

W*ork-related cancer in the Nordic countries*

*by Aage Andersen,¹ Lotti Barlow,² Anders Engeland,^{1,3}
Kristina Kjærheim,¹ Elsebeth Lynge,⁴ Eero Pukkala⁵*

¹ Cancer Registry of Norway, Montebello, Oslo, Norway.

² National Board of Health and Welfare, Stockholm, Sweden.

³ Present address: National Institute of Public Health, Oslo, Norway.

⁴ Danish Cancer Society, Copenhagen, Denmark.

⁵ Finnish Cancer Registry, Helsinki, Finland.

Abbreviations

CI	confidence interval
ICD	International Classification of Diseases
ICD-O	International Classification of Diseases for Oncology
ISCO	International Standard Classification of Occupation
NYK	Nordisk Yrkesklassifisering (Nordic Classification of Occupation)
O	observed number of cancer cases
SIR	standardized incidence ratio

Single copies of this issue (volume 25, supplement 2) can be obtained free of charge from Aage Andersen at the following address: The Cancer Registry of Norway, Montebello, N-0310 Oslo, Norway.

Summary

This report presents 20 years' of cancer incidence data by occupational group for the Nordic populations. The study covers the 10 million people aged 25–64 years at the time of the 1970 censuses in Denmark, Finland, Norway, and Sweden, and the 1 million incident cancer cases diagnosed among these people during the subsequent 20 years. The project was undertaken as a cohort study with linkage of individual records based on the personal identification numbers used in all the Nordic countries.

In the 1970 censuses, information on occupation for each economically active member of the household was provided in free text in self-administered questionnaires. The data were centrally coded and computerized in the statistical offices. Norway, Sweden, and Finland used the Nordic Classification of Occupations, while Denmark used a national coding scheme. However, all the data could be reclassified into 53 occupational groups and 1 group of economically inactive persons.

Person-years at risk were accumulated from 1 January 1971 until the date of emigration, date of death or 31 December 1987 in Denmark, 1989 in Sweden, 1990 in Finland, and 1991 in Norway.

The 4 countries all had nationwide registration of incident cancer cases during the entire study period. All incident cancer cases during the individual risk periods were included in the analysis. Despite minor differences between the countries, the International Classification of Diseases, 7th revision, formed the core basis for the diagnostic coding in all 4 countries. For the present study the incident cancer cases have been classified into 35 broad diagnostic groups.

The observed number of cancer cases in each group of persons defined by country, gender, and occupation was compared with the expected number calculated from the age-, gender-, and period-specific person-years and the incidence rates for the national population. The result has been presented as a standardized incidence ratio (SIR), defined as the observed number of cases divided by the expected number and multiplied by 100. In the tables of this report, all the SIR values for which the upper limit of the 95% confidence interval is below 100 are printed in green and all those for which the lower limit of the confidence interval is above 100 are printed in red.

For all cancers combined, the study showed a wide variation among the men, from an SIR of 79 for farmers to 159 for waiters. The occupations with the highest SIR values also included seamen and workers producing beverages and tobacco. Among the women the SIR values

varied from 83 for gardeners to 129 for tobacco workers. Low SIR values were found for farmers and teachers.

Outdoor workers such as fishermen and gardeners had the highest risk of lip cancer, while the lowest risk was found among indoor workers such as physicians and artistic workers.

Almost all pleural cancers are associated with asbestos exposure. Accordingly, plumbers, welders, mechanics, and seamen were the occupations with the highest risk. There was also an excess risk of pleural cancer in the occupational group of technical, chemical, physical, and biological workers, including, among others, engineers and chemists potentially exposed to asbestos.

The wood workers included in the present study had the highest risk of nasal cancer. Most studies of nasal cancer have shown increased risks associated with exposure to wood dust, both for those in furniture making and for those exposed exclusively to soft wood. Nickel refinery workers are also known for their high risk of nasal cancer. In the present study they were included in the occupational group of smelting workers.

Lung cancer was the most frequent cancer among men in the present study. Tobacco smoking is the major risk factor for this disease, but occupational exposures also play an important role. Waiters and tobacco workers had the highest risk of lung cancer. Miners and quarry workers also had a high risk of lung cancer, which may be related to their exposure to silica dust and radon daughters. Among women, tobacco workers had the highest risk of lung cancer and farmers and gardeners had the lowest risk.

Waiters had the highest risk of bladder cancer for men, and they were one of the groups at highest risk among the women. Chimney sweeps and male hairdressers also had high SIR values for bladder cancer. Chimney sweeps are exposed to polycyclic aromatic hydrocarbons from chimney soot, and the carcinogenicity of these compounds is well documented. Almost all occupational groups with low SIR values for bladder cancer also had low SIR values for lung cancer, groups such as farmers, gardeners, and those working in pedagogical work.

Exposure to the known hepatocarcinogens, Hepatitis B virus and aflatoxins is rare in the Nordic countries, and a large proportion of primary liver cancers can therefore be attributed to alcohol consumption. When primary liver cancer was classified by occupation, high risks were

found for occupational groups with easy access to alcohol at the workplace or with cultural traditions for high alcohol consumption. Among men, waiters, journalists, cooks, beverage workers, and seamen had the highest risk. The lowest SIR values were found for farmers, forestry workers, teachers, wood workers, and gardeners.

The risk of colon cancer has been related to sedentary work. The findings in the present study were in agreement, especially for men with this pattern, as journalists and physicians had the highest risk and outdoor workers such as farmers and forestry workers had the lowest risk.

The occupational categories with the highest risks of breast cancer in the present study are accompanied by a university or equivalent education. This pattern is in agreement with a relatively late age at first birth among

the well-educated Nordic women from the relevant birth cohorts.

Malignant melanoma showed the same strong social gradient as cancers of the colon and breast. The major risk factor for malignant melanoma is intermittent sunlight exposure and sunburns of susceptible persons, which occur particularly during leisure time.

The Nordic countries are well known for equity and free and equal access to health care for all citizens. The present study shows that the risk of cancer, even under these circumstances, is highly dependent on the person's position in society.

Key terms cancer, environment, incidence, industry, malignant neoplasms, occupation.

Introduction

In this publication, we present 20 years of cancer incidence data by occupational group for the Nordic populations. The study covers the 10 million people aged 25–64 years at the time of the 1970 censuses in Denmark, Finland, Norway, and Sweden, and the 1 million incident cancer cases diagnosed among these people during the next 20 years. The smaller populations of Iceland, Greenland, and the Faroe Islands are not included in the study. The project was undertaken as a cohort study with linkage of individual records based on the personal identification numbers used in the Nordic countries.

The use of census data as a basis for tabulating cancer incidence by occupation builds on the tradition of occupational mortality studies. Cross-sectional occupational mortality studies started in England and Wales in 1855 (1). In these studies, data from the death certificates provided the numerator, and data from the census provided the denominator in the calculation of mortality rates. Already in the mid-1800s Farr (2) realized that “if the age of the various classes of society . . . are abstracted from the census returns . . . and if the deaths are abstracted in the same classes . . . the relative mortality . . . can be satisfactory deduced . . . and much light will be thrown upon the causes which really influence the health and well being of the working, middle and higher classes”. Cross-sectional occupational mortality studies were published for England and Wales every 10 years during the next 150 years. These studies provided the most useful insight into the occupational and social class differences in mortality.

Cross-sectional mortality studies were undertaken in several other countries, for example, in Denmark in 1880 (3, 4), and studies of cancer mortality in 1935–1939 (5), but in no other country did these studies have the same importance for the social debate as in England and Wales.

The potential bias in combining a numerator from death certificate data with a denominator from census data was accentuated in the modern, rapidly changing society. Advancement in technology, furthermore, rendered the cross-sectional method obsolete, and the publication of cross-sectional occupational mortality studies for England and Wales stopped in 1990.

That the numerator-denominator bias in the cross-sectional studies could be overcome in cohort studies with linkage of individual census and death certificate records was realized already the 1920s in the Nordic countries, among others (6). It was, however, only 50 years later that such studies started to emerge after the computer facilities for linkage of large data sets became available.

The earliest studies of occupational mortality based on the linkage of individual death certificate and census records were a 4-month follow-up of a sample of the 1960 census population from the United States (7), a 5-year follow-up of the Norwegian 1960 census population (8), a 17-year follow-up of a sample of the French 1954 census population (9), and a 10-year follow-up of the Swedish 1960 census population (10). The longitudinal study from the United Kingdom was a follow-up of a 1% sample of the 1971 census population, and the sample was, in addition, continuously supplemented with 1% of births and immigrations (11). A 6-month follow-up of the Italian 1980 census population was published in 1995 (12). In addition to gender, age, and occupation these studies often also include census variables such as marital status, housing conditions, region, and family composition.

Cohort studies are further facilitated by use of personal identification numbers. Such numbers were introduced in Sweden in 1948, in Norway in 1964 (based on the census in 1960), in Finland in 1967, and in Denmark in 1968. All 4 countries have computerized central population registers with daily updates on births, deaths, immigrations, and emigrations. The personal identification numbers are widely used for administrative purposes, such as payment of salaries, taxation, bank accounts, social security, health insurance, and hospitalization. The use of the personal identification numbers is thus a part of daily life and ensures a high quality of the data.

The registration of census data by personal identification numbers started in Norway and Sweden in 1960, and in Finland and Denmark in 1970. The 1970 censuses were used for cohort studies of the occupational mortality in Denmark (13, 14), Finland (15–17), and Norway (18–20), and a joint analysis was made of the occupational mortality in Norway, Sweden, Finland and Denmark for the 10-year period 1971–1980 (21).

National cancer registration started in 1943 in Denmark, in 1953 in Finland and Norway, and in 1958 in Sweden. In Denmark (22), Finland (23), and Sweden (24, 25), general studies on work-related cancer have been undertaken with linkages between the 1970 census data, the population register data, and the data on incident cancer cases. These “cancer environment registers” have formed the basis for a broad spectrum of epidemiologic studies in Sweden (26–30), Denmark (31–34), Norway (35, 36), and Finland (37–39).

Combining Nordic data has proved to be a useful way of elucidating work-related cancer patterns. Common

studies have thus been performed, for example, for cancer in persons with silica dust exposure (40), in painters (41), in hairdressers (42, 43) and in service-station workers exposed to gasoline vapors (44).

We therefore decided to systematize the combination of Nordic data and publish a comprehensive analysis of work-related cancer in Denmark, Finland, Norway, and Sweden.

The Nordic countries around 1970

This chapter is based primarily on information in the *Yearbook of Nordic Statistics* (45) and on the international comparisons presented in the Danish yearbook of statistics (46).

Geography

Denmark, Finland, Norway, and Sweden, together, cover an area of 1.15 million square kilometers. The northernmost parts of Norway, Finland, and Sweden are located north of the Arctic Circle, and thus have a long period without sunrise in winter and midnight sun in summertime. This solaced Nordkalott area is sparsely populated. Denmark and most of Finland and Sweden are flat countries, whereas mountainous areas are found in the central and northern parts of Norway and in the northern part of Sweden. All 4 countries have a temperate climate but with variation between the southern and northern parts and between the coastal and inland areas. The 4 capitals, Copenhagen, Helsinki, Oslo, and Stockholm, are all located on the sea. The average temperature in the capitals is between 0°C and -5°C in January, and between 17°C and 18°C in July.

