Effects of occupation on risks of avoidable cancers in the Nordic countries

K. Kjaerheim [a], J.I. Martinsen [a], E. Lynge [b], H.K. Gunnarsdottir [c], P. Sparen [d], L. Tryggvadottir [e], E. Weiderpass [a,d,f,g], E. Pukkala [h,i,*]

[a] Cancer Registry of Norway, Oslo, Norway
[b] University of Copenhagen, Denmark
[c] Center of Public Health Sciences, University of Iceland, Reykjavik, Iceland
[d] Department of Epidemiology and Biostatistics, Karolinska Institute, Stockholm, Sweden
[e] Icelandic Cancer Registry, Reykjavik, Iceland
[f] Samfundet Folkhalsan, Helsinki, Finland
[g] Department of Community Medicine, University of Tromsø, Tromso, Norway
[h] Finnish Cancer Registry, Institute for Statistical and Epidemiological Cancer Research, Helsinki, Finland
[i] School of Public Health, University of Tampere, Tampere, Finland

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ABSTRACT

Knowledge of cancer risk according to occupational affiliation is an essential part of formatting preventive actions aimed at the adult population. Herein, data on 10 major cancer sites amenable by life style exposures from the Nordic Occupational Cancer Study (NOCCA) are presented. All subjects aged 30–64 years participating in one or more national censuses in Denmark, Finland, Iceland, Norway, or Sweden between 1960 and 1990 were included in the cohort and followed up for cancer from inclusion until 2003/2005 via a linkage with the national cancer registries, and standardised incidence ratios (SIRs) were computed. Variation in risk across occupations was generally larger in men than in women. In men, the most consistent cluster with high risk of numerous cancer types included waiters, cooks and stewards, beverage workers, seamen, and chimney sweeps. Two clusters of occupations with generally low cancer risks were seen in both men and women. The first one comprised farmers, gardeners, and forestry workers, the second one included groups with high education, specifically those in health and pedagogical work. Although cancer risk varies by occupation, only a smaller part of the variation can be attributed to occupational exposures in the strict sense. Preventive measures at the work place are important to avoid established and new occupational health hazards. This study also indicates that the work place in addition should be seen as a useful arena for reaching groups of adults with more or less similar habits and attitudes for general health promotion.

1. Introduction

Estimates of occupation specific cancer risk reflect occupational exposure to carcinogenic agents as well as the lifestyle habits, cultural norms, and socioeconomic position of the respective occupational groups. Here we will present data from the Nordic Occupational Cancer Study (NOCCA) on risk of 10 cancers by occupation in five Nordic countries during

a period of 45 years.[1] The results will be interpreted in the light of what is known regarding the aetiology of the respective cancer sites and the distribution of risk factors and occupational exposures over the occupational groups defined.

2.   Subjects and methods

Included in the study cohort were all subjects aged 30–64 years who participated in the 1960, 1970, 1980/1981, and/or 1990 censuses in Denmark, Finland, Iceland, Norway, and Sweden, and who were still alive and living in the respective countries on 1st January in the year following the census. Personal identification codes were used to link the census data of each individual to the national cancer registries to add cancer data, and to the national population registries for information on deaths and emigrations. The unique personal identity codes have been given to each individual alive in Sweden from 1947, in Iceland from 1953, in Norway from 1960, in Finland from 1967, and in Denmark from 1968. National cancer registration started in 1943 in Denmark, in 1953 in Finland and Norway, in 1955 in Iceland, and in 1958 in Sweden. In Sweden and Norway, the individual data from the 1960 census and later censuses have been computerised, whereas in Denmark and Finland the first computerised data are available from 1970 census and in Iceland only for the year 1981. Census questionnaires included questions related to the persons' economic activity, occupation, and industry. All questionnaires were centrally coded and computerised in the national statistical offices. Details concerning the structure of the population and history of the five Nordic countries, and also the culture, smoking and alcohol consumption habits of the population, living conditions, climate, and occupational history, have been described previously.[1]

The original national occupational codes recorded in the censuses[2] were converted into a common classification with 53 relatively specific, but not too narrow, occupational categories, and an additional category of economically inactive persons.

The cohort was followed-up for cancer incidence during the period from 1st January of the year after the first available census through emigration, death, or to 31st December of the following years: in Denmark 2003, in Finland 2005, in Iceland 2004, in Norway 2003, and in Sweden 2005. The ICD-7,[3] with local modifications, served as a common coding system for all countries through the study period, either as the main system or as a system used in parallel with newer codes.[4,5] All cancer cases were grouped into 49 main categories and 29 morphological or site specific subgroups. For this presentation, the selection of cancer sites was based on previous publications from the EUROCADET project which focuses on avoidable cancers[6], and the chosen cancer sites were thus cancer of the mouth, tongue and pharynx (ICD-7 141, 143-148), cancer of the oesophagus (ICD-7 150), stomach (ICD-7 151), colon (ICD-7 153), rectum (ICD-7 154), pancreas (ICD-7 157), larynx (ICD-7 161), lung (ICD-7 162), kidney (ICD-7 180), and bladder (ICD-7 181). For women, cancer of the breast (ICD-7 170) and endometrium (ICD-7 172) has also been included. Compared to European countries overall, incidence rates for Nordic men tended to be somewhat lower.[7] Gender differences were however in general smaller in the Nordic countries, and breast cancer rates were relatively high.[7]

The results are presented as standardised incidence ratios (SIRs) with the cancer incidence rates for the entire national study populations used as reference rates. SIR is counted as the ratio of observed (Obs) and expected numbers of cases. 95% confidence intervals (CIs) were calculated assuming a Poisson distribution of the observed cases. Occupations with less than 20 cases in all defined cancer groups were omitted from the tables, thus, results for male nurses and home helpers/domestic servants and female seamen, plumbers, bricklayers, and chimney sweeps are not shown.

The study was approved by the ethical committee and data inspection boards in each country.

3.   Results

SIRs by occupational group are shown in Table 1 for men and Table 2 for women. Table 3 gives the risk estimates for breast and endometrial cancer for women.

3.1.   Cancer of the mouth, tongue and pharynx

Among men, the highest risks of oral and pharyngeal cancer were seen among waiters (SIR 5.4), cooks and stewards, beverage manufacturing workers, seamen, and artistic workers. Low SIRs were observed among male farmers (SIR 0.5), forestry workers, gardeners, and teachers. Elevated SIRs among women were seen among journalists (SIR 2.1), tobacco production workers, waiters, and artistic workers, while the groups with lowest risks were 'other health workers' (SIR 0.6), nurses, teachers, farmers, and gardeners.

3.2.   Oesophageal cancer

Increased risks of oesophageal cancer were seen among male waiters (SIR 3.3), beverage manufacture workers, cooks and stewards, chimney sweeps, and seamen. Physicians (SIR 0.5), dentists, 'other health workers', teachers, farmers, and 'religious, juridical, and other academics' form the most important low risk groups. Among women, waitresses (SIR 1.4) and launderers had elevated risk. Low SIRs were observed among nurses (0.7), assistant nurses, teachers, and farmers. Separate analyses for adenocarcinoma of the oesophagus (not shown here) showed smaller variations across the occupational categories, with seamen (SIR 1.4), mechanics, and 'other construction workers' as the high risk groups.

3.3.   Cancer of the larynx

Elevated SIRs for cancer of the larynx were seen in several groups, among men most pronounced in waiters (SIR 3.5), beverage manufacture workers, cooks and stewards, seamen, and hairdressers. Male farmers and laboratory assistants (SIR 0.5), teachers, gardeners, and physicians were all at low risk. Among women, 'other construction workers' (SIR 7.4), public safety protection workers (five cases), mechanics, waitresses, printers, electrical workers, hairdressers, cooks and stewards, building caretakers, cleaners, and food workers

Table 1 – Observed (Obs) number of cancer cases and standardized incidence ratios (SIR) with 95% confidence intervals (CI) among men, for selected cancer sites, by occupational group.

