non-specified transport and communications work	NIGW, UV	5	0	0.00	0.00, 13,319.00	0	0.00	0.00, 3,922.00
701	Spinners, weavers, knitters, and dyers	NIGW	15,722	2	1.66	0.20, 5.99	4	1.11	0.30, 2.84
711	Tailors and dressmakers	NOEXP	11,440	0	0.00	0.00, 4.98	4	2.00	0.55, 5.12
713	Milliners and hat makers	NOEXP	2,263	0	0.00	0.00, 18.90	0	0.00	0.00, 6.43
719	Non-specified sewing work	NIGW	462	0	0.00	0.00, 124.00	0	0.00	0.00, 39.00
721	Shoemakers and shoe repairers	NOEXP	100	0	0.00	0.00, 739.00	0	0.00	0.00, 250.00
726	Leather goods makers	NOEXP	1,226	0	0.00	0.00, 43.80	0	0.00	0.00, 12.80
741	Precision-tool makers	NIGW	1,020	0	0.00	0.00, 102.00	1	8.84	0.22, 49.30
742	Watchmakers	NOEXP	53	0	0.00	0.00, 1,666.00	0	0.00	0.00, 518.00
743	Opticians	NOEXP	591	0	0.00	0.00, 229.00	0	0.00	0.00, 85.90
744	Dental technicians	NOEXP	1,574	0	0.00	0.00, 53.90	0	0.00	0.00, 17.10
745	Goldsmiths and silversmiths	NOEXP	390	0	0.00	0.00, 172.00	0	0.00	0.00, 58.50
749	Non-specified precision-tool manufacturing work	NOEXP	10	0	0.00	0.00, 5,704.00	0	0.00	0.00, 1,617.00
765	Recording, sound, and light equipment operators	NOEXP	147	0	0.00	0.00, 1,187.00	0	0.00	0.00, 501.00
795	Glaziers	PPWL, UV	99	0	0.00	0.00, 1,149.00	0	0.00	0.00, 401.00
797	Divers and pipe layers	PPWL	7	0	0.00	0.00, 20,442.00	0	0.00	0.00, 7,486.00
821	Grain mill and oil press workers	PPWL	62	0	0.00	0.00, 1,237.00	0	0.00	0.00, 400.00
822	Bakers and pastry cooks	PPWL	6,126	0	0.00	0.00, 8.11	2	1.49	0.18, 5.39
823	Chocolate and confectionary workers	PPWL	1,823	0	0.00	0.00, 32.10	0	0.00	0.00, 10.60
824	Brewery, distillery, and other beverage plant workers	PPWL	979	0	0.00	0.00, 51.70	1	5.06	0.13, 28.20
825	Canning workers	PPWL	3,882	0	0.00	0.00, 13.40	4	4.90	1.33, 12.50
826	Butchers and meat preparers	PPWL	1,989	0	0.00	0.00, 34.00	1	3.01	0.08, 16.80
827	Dairy workers	PPWL	918	0	0.00	0.00, 56.70	0	0.00	0.00, 18.90
828	Food processing work n.e.c.	PPWL	1,492	0	0.00	0.00, 48.20	0	0.00	0.00, 15.60
829	Non-specified food processing work	PPWL	21	0	0.00	0.00, 2,444.00	0	0.00	0.00, 818.00
841	Tobacco workers	NIGW, PPWL	680	0	0.00	0.00, 85.50	0	0.00	0.00, 25.90
850	Basketry weavers	NIGW	47	0	0.00	0.00, 951.00	0	0.00	0.00, 351.00
854	Photographic laboratory workers	PPWL	1,105	0	0.00	0.00, 67.40	0	0.00	0.00, 20.80
855	Musical instrument makers and tuners	NIGW	44	0	0.00	0.00, 1,444.00	0	0.00	0.00, 498.00
858	Other production and related work n.e.c.	PPWL	3,641	0	0.00	0.00, 17.60	1	1.55	0.04, 8.62
859	Non-specified other production and related work	PPWL	1	0	0.00	0.00, 154,749.00	0	0.00	0.00, 49,892.00
861	Unskilled manual workers	PPWL	3,258	0	0.00	0.00, 15.30	0	0.00	0.00, 5.62
881	Packers	NIGW, PPWL	15,318	4	4.49	1.22, 11.50	3	1.07	0.22, 3.13
888	Furniture removers and porters	PPWL	1	0	0.00	0.00, 9,705,438.00	0	0.00	0.00, 9,705,438.00
889	Non-specified packing, freight handling, and storage work	PPWL	111	0	0.00	0.00, 445.00	0	0.00	0.00, 138.00
901	Firefighters	PPWL	15	0	0.00	0.00, 8,983.00	0	0.00	0.00, 2,954.00
903	Customs officials	NIGW, PPWL	298	0	0.00	0.00, 595.00	0	0.00	0.00, 256.00
904	Prison and reformatory officials	NIGW, PPWL	1,393	0	0.00	0.00, 105.00	0	0.00	0.00, 44.70