Population

In 1970, Denmark had a population of 4.9 million; Finland's was 4.7 million; Norway's was 3.9 million; and Sweden's was 8.0 million. The combined population of the 4 countries was thus 21.5 million. In all 4 countries, approximately half of the population was in the age group 25–64 years. The population density varied considerably between the countries, being 112/km² in Denmark, but only 18/km² in Sweden, 14/km² in Finland, and 12/km² in Norway. The Nordic populations were practical-

ly all Caucasian, apart from the small group of Lapps in the Nordkalott area.

Culture

Each of the Nordic countries have their own languages. Danish, Norwegian, and Swedish are, however, closely related, while Finnish belongs to another group of languages. About 6% of the Finnish population is Swedish speaking, and both Finnish and Swedish are official languages in that country. Foreign citizens constituted a very small proportion of the Nordic populations in 1970, by far the largest group being 200 000 Finns living in Sweden. Lapps have their own language.

Parliamentary democracy has a long tradition in the Nordic countries. The living conditions in Norway and Finland were heavily affected by the Second World War, whereas this was not the case to the same extent in Denmark and Sweden.

The Nordic populations were well educated already in 1970. A rough estimate of the proportions of 35-to-54-year-old persons with 13 or more years of education is available from the person-years in a Nordic mortality study. In Denmark, Norway, and Sweden, 13% and in Finland 8% of men had 13 or more years of education. The proportions for women were 10% in Sweden, 7% in Finland, 6% in Norway, and 5% in Denmark (47).

Lutheranism is the predominant religion in all the Nordic countries. The extent to which religion plays a role in daily life varies between regions.

Industry

Around 1970, agriculture was still an important industry in Denmark with more than 60% of the area used for agriculture. In Norway, Sweden, and Finland the area used

for agriculture constituted less than 10%, whereas the importance of forestry and paper production is illustrated by the fact that more than 50% of the area in Sweden and Finland and 25% of the area in Norway was covered by forest. Fishing was an important industry in Norway.

With water power as the reference, Norway had a very high energy production. Water power was the basis for 75% of the energy production in Sweden and for about 50% in Finland. Energy in Denmark was produced from coal and oil. The oil drilling in the North Sea started on a larger scale in the mid-1970s, which increased the wealth in Norway. Iron mining was important in Sweden and to a less extent in Norway, where, on the other hand, the cheap supply of energy formed the basis for production of, for example, aluminum.

The industrial structure of the Nordic populations has changed dramatically during the century. How these changes have affected the population covered by our study will be described later.

Living conditions

In 1971, the gross domestic product per capita was USD 3562 in Denmark, USD 2604 in Finland, USD 3555 in Norway, and USD 4545 in Sweden, compared with, for example, USD 5288 in the United States (48).

Nordic citizens averaged about 1 room per person around 1970. It is worth noting that the differences between the Nordic countries practically disappeared by the end of 1980. In Finland, with winter temperatures averaging below the freezing point, only about 60% of the houses had an indoor water closet. Water closets existed in about 70% of Norwegian houses, 90% of Swedish houses, and 96% of Danish houses.

In 1970, Sweden had the highest number of cars (0.31), telephones (0.58), and televisions (0.32) per capita in the Nordic countries. In Finland the numbers were only 0.19, 0.30, and 0.24, respectively.

Although dietary habits have been fairly similar across the Nordic countries, there were nevertheless some differences in the average consumption of the main food components in 1970 (49). The average milk consumption in Finland in 1970 was 263 kg/person, equivalent to almost three-quarters of a liter per person per day. In the other Nordic countries, the average milk consumption was in the range of 172 to 193 kg per person. Denmark had a high consumption of meat and offals with 84 kg per person, or close to a quarter of a kilogram per person per day. The consumption of meat and offals in the other countries was between 43 and 56 kg/person. Norway, on the other hand, had the highest consumption of fish with 40 kg/person, and Finland had the lowest with 13 kg/person.

Norway had the highest annual average consumption of potatoes with 89 kg/person, and Denmark had the lowest with 73/person. Sweden, with 122 kg/person, had twice the consumption of vegetables, fruit and berries as Finland, with the consumption in Denmark and Norway being in between. The sugar consumption in all 4 countries was in the range of 42–47 kg/person.

Denmark had, in 1970, a consumption of alcohol and tobacco clearly above that of the other Nordic countries. Danish inhabitants, 15 years and over, consumed an average of 9.3 liters of pure alcohol, compared with 7.0 liters in Sweden, 6.4 liters in Finland, and 4.9 liters in Norway.

In 1970, the tobacco consumption per capita was 3.1 kg as the annual average in Denmark, 1.6 kg in Sweden, 1.6 kg in Norway, and 1.5 kg in Finland. The tobacco consumption was higher in Denmark than in the other Nordic countries already in 1920 (50). Historically there have been major differences between the tobacco consumption of the 4 countries. In Finland by far the majority of tobacco was consumed as cigarettes already before the Second World War. In the other countries, the consumption of cigarettes increased the most rapidly after the war in Denmark and, with the special feature that hand-rolled cigarettes constituted more than half of the cigarette consumption, in Norway. Chewing tobacco constituted two-thirds of the tobacco consumption in Sweden before the Second World War and still constituted more than half of the consumption in 1970. Tobacco chewing was common in Denmark and Norway between the 2 world wars but had largely diminished by 1970.

The tobacco consumption was not evenly distributed in the population in 1970. In Denmark, on the average, 68% of the men and 47% of the women were smokers (51). The numbers were 54% for men and 37% for women in Norway in 1973–1977 (52). In Sweden in 1968, about 56% of the men smoked, whereas the proportion of smoking women varied from 46% in the 15–24 year age group to 17% in the 55–64 year age group (53). In Finland practically all tobacco consumption until the early 1960s was attributable to men. Thereafter the prevalence of smokers among men was halved to 30%, and among women it increased to 30% (54).

Health

The life expectancies in Sweden and Norway in the early 1970s were among the highest in the world. Swedish men and women could expect to live an average of 72.1 and 77.6 years, respectively, and the Norwegian numbers were 71.4 and 77.7 years, respectively. Denmark was a bit lower with 70.9 years for the men and 76.5 years for the women. Finland lagged behind with 66.7 years for

the men and 75.2 years for the women. The differences in life expectancy between the Nordic countries were due to mortality differences in adult life, as all the Nordic countries in the early 1970s had equally low infant mortality rates of 10–12 per 1000 live births.

Health care and social security

In 1970, all the Nordic countries had both primary and hospital care paid by tax money and provided free of charge for all citizens. Old-age and disability pensions were also covered by tax funds.

Occupational history of the study populations

We have included a population born between 1906 and 1945. People in these generations typically started working around 15 years of age and stopped working at the age 65 years. Hence the oldest generation in the study started working in 1921 and stopped working in 1970, just at the time when we started the follow-up for incident cancer cases. The youngest generation in the study started working in 1961, and its members were in the middle of their worklife when the follow-up for incident cancer cases ended around 1990 (figure 1).

Over this long period considerable changes have taken place in the economic activities of the Nordic countries and in the structure of their labor forces. One of the main changes has been the decline in the proportion of the population working in agriculture. Figure 2 shows the time trends in the proportion of economically active men working in agriculture, forestry, and related occupations

in each of the Nordic countries. The steepest decline was seen in Finland, where 63% of the men worked in agriculture in 1930, while only 10% did so in 1990. The proportions of men working in agriculture, forestry, and related occupations in 1970 were 13% in Denmark, 23% in Finland, 13% in Norway, and 10% in Sweden.

Another important change during this period has been the labor market participation of women. Figure 3 shows the time trends for the proportion of women who were economically active between 15 and 64 years of age in each of the Nordic countries. However, as data from the 4 countries have not been reported in exactly the same way throughout the 60-year period, some approximations were needed.

Finland has a long tradition for women's labor market participation with 60% of its women working outside the home already in 1930. Norway was at the other

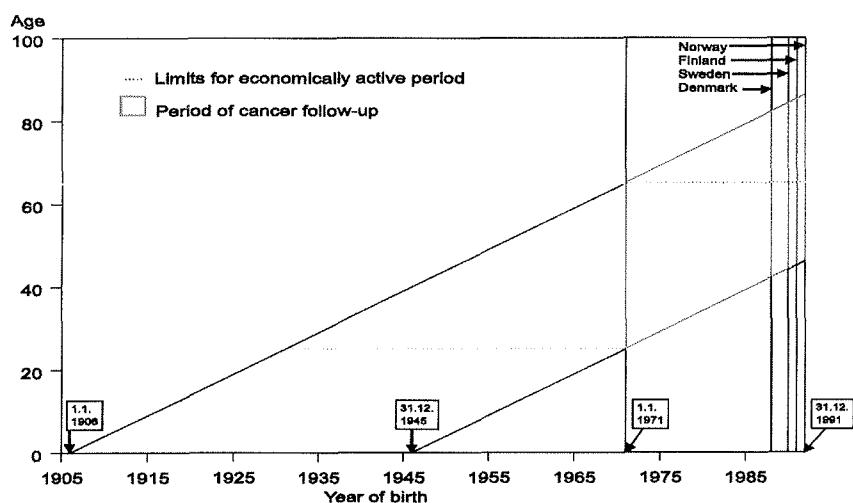


Figure 1. Follow-up window of the study cohort defined by year of birth and age.

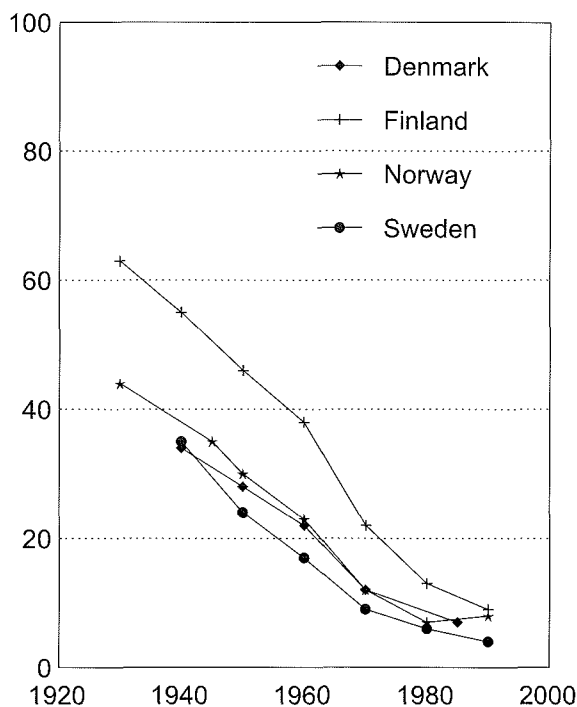


Figure 2. Men working in agriculture as the percentage of all economically active men.

end of the scale with less than 40% of women working outside the home in 1930. The lowest labor market participation was seen in all the 4 countries around 1960 followed by a steady increase throughout the next 30 years.