Men / Occupational group	Mouth, tongue, pharynx OBS	SIR	95% CI	Oesophagus cancer OBS	SIR	95% CI	Stomach cancer OBS	SIR	95% CI	Colon cancer OBS	SIR	95% CI	Rectal cancer OBS	SIR	95% CI	Larynx cancer OBS	SIR	95% CI	Lung cancer OBS	SIR	95% CI	Pancreas cancer OBS	SIR	95% CI	Kidney cancer OBS	SIR	95% CI	Bladder cancer, incl. ureter + urethra OBS	SIR	95% CI
Technical workers, etc.	1401	0.8	0.8-0.8	1019	0.8	0.7-0.8	3698	0.8	0.8-0.8	7855	1.1	1.1-1.1	5039	1.0	1.0-1.0	899	0.7	0.7-0.8	10540	0.8	0.8-0.8	2777	0.9	0.9-1.0	3647	1.0	1.0-1.1	7679	1.0	1.0-1.1
Laboratory assistants	31	1.1	0.7-1.5	20	1.0	0.6-1.5	57	0.8	0.6-1.1	111	1.0	0.8-1.2	84	1.1	0.9-1.4	11	0.5	0.3-1.0	196	0.5	0.4-0.6	53	1.1	0.9-1.5	42	0.8	0.6-1.1	124	1.0	0.9-1.3
Physicians	93	0.8	0.7-1.0	42	0.5	0.4-0.7	165	0.5	0.5-0.6	543	1.1	1.1-1.2	278	0.9	0.8-1.0	47	0.6	0.4-0.8	455	0.5	0.4-0.6	202	1.1	0.9-1.2	204	1.0	0.8-1.1	505	1.0	0.9-1.1
Dentists	42	0.9	0.7-1.3	20	0.6	0.4-0.9	90	1.2	1.0-1.5	217	1.1	1.1-1.2	134	1.0	0.9-1.2	26	0.9	0.6-1.2	159	0.5	0.4-0.6	68	0.9	0.7-1.1	89	1.1	0.8-1.3	214	1.1	1.0-1.3
Assistant nurses	24	0.8	0.5-1.2	20	0.8	0.6-1.4	57	1.0	1.0-1.5	114	1.0	0.8-1.2	70	0.9	0.7-1.1	21	1.0	0.7-1.6	170	0.9	0.7-1.0	53	1.1	0.8-1.5	59	1.1	0.8-1.4	159	1.3	1.1-1.5
Other health workers	71	0.9	0.7-1.1	37	0.6	0.4-0.8	189	0.7	0.7-0.8	338	1.0	0.9-1.1	239	1.0	0.9-1.1	52	0.8	0.6-1.1	565	0.6	0.5-0.6	156	1.1	0.9-1.2	159	0.9	0.8-1.0	370	0.9	0.8-1.1
Teachers	421	0.6	0.6-0.7	272	0.6	0.5-0.6	1198	0.7	0.7-0.8	2695	1.0	1.0-1.1	1605	0.9	0.8-0.9	253	0.6	0.5-0.6	2419	0.5	0.5-0.5	938	0.9	0.8-0.9	1090	0.9	0.8-0.9	2297	0.8	0.8-0.9
Religious workers etc.	360	0.8	0.8-1.0	190	0.7	0.6-0.8	721	0.7	0.6-0.7	1875	1.2	1.1-1.2	1098	1.0	0.9-1.1	184	0.7	0.6-0.8	1731	0.6	0.6-0.7	605	0.9	0.8-1.0	751	1.0	0.9-1.1	1479	0.9	0.9-1.0
Artistic workers	232	2.0	1.7-2.3	109	2.2	1.0-1.5	249	0.7	0.5-0.7	554	1.1	1.0-1.2	361	1.1	0.9-1.2	92	1.1	0.9-1.2	847	0.9	0.9-1.0	106	1.1	0.9-1.3	256	1.1	0.9-1.2	594	1.2	1.1-1.3
Journalists	94	1.7	1.4-2.1	50	1.7	0.9-1.6	95	0.6	0.5-0.7	266	1.2	1.0-1.3	149	0.9	0.8-1.1	50	1.3	1.0-1.7	395	0.9	0.9-1.0	106	1.1	0.9-1.3	132	1.2	1.0-1.4	238	1.0	0.9-1.2
Administrators	1152	1.1	1.0-1.1	863	1.0	0.9-1.0	2483	0.8	0.8-0.8	5971	1.2	1.2-1.2	3612	1.1	1.0-1.1	847	1.1	1.0-1.1	7979	0.9	0.9-0.9	2084	1.0	1.0-1.1	2301	1.1	1.0-1.1	5622	1.1	1.1-1.1
Clerical workers	849	1.0	1.0-1.1	603	0.9	0.8-1.0	2135	0.9	0.8-0.9	4195	1.1	1.0-1.1	2603	1.0	1.0-1.1	573	0.9	0.9-1.0	6021	0.9	0.9-0.9	1559	1.0	0.9-1.1	1810	1.1	1.0-1.1	4128	1.1	1.1-1.1
Sales agents	1203	1.2	1.1-1.3	809	1.0	1.0-1.1	2790	0.9	0.8-0.9	5039	1.1	1.1-1.2	3385	1.1	1.1-1.2	839	1.0	1.0-1.1	7664	1.0	1.0-1.0	2058	1.1	1.0-1.2	2398	1.1	1.1-1.2	5095	1.2	1.1-1.2
Shop workers	764	1.2	1.1-1.2	620	1.1	1.0-1.2	1469	0.9	0.8-0.9	3280	1.1	1.1-1.1	2155	1.0	1.0-1.1	580	1.0	0.9-1.1	6143	1.0	1.0-1.0	1290	1.1	1.0-1.2	1351	1.1	1.1-1.2	3609	1.0	1.0-1.1
Farmers	1187	0.5	0.5-0.5	1544	0.7	0.6-0.7	10793	1.0	1.0-1.0	10026	0.8	0.8-0.8	7636	0.9	0.8-0.9	1052	0.5	0.4-0.5	15537	0.6	0.6-0.6	4824	0.8	0.8-0.8	4458	0.8	0.8-0.8	9447	0.7	0.7-0.7
Gardeners	389	0.6	0.6-0.7	418	0.8	0.7-0.8	2382	1.0	0.9-1.0	2607	0.8	0.8-0.9	2035	0.9	0.9-1.0	291	0.6	0.6-0.7	3866	0.7	0.7-0.7	1150	0.8	0.8-0.9	1233	0.8	0.8-0.9	2491	0.8	0.7-0.8
Fishermen	217	0.8	0.8-1.0	205	1.0	0.9-1.2	1428	1.4	1.3-1.4	1271	0.9	0.9-1.0	791	0.9	0.9-1.0	241	1.2	1.1-1.4	2547	1.2	1.1-1.2	596	0.9	0.8-1.0	572	0.8	0.7-0.8	1450	0.7	0.7-0.8
Forestry workers	250	0.6	0.5-0.6	352	0.9	0.8-1.0	1954	1.1	1.0-1.1	1643	0.8	0.7-0.8	1312	0.9	0.8-0.9	255	0.7	0.6-0.8	3577	0.9	0.9-0.9	899	0.9	0.8-0.9	849	0.8	0.7-0.8	1599	0.7	0.7-0.8
Miners and quarry workers	86	1.0	0.8-1.2	100	2.1	0.9-1.3	548	1.2	1.2-1.5	494	0.9	0.8-1.0	306	0.9	0.8-1.1	80	1.0	0.8-1.2	1445	1.6	1.5-1.7	256	1.1	1.0-1.3	278	1.2	1.0-1.2	480	0.9	0.9-1.0
Seamen	540	2.0	1.8-2.1	332	1.7	1.5-1.8	1075	1.0	1.0-1.1	1397	1.1	1.1-1.2	885	1.1	1.0-1.2	378	1.9	1.7-2.0	3583	1.6	1.6-1.7	580	1.2	1.1-1.3	628	1.2	1.1-1.3	1478	1.2	1.2-1.3
Transport workers	359	0.9	0.8-1.0	281	0.8	0.7-0.9	1198	0.9	0.9-1.0	1961	1.0	1.0-1.1	1331	1.0	0.9-1.1	313	1.0	0.9-1.1	3464	1.0	0.9-1.0	813	1.0	0.9-1.1	956	1.1	1.0-1.2	2107	1.1	1.0-1.1
Drivers	1270	1.0	1.0-1.1	1126	1.2	1.1-1.3	3847	1.1	1.1-1.2	5429	1.1	1.1-1.1	3755	1.1	1.1-1.1	1226	1.4	1.3-1.5	12882	1.3	1.3-1.3	2432	1.1	1.1-1.2	2747	1.1	1.1-1.2	5973	1.2	1.1-1.2
Postal workers	241	1.0	0.9-1.2	161	0.9	0.7-1.0	656	0.9	0.9-1.0	1078	1.1	1.0-1.2	687	1.0	0.9-1.1	172	1.0	0.9-1.2	1783	1.0	0.9-1.0	440	1.0	0.9-1.1	460	1.0	0.9-1.1	1106	1.1	1.0-1.1
Textile workers	188	0.9	0.8-1.0	165	0.9	0.8-1.0	776	1.1	1.1-1.2	1128	1.1	1.1-1.2	783	1.1	1.0-1.1	182	1.1	0.9-1.3	1854	1.0	0.9-1.0	441	1.0	0.9-1.1	475	1.0	0.9-1.1	1133	1.1	1.0-1.1
Shoe and leather workers	93	1.2	1.0-1.5	84	1.2	1.0-1.5	349	1.1	1.0-1.1	457	1.1	1.0-1.2	299	1.1	1.0-1.2	87	1.4	1.1-1.7	742	1.1	1.0-1.1	177	1.0	0.9-1.2	186	1.0	0.9-1.2	428	1.0	0.9-1.2
Smelting workers	352	1.0	0.9-1.1	326	1.0	0.9-1.1	1321	1.1	1.0-1.1	1729	1.0	1.0-1.0	1185	1.0	1.0-1.1	374	1.3	1.2-1.4	4227	1.3	1.2-1.3	750	1.0	0.9-1.2	814	1.0	1.0-1.1	1929	1.1	1.0-1.2