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Appendix 5. Continued

NYK	Occupation title, 1980	Exposure code ¹	N	Peritoneum (ICD-7 158)			Pleura (ICD-7 162.2)		
				Obs	SIR	95% CI	Obs	SIR	95% CI
908	Civilian protective service work n.e.c.	NIGW, PPWL	1,946	0	0.00	0.00, 50.10	1	4.54	0.12, 25.30
911	Catering supervisors	PPWL	14,586	0	0.00	0.00, 3.43	4	1.32	0.36, 3.38
912	Cooks	PPWL	18,248	1	0.88	0.02, 4.90	2	0.65	0.08, 2.33
913	Kitchen maids	PPWL	34,249	3	1.64	0.34, 4.80	4	0.72	0.20, 1.84
914	Nursemaids	NIGW, PPWL	72,368	1	0.41	0.01, 2.27	6	0.84	0.31, 1.82
915	Housekeeping service workers	PPWL, PPWL	67,042	2	0.52	0.06, 1.87	4	0.40	0.11, 1.02
916	Hotel receptionists	PPWL	1,097	0	0.00	0.00, 100.00	1	9.07	0.23, 50.50
917	Purser's, stewards, and stewardesses	IRAD, NIGW, PPWL	3,237	0	0.00	0.00, 34.50	0	0.00	0.00, 11.90
918	Housekeeping and related service work n.e.c.	PPWL	1,770	0	0.00	0.00, 31.00	0	0.00	0.00, 11.80
919	Non-specified housekeeping and related service work	PPWL	57	0	0.00	0.00, 965.00	0	0.00	0.00, 352.00
921	Waiters and waitresses	NIGW, PPWL	31,531	4	1.88	0.51, 4.82	8	1.19	0.51, 2.34
931	Building caretakers	PPWL	3,728	0	0.00	0.00, 15.00	1	1.50	0.04, 8.34
932	Cleaners	PPWL	103,538	7	1.21	0.49, 2.49	27	1.59	1.05, 2.31
939	Non-specified caretaking and cleaning work	PPWL	4	0	0.00	0.00, 8,805.00	0	0.00	0.00, 3,307.00
941	Hairdressers and beauticians	PPWL	18,912	1	1.06	0.03, 5.92	2	0.64	0.08, 2.31
942	Bath attendants	PPWL	1,625	0	0.00	0.00, 31.80	1	3.05	0.08, 17.00
944	Pressers	NOEXP	4,387	0	0.00	0.00, 9.92	3	2.76	0.57, 8.08
945	Coaches and horse trainers	PPWL, UV	814	0	0.00	0.00, 157.00	0	0.00	0.00, 53.60
946	Photographers	NIGW, UV	1,098	0	0.00	0.00, 58.80	1	5.09	0.13, 28.40
947	Undertakers	NIGW	159	0	0.00	0.00, 376.00	0	0.00	0.00, 145.00
948	Other service work n.e.c.	NIGW	2,141	0	0.00	0.00, 35.60	0	0.00	0.00, 11.80
949	Non-specified other service work	NIGW	4	0	0.00	0.00, 21,285.00	0	0.00	0.00, 5,925.00
981	Members of the armed forces	PPWL	204	0	0.00	0.00, 712.00	0	0.00	0.00, 251.00

SIR, standardized incidence ratio; NYK, Nordic Occupational Classification; N, number of persons in follow-up; ICD, International Classification of Diseases; Obs, observed; CI, confidence interval; n.e.c., not elsewhere classified.

¹See Appendix 1 for exposure codes.