The occupational data from the 1970 census reflect the economic activity of the persons in the census year.

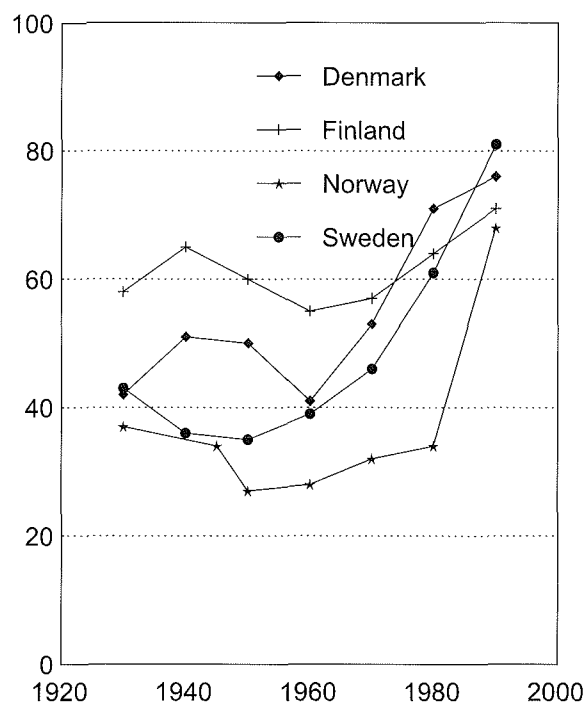


Figure 3. Women working outside the home as the percentage of all women aged 15–64 years.

With the large changes in the labor market during the period 1930 to 1990, it is clear that the occupation in 1970 will, for some persons, not be representative for their entire worklife.

Many women registered as housewives in 1970 entered the labor market during the following 20 years, often as part-time workers.

Material and methods

Study populations

The 1970 censuses took place on 1 November in Norway and Sweden, on 9 November in Denmark, and on 31 December in Finland. From Denmark, Norway, and Finland our study includes all persons enumerated in the 1970 censuses and alive in the respective countries and aged 25–64 years on 1 January 1971. The study population from Sweden is defined similarly, but includes only persons who were also present in Sweden at the time of

the 1960 census. The immigrants arriving in Sweden after 1960, and thus not included in the study population, constituted about 1% of the population in 1970.

The study population comprised 10.0 million persons with 3.8 million from Sweden, 2.3 million from Denmark, 2.1 million from Finland, and 1.8 million from Norway. The numbers are approximate and have been based on the number of person-years accumulated within the first 5 years of the follow-up and divided by 5. Due to mortality and emigration in 1971–1975, and the

undercoverage of the census, the numbers mentioned are slightly lower than the actual population sizes on 1 January 1971.

Collection of census data

In the 1970 census, it was compulsory for all heads of households to fill out self-administered questionnaires for all members of the household and for the dwelling. Recorded for each person were personal identification number, name, address, marital status, education, economic activity, occupation, and industry. Recorded for the dwelling were year of building, type of building, number of rooms, and type of facilities.

All questionnaires were centrally coded and computerized in the national statistical offices.

Economic activity

All persons who were gainfully employed at the time of the census or were temporarily absent from work due to illness, unemployment, vacation, or military service were classified as economically active in Denmark. A fairly similar definition was used in Sweden.

In Finland, only people who were gainfully employed at the time of the census for at least half of the industry's normal work hours or were temporarily absent were considered economically active.

In Norway, only persons who reported at least 100 hours of gainful employment during the last 12 months before the census or were temporarily absent were classified as economically active.

While both the Danish, Norwegian, and Swedish definitions include jobs held for a relatively short period and part-time jobs with few work hours, the Finnish definition sets a threshold for the inclusion of approximately 20 workhours a week at the time of the census. These differences will probably not have affected the classification of men, but part-time working women could have been classified differently across the countries. There are minor differences across the countries in the way a distinction was made between not economically active housewives and economically active housewives on the family farm or in the family shop.

Occupation

In all 4 countries, the forms requested that the heads of households write a free description of the education, occupation, industry, and name and address of employer at

the time of the census for each economically active member of the household.

For Norway, Sweden and Finland, our study is based on the occupation thus reported at the time of the census. As occupation was coded in a special way in Denmark, also industry was taken into account for that country.

Finland, Norway and Sweden

Occupation was coded according to national adaptations of the Nordic Occupational Classification, usually abbreviated to NYK (55). NYK again is a common Nordic adaptation of the International Standard Classification of Occupations from 1958, usually abbreviated to "ISCO 1958" (56).

The first digit of NYK, as well as the ISCO 1958 codes, indicates major occupational groups as follows:

- 0 Technical, scientific, humanistic and artistic work
- 1 Administrative work
- 2 Clerical and technical clerical work
- 3 Sales work
- 4 Farming, horticulture, forestry and fishing work
- 5 Mining and quarrying work, and the like
- 6 Road transport work and traffic work
- 7—8 Manufacturing work, machine surveillance, and the like
- 9 Service work
- X Military work and work which cannot be classified.

NYK on a 2-digit level includes about 70 minor occupational groups, and on a 3-digit level more than 300 occupational unit groups are available. The national code values may differ, but the coding principle is similar in Finland, Norway, and Sweden.

Denmark

Occupation was coded according to a special Danish nomenclature with a distinction between the self-employed persons, family workers, salaried employees, skilled workers, and unskilled workers — a total of 218 codes — were possible. Entities similar to those used in the NYK could be formed by combining these occupational codes with the 245 codes for industry.

Common classification

For our study a common classification with 53 occupational groups and an additional category of economically inactive persons was used. These groups were defined by the NYK codes, as shown in appendix 1. The conversion to ISCO 1958 codes is also listed in appendix 1. A classification of 54 groups was chosen as a practical compromise between relatively specific, but not too small, groups. A free text description of each of the occupational groups is provided together with the presentation of the cancer incidence data.

The numbers of persons aged 25–64 years in the study are shown in appendix 2 by gender, country, and occupational group.

Person-years

In all 4 countries, person-years were accumulated from 1 January 1971 on. Person-years were accumulated until date of death, emigration, or the end of follow-up, whichever came first.

In Denmark, the study population was followed for deaths and emigrations until 31 December 1987 by linkage with the Central Population Register.

In Finland, the study population was followed for deaths and emigrations until 31 December 1990 by linkage with files of Statistics Finland.

In Norway, the study population was followed for deaths and emigrations until 31 December 1991 by linkage with the Central Population Register.

In Sweden, the study population was followed for deaths until 31 December 1989 by linkage with the cause of death register, but not for emigration. As emigration from Sweden was limited in the 1970s and 1980s, it played, in practice, a minor role in whether or not emigrations were taken into account in the accumulation of person-years.

The numbers of person-years by gender, country, and occupational group are shown in appendix 3.

Incident cancer cases

All incident cancer cases diagnosed within the individual risk periods have been included in the study (appendix 4), apart from multiple cancers of the same site in Denmark. Data on the incident cancer cases have been collected and coded in the following ways.

Denmark

The cancer registration in Denmark in 1971–1987 was based on notifications from clinical hospital departments, supplemented with notifications from practicing specialists in dermatology and gynecology, and with autopsy reports from pathology departments. Throughout the period, the notifications were supplemented with information on cancer cases reported on death certificates. From 1971 to 1977 the cancer cases were coded according to an extended version of the International Classification of Diseases, version 7 (ICD-7) (57), and from 1978 on according to the International Classification of Diseases for Oncology, version 1 (ICD-O, ver 1) (58).

Within a given diagnostic group only the first incident cancer of this particular type diagnosed within a person's risk period is included in the study. In other

words, if a woman developed 2 breast cancers during the 17-year follow-up period only the first of these has been included in the study. The same principle was followed in the tabulation of all cancer sites, as only the first cancer of any type diagnosed within a person's risk period has been included in the study.

As the proportion of persons with more than 1 incident primary cancer of the same site in a 17-year period is marginal, the method used in Denmark is, in practice, similar to that used in the other 3 countries.

Finland

The cancer registration in Finland in 1971–1990 was based on similar data sources as in Denmark, supplemented with reports on all malignant neoplasms diagnosed in pathology laboratories. The incident cancer cases were coded for topography according to the ICD-7 code (57) and for morphology according to MOTNAC 1951 (59); both codings, however, extended to correspond to the practical new needs of classifications.

Norway

The cancer registration in Norway in 1971–1991 was based on the same data sources as in Finland, and the topography was coded according to ICD-7 (57) and the morphology according to MOTNAC 1968 (60).

Sweden

The cancer registration in Sweden in 1971–1982 was based on reports from hospital clinicians and from hospital pathologists for all diagnosed cases. Reporting from private practices was included from 1983 on. Notifications were collected and centrally coded in Stockholm until 1984, when the activity was decentralized to 6 oncology centers. The coding was done according to ICD-7 (57) until 1986. From 1987 on, ICD-9 (61) was used. The histology code has been coded with 3 digits (62).

Combined

Although all the 4 national cancer registers are normally considered to be complete, it should be noted that there are minor differences between the registration methods. Reports on all pathology specimens have thus not been used as a data source in Denmark, and death certificates have not been used as a data source in Sweden. Minor differences have probably also occurred over time and between countries in the way multiple primary tumors have been defined and coded.

The incident cancer cases included in the present study involve all invasive cancers and also benign brain tumors. There have probably been some differences in the notification and coding of bladder papillomas and cancers between the 4 countries (63). Basal-cell carcinomas of the skin have been included only in the Danish data.

The cancer cases have been grouped into 35 diagnostic groups based on the ICD-7 codes available from all the countries (appendix 5). The age-standardized incidence rates for 1981–1985 are shown by gender, country, and diagnostic group in appendix 6. A group has also been formed of all alcohol-related cancers, including cancers of the tongue (ICD-7 141), the mouth and pharynx (ICD-7 143–8), the esophagus (ICD-7 150), primary liver (ICD-7 155.0), and the larynx (ICD-7 161). It should be noted that cancer of the tongue, mouth, pharynx, esophagus, and larynx are also tobacco-related cancers.

More than 1 million incident cancer cases are included in the present study: 228 456, 197 305, 207 068, and 397 433 from Denmark, Finland, Norway, and Sweden, respectively.

The numbers of incident cancer cases by gender, country, and diagnostic group are presented with the results for each occupational group. In these tables, “all sites” represents the sum of all incident cancer cases apart from the nonmelanoma skin cancers (ICD-7 191) for Norway, Sweden, and Finland. For Denmark, as described earlier, only the first incident cancer observed for a given person during the study period, excluding the nonmelanoma skin cancers, has been included under the heading “all sites”.

Standardized incidence ratio

The relative level of the cancer incidence of an occupational group is described by the standardized incidence ratio (SIR), with the cancer incidence rates for the entire national study populations used as the reference rates.

For each country, gender, and occupational group, the observed number of cancer cases and person-years have been divided into 8 5-year age groups defined by age on 1 January 1971 (25–29, 30–34, ... 60–64 years) and into the calendar periods 1971–1975, 1976–1980, 1981–1985, and 1986–1987 for Denmark, 1986–1989 for Sweden, 1986–1990 for Finland, and 1986–1991 for Norway.