Mechanics	1651	1.0	0.9-1.0	1412	1.1	0.9-1.0	5194	1.1	1.0-1.1	7386	1.1	1.1-1.2	4997	1.0	1.0-1.0	1356	1.1	1.0-1.2	16203	1.1	1.0-1.1	3208	1.1	1.0-1.1	3669	1.1	1.0-1.1	8138	1.1	1.1-1.1
Plumbers	191	1.0	0.8-1.1	184	1.2	1.0-1.4	662	1.1	1.0-1.1	913	1.1	1.0-1.2	653	1.1	0.9-1.2	149	1.1	0.9-1.2	2225	1.4	1.4-1.5	403	1.1	0.9-1.2	471	1.1	1.0-1.2	1022	1.2	1.1-1.3
Welders	210	1.0	0.9-1.2	141	0.8	0.8-1.2	581	1.1	1.0-1.1	745	0.9	0.9-1.0	596	1.1	1.0-1.2	146	1.1	1.3-1.4	1798	1.3	1.3-1.4	348	1.0	0.9-1.2	533	1.3	1.1-1.4	822	1.1	1.0-1.1
Electrical workers	592	1.0	0.9-1.0	457	1.0	0.9-1.1	1778	1.0	1.0-1.1	2615	1.1	1.0-1.1	1789	1.0	0.9-1.1	477	1.1	1.0-1.2	4710	1.0	0.9-1.0	1113	1.0	1.0-1.1	1289	1.0	1.0-1.1	2758	1.1	1.1-1.1
Wood workers	977	0.9	0.9-1.0	882	0.9	0.8-0.9	4904	1.0	1.0-1.0	5478	1.0	1.0-1.0	3988	0.9	0.9-0.9	819	0.8	0.8-0.9	10941	1.0	0.9-1.0	2521	0.9	0.9-1.0	2602	0.9	0.9-1.0	5698	0.9	0.9-1.0
Painters	429	1.3	1.2-1.5	306	1.1	1.0-1.3	2919	1.2	1.2-1.3	1510	1.0	0.9-1.0	1131	1.1	1.0-1.2	303	1.2	1.0-1.4	3208	1.2	1.2-1.3	641	1.0	0.9-1.1	671	0.9	0.9-1.0	1642	1.0	1.0-1.1
Other construction workers	809	1.2	1.1-1.2	815	1.3	1.2-1.4	2919	1.2	1.2-1.3	3122	1.0	0.9-1.0	2304	1.0	1.0-1.1	751	1.2	1.1-1.3	9480	1.3	1.3-1.4	1520	1.0	0.9-1.1	1488	1.0	0.9-1.0	3592	1.0	1.0-1.1
Bricklayers	257	1.4	1.2-1.5	180	1.3	1.0-1.3	689	1.1	1.1-1.2	848	1.0	0.9-1.0	641	1.1	1.0-1.2	167	1.2	0.9-1.2	2233	1.3	1.2-1.3	406	1.0	1.0-1.4	385	1.0	0.9-1.1	976	1.0	0.9-1.1
Printers	256	1.3	1.1-1.5	200	1.3	1.1-1.5	532	0.9	0.9-1.0	958	1.0	1.0-1.2	968	1.1	1.0-1.3	173	1.2	1.0-1.4	2705	1.2	1.1-1.2	622	1.1	1.0-1.3	570	0.9	0.9-1.0	1389	1.2	1.1-1.2
Chemical process workers	272	1.1	1.0-1.2	223	1.1	0.9-1.1	1158	1.1	1.1-1.2	1672	1.0	0.9-1.0	1261	1.1	1.0-1.1	247	1.2	1.0-1.2	3948	1.2	1.2-1.2	747	1.1	1.0-1.1	812	1.1	1.0-1.2	2068	1.1	1.1-1.2
Food workers	406	1.1	1.0-1.2	371	1.2	1.0-1.3	1335	1.1	1.1-1.2	142	1.3	1.1-1.5	112	1.4	1.2-1.7	379	1.3	1.1-1.4	368	1.4	1.3-1.6	82	1.7	1.3-1.6	52	1.2	0.9-1.5	153	1.2	1.0-1.4
Beverage workers	66	2.6	2.0-3.3	61	2.7	2.1-3.5	81	1.1	0.9-1.4	29	1.3	0.9-1.9	12	0.8	0.4-1.4	59	2.7	2.0-3.4	84	1.8	1.4-2.2	10	1.7	0.5-2.0	12	1.5	0.8-2.6	29	1.2	0.8-1.7
Tobacco workers	6	1.0	0.5-3.0	5	1.3	0.4-3.0	11	0.8	0.4-1.4	1318	1.0	0.9-1.0	981	1.0	0.9-1.1	4	1.0	0.3-2.6	3055	1.2	1.1-1.3	570	1.0	0.9-1.1	596	0.9	0.9-1.0	1486	1.0	1.0-1.1
Glass makers etc.	303	1.0	0.9-1.1	268	1.0	0.9-1.2	1032	1.1	1.0-1.1	2688	1.1	1.0-1.1	1918	1.1	1.1-1.2	284	1.2	1.1-1.4	5913	1.3	1.3-1.3	1327	1.2	1.1-1.2	1264	1.1	1.0-1.1	2700	1.1	1.0-1.1
Packers	690	1.2	1.1-1.3	422	1.1	1.0-1.2	1711	1.2	1.1-1.2	2126	1.0	1.0-1.1	1509	1.1	1.0-1.1	536	1.2	1.2-1.3	4848	1.2	1.2-1.2	970	1.1	1.0-1.1	1142	1.1	1.0-1.1	2220	1.1	1.0-1.1
Engine operators	457	0.9	0.8-1.0	220	0.9	0.8-1.0	974	1.0	0.9-1.1	1635	1.0	1.0-1.1	1055	1.0	0.9-1.1	435	1.2	1.1-1.3	2653	1.0	0.9-1.0	663	1.1	1.0-1.2	768	1.2	1.1-1.2	1565	1.0	1.0-1.1
Public safety workers	265	1.1	1.0-1.2	96	0.8	0.7-1.0	206	1.0	0.9-1.2	259	1.0	0.9-1.1	205	1.2	1.0-1.3	233	2.3	1.8-2.8	679	1.1	1.0-1.1	143	1.3	1.1-1.5	155	1.2	1.1-1.5	309	1.2	1.1-1.4
Cooks and stewards	180	2.7	2.4-3.2	96	2.4	1.7-2.6	7	0.4	0.2-1.8	11	1.2	0.6-2.0	8	1.1	0.5-2.2	1	0.3	0.0-3.7	10	0.7	0.3-1.2	2	0.5	0.2-1.8	4	0.7	0.2-1.8	7	0.7	0.3-1.5
Home helpers	5	1.4	0.5-3.3	3	1.6	0.3-4.6	117	1.1	0.9-1.2	167	1.0	0.9-1.2	98	0.9	0.7-1.1	25	1.0	0.6-1.4	353	1.5	1.4-1.7	78	1.2	0.9-1.5	62	0.9	0.7-1.1	186	1.1	0.9-1.3
Waiters	218	5.4	4.7-6.2	100	4.7	2.7-4.1	124	1.1	0.9-1.4	220	1.3	1.2-1.5	159	1.4	1.2-1.7	102	3.5	2.9-4.3	603	1.9	1.8-2.1	100	1.5	1.2-1.8	96	1.3	1.0-1.6	249	1.5	1.3-1.7
Building caretakers	265	1.1	1.0-1.2	210	1.0	0.9-1.2	956	1.1	1.1-1.2	1188	1.1	1.0-1.1	786	1.0	0.9-1.1	255	1.3	1.1-1.5	2795	1.2	1.2-1.2	566	1.1	1.0-1.2	531	1.1	0.9-1.3	1276	1.1	1.1-1.1
Chimney sweeps	33	2.1	1.4-2.9	24	1.9	1.2-2.8	66	1.2	0.9-1.1	104	1.5	1.3-1.8	51	1.1	0.8-1.4	13	1.6	1.2-2.0	212	1.5	1.3-1.7	44	1.4	1.0-1.9	42	1.1	0.9-1.6	105	1.3	1.2-1.8
Hairdressers	91	1.7	1.4-2.1	45	1.4	1.0-2.1	158	0.9	0.8-1.1	274	1.1	1.0-1.2	200	1.1	1.0-1.3	66	1.6	1.2-2.0	560	1.2	1.1-1.3	112	1.1	0.9-1.3	119	1.1	0.9-1.3	359	1.3	1.2-1.5
Launderers	29	0.9	0.6-1.3	28	1.0	0.7-1.4	117	1.1	0.9-1.3	167	0.9	0.9-1.2	98	0.9	0.7-1.1	25	1.0	0.6-1.4	353	1.3	0.9-1.2	78	0.9	0.8-1.1	62	0.9	0.7-1.1	186	0.7	0.3-1.5
Military personnel	181	1.0	0.8-1.1	138	1.0	0.8-1.1	433	0.9	0.8-1.0	902	1.1	1.1-1.2	568	1.0	0.9-1.1	130	1.0	0.8-1.1	1295	0.9	0.9-1.0	293	0.9	0.8-1.1	417	1.0	0.9-1.2	915	1.1	1.1-1.2
Other workers	1037	1.3	1.2-1.4	925	1.3	1.3-1.4	3362	1.1	1.1-1.1	3818	1.0	0.9-1.0	2779	1.0	1.0-1.1	835	1.3	1.2-1.4	8513	1.2	1.2-1.2	1753	1.0	1.0-1.1	1671	1.0	0.9-1.0	4081	1.0	1.0-1.1
Economically inactive	1909	1.8	1.7-1.8	1474	1.5	1.4-1.6	5213	1.1	1.1-1.1	4768	1.0	1.0-1.0	3361	1.0	0.9-1.0	1322	1.4	1.4-1.5	16068	1.3	1.2-1.3	2773	1.1	1.1-1.1	2576	1.0	1.0-1.1	4993	1.0	1.0-1.0
Total	23697	1.0	ref	19577	1.0	ref	79385	1.0	ref	108456	1.0	ref	74654	1.0	ref	18488	1.0	ref	208297	1.0	ref	46945	1.0	ref	50344	1.0	ref	111501	1.0	ref