For a given gender, the SIR for a given occupational group in a given country is then calculated as

$$SIR_{soc} = \frac{\sum_a \sum_p Obs_{socap}}{\sum_a \sum_p PY_{socap} \cdot \frac{\sum_o Obs_{socap}}{\sum_o PY_{socap}}} \cdot 100,$$

where O = observed number of cancer cases, PY = person-years, g = gender, a = age, p = period, c = country, and o = occupation. The denominator in the equation is the expected number of cancer cases for the given gender, occupational group, and country.

For each gender and occupational group, an SIR has also been calculated for the 4 countries together by summarizing the numbers in the numerator and the denominator, respectively, across countries.

For the SIR values based on 100 cancer cases or fewer, exact 95% confidence intervals (95% CI) were calculated on the assumption of a Poisson distribution of the observed number of cases, the numerator, with the mean estimated by the expected number of cases, the denominator. When the observed number of cases exceeded 100, the 95% CI values were approximated by:

$$[SIR \cdot \exp(-1.96 / \sqrt{Obs}), SIR \cdot \exp(1.96 / \sqrt{Obs})].$$

In the evaluation of the SIR values for the 4 countries together, it should be remembered that they represent simple averages of the observed and expected numbers. Given that the follow-up of the Danish data stopped in 1987, the oldest persons included from Denmark will be 81 years. The follow-up of the Norwegian data stopped in 1991, and the oldest Norwegian persons will thus be 85 years.

The background cancer incidence furthermore varies across the 4 countries, as illustrated by the age-standardized incidence rates in appendix 6.

Method of presentation

The data are presented in tables for each gender and occupational group with all cancer and 34 diagnostic groups for each country and for all countries combined. Presented are the observed numbers of cancer cases, the SIR values, and the 95% confidence intervals for the SIR values for the 4 countries combined. In cells where the observed numbers of cancers are zero, the expected numbers of cancer cases are presented in brackets.

All the SIR values for which the upper limit of the confidence interval is below 100 are printed in green, and all the SIR values for which the lower limit of the confidence interval is above 100 are printed in red.

Cancer incidence by occupational group

Technical, chemical, physical and biological workers: occupational group 01

Group 01 includes engineers, physicists, architects, chemists, geologists, biologists, meteorologists, and related professionals with an education of 3–7 years at the university or equivalent level. Their main tasks require a high level of professional knowledge and experience.

Results

This group of occupations showed a significant excess risk for skin melanoma and cancer of the prostate among men in all the Nordic countries (table 1). There was also an excess risk for pleural cancer for men in all countries

except Norway. The group also showed a consistent low risk for alcohol- or smoking-related types of cancer. For women, excess risks of cancers of the lung and breast were observed in every country except Denmark (table 2).

Comments

A high risk of breast cancer in women is often observed in higher social classes, probably due to a reproductive pattern with less children and a higher age at first birth. An increased risk for malignant melanoma in occupations with higher education is believed to be related to sun-burn during leisure-time activities (64). The high risk of pleural cancer was an unexpected finding. With a more-

Table 1. Technical, chemical, physical and biological workers, men (N=365 910) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	37	42	38	47	23	53	106	61	204	53	46–61
141	Tongue	12	58	12	66	11	60	45	59	80	60	48–75
143–144	Mouth	34	87	18	103	14	56	82	71	148	75	64–88
145–148	Pharynx	39	75	30	97	14	46	122	75	205	74	65–85
150	Esophagus	58	77	29	55	12	29	161	79	260	70	62–78
151	Stomach	191	72	265	74	143	65	710	83	1309	77	73–81
153	Colon	452	113	260	140	315	114	1247	103	2274	110	105–114
154	Rectum	344	103	183	112	211	109	826	94	1564	100	95–105
155.0	Liver	58	86	52	85	22	92	192	78	324	81	73–91
155.1	Gall bladder	36	90	26	77	9	62	93	98	164	89	77–104
157	Pancreas	200	103	160	96	91	79	571	91	1022	93	87–99
160	Nose	19	99	9	69	12	107	29	63	69	77	60–98
161	Larynx	116	91	47	53	33	63	189	79	385	75	68–83
162	Lung	1200	92	647	55	321	64	1886	93	4054	81	79–83
162.2	Pleura	48	160	28	159	13	86	81	122	170	132	113–153
170	Breast	17	174	6	128	7	141	27	90	57	115	87–150
177	Prostate	496	111	546	121	550	114	3395	106	4987	109	106–112
178	Testis	131	105	35	138	73	136	140	95	379	108	99–119
180.0	Kidney	180	111	217	127	125	107	708	98	1230	105	99–111
181	Bladder	569	110	191	87	244	95	1370	106	2374	104	100–108
190	Melanoma	197	134	154	124	259	154	778	120	1388	127	121–134
191	Other skin ^b	978	123	99	112	92	97	583	104	1752	114	108–119
193	Brain	196	97	156	106	112	95	689	104	1153	102	96–108
194	Thyroid	22	110	44	143	21	90	114	100	201	107	93–122
197	Connective tissue	23	98	29	91	22	119	150	104	224	103	90–117
201	Hodgkin's disease	38	81	25	66	18	75	145	106	226	92	81–105
200, 202	Non-Hodgkin's lymphoma	120	88	97	100	125	116	604	100	946	100	94–107
203	Multiple myeloma	63	96	73	125	70	121	286	101	492	106	97–116
204.3	Acute leukemia	48	77	43	100	27	83	209	109	327	99	89–111
204.0–2.4	Other leukemia	91	91	47	65	35	89	287	95	460	89	82–98
199	Unknown	31	69	64	84	90	76	473	93	658	88	82–95
140–204	All sites ^c	5132	98	3634	87	3111	95	16851	98	28728	96	95–97

^a International Classification of Diseases (7th revision).
and Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway,

Table 2. Technical, chemical, physical and biological workers, women (N=20 243) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.4]	0	[0.7]	0	[0.1]	0	1	126	1	49	1—271
141	Tongue	1	178	[0.9]	0	[0.2]	0	[1.2]	0	1	36	1—198
143—144	Mouth	2	167	[0.9]	0	[0.3]	0	3	180	5	124	40—289
145—148	Pharynx	1	91	1	90	[0.2]	0	1	54	3	70	14—203
150	Esophagus	[1.4]	0	2	73	[0.3]	0	1	64	3	50	10—146
151	Stomach	5	69	13	78	1	33	7	51	26	64	42—93
153	Colon	24	101	19	123	11	149	35	95	89	107	86—131
154	Rectum	14	113	15	148	4	109	18	89	51	110	82—144
155.0	Liver	[2.2]	0	2	73	1	276	4	100	7	75	30—154
155.1	Gall bladder	2	55	2	39	[0.5]	0	4	56	8	49	21—96
157	Pancreas	9	110	10	107	1	48	14	101	34	102	70—142
160	Nose	[0.5]	0	[0.6]	0	[0.2]	0	1	138	1	50	1—279
161	Larynx	3	202	[0.6]	0	[0.1]	0	1	94	4	123	34—315
162	Lung	24	92	15	125	10	244	38	157	87	131	105—161
162.2	Pleura	1	173	[0.5]	0	[0.1]	0	[0.4]	0	1	63	2—350
170	Breast	109	109	178	175	46	173	254	125	587	136	126—148
171	Cervix uteri	24	75	6	63	3	40	25	74	58	70	53—91
172	Corpus uteri	22	99	23	105	8	137	36	88	89	98	78—120
175	Ovary	30	134	16	89	7	102	54	114	107	113	93—137
180.0	Kidney	6	97	6	73	1	59	9	66	22	74	46—112
181	Bladder	10	128	4	102	1	55	14	121	29	116	77—166
190	Melanoma	15	114	12	124	8	137	28	102	63	113	86—144
191	Other skin ^b	42	117	3	62	3	190	11	131	59	116	89—150
193	Brain	16	134	13	88	[3.3]	0	24	91	53	94	70—123
194	Thyroid	1	44	17	200	1	46	11	95	30	122	82—174
197	Connective tissue	2	181	1	45	[0.5]	0	3	65	6	71	26—155
201	Hodgkin's disease	1	56	2	101	[0.4]	0	1	31	4	54	15—139
200,202	Non-Hodgkin's lymphoma	3	50	5	81	6	251	8	55	22	76	47—115
203	Multiple myeloma	3	111	4	100	1	95	6	101	14	102	56—171
204.3	Acute leukemia	2	61	2	62	4	530	8	141	16	124	71—201
204.0—2,4	Other leukemia	[3.1]	0	6	167	[0.6]	0	2	39	8	64	28—126
199	Unknown	1	40	4	72	4	154	10	64	19	72	43—113
140—204	All sites ^c	343	103	386	123	122	128	656	101	1507	108	103—114

^a International Classification of Diseases (7th revision).
and Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway,

detailed occupational classification an elevated mesothelioma risk has been shown, for example, among architects and engineers in Finland (23). A Finnish study found a history of work-related asbestos exposure for a majority of mesothelioma patients irrespective of their current occupation (65).

Laboratory assistants: occupational group 02

Group 02 includes life science technicians, pharmaceutical assistants, laboratory technicians, and other health professional assistants. Most of the people in this group have a 2-year education after secondary school. Their main tasks involve preparing materials and equipment for experiments, tests, and analyses. They collect and prepare specimens such as plant, animal, or human cells, and tissues. They assist with and perform experiments and

analyses. Pharmaceutical assistants also dispense medicines and drugs.

Results

For men in all the Nordic countries combined, excess risks were found for cancer of the pleura and for skin melanoma (table 3). The combined risk of alcohol-related cancers was decreased by 25%. For women, there was a significant excess risk of breast cancer and acute leukemia and a low risk of cervical cancer (table 4). The excess risk of other skin cancer was attributable to an excess risk in Denmark as this group is included in the group "other skin".