Table 2 – Observed (Obs) number of cancer cases and standardised incidence ratios (SIR) with 95% confidence intervals (CI) among women, for selected cancer sites, by occupational group.

Women Occupational group	Mouth, tongue, pharynx OBS	SIR	95% CI	Oesophagus OBS	SIR	95% CI	Stomach OBS	SIR	95% CI	Colon OBS	SIR	95% CI	Rectum OBS	SIR	95% CI	Larynx OBS	SIR	95% CI	Lung OBS	SIR	95% CI	Pancreas OBS	SIR	95% CI	Kidney OBS	SIR	95% CI	Bladder, incl ureter + urethra OBS	SIR	95% CI
Technical workers, etc.	37	0.7	0.5–1.0	23	0.9	0.5–1.3	114	0.8	0.7–1.0	401	1.1	1.0–1.2	215	1.1	0.9–1.2	9	0.9	0.4–1.8	314	1.0	0.9–1.1	141	1.0	0.9–1.2	88	0.7	0.6–0.9	126	1.1	0.9–1.3
Laboratory assistants	18	0.7	0.4–1.1	10	0.8	0.4–1.4	64	1.0	0.8–1.3	163	0.9	0.8–1.1	80	1.0	0.7–1.1	5	0.9	0.3–2.1	162	0.9	0.8–1.0	61	0.9	0.7–1.2	41	0.7	0.5–1.0	58	1.1	0.8–1.4
Physicians	12	0.9	0.4–1.5	8	1.2	0.5–2.3	15	0.4	0.2–0.7	109	1.1	0.9–1.3	53	1.0	0.7–1.3	1	0.4	0.0–2.0	62	0.7	0.5–0.9	31	0.9	0.6–1.2	22	0.7	0.4–1.1	24	0.8	0.5–1.1
Dentists	17	1.4	0.8–2.3	6	0.8	0.3–1.7	32	0.8	0.6–1.2	104	1.1	0.9–1.3	59	1.2	0.9–1.6	1	0.8	0.0–2.4	46	0.6	0.5–0.8	30	0.8	0.6–1.2	17	0.6	0.3–0.9	21	0.7	0.4–1.1
Nurses	158	0.8	0.7–0.9	73	0.8	0.7–0.9	474	0.9	0.8–0.9	1908	1.0	1.0–1.1	973	1.0	0.9–1.0	13	0.7	0.3–0.9	931	1.0	1.0–1.1	527	1.0	0.9–1.0	415	0.9	0.8–1.0	504	1.0	0.9–1.1
Assistant nurses	225	0.9	0.8–1.0	103	0.8	0.6–0.9	689	0.9	0.8–0.9	1614	1.0	0.9–1.0	1448	1.0	0.9–1.0	41	0.8	0.6–1.1	1682	1.0	1.0–1.1	661	1.0	0.9–1.1	551	0.9	0.8–1.0	653	1.1	1.0–1.2
Other health workers	106	0.8	0.6–0.9	60	0.8	0.6–1.0	362	0.9	0.8–1.0	1123	1.0	0.9–1.0	580	1.0	0.9–1.1	27	0.8	0.5–1.2	725	0.8	0.7–0.8	403	1.0	0.9–1.1	305	0.9	0.8–1.0	363	1.1	1.0–1.2
Teachers	329	0.9	0.8–1.0	162	0.9	0.7–0.9	761	0.7	0.6–0.7	3022	1.0	0.9–1.0	1448	1.0	0.9–1.0	34	0.5	0.3–0.6	1345	0.6	0.5–0.6	971	0.9	0.9–1.0	784	0.9	0.8–0.9	810	0.9	0.8–0.9
Religious workers etc.	105	0.9	0.7–1.1	49	0.9	0.7–1.2	261	0.8	0.7–0.9	837	1.0	0.9–1.1	423	0.9	0.8–1.0	10	0.5	0.3–1.0	504	0.7	0.7–0.8	278	0.9	0.8–1.0	244	0.9	0.8–1.0	232	0.9	0.8–1.1
Artistic workers	45	1.7	1.3–2.3	17	1.2	0.7–1.9	62	0.8	0.6–1.0	195	1.0	0.9–1.1	103	1.0	0.8–1.2	6	1.2	0.4–2.6	165	1.0	0.9–1.2	74	1.0	0.8–1.2	56	0.9	0.7–1.1	72	1.1	0.9–1.4
Journalists	23	2.1	1.3–3.1	6	1.0	0.4–2.1	19	0.6	0.3–0.9	74	0.9	0.7–1.1	40	0.9	0.7–1.3	1	0.5	0.0–2.9	91	1.4	1.1–1.7	25	0.8	0.5–1.2	23	0.8	0.5–1.2	15	0.6	0.3–1.0
Administrators	79	1.1	0.8–1.3	50	1.1	0.8–1.5	181	0.8	0.7–0.9	750	1.1	1.0–1.1	326	1.0	0.9–1.1	23	1.3	0.8–1.9	581	1.0	0.9–1.1	263	1.0	0.9–1.1	153	0.8	0.7–1.0	251	1.2	1.1–1.4
Clerical workers	1257	1.1	1.1–1.2	654	1.1	1.0–1.1	2642	0.8	0.8–0.9	9885	1.1	1.1–1.1	4910	1.1	1.1–1.1	243	1.0	0.9–1.1	8377	1.1	1.1–1.1	3325	1.0	1.0–1.1	2557	0.9	0.9–1.0	3262	1.2	1.1–1.2
Sales agents	140	1.1	1.0–1.3	81	1.0	0.8–1.3	458	0.9	0.8–1.0	1155	1.1	1.0–1.2	599	1.1	1.0–1.2	19	1.0	0.6–1.6	768	1.2	1.1–1.3	436	1.0	0.9–1.1	339	1.0	0.9–1.1	405	1.3	1.2–1.4
Shop workers	655	0.9	0.9–1.1	426	0.9	0.9–1.1	2302	1.0	1.0–1.1	6871	1.1	1.0–1.1	3345	1.0	1.0–1.1	137	0.9	0.7–1.0	5240	1.1	1.1–1.1	2329	1.1	1.0–1.1	1819	1.0	0.9–1.1	2197	1.1	1.1–1.1
Farmers	257	0.8	0.7–0.9	206	0.9	0.8–1.0	1244	1.0	0.9–1.1	2840	0.9	0.8–0.9	1275	0.9	0.8–0.9	35	0.4	0.3–0.6	1089	0.5	0.4–0.5	967	0.8	0.8–0.9	806	1.0	0.9–1.1	652	0.7	0.6–0.7
Gardeners	283	0.8	0.7–0.9	286	0.9	0.7–0.9	1638	1.0	1.0–1.1	2664	0.9	0.8–0.9	1441	0.9	0.9–1.0	34	0.9	0.6–1.2	1068	0.5	0.5–0.6	1297	0.9	0.9–0.9	1087	1.0	0.9–1.1	671	0.8	0.7–0.8
Fishermen	3	1.4	0.3–3.9	1	0.7	0.0–4.0	13	1.8	0.9–3.0	19	0.9	0.5–1.4	7	0.7	0.3–1.5	1	1.8	0.1–10.2	15	0.9	0.5–1.5	6	0.8	0.3–1.8	3	0.5	0.1–1.6	3	0.5	0.1–1.4
Forestry workers	2	0.5	0.1–2.0	2	0.9	0.1–3.1	2	0.6	0.1–2.3	32	0.9	0.6–1.3	14	0.8	0.4–1.4	0	0.0	0.0–5.5	24	1.1	0.7–1.6	5	0.4	0.1–0.9	9	0.9	0.4–1.6	6	0.6	0.2–1.3
Miners and quarry workers	0	0.0	0.0–4.7	0	0.0	0.0–5.8	—	0.6	0.1–2.3	2	0.3	0.0–1.2	0	0.0	0.0–1.1	0	0.0	0.0–27.4	3	0.7	0.1–1.9	3	1.1	0.2–3.1	1	0.4	0.0–2.4	3	1.6	0.3–4.7
Transport workers	8	0.8	0.3–1.5	5	0.6	0.2–1.4	46	1.1	0.8–1.5	95	1.1	0.8–1.3	49	1.1	0.8–1.4	9	2.8	0.9–6.5	114	1.9	1.6–2.3	46	1.2	0.9–1.6	41	1.2	0.9–1.7	31	1.2	0.8–1.8
Drivers	27	1.3	0.9–1.9	16	1.3	0.9–1.9	63	0.9	0.8–1.4	160	0.9	0.8–1.1	85	1.0	0.8–1.1	9	1.3	0.9–3.8	210	1.3	1.3–1.7	78	1.3	1.0–1.6	44	1.3	0.6–1.2	64	1.2	0.9–1.5
Postal workers	143	0.9	0.8–1.1	95	1.0	0.8–1.2	505	1.0	1.0–1.1	1484	1.1	1.0–1.1	701	1.0	0.9–1.1	21	0.7	0.5–1.1	962	1.0	1.0–1.1	528	1.0	0.9–1.1	470	1.1	1.0–1.2	439	1.1	1.0–1.1
Textile workers	333	1.0	0.9–1.1	240	1.0	0.9–1.2	1425	1.1	1.0–1.1	3474	1.1	1.0–1.1	1663	1.1	1.0–1.1	52	0.8	0.6–1.0	2339	1.1	1.1–1.2	1274	1.1	0.9–1.3	987	1.0	1.0–1.1	1049	1.1	1.0–1.1
Shoe and leather workers	20	0.7	0.4–1.1	24	1.2	0.7–1.7	130	1.1	0.9–1.3	246	1.1	0.9–1.3	141	1.1	0.9–1.3	8	1.4	0.6–2.8	191	1.0	1.0–1.3	118	1.1	0.9–1.3	83	1.0	0.8–1.2	93	1.2	1.0–1.4
Smelting workers	9	1.3	0.6–2.5	7	1.6	0.6–3.2	24	1.1	0.7–1.6	45	0.8	0.6–1.1	20	0.7	0.4–1.1	2	1.4	0.2–5.1	62	1.4	1.0–1.8	25	1.1	0.7–1.7	19	1.0	0.6–1.6	14	0.8	0.5–1.4
Mechanics	70	1.2	1.0–1.6	32	1.0	0.7–1.4	220	1.1	1.1–1.4	476	0.8	0.7–0.8	230	1.0	0.8–1.1	27	2.3	1.5–3.3	605	1.6	1.5–1.7	210	1.2	1.1–1.4	170	1.1	0.9–1.3	180	1.2	1.0–1.4
Welders	3	1.2	0.3–3.5	10	1.6	0.7–3.0	8	1.2	0.5–2.4	14	0.8	0.5–1.4	14	1.5	0.8–2.5	2	4.9	0.6–17.8	25	1.7	1.1–2.5	9	1.4	0.6–2.6	7	1.1	0.5–2.3	4	0.8	0.2–2.0
Electrical workers	45	1.0	0.7–1.4	26	1.1	0.7–1.5	155	1.1	1.1–1.5	368	1.1	1.0–1.2	195	1.1	1.0–1.3	7	1.9	1.2–3.0	588	1.8	1.7–2.0	125	1.0	0.8–1.2	114	1.1	0.9–1.3	123	1.1	0.9–1.3
Wood workers	29	1.0	0.6–1.4	18	1.1	0.6–1.4	133	1.1	0.9–1.3	206	0.9	0.8–1.0	123	1.0	0.8–1.1	7	1.1	0.5–2.3	235	1.2	1.1–1.4	111	1.0	0.8–1.2	90	1.0	0.8–1.2	56	0.8	0.6–1.0
Painters	2	0.5	0.1–1.7	5	1.6	0.5–3.7	18	1.1	0.7–1.7	38	1.1	0.8–1.6	36	1.6	1.1–2.2	10	2.7	0.3–9.8	47	1.9	1.4–2.5	21	1.4	0.9–2.1	8	0.6	0.3–1.2	15	1.5	0.9–2.5
Other construction workers	7	0.9	0.4–1.8	10	1.1	0.5–2.1	56	1.4	1.0–1.8	327	1.2	1.0–1.4	164	1.1	1.0–1.3	14	2.1	1.1–3.5	361	1.7	1.5–1.9	120	1.1	0.9–1.3	39	1.4	0.3–1.2	126	1.5	1.2–1.7
Printers	40	1.2	0.9–1.6	23	1.1	0.7–1.6	144	1.2	1.0–1.4	292	1.1	1.0–1.3	133	1.0	0.9–1.4	6	1.4	1.1–3.5	291	1.5	1.3–1.7	104	1.1	0.9–1.3	98	1.1	0.8–1.2	123	1.3	1.1–1.6
Chemical process workers	24	0.9	0.6–1.3	22	1.2	0.7–2.5	108	1.1	0.9–1.4	1218	1.0	0.4–0.9	598	1.0	0.9–1.1	5	1.9	0.6–4.4	110	1.9	1.6–2.3	34	1.3	0.9–1.9	73	1.0	0.7–1.8	29	1.0	0.7–1.8
Food workers	148	1.4	1.0–1.3	101	1.1	0.9–1.5	526	1.1	1.0–1.2	66	1.0	0.9–1.1	19	0.6	0.4–0.9	46	2.4	0.6–2.3	1247	1.5	1.3–1.6	478	1.1	0.9–1.2	357	1.0	0.9–1.1	378	1.0	0.9–1.1
Beverage workers	10	1.8	1.0–3.0	7	1.3	0.5–2.6	31	1.3	0.9–1.8	71	1.0	0.7–1.6	58	1.6	1.2–2.1	5	1.9	0.6–4.4	169	2.3	2.0–2.7	32	1.2	0.8–1.7	18	1.0	0.7–1.8	50	2.0	1.5–2.7
Tobacco workers	15	1.2	1.0–1.5	51	1.2	0.9–1.5	251	1.2	1.0–1.3	620	1.1	0.9–1.1	290	1.0	0.9–1.2	18	1.4	0.8–2.1	605	1.5	1.3–1.6	235	1.1	0.9–1.2	169	0.9	0.8–1.1	201	1.2	1.0–1.3
Glass makers etc.	79	1.3	1.1–1.5	80	1.2	0.9–1.5	463	1.2	1.1–1.3	939	1.0	1.0–1.1	480	1.0	0.9–1.0	17	1.0	0.6–1.6	857	1.5	1.4–1.6	357	1.0	0.9–1.2	330	1.1	1.0–1.2	314	1.2	1.1–1.3
Packers	10	0.6	0.2–1.4	7	1.2	0.6–2.2	33	1.1	0.8–1.6	46	0.8	0.6–1.2	28	0.9	0.6–1.2	4	2.9	0.8–7.4	125	2.6	2.2–3.1	27	1.0	0.6–1.4	23	0.9	0.6–1.4	14	0.8	0.5–1.4
Engine operators	5	0.9	0.3–1.3	3	0.7	0.1–2.0	36	1.3	1.0–1.6	79	1.1	0.8–1.6	42	1.2	0.8–1.6	3	3.6	1.2–8.4	61	1.2	0.9–1.6	20	0.8	0.5–1.2	25	1.2	0.8–1.8	25	1.2	0.8–1.8
Public safety workers	146	0.9	0.8–1.0	96	1.1	0.9–1.3	626	1.1	1.0–1.1	1260	1.0	0.9–1.0	651	1.1	1.0–1.1	32	1.0	0.7–1.4	761	1.1	1.0–1.1	513	1.0	0.9–1.0	408	1.0	0.9–1.1	404	1.1	1.0–1.2
Home helpers	313	0.9	0.8–1.0	197	0.9	0.8–1.0	1349	1.1	1.0–1.1	3129	1.0	0.9–1.0	1567	1.0	0.9–1.0	70	1.0	0.8–1.3	2256	1.0	1.0–1.1	1137	1.0	0.9–1.0	867	1.0	0.9–1.1	1036	1.1	1.0–1.1
Waiters	232	1.4	1.2–1.6	119	1.4	1.0–1.6	587	1.1	1.0–1.2	1408	1.0	0.9–1.0	699	1.1	1.0–1.2	55	2.2	1.7–2.9	1524	1.9	1.8–2.0	547	1.1	1.1–1.2	400	1.0	0.9–1.1	554	1.4	1.3–1.6
Building caretakers	692	1.1	1.0–1.2	442	1.1	1.0–1.2	2421	1.1	1.0–1.1	5581	1.0	1.0–1.0	2791	1.0	1.0–1.0	215	1.5	1.3–1.7	5657	1.3	1.3–1.3	2407	1.1	1.1–1.2	1813	1.1	1.1–1.2	1946	1.1	1.0–1.1
Hairdressers	38	1.1	0.9–1.5	38	1.1	0.8–1.5	170	0.9	0.8–1.0	550	1.1	0.9–1.1	256	1.0	0.9–1.2	21	1.7	1.3–1.7	496	1.3	1.2–1.4	218	1.2	1.1–1.4	149	1.1	1.1–1.2	193	1.2	1.1–1.4
Launderers	82	1.1	0.9–1.3	67	1.3	0.9–1.3	332	1.1	1.0–1.3	723	1.0	0.9–1.1	347	1.0	0.9–1.0	22	1.3	0.8–2.0	612	1.2	1.1–1.3	305	1.1	1.0–1.3	201	1.0	0.8–1.1	248	1.1	1.0–1.3
Military personnel	1	2.5	0.1–13.9	2	12.0	1.5–43.4	—	0.0	0.0–4.0	3	1.2	0.2–3.4	1	0.7	0.0–4.0	0	0.0	0.0–43.2	0	0.4	0.0–2.1	0	0.0	0.0–4.1	2	2.4	0.3–8.8	1	1.3	0.0–7.0
Other workers	285	1.0	1.0–1.3	155	1.0	0.9–1.2	922	1.0	1.0–1.1	2356	1.0	1.0–1.0	1185	1.0	1.0–1.1	81	1.5	1.2–1.9	2078	1.2	1.2–1.3	896	1.0	1.0–1.1	667	1.0	1.0–1.1	746	1.1	1.0–1.2
Economically inactive	6442	1.0	1.0–1.0	4600	1.0	1.0–1.0	27655	1.0	1.0–1.0	63208	1.0	1.0–1.0	30358	1.0	1.0–1.0	1255	0.9	0.9–1.0	35961	0.9	0.9–1.0	23523	1.0	1.0–1.0	18604	1.0	1.0–1.0	18443	1.0	0.9–1.0
Total	13165	1.0	1.0–1.0	8721	1.0	1.0–1.0	49812	1.0	1.0–1.0	122312	1.0	1.0–1.0	59585	1.0	ref	2678	1.0	1.0–1.0	81843	1.0	1.0–1.0	45368	1.0	1.0–1.0	35618	1.0	1.0–1.0	37224	1.0	1.0–1.0