Comments

In many types of laboratories the employees have been exposed to asbestos, which may be related to the increased risk of pleural cancer. They are also exposed to

Table 3. Laboratory assistants, men (N=8741) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[1.9]	0	[1.7]	0	3	115	4	133	7	76	31—158
141	Tongue	[0.4]	0	1	239	1	95	2	154	4	125	34—320
143—144	Mouth	[0.8]	0	1	259	2	139	1	51	4	87	24—222
145—148	Pharynx	2	182	[0.7]	0	2	117	2	73	6	96	35—209
150	Esophagus	3	183	1	92	2	81	1	29	7	81	32—166
151	Stomach	2	34	5	67	13	93	14	94	34	81	56—113
153	Colon	6	68	2	50	27	160	19	91	54	107	80—140
154	Rectum	11	152	4	119	13	111	15	100	43	115	83—155
155.0	Liver	1	68	1	81	1	66	4	94	7	83	33—171
155.1	Gall bladder	1	114	1	142	[0.9]	0	1	62	3	73	15—212
157	Pancreas	3	70	4	116	3	42	13	121	23	90	57—135
160	Nose	1	242	[0.3]	0	[0.7]	0	1	128	2	94	11—339
161	Larynx	1	36	1	55	1	33	2	49	5	43	14—99
162	Lung	33	116	20	85	28	93	33	96	114	98	81—118
162.2	Pleura	3	463	1	248	2	226	2	174	8	260	112—512
170	Breast	[0.2]	0	[0.1]	0	[0.3]	0	[0.5]	0	[1.1]	0	0—329
177	Prostate	11	110	10	115	45	138	57	104	123	116	97—139
178	Testis	1	41	[0.7]	0	2	72	2	71	5	57	19—133
180.0	Kidney	1	28	6	162	4	58	11	89	22	83	52—126
181	Bladder	15	133	3	67	16	101	14	63	48	89	66—119
190	Melanoma	8	262	2	65	17	187	12	106	39	147	104—201
191	Other skin ^b	17	99	2	109	4	67	9	93	32	92	63—130
193	Brain	[4.2]	0	3	83	13	199	11	96	27	104	69—152
194	Thyroid	[0.4]	0	1	134	[1.3]	0	1	49	2	44	5—160
197	Connective tissue	[0.5]	0	1	132	[1.1]	0	3	120	4	83	23—212
201	Hodgkin's disease	3	312	2	201	[1.4]	0	4	161	9	155	71—294
200, 202	Non-Hodgkin's lymphoma	2	69	1	45	10	159	9	87	22	101	63—153
203	Multiple myeloma	2	140	1	83	3	84	2	42	8	73	31—143
204.3	Acute leukemia	1	74	2	200	1	51	4	120	8	105	45—206
204.0—2.4	Other leukemia	6	275	[1.5]	0	2	81	6	115	14	123	67—206
199	Unknown	1	103	2	125	4	54	16	185	23	123	78—185
140—204	All sites ^c	115	101	78	89	223	111	284	96	700	100	93—108

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

formaldehyde and also to some extent to benzene, especially those working in hematological laboratories. It is difficult to judge whether the excess risk for skin cancer is attributable to exposures in the laboratories or to sun-bathing habits.

Physicians: occupational group 03

Medical doctors diagnose and treat patients; some conduct research. All physicians working in the Nordic countries have at least 5 years of university education.

Results

Male physicians showed an excess risk for colon cancer, and a significantly low risk of rectum cancer (table 5). For all alcohol-related cancers combined, a significantly low risk was found, and the SIR for lung cancer was sig-

nificantly low in every country except in Sweden. The SIR values for cancers of the lip and gallbladder were extremely low. Female physicians had a significant excess risk for all cancers combined (table 6). This excess risk was mainly due to an excess risk of breast cancer. The SIR was similarly high for endometrial cancer. There was an excess risk for cancers of the brain and bladder and, especially, for skin melanoma and other skin cancer for both genders. The risk for stomach cancer was very low.

Comments

Women with a low number of births and a higher age at first birth have an increased risk of cancer of the breast. It is likely that female physicians have their first birth at a higher age than the general population. Although some physicians are occupationally exposed to ultraviolet radiation, it is more likely that the excess in the risk of skin cancer for physicians is attributable to sunlight. The easy

Table 4. Laboratory assistants, women (N=13 586) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.3]	0	[0.5]	0	[0.2]	0	[0.4]	0	[1.4]	0	0—262
141	Tongue	[0.4]	0	1	163	[0.3]	0	1	168	2	105	13—380
143—144	Mouth	1	127	[0.6]	0	[0.5]	0	3	333	4	144	39—369
145—148	Pharynx	1	123	[0.8]	0	1	270	1	105	3	103	21—302
150	Esophagus	[0.9]	0	2	113	[0.5]	0	2	214	4	98	27—251
151	Stomach	2	44	13	114	9	166	3	39	27	93	61—135
153	Colon	16	109	14	132	7	55	14	68	51	87	65—114
154	Rectum	5	65	4	57	3	47	14	125	26	81	53—118
155.0	Liver	1	71	3	162	[0.6]	0	2	87	6	97	36—211
155.1	Gall bladder	1	47	5	146	[0.9]	0	2	48	8	75	32—148
157	Pancreas	6	125	8	129	3	79	6	74	23	101	64—151
160	Nose	[0.4]	0	[0.4]	0	[0.3]	0	[0.4]	0	[1.4]	0	0—261
161	Larynx	1	97	[0.4]	0	[0.2]	0	[0.5]	0	1	46	1—256
162	Lung	15	86	10	120	9	135	17	134	51	113	84—148
162.2	Pleura	[0.4]	0	1	275	1	995	[0.2]	0	2	188	23—679
170	Breast	92	119	104	137	59	153	111	113	366	126	114—140
171	Cervix uteri	17	65	5	73	5	51	13	86	40	69	49—94
172	Corpus uteri	16	113	19	120	13	143	14	65	62	102	78—131
175	Ovary	20	127	20	151	10	98	21	89	71	113	88—143
180.0	Kidney	1	25	3	51	1	35	8	107	13	65	35—111
181	Bladder	9	187	6	227	1	30	11	167	27	156	103—227
190	Melanoma	21	190	9	126	5	67	12	98	47	124	91—165
191	Other skin ^b	38	149	3	94	2	74	8	168	51	141	105—185
193	Brain	8	87	9	82	10	214	10	79	37	99	70—136
194	Thyroid	2	113	3	47	2	72	6	114	13	81	43—138
197	Connective tissue	[0.9]	0	4	249	[0.7]	0	2	89	6	111	41—241
201	Hodgkin's disease	[1.5]	0	1	69	[0.6]	0	1	67	2	40	5—144
200, 202	Non-Hodgkin's lymphoma	6	144	4	91	2	54	12	159	24	121	78—180
203	Multiple myeloma	[1.6]	0	4	147	1	52	6	173	11	113	57—203
204.3	Acute leukemia	4	167	6	261	4	350	3	106	17	196	114—314
204.0—2.4	Other leukemia	[2.0]	0	5	200	[1.1]	0	1	35	6	71	26—155
199	Unknown	2	128	3	79	2	44	9	104	16	86	49—139
140—204	All sites ^c	244	102	272	121	150	103	329	100	995	106	100—113

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 5. Physicians, men (N=19 311) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	14	[4.4]	0	5	87	1	15	7	29	12—60
141	Tongue	1	61	[1.0]	0	4	192	5	181	10	134	64—246
143—144	Mouth	5	157	3	320	3	104	6	143	17	152	88—243
145—148	Pharynx	3	72	2	122	2	58	[5.9]	0	7	46	19—95
150	Esophagus	3	46	1	34	2	36	4	53	10	45	21—82
151	Stomach	12	51	8	41	14	43	12	38	46	43	31—57
153	Colon	51	144	18	179	53	139	55	122	177	138	119—159
154	Rectum	22	75	5	56	18	69	28	86	73	75	59—95
155.0	Liver	6	101	2	60	6	172	5	54	19	87	52—135
155.1	Gall bladder	1	28	1	54	1	45	1	28	4	36	10—91
157	Pancreas	18	105	9	100	16	96	30	129	73	111	87—139
160	Nose	1	63	[0.7]	0	2	144	[1.7]	0	3	56	12—165
161	Larynx	10	93	5	106	3	46	4	46	22	72	45—109
162	Lung	54	47	18	28	32	49	66	89	170	54	46—62
162.2	Pleura	2	78	1	106	1	53	1	41	5	64	21—148
170	Breast	[0.9]	0	[0.3]	0	[0.6]	0	2	178	2	70	9—254
177	Prostate	54	127	28	109	95	112	126	104	303	111	99—124
178	Testis	14	170	2	144	7	152	3	59	26	134	88—197

(continued)

Table 5. Continued.

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	12	87	14	153	12	82	27	102	65	102	78—129
181	Bladder	36	80	18	150	38	105	79	166	171	121	104—141
190	Melanoma	14	127	15	226	32	192	34	146	95	165	133—201
191	Other skin ^b	89	132	7	142	34	238	50	235	180	167	144—193
193	Brain	31	196	13	166	16	128	25	105	85	142	113—175
194	Thyroid	1	63	[1.7]	0	3	115	3	73	7	70	28—145
197	Connective tissue	1	54	2	115	4	183	7	134	14	127	70—213
201	Hodgkin's disease	4	117	2	98	3	116	6	121	15	115	64—190
200, 202	Non-Hodgkin's lymphoma	12	108	11	210	18	139	31	140	72	140	110—176
203	Multiple myeloma	5	87	3	95	11	134	7	67	26	94	62—138
204.3	Acute leukemia	4	78	6	257	8	189	9	128	27	144	95—210
204.0—2.4	Other leukemia	6	69	4	102	5	88	9	81	24	81	52—121
199	Unknown	4	103	2	48	16	93	16	85	38	86	61—119
140—204	All sites ^c	388	86	202	89	448	100	636	100	1674	95	90—99

^a International Classification of Diseases (7th revision).
and Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway,

Table 6. Physicians, women (N=4582) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.1]	0	[0.2]	0	[0.1]	0	[0.2]	0	[0.6]	0	0—673
141	Tongue	[0.2]	0	[0.2]	0	[0.1]	0	[0.3]	0	[0.8]	0	0—480
143—144	Mouth	[0.4]	0	[0.2]	0	[0.2]	0	[0.4]	0	[1.2]	0	0—319
145—148	Pharynx	1	300	[0.3]	0	[0.2]	0	[0.4]	0	1	87	2—483
150	Esophagus	[0.4]	0	[0.7]	0	1	506	[0.4]	0	1	61	2—338
151	Stomach	2	94	3	74	[2.2]	0	1	33	6	53	19—115
153	Colon	6	83	4	108	9	179	12	145	31	128	87—182
154	Rectum	4	106	1	41	2	80	7	154	14	105	58—177
155.0	Liver	[0.7]	0	[0.7]	0	[0.2]	0	1	109	1	40	1—225
155.1	Gall bladder	3	269	1	82	1	270	[1.7]	0	5	114	37—266
157	Pancreas	3	121	3	134	1	67	[3.2]	0	7	75	30—154
160	Nose	[0.1]	0	[0.1]	0	[0.1]	0	[0.2]	0	[0.5]	0	0—681
161	Larynx	1	229	[0.1]	0	[0.1]	0	[0.2]	0	1	114	3—636
162	Lung	5	63	6	207	1	39	7	132	19	102	61—159
162.2	Pleura	[0.2]	0	1	807	[0.0]	0	[0.1]	0	1	239	6—1332
170	Breast	44	158	40	163	20	133	70	167	174	159	137—184
171	Cervix uteri	3	36	1	43	1	26	5	81	10	48	23—89
172	Corpus uteri	11	160	6	113	8	228	12	131	37	149	105—205
175	Ovary	6	91	8	183	2	50	8	80	24	96	62—143
180.0	Kidney	1	54	2	100	[1.1]	0	2	66	5	62	20—146
181	Bladder	4	165	3	319	[1.3]	0	3	116	10	138	66—254
190	Melanoma	9	284	7	302	5	173	4	79	25	186	120—275
191	Other skin ^b	19	186	2	172	1	92	5	265	27	188	124—274
193	Brain	8	252	4	111	1	55	5	95	18	130	77—206
194	Thyroid	[0.6]	0	2	98	1	93	2	91	5	85	28—199
197	Connective tissue	[0.3]	0	1	187	[0.3]	0	[0.9]	0	1	50	1—276
201	Hodgkin's disease	1	249	[0.5]	0	1	442	1	174	3	179	37—522
200, 202	Non-Hodgkin's lymphoma	2	120	2	134	1	70	5	164	10	131	63—241
203	Multiple myeloma	1	120	[1.0]	0	[0.8]	0	2	146	3	76	16—223
204.3	Acute leukemia	2	223	[0.8]	0	1	221	1	86	4	122	33—312
204.0—2.4	Other leukemia	1	111	1	114	[0.4]	0	1	88	3	90	18—262
199	Unknown	1	134	[1.4]	0	1	55	1	29	3	41	8—119
140—204	All sites ^c	116	122	97	128	60	106	160	117	433	119	108—131

^a International Classification of Diseases (7th revision).
and Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway,

access to diagnostic techniques may explain the elevated risk of skin and brain cancers. The low incidence of cancers of the stomach and esophagus points to a diet rich in fruit and vegetables, whereas an elevated risk of colon cancer is usually related to a high consumption of meat. The risk has also been reported for occupations with sedentary types of work. The risk factors of rectal cancer are normally thought to be similar to those of colon cancer; however, the decreased risk for rectal cancer among the male physicians does not fit this pattern.