Table 3 – Observed (Obs) number of cancer cases and standardised incidence ratios (SIR) with 95% confidence intervals (CI) among women, for cancers of the breast and corpus uteri, by occupational group.

Occupational group	Breast			Corpus uteri		
	OBS	SIR	95% CI	OBS	SIR	95% CI
Technical workers, etc.	2313	1.2	1.2-1.3	371	1.1	1.0-1.2
Laboratory assistants	1189	1.2	1.1-1.3	168	1.0	0.9-1.2
Physicians	702	1.4	1.3-1.5	110	1.2	1.0-1.4
Dentists	538	1.4	1.3-1.6	98	1.2	1.0-1.5
Nurses	7682	1.2	1.2-1.2	1445	1.1	1.0-1.1
Assistant nurses	8060	1.0	0.9-1.0	1588	0.9	0.9-1.0
Other health workers	5248	1.1	1.1-1.2	987	1.1	1.0-1.1
Teachers	15315	1.2	1.2-1.2	2788	1.1	1.1-1.2
Religious workers etc.	5560	1.2	1.2-1.2	909	1.2	1.1-1.3
Artistic workers	1121	1.3	1.2-1.3	212	1.2	1.1-1.4
Journalists	550	1.4	1.3-1.5	94	1.2	1.0-1.5
Administrators	3167	1.3	1.2-1.3	585	1.2	1.1-1.3
Clerical workers	43064	1.2	1.2-1.2	8404	1.1	1.1-1.1
Sales agents	4152	1.1	1.1-1.1	855	1.1	1.0-1.1
Shop workers	20193	1.0	1.0-1.0	4855	1.0	1.0-1.0
Farmers	6453	0.8	0.8-0.8	1860	0.9	0.9-1.0
Gardeners	7300	0.8	0.7-0.8	2365	1.0	0.9-1.0
Fishermen	44	0.7	0.5-0.9	11	0.8	0.4-1.4
Forestry workers	85	0.8	0.6-0.9	25	1.0	0.6-1.4
Miners and quarry workers	24	0.9	0.6-1.4	2	0.3	0.0-1.2
Transport workers	398	1.2	1.0-1.3	97	1.2	1.0-1.5
Drivers	568	0.8	0.8-0.9	99	0.7	0.6-0.8
Postal workers	5191	1.1	1.1-1.1	1192	1.1	1.0-1.1
Textile workers	9342	1.0	1.0-1.0	2279	1.0	0.9-1.0
Shoe and leather workers	841	1.0	0.9-1.1	224	1.1	1.0-1.2
Smelting workers	189	0.8	0.7-1.0	50	1.0	0.7-1.3
Mechanics	1714	0.9	0.9-1.0	365	0.9	0.8-1.0
Welders	74	0.8	0.6-1.0	16	0.9	0.5-1.5
Electrical workers	1345	1.0	0.9-1.0	274	0.9	0.8-1.0
Wood workers	725	0.8	0.7-0.8	224	1.0	0.9-1.1
Painters	132	0.9	0.8-1.1	31	1.0	0.7-1.4
Other construction workers	200	0.9	0.8-1.0	56	0.9	0.7-1.2
Printers	1209	1.2	1.1-1.2	223	1.0	0.8-1.1
Chemical process workers	726	0.9	0.8-1.0	170	0.9	0.8-1.0
Food workers	3077	0.9	0.8-0.9	795	0.9	0.9-1.0
Beverage workers	195	1.0	0.9-1.2	33	0.7	0.5-1.0
Tobacco workers	222	1.0	0.9-1.2	49	0.9	0.7-1.2
Glass makers etc.	1806	0.9	0.9-1.0	429	0.9	0.8-1.0
Packers	2872	1.0	0.9-1.0	698	1.0	0.9-1.1
Engine operators	255	0.8	0.7-0.9	59	0.9	0.7-1.2
Public safety workers	317	1.1	1.0-1.2	44	0.9	0.6-1.2
Cooks and stewards	3693	1.0	0.9-1.0	892	1.0	1.0-1.1
Home helpers	9910	0.9	0.9-0.9	2332	1.0	1.0-1.1
Waiters	4071	1.0	1.0-1.0	805	0.8	0.8-0.9
Building caretakers	14952	0.9	0.8-0.9	3777	0.9	0.9-1.0
Hairdressers	1983	1.1	1.0-1.1	423	1.0	0.9-1.1
Launderers	1757	0.9	0.9-0.9	437	0.9	0.8-1.0
Military personnel	26	1.6	1.0-2.3	1	0.4	0.0-2.1
Other workers	6822	1.0	0.9-1.0	1546	1.0	0.9-1.0
Economically inactive	165970	1.0	1.0-1.0	42262	1.0	1.0-1.0
Total	373361	1.0	1.0-1.0	87617	1.0	1.0-1.0