Dentists: occupational group 04

Group 04 includes all dentists working in districts or schools or as private practitioners and all types of specialists and researchers in the field of odontology. All

dentists in the Nordic countries have at least 4 years of education at a university.

Results

For both genders and all the Nordic countries, dentists showed a 2-fold excess risk of malignant melanoma; dentists were the occupational category with the highest SIR for malignant melanoma included in this study. Significantly low risks of cancers of the lung, stomach, and pancreas were observed for men (table 7). Female dentists had an excess risk of breast cancer and significantly low risks of cervical and bladder cancer (table 8).

Comments

Dentists are exposed to different types of solvents from metals, particularly to mercury vapor and ultraviolet radiation. A high income has made it possible for dentists to travel more frequently to the south than other occupational groups, and frequent sunburns may explain the el-

Table 7. Dentists, men (N=8273) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[2.1]	0	[0.9]	0	3	125	3	84	6	67	25–145
141	Tongue	[0.5]	0	1	488	2	201	3	199	6	187	69–408
143–144	Mouth	1	109	[0.2]	0	[1.3]	0	1	44	2	42	5–153
145–148	Pharynx	3	243	[0.3]	0	1	62	2	62	6	94	34–204
150	Esophagus	3	172	[0.6]	0	[2.3]	0	3	73	6	68	25–149
151	Stomach	6	97	2	48	7	52	8	45	23	55	35–83
153	Colon	10	108	1	47	17	107	31	124	59	113	86–146
154	Rectum	13	171	2	104	10	91	23	130	48	125	92–166
155.0	Liver	4	259	1	142	1	71	8	157	14	160	87–268
155.1	Gall bladder	1	108	1	255	3	334	2	101	7	167	67–344
157	Pancreas	3	67	1	53	4	59	4	32	12	47	24–81
160	Nose	[0.4]	0	[0.1]	0	1	162	[0.9]	0	1	48	1–266
161	Larynx	4	135	[1.0]	0	2	72	7	149	13	114	61–195
162	Lung	15	51	5	38	20	73	20	49	60	54	41–70
162.2	Pleura	1	143	[0.2]	0	[0.9]	0	1	74	2	65	8–233
170	Breast	[0.2]	0	[0.1]	0	1	380	[0.6]	0	1	85	2–475
177	Prostate	10	100	5	87	38	120	82	121	135	117	99–139
178	Testis	7	214	[0.3]	0	3	118	2	69	12	133	69–232
180.0	Kidney	3	79	3	159	7	109	15	105	28	106	70–153
181	Bladder	15	127	3	117	14	94	23	88	55	99	75–129
190	Melanoma	10	276	2	144	19	228	24	189	55	211	159–275
191	Other skin ^b	31	167	[1.1]	0	4	69	13	109	48	128	95–170
193	Brain	5	104	6	368	4	68	20	154	35	138	96–192
194	Thyroid	[0.5]	0	[0.3]	0	1	83	1	45	2	47	6–170
197	Connective tissue	[0.6]	0	2	542	[1.0]	0	4	140	6	126	46–274
201	Hodgkin's disease	2	172	[0.4]	0	3	241	[2.8]	0	5	89	29–208
200, 202	Non-Hodgkin's lymphoma	5	156	1	91	8	139	9	74	23	104	66–156
203	Multiple myeloma	[1.5]	0	1	151	1	30	6	105	8	71	31–140
204.3	Acute leukemia	1	68	1	201	2	108	2	52	6	78	29–170
204.0–2,4	Other leukemia	1	43	1	119	3	127	4	65	9	77	35–146
199	Unknown	1	97	1	112	5	71	10	97	17	88	51–141
140–204	All sites ^c	126	104	40	83	186	99	337	96	689	97	90–105

^a International Classification of Diseases (7th revision).
and Sweden.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.
^c Excludes nonmelanoma skin cancer.

evated skin melanoma risk. The possible influence of the occupational ultraviolet radiation exposure should be further examined.

Nurses: occupational group 05

Workers in group 05 nurse sick and injured patients in somatic and psychiatric hospitals. They give first-aid treatment, take part in administering medication and assist at deliveries. All nurses working in the Nordic countries have 2–4 years of education after secondary school. Almost all nurses in 1970 were women. Due to their small numbers, the men have been included in occupational group 53.

Results

Breast cancers represented almost 40% of all cancers among nurses, and an excess risk of breast cancer was

found for all the Nordic countries (table 9). Skin cancers showed a 20% excess risk in all the countries. For thyroid cancer, the SIR was elevated in all 4 countries except Sweden. Significantly low risks were seen for cancers of the larynx, gallbladder, cervix uteri, esophagus, lung, and pancreas. The incidence of cancers with an unknown primary site was significantly below the average for the population.

Comments

This is one of the most homogeneous groups included in our study. The increased risks for thyroid cancer, malignant melanoma, and other skin cancer may be related to increased diagnostic activity. Reproductive factors, such as a high proportion of nulliparous women, are likely to explain the elevated risks of cancers of the breast and endometrium (66). The former association between nursing and religion may reflect the relatively low risk of cancers related to alcohol, smoking, and sexual activity.

Table 8. Dentists, women (N=4747) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.1]	0	[0.4]	0	[0.1]	0	[0.2]	0	[0.8]	0	0–474
141	Tongue	[0.2]	0	1	246	1	886	[0.3]	0	2	213	26–771
143–144	Mouth	[0.3]	0	[0.4]	0	[0.2]	0	1	255	1	75	2–418
145–148	Pharynx	1	335	1	197	[0.1]	0	1	252	3	226	47–659
150	Esophagus	2	500	[1.6]	0	1	591	[0.4]	0	3	116	24–338
151	Stomach	2	98	9	106	[1.9]	0	6	178	17	107	63–172
153	Colon	7	104	4	52	6	138	7	78	24	87	56–129
154	Rectum	3	85	8	159	4	186	3	63	18	116	69–184
155.0	Liver	1	161	[1.4]	0	[0.2]	0	[1.0]	0	1	31	1–170
155.1	Gall bladder	2	190	[2.8]	0	[0.3]	0	1	54	3	50	10–145
157	Pancreas	1	43	3	60	5	392	5	142	14	115	63–193
160	Nose	[0.1]	0	[0.3]	0	[0.1]	0	[0.2]	0	[0.7]	0	0–559
161	Larynx	[0.4]	0	1	419	[0.1]	0	[0.2]	0	1	109	3–606
162	Lung	3	42	4	73	2	88	4	76	13	64	34–110
162.2	Pleura	[0.2]	0	[0.2]	0	[0.0]	0	[0.1]	0	[0.5]	0	0–728
170	Breast	41	160	56	147	20	148	56	139	173	147	127–171
171	Cervix uteri	2	26	[4.0]	0	5	142	2	34	9	43	19–81
172	Corpus uteri	6	96	13	142	6	191	7	80	32	117	80–165
175	Ovary	3	50	10	138	2	56	6	62	21	79	49–121
180.0	Kidney	[1.7]	0	1	27	1	105	3	96	5	52	17–122
181	Bladder	[2.3]	0	[2.0]	0	[1.1]	0	2	71	2	24	3–88
190	Melanoma	7	233	8	231	6	225	7	146	28	201	134–290
191	Other skin ^b	17	179	3	108	2	212	7	330	29	189	127–271
193	Brain	3	102	1	19	1	62	5	98	10	66	32–122
194	Thyroid	[0.6]	0	1	34	[1.0]	0	4	191	5	76	25–178
197	Connective tissue	[0.3]	0	2	222	[0.2]	0	2	215	4	171	47–438
201	Hodgkin's disease	[0.4]	0	2	274	2	973	1	169	5	260	84–607
200, 202	Non-Hodgkin's lymphoma	1	63	4	148	2	160	2	63	9	104	47–197
203	Multiple myeloma	[0.8]	0	2	101	1	152	1	66	4	81	22–208
204.3	Acute leukemia	[0.9]	0	2	145	[0.4]	0	[1.2]	0	2	52	6–189
204.0–2.4	Other leukemia	2	236	1	57	1	275	[1.2]	0	4	95	26–244
199	Unknown	[0.7]	0	2	68	2	125	2	54	6	67	25–146
140–204	All sites ^c	90	102	143	107	69	137	139	102	441	108	98–119

^a International Classification of Diseases (7th revision).
and Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway,

Table 9. Nurses, women (N=82 785) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	44	2	98	2	80	3	101	8	82	35–161
141	Tongue	2	64	1	35	2	59	3	70	8	58	25–115
143–144	Mouth	7	104	5	179	5	95	5	79	22	104	65–158
145–148	Pharynx	5	84	3	84	2	52	6	89	16	79	45–129
150	Esophagus	6	75	6	77	3	55	2	31	17	61	36–98
151	Stomach	43	106	44	85	58	98	45	84	190	93	80–107
153	Colon	140	103	57	118	128	94	118	82	443	95	87–104
154	Rectum	71	100	41	129	66	97	85	109	263	106	94–119
155.0	Liver	13	105	6	72	5	75	14	88	38	88	62–120
155.1	Gall bladder	12	56	6	40	12	117	9	31	39	51	37–70
157	Pancreas	46	97	25	90	26	64	44	79	141	82	70–97
160	Nose	7	256	1	53	1	36	1	37	10	99	47–182
161	Larynx	2	25	[1.9]	0	[2.1]	0	3	80	5	32	10–75
162	Lung	92	64	35	91	50	71	57	64	234	68	60–78
162.2	Pleura	4	125	[1.7]	0	2	199	4	254	10	134	64–246
170	Breast	629	123	585	161	505	126	821	118	2540	129	124–134
171	Cervix uteri	66	43	21	66	79	79	54	51	220	56	49–64
172	Corpus uteri	155	126	89	122	94	98	160	106	498	113	103–123
175	Ovary	121	101	70	113	112	106	163	98	466	103	94–113
180.0	Kidney	24	69	19	71	20	66	57	110	120	84	70–100
181	Bladder	37	82	19	162	46	130	50	110	152	110	94–129
190	Melanoma	76	127	43	124	89	119	105	123	313	123	110–137
191	Other skin ^b	223	117	17	120	34	116	43	129	317	118	106–132
193	Brain	64	108	66	125	44	92	99	112	273	110	98–124
194	Thyroid	16	146	38	124	41	147	33	89	128	120	101–143
197	Connective tissue	5	91	6	79	5	71	12	76	28	78	52–113
201	Hodgkin's disease	9	115	6	86	9	152	14	138	38	123	87–169
200, 202	Non-Hodgkin's lymphoma	36	113	15	73	43	111	56	106	150	104	89–122
203	Multiple myeloma	11	70	13	105	22	105	22	91	68	93	72–118
204.3	Acute leukemia	19	112	6	55	15	124	21	106	61	102	78–131
204.0–2.4	Other leukemia	21	122	4	35	16	136	26	132	67	111	86–141
199	Unknown	10	70	16	94	41	82	50	83	117	83	69–99
140–204	All sites ^c	1763	100	1290	122	1580	104	2272	98	6905	104	102–106

^a International Classification of Diseases (7th revision).
and Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway,

Assistant nurses: occupational group 06

Assistant nurses' tasks include assisting physicians, nurses, and midwives in their practical application of preventive and curative measures. They provide nursing services and care for the sick and injured. In 1970, more than 95% of the workers included in this occupational group were women.

Results

The risks for most cancer sites among the men and women were close to the national averages (tables 10 and 11). For men, there was an excess risk for colon cancer and other skin cancer.

Comments

This is a category of people with a low salary but a relatively good knowledge of health-related factors that accounts for a cancer pattern between those of low and high

social or educational status. Female assistant nurses had a cancer profile different from that of nurses, as they have low risks of cancers of the breast, corpus uteri, and other skin cancer.

Other health and medical workers: occupational group 07

Group 07 consists of veterinarians, pharmacists, physiotherapists, assistant nurses at psychiatric institutions, and other types of health professionals not included in occupational groups 05 or 06. Some of them perform technical tasks related to research, practical application, and operational methods in the field of medicine, veterinary medicine, dentistry, pharmacy, and sanitation. Pharmacists prepare and sell medicaments. Veterinarians and pharmacists have at least 5 years of education at a university.

Table 10. Assistant nurses, men (N=6980) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	3	145	1	1536	1	88	6	143	11	147	73—263
141	Tongue	1	197	[0.0]	0	[0.4]	0	3	178	4	151	41—388
143—144	Mouth	3	319	[0.0]	0	1	171	5	196	9	219	100—416
145—148	Pharynx	[1.3]	0	[0.0]	0	1	147	4	111	5	89	29—209
150	Esophagus	1	57	[0.0]	0	1	92	4	80	6	76	28—166
151	Stomach	8	132	1	317	7	111	25	117	41	121	86—164
153	Colon	17	185	[0.2]	0	9	121	36	123	62	135	103—173
154	Rectum	8	105	1	736	7	136	24	114	40	118	84—160
155.0	Liver	[1.6]	0	[0.1]	0	2	294	8	131	10	119	57—219
155.1	Gall bladder	1	110	[0.0]	0	[0.4]	0	4	172	5	135	44—315
157	Pancreas	3	67	[0.1]	0	4	123	9	59	16	70	40—113
160	Nose	1	216	[0.0]	0	[0.3]	0	2	194	3	168	35—490
161	Larynx	2	67	[0.1]	0	2	153	9	164	13	131	70—225
162	Lung	26	88	1	117	10	76	47	98	84	92	73—114
162.2	Pleura	[0.7]	0	[0.0]	0	1	270	1	67	2	77	9—277
170	Breast	[0.2]	0	[0.0]	0	[0.1]	0	1	145	1	95	2—529
177	Prostate	13	135	[0.2]	0	17	107	85	102	115	106	88—127
178	Testis	1	27	[0.1]	0	1	100	3	115	5	67	22—157
180.0	Kidney	2	52	[0.2]	0	2	68	26	157	30	128	86—183
181	Bladder	17	143	[0.2]	0	8	114	29	94	54	108	81—141
190	Melanoma	4	104	[0.2]	0	8	228	15	113	27	129	85—188
191	Other skin ^b	31	163	[0.1]	0	6	220	19	135	56	156	118—203
193	Brain	3	59	[0.3]	0	1	38	22	157	26	118	77—173
194	Thyroid	[0.5]	0	[0.1]	0	[0.5]	0	2	81	2	56	7—202
197	Connective tissue	[0.6]	0	[0.1]	0	[0.4]	0	1	32	1	23	1—131
201	Hodgkin's disease	2	156	[0.1]	0	[0.6]	0	1	35	3	62	13—182
200, 202	Non-Hodgkin's lymphoma	1	30	[0.1]	0	4	153	12	88	17	86	50—138
203	Multiple myeloma	2	133	[0.1]	0	1	62	5	74	8	81	35—159
204.3	Acute leukemia	[1.5]	0	[0.1]	0	[0.9]	0	4	92	4	59	16—151
204.0—2.4	Other leukemia	[2.3]	0	[0.1]	0	2	179	5	70	7	66	26—135
199	Unknown	[1.0]	0	[0.1]	0	5	149	10	84	15	92	51—151
140—204	All sites ^c	125	102	5	128	97	110	432	105	659	105	98—114

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Results

In both genders, there was an excess risk of nonmelanoma skin cancer and a significantly low risk of lung cancer. For men, there was also low risk of lip cancer and of multiple myeloma (table 12). For women, the present study showed excess risks for cancer of the breast, corpus uteri, and malignant melanoma and a low risk for cervical cancer (table 13).

Comments

Most people in this category have good access to health care. Therefore, cancer sites depending on the level of diagnostic activity tend to show elevated SIR values. There were excess risks of other skin cancers, particularly in Denmark, and of prostate cancer in all the countries except Norway. On the other hand, the SIR for cancers with an unknown primary site — those with poor diagnosis — was decreased. This is a heterogeneous occupational category, and it probably consists of various

subgroups in different Nordic countries. Therefore, the observations made in only 1 or 2 countries may deserve attention, such as the high SIR values for multiple myeloma among Swedish women and of bladder and rectum cancer among Finnish men.

Teachers: occupational group 08

Group 08 includes teachers at preschool, primary and secondary schools, colleges, and universities and special educational professionals. The majority works in primary schools and usually has 2—4 years of education after secondary school.

Results

For the men, a significantly low risk of all cancers combined was shown (table 14), while an average cancer in-

Table 11. Assistant nurses, women (N=121 965) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	4	245	4	142	1	53	11	116	20	127	77—196
141	Tongue	2	89	5	140	2	80	14	105	23	106	67—160
143—144	Mouth	3	64	3	84	5	126	15	73	26	79	52—116
145—148	Pharynx	6	133	2	44	4	138	22	104	34	103	71—144
150	Esophagus	8	145	8	76	3	69	13	60	32	76	52—107
151	Stomach	23	83	67	100	44	95	181	104	315	100	90—112
153	Colon	95	104	57	92	107	101	425	90	684	94	87—101
154	Rectum	37	77	39	94	58	110	244	96	378	95	86—105
155.0	Liver	6	70	12	110	4	77	44	83	66	85	66—108
155.1	Gall bladder	11	79	9	44	8	99	78	80	106	76	63—92
157	Pancreas	32	102	31	84	34	105	168	90	265	92	82—104
160	Nose	2	101	2	84	2	94	8	94	14	93	51—156
161	Larynx	6	101	1	41	[1.6]	0	8	68	15	69	38—113
162	Lung	113	107	43	85	44	82	265	93	465	94	86—103
162.2	Pleura	1	46	[2.1]	0	1	133	5	99	7	69	28—143
170	Breast	355	91	395	92	296	102	1982	94	3028	94	91—97
171	Cervix uteri	135	111	35	89	74	107	302	101	546	103	95—112
172	Corpus uteri	77	85	92	95	60	84	451	91	680	91	84—98
175	Ovary	87	98	76	98	88	114	470	91	721	95	88—102
180.0	Kidney	19	78	24	68	29	124	168	99	240	95	84—108
181	Bladder	36	116	23	144	27	97	157	105	243	108	95—123
190	Melanoma	50	105	38	97	47	93	212	87	347	91	82—101
191	Other skin ^b	117	85	23	125	14	62	96	88	250	87	77—98
193	Brain	42	93	71	115	24	70	279	104	416	102	92—112
194	Thyroid	7	86	34	100	15	79	123	115	179	107	92—124
197	Connective tissue	3	72	4	44	5	97	38	80	50	76	56—100
201	Hodgkin's disease	5	83	10	132	6	145	31	106	52	110	82—145
200, 202	Non-Hodgkin's lymphoma	17	76	23	92	22	75	165	100	227	94	82—107
203	Multiple myeloma	13	124	9	55	23	138	74	92	119	96	80—115
204.3	Acute leukemia	15	122	21	161	5	56	66	109	107	113	93—136
204.0—2.4	Other leukemia	15	129	21	145	9	98	65	102	110	111	92—134
199	Unknown	9	94	21	94	31	79	159	80	220	82	72—93
140—204	All sites ^c	1278	99	1223	94	1108	98	6833	95	10442	95	94—97

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 12.** Other health and medical workers, men (N=16 082) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	2	30	2	41	1	33	4	68	9	44	20—83
141	Tongue	[1.5]	0	2	201	1	90	1	41	4	66	18—169
143—144	Mouth	1	33	2	205	4	259	4	108	11	120	60—214
145—148	Pharynx	4	103	3	168	4	216	4	77	15	118	66—194
150	Esophagus	4	66	4	125	4	138	3	43	15	79	44—130
151	Stomach	16	74	15	70	15	90	18	61	64	72	55—92
153	Colon	39	120	8	74	18	91	39	95	104	100	83—121
154	Rectum	31	115	16	163	9	66	27	91	83	104	83—129
155.0	Liver	6	110	5	134	3	167	6	71	20	103	63—159
155.1	Gall bladder	7	213	[2.0]	0	2	179	3	93	12	124	64—217
157	Pancreas	16	101	6	60	7	81	15	71	44	79	57—106
160	Nose	[1.5]	0	1	133	[0.7]	0	[1.5]	0	1	22	1—124
161	Larynx	9	90	5	93	3	86	5	64	22	82	52—124
162	Lung	89	84	45	62	23	65	64	95	221	78	69—90
162.2	Pleura	[2.4]	0	3	307	[1.0]	0	1	46	4	61	17—157
170	Breast	[0.8]	0	1	374	[0.3]	0	[1.0]	0	1	42	1—237
177	Prostate	46	120	35	123	29	69	136	120	246	111	98—125
178	Testis	9	116	[1.1]	0	1	46	3	66	13	83	44—142

(continued)

Table 12. Continued.

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	12	94	7	71	5	64	24	101	48	89	65—118
181	Bladder	31	74	9	68	17	90	57	131	114	97	81—117
190	Melanoma	12	116	2	31	9	104	18	88	41	89	64—121
191	Other skin ^b	85	137	3	57	3	42	25	128	116	123	103—148
193	Brain	17	114	10	130	7	106	27	128	61	121	93—156
194	Thyroid	1	67	2	123	5	369	5	134	13	159	85—271
197	Connective tissue	1	58	2	117	3	262	6	128	12	129	67—226
201	Hodgkin's disease	1	31	2	104	2	153	5	112	10	92	44—168
200, 202	Non-Hodgkin's lymphoma	11	106	6	112	6	89	21	106	44	104	76—140
203	Multiple myeloma	3	57	3	87	1	24	6	63	13	58	31—99
204.3	Acute leukemia	1	21	3	127	1	46	7	110	12	77	40—134
204.0—2,4	Other leukemia	11	137	3	71	3	103	11	108	28	111	74—160
199	Unknown	4	112	3	66	8	90	13	77	28	83	55—120
140—204	All sites ^c	386	93	216	87	200	86	576	99	1378	93	88—98

^a International Classification of Diseases (7th revision).
and Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway,

Table 13. Other health and medical workers, women (N=54 176) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	76	1	49	1	85	1	46	4	60	16—153
141	Tongue	[1.8]	0	5	196	3	184	6	193	14	154	84—259
143—144	Mouth	2	51	3	118	2	80	2	44	9	67	30—126
145—148	Pharynx	1	29	4	124	[1.9]	0	4	82	9	67	31—128
150	Esophagus	5	108	2	26	1	40	8	171	16	82	47—133
151	Stomach	17	72	50	103	21	77	37	95	125	91	76—108
153	Colon	85	109	43	97	57	89	108	103	293	101	90—113
154	Rectum	38	93	43	144	37	116	54	95	172	108	93—126
155.0	Liver	11	154	13	164	2	64	13	112	39	131	93—179
155.1	Gall bladder	9	73	14	94	6	129	14	66	43	81	59—109
157	Pancreas	30	110	26	97	23	122	35	86	114	100	83—120
160	Nose	3	189	1	58	1	76	[2.0]	0	5	76	25—177
161	Larynx	3	66	[1.7]	0	[1.0]	0	4	148	7	70	28—145
162	Lung	61	74	28	78	26	77	66	102	181	83	72—96
162.2	Pleura	3	165	1	66	1	202	1	87	6	121	44—263
170	Breast	405	140	379	124	219	110	553	109	1556	120	114—126
171	Cervix uteri	40	46	17	61	38	74	57	74	152	62	53—73
172	Corpus uteri	92	129	69	101	57	123	118	108	336	114	102—127
175	Ovary	61	89	62	113	54	103	114	95	291	98	88—110
180.0	Kidney	16	80	21	84	7	49	35	93	79	81	64—102
181	Bladder	25	96	20	173	17	104	39	118	101	116	95—141
190	Melanoma	43	128	33	118	48	123	71	114	195	120	104—138
191	Other skin ^b	139	128	14	104	16	117	24	99	193	120	105—139
193	Brain	35	104	37	85	31	129	65	101	168	101	87—118
194	Thyroid	6	96	22	90	14	97	17	63	59	82	62—106
197	Connective tissue	2	64	9	138	5	143	9	78	25	102	66—150
201	Hodgkin's disease	6	137	7	128	2	66	9	120	24	118	76—175
200, 202	Non-Hodgkin's lymphoma	20	110	16	89	16	85	41	107	93	100	80—122
203	Multiple myeloma	10	110	13	111	4	41	28	160	55	115	86—149
204.3	Acute leukemia	4	41	11	117	7	120	11	76	33	84	58—118
204.0—2,4	Other leukemia	10	101	17	162	5	92	8	56	40	100	71—136
199	Unknown	8	97	15	92	15	65	27	61	65	71	55—91
140—204	All sites ^c	1049	105	1012	109	740	100	1681	100	4482	103	100—106

^a International Classification of Diseases (7th revision).
and Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway,

Table 14. Teachers, men (N=135 073) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	13	35	9	28	13	41	18	45	53	38	28–49
141	Tongue	4	46	6	81	9	68	15	82	34	72	50–100
143–144	Mouth	14	86	6	83	12	67	12	44	44	64	46–86
145–148	Pharynx	16	73	11	88	12	56	20	52	59	62	47–80
150	Esophagus	15	48	2	10	12	40	24	53	53	41	31–54
151	Stomach	77	69	113	80	109	65	120	63	419	69	62–75
153	Colon	170	101	69	94	224	108	305	110	768	106	99–114
154	Rectum	111	81	57	88	124	86	168	85	460	84	77–93
155.0	Liver	17	61	18	76	11	61	28	51	74	59	47–74
155.1	Gall bladder	18	107	16	120	11	98	27	126	72	115	90–144
157	Pancreas	73	90	52	79	77	88	116	82	318	85	76–95
160	Nose	5	62	[5.3]	0	3	37	10	94	18	56	33–89
161	Larynx	27	52	15	42	15	40	33	60	90	50	40–61
162	Lung	262	49	167	36	168	46	278	61	875	48	45–51
162.2	Pleura	6	48	2	28	5	45	12	75	25	54	35–79
170	Breast	3	73	3	159	3	83	10	140	19	113	68–177
177	Prostate	188	101	185	108	413	107	654	96	1440	101	96–106
178	Testis	80	133	17	168	30	79	50	120	177	118	102–137
180.0	Kidney	57	84	69	99	73	85	143	85	342	87	78–97
181	Bladder	173	81	73	84	175	91	230	78	651	83	77–89
190	Melanoma	108	167	96	188	148	124	230	140	582	146	135–158
191	Other skin ^b	458	137	34	98	94	129	152	121	738	130	121–140
193	Brain	95	110	62	103	87	104	151	92	395	100	91–111
194	Thyroid	12	139	15	120	16	94	35	124	78	118	93–147
197	Connective tissue	12	118	12	93	17	126	36	103	77	108	85–135
201	Hodgkin's disease	19	90	16	106	13	75	34	97	82	93	74–115
200, 202	Non-Hodgkin's lymphoma	60	103	53	136	84	106	148	103	345	108	97–120
203	Multiple myeloma	26	96	13	56	43	99	64	100	146	92	78–108
204.3	Acute leukemia	29	109	11	64	25	103	45	99	110	97	80–117
204.0–2,4	Other leukemia	39	92	27	94	26	87	61	88	153	90	77–105
199	Unknown	16	86	23	77	70	78	90	77	199	78	68–90
140–204	All sites ^c	1787	81	1272	77	2078	84	3419	87	8556	84	82–85

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

cidence was found for the women (table 15). There was a consistent significant excess of malignant melanoma for both genders, and for breast cancer among women. The SIR values for cancers of the upper gastrointestinal tract, as well as for respiratory organs, were systematically low for both genders. Significant excess risks of testicular cancer and decreased risks of kidney and bladder cancer were found for the men. Among the women, low risks of cancers of the gallbladder and cervix uteri were found.

Comments

The results for teachers are consistent across countries and gender. The risks for alcohol- and smoking-related cancers are systematically low, indicating a lower-than-average consumption of tobacco and alcohol. A low risk of stomach cancer is typical in populations with a high intake of fruit and vegetables. A high risk of breast cancer is often observed for women in populations with high-

er education due to lower parity and later age at first delivery. An increased risk for malignant melanoma has been related to sun bathing.

Religious, juridical and other social-science-related workers: occupational group 09

Category 09 forms a heterogeneous group of religious and legal professionals, archivists, librarians, economists, sociologists, psychologists, and social work professionals. The tasks of religious professionals include ritual services and various administrative and social duties. Legal professionals advise clients on legal problems and plead cases or conduct prosecutions in courts of justice. Social science and related professionals conduct research or apply knowledge relating to philosophy, politics, and

Table 15. Teachers, women (N=152 120) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	6	209	[5.1]	0	1	34	3	45	10	57	27—104
141	Tongue	2	53	4	66	5	117	10	99	21	87	54—133
143—144	Mouth	6	74	9	145	5	79	12	81	32	91	62—128
145—148	Pharynx	6	80	6	80	1	21	12	78	25	71	46—104
150	Esophagus	8	87	8	40	7	117	7	50	30	61	41—87
151	Stomach	39	81	94	80	52	80	80	66	265	75	67—85
153	Colon	170	108	129	120	168	108	312	96	779	104	97—112
154	Rectum	68	83	81	113	91	117	169	96	409	100	91—111
155.0	Liver	15	103	16	82	7	93	22	61	60	78	59—100
155.1	Gall bladder	22	92	30	82	4	37	46	70	102	74	61—90
157	Pancreas	52	97	65	98	38	86	112	90	267	93	82—104
160	Nose	4	119	2	49	2	60	6	97	14	83	45—139
161	Larynx	3	31	2	50	2	79	4	46	11	44	22—79
162	Lung	100	58	50	59	56	65	112	55	318	58	52—65
162.2	Pleura	4	107	4	115	[1.3]	0	3	84	11	91	45—163
170	Breast	833	123	983	144	641	121	2044	125	4501	127	124—131
171	Cervix uteri	107	50	25	39	89	61	141	57	362	54	48—59
172	Corpus uteri	139	98	176	114	137	113	362	106	814	107	100—115
175	Ovary	174	117	141	114	152	109	354	92	821	103	96—110
180.0	Kidney	34	84	66	114	28	79	109	93	237	94	83—107
181	Bladder	48	92	31	111	42	107	94	93	215	97	85—111
190	Melanoma	116	134	79	127	179	160	271	132	645	139	128—150
191	Other skin ^b	339	141	27	78	39	118	90	120	495	129	119—141
193	Brain	72	92	101	104	72	110	234	113	479	107	98—117
194	Thyroid	12	80	60	112	42	102	78	88	192	97	84—112
197	Connective tissue	5	68	17	115	9	97	41	111	72	105	82—133
201	Hodgkin's disease	7	61	8	66	7	83	17	71	39	69	49—95
200, 202	Non-Hodgkin's lymphoma	42	107	32	77	54	112	107	89	235	94	83—107
203	Multiple myeloma	15	85	33	116	24	106	48	90	120	98	82—118
204.3	Acute leukemia	17	78	21	97	14	92	41	89	93	89	72—109
204.0—2.4	Other leukemia	25	123	25	99	13	101	43	96	106	103	85—124
199	Unknown	11	66	24	61	43	78	84	62	162	66	56—77
140—204	All sites ^c	2171	98	2375	111	2032	105	5335	100	11913	102	101—104

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

economics. Most persons in this occupational group have at least 5 years of education at the university level.

Results

Increased SIR values were found systematically for skin melanoma and colon cancer among the men, but not among the women (tables 16 and 17). Cancers of the esophagus, stomach, liver, and lung showed low SIR values for both genders, and the risks of cervical cancer for women and lip cancer for men were very low. Breast cancer was found in excess for both genders.

Comments

Men and women in this occupational group have different work tasks. The men are predominantly priests and lawyers with a high socioeconomic status. Therefore cancers related to affluence such as skin melanoma and