were at elevated risk. Low risks were seen among nurses (SIR 0.3), farmers, teachers, the group of religious, juridical, and other academic professions, and gardeners.

3.4. Lung cancer

For lung cancer, the occupational differences in risk were large. The highest SIRs in men were observed among waiters

(SIR 1.9), tobacco manufacture workers, seamen, miners and quarry workers, cooks and stewards, chimney sweeps, plumbers, and beverage manufacture workers. The SIRs were lowest among male nurses (SIR 0.4), teachers, dentists, physicians, farmers, the group comprising religious and juridical professions, and gardeners. Among women the highest SIRs were found among engine operators (SIR 2.6), tobacco workers, and 'other construction workers'. Painters, waiters,

beverage workers, transport workers, electrical workers, printers, welders, mechanics, packers, chemical process workers, drivers, and glass makers also had significant SIRs above 1.4. The lowest SIRs among women were found among farmers (SIR 0.5), followed by gardeners and teachers. No major differences were seen in the occupational risk distribution when stratifying the analyses by histological subgroups (adeno/squamous/small-cell/other) (not shown).

3.5.   Cancer of the pancreas

For pancreatic cancer the highest SIR in men was observed among beverage workers (SIR 1.7), followed by waiters, chimney sweeps, and cooks and stewards. The SIR was lowest among farmers and gardeners (SIR 0.8). In women, the highest significant SIRs were seen among drivers (SIR 1.3), mechanics, and hairdressers. The SIR was lowest among forestry workers (SIR 0.4) and farmers.

3.6.   Cancer of the kidney and renal pelvis

Among men, waiters (SIR 1.3), welders, and cooks and stewards had the highest risk of kidney cancer. The lowest risk was seen among forestry workers and farmers (SIR 0.8). For women, none of the occupations showed a significantly elevated risk of kidney cancer above 1.2. The lowest significant risks were found for female dentists (SIR 0.6), technical workers, and laboratory assistants. The variation of the SIR was essentially larger when analysing on the sub-group cancer of the renal pelvis, which constitutes about one-tenth of all renal cancers (not shown). High SIRs of cancer for renal pelvis cancer in men were observed among seamen (SIR 1.5), printers, welders, public safety workers, and textile workers. Low-risk occupational groups included forestry workers (SIR 0.5) and farmers. Among women, a small increase in risk was found in clerical workers and shop workers (SIR 1.2). Women belonging to the group of religious, juridical, and other academic professions had the lowest significant risk (SIR 0.5), followed by farmers and gardeners.

3.7.   Bladder cancer

Among men, the highest bladder cancer risks were observed in waiters (SIR 1.5), chimney sweeps, hairdressers, assistant nurses, seamen, cooks and stewards, plumbers, and beverage production workers. The SIRs were lowest among farmers (SIR 0.7), forestry workers, and gardeners. The highest risks among women were found in tobacco workers (SIR 2.0), printers, waitresses, chemical process workers, sales agents, and hairdressers. Farmers (SIR 0.7) and gardeners had SIRs significantly below 1.0.

3.8.   Stomach cancer

The highest risk among the men was observed among fishermen (SIR 1.4), but SIRs were also elevated among miners and quarry workers, seamen, 'other construction workers', packers, and engine operators. SIRs were lowest among dentists and physicians (SIR 0.5), journalists, religious workers, and teachers. Separate analyses of cancers of the gastric cardia

among men (not shown) identified beverage workers (SIR 1.8) and fishermen as high risk groups. In women, the highest SIR observed was among 'other construction workers' (SIR 1.4), followed by electrical workers and mechanics. The SIR was lowest among physicians (SIR 0.4), journalists, and teachers.

3.9.   Colon cancer

For colon cancer the highest SIRs among men were observed in chimney sweeps (SIR 1.5), waiters, and beverage workers. Elevations were also seen in journalists, administrators, the group of religious, juridical, and other academic professions, and printers. SIRs were lowest in forestry workers, farmers, and gardeners (SIR 0.8). Among women, the variation in colon cancer incidence across the occupational groups was small. Only printers, chemical process workers, and administrators exhibited SIRs significantly greater than 1.1, and only farmers and gardeners had SIRs smaller than 0.9.

3.10.   Rectal cancer

The variation in rectal cancer risk between occupational categories was very small. The highest risk was seen among male waiters and beverage workers (SIR 1.4). None of the significantly low SIRs among the men were below 0.9. In women, risk was high among tobacco manufacture workers (SIR 1.6). A low SIR was observed among the female beverage manufacture workers (SIR 0.6).

3.11.   Breast cancer

In women, the occupational groups with the highest breast cancer SIRs were military personnel (SIR 1.6), dentists, journalists, physicians, administrators, and artistic workers. The SIR was lowest among women in fishery (SIR 0.7), followed by forestry workers, wood workers, gardeners, and farmers.

3.12.   Endometrial cancer

For endometrial cancer the differences in risk between occupations were very small, and no real pattern emerged in the analysis. Artistic workers, journalists, and dentists (SIR 1.2) had the highest risk of cancer of the endometrium, while beverage workers and drivers presented the lowest risk (SIR 0.7).

4.   Discussion

The above presentation of results reveals clusters of high and low risk occupations. Among men, the most consistent high risk cluster comprises the occupational groups of waiters, cooks and stewards, beverage workers, seamen, and chimney sweeps. For women, no consistent high risk cluster is observed. Two clusters of occupations with generally low cancer risks are seen both for men and women, the first one comprising the primary sector occupations of farmers, gardeners, and forestry workers, the second cluster includes groups with high education, specifically those in health and pedagogical work, such as physicians, dentists, teachers, and religious and juridical professions. Although occupations in these

clusters to some extent can be commented on as a group with similar health habits, some occupations show specific risk patterns which require more detailed consideration.

Male waiters, cooks and stewards, beverage workers, and seamen all had elevated risk of oral/pharyngeal, oesophageal, and laryngeal cancer; cancer sites where alcohol and tobacco constitute the main risk factors and consumption of fruit and vegetables are considered protective.[8,9] These occupations are those mostly working with the production or distribution of alcohol or tobacco, or having easy access to them, and those which belong to work cultures where liberal attitudes towards drinking and smoking have been prevalent. Several studies have indicated a high alcohol consumption and smoking prevalence in these groups.[10–13] Most of the variation in risk at these cancer sites across occupations can probably be explained by smoking and drinking habits. This assumption is supported by a comparison of risk of cancer of the mouth, pharynx, larynx, oesophagus, and liver with mortality of alcohol related liver disease[1] which showed that the high risk groups to a large extent were the same. According to our results, direct occupational exposures appear to have a relatively small effect on risk of cancers of the mouth, pharynx, larynx, and oesophagus, although an association with the inhalation of organic or inorganic dust has been suggested, and for larynx cancer specifically the exposure to strong sulphur acid mists and asbestos are considered established risk factors.[14]

Chimney sweeps had elevated risk of oral/pharyngeal and oesophageal cancer, which may not be attributed to alcohol and tobacco alone. There are some indications that the inhalation of organic or inorganic dust may be associated with elevated risk, and an effect of exposure to combustion products in risk of oesophageal cancer has also been suggested.[14–16] Such factors could possibly contribute to the high risk seen among chimney sweeps. For groups such as male hairdressers and female launderers it can also not be excluded that occupational exposures contribute to risk of oral/pharyngeal cancer and oesophageal cancer, respectively.

Among women, the variation in risk of cancers of the mouth, pharynx, larynx, and oesophagus was smaller across occupations, which probably may be explained by the generally lower consumption of alcohol and tobacco. Only waitresses had significantly elevated risk at all sites related to alcohol and tobacco (in fact they had elevated risk at all sites reported here except kidney cancer), consistent with previous reports of a higher than average alcohol and tobacco consumption.[17] No risk elevations at sites related to alcohol were seen among the female beverage production workers. This different risk profile between the genders in the same occupational group may well be an example of a situation where the men and women under the same occupational code do different types of work: men may work mainly with beer brewing, while women with other types of beverages.

Low risk groups for oral/pharyngeal, and oesophageal cancer among men and women were the primary sector occupations and those requiring long education described above. A low smoking prevalence is assumed to contribute to the low risk in both groups,[18–22] in addition to low alcohol consumption in the primary sector[23,24] and healthy dietary habits among those with high education.[25–30] Both groups tend to

be physically active, either during working hours or during leisure time.[23]

The occupational categories with high SIRs for lung cancer were all manual workers within the industrial sector with low education who tend to smoke more than others.[18–22] Tobacco smoking is the main cause of lung cancer,[31] and much of the observed variation in occupational risk can be explained by smoking habits. Waiters and waitresses have had a high smoking prevalence, and have in addition until recently been heavily exposed to passive smoking.[10,17] Many of the high SIR occupations were, however, also likely to be exposed to various known or suspected occupational carcinogens.[32] Miners and quarry workers may have been exposed to radon, silica dust, diesel exhaust, and asbestos; plumbers to asbestos; smelting workers e.g. to arsenic, nickel, and chromium compounds; welders to welding fumes, nickel, and chromium compounds; drivers to diesel exhaust; bricklayers and other construction workers to silica dust and asbestos; and chemical workers and mechanics to mixed exposures.[1,14,32,33] A high prevalence of cigarette smoking has previously been demonstrated among seamen,[13,12] but among those working in the machine room, exposure to asbestos, polyaromatic hydrocarbons, and oil mist may also contribute to the elevated lung cancer risk.[32] Although not an established association, exposure to endoxotins has previously been seen to protect against lung cancer in a dose–response manner, which might be part of the explanation for the very low lung cancer risk among farmers.[34] The findings for the histological subtypes of lung cancer did not suggest that aetiological factors would be specific to one subtype only. The results on lung cancer are clearly supportive of the interpretation that the varying smoking habits do not explain all the occupational variation in lung cancer risk.

In a publication by Haldorsen and co-workers[18] data on occupational smoking habits were used to control for confounding by smoking on the occupational lung cancer risk seen in the Norwegian part of a previous census-based follow-up study.[35] In most of the groups defined as 'probably occupationally exposed' (such as welders, plumbers, painters, bricklayers, smelters, glass workers, beverage workers, launderers, and tobacco workers), initial SIRs were above 1.00, and adjustment led to further elevation of the risk estimate, indicating an effect of occupational exposure. On the other hand, the initially significantly elevated lung cancer SIRs for waiters and cooks were lowered to unity after smoking adjustment, indicating smoking habits to be the main explanation for the elevated risk. For physicians and dentists, the smoking adjustment further decreased the already low SIRs, indicating a lower smoking prevalence as compared to other occupations. The risk estimates for gardeners and wood workers changed from being significantly low to being significantly high, which might be an indication of work-related exposure to lung carcinogens.[18]

Tobacco smoking is an established risk factor for bladder cancer,[36] and almost all occupational categories with a low SIR for bladder cancer, such as gardeners and those working in agriculture and pedagogical work, also had a low SIR for lung cancer. On the opposite side of the risk spectrum, waiters and tobacco workers were among those with the highest SIRs for lung cancer, and as there are no known occupational

bladder carcinogens in these occupations, the excess risk for bladder cancer therefore is most probably due to smoking. Several chemical exposures have however also been identified as risk factors for bladder cancer,[14] and in the present study hairdressers and printers were among the occupations with the highest SIRs for bladder cancer where occupational exposures may have played a role. A number of studies have found an excess of bladder cancer among workers exposed to polycyclic aromatic hydrocarbons.[37] Chimney sweeps are exposed to chimney soot which is rich in these chemicals, a group of compounds well documented as carcinogenic.[38,39]

For stomach cancer the SIRs were consistently high for unskilled workers and low for occupations characterised by a high educational level and a high social status. The low risk occupations presumably have lower risk of infection with *H. pylori*[40] and diets rich in fruits and vegetables.[41] The increased SIRs for stomach cancer among miners, chimney sweeps, and construction workers may be associated with exposure to airborne particles, especially cement- and silica dust.[42]

The variation in colon cancer incidence between occupations was very small among women as well as men, indicating that there are no major contrasts neither in socioeconomic nor in occupational determinants of risk. The effect of physical activity[43] was thus not strongly reflected in the occupational risk pattern of the present study. The occupational categories with highest SIRs (male waiters and chimney sweeps) do not generally imply sedentary work, and have no obvious explanations. Similarly, very little variation was seen across occupational categories for rectal cancer. The elevated risk among brewery workers and waiters may be associated with alcohol consumption,[44] which is frequently seen to be elevated in these groups.[10,11]

Breast cancer risk has been shown to be strongly correlated with age at first birth.[45] This was clearly mirrored in the present study, where occupations requiring a long education, and the mean age at first birth consequently was high,[1] systematically had elevated SIRs for breast cancer. In occupations where women tend to have a high number of children[1,46-49] the risk of breast cancer was low. These results are consistent with hormonal factors strongly connected with reproductive behaviour being the most important non-genetic risk factors for breast cancer.[50] Other known risk factors were not particularly reflected in the present results, except for a tendency for occupations with high levels of physical activity to have the lowest SIRs, while sedentary workers tended to have an increased risk of breast cancer. Since the duration of education is associated with both reproductive pattern and the degree of physical demands of the job, it is hard to estimate how much sedentary work in itself contributes to risk. For cancer of the endometrium the occupational variation in risk was very small and was not clearly associated with the fertility pattern.

Our study was based on a large cohort with a long follow-up period. Because of the high coverage, precision, and validity of the linked files, the cancer risk estimates can be considered very reliable. The occupational affiliation at one point in time may not always correspond to the lifelong occupational history of a person. However, comparison with results of special occupational cancer studies indicates that the risk-diluting effect of misclassification is small.[1] Because the present study was based on incident cancer cases and exact person-years, there was no bias caused by occupational variation in cancer survival and in mortality from competing causes of death that may be a serious problem in analyses based on cancer deaths and cross-sectional proportionate analyses.

5.   Conclusions

Occupational differences in cancer risk were smaller among women than among men, which is consistent with a lower employment rate of women in heavily exposed industries and occupations. The cancer sites with the largest occupational differences were those etiologically related to asbestos exposure and to the combined or separate effects of tobacco and alcohol. With the exception of lung cancer, occupational exposure does not appear to contribute strongly to risk of major cancer sites. Many of the occupational differences seen in the present analysis could be ascribed to socio-economic differences in smoking habits. Occupation-related social factors thus seem to be more important determinants of cancer risk than the strictly occupational exposures.

It was estimated from a similar results pattern in Finland from 1971 to 1985 that some 5% of all cancers both in males and in females would be related to work, and about 35% of cancer incidence in males and 16% in females would be attributable to socio-economic position.[49] The current risk estimates indicate that the population attributable fractions for the Nordic region would still be of similar magnitude.

These results underscore the importance of continuing work place preventive activity, which is mainly the responsibility of employers, but which also involves governments, trade unions, employees, and professional associations.[51] In addition, although strictly occupational factors are not the major sources of cancer risk, the work place should be seen as a central arena for cancer prevention in general. In the time span after preventive initiatives in school and before treatment/preventive interventions in old age, working life situations are ideal for reaching groups of adults with more or less similar habits and attitudes for health promoting campaigns. Such initiatives have recently been seen aiming at for instance increased physical activity or healthier diets, and should be encouraged to expand to all occupations and industrial sectors.

Conflict of interest statement

None declared.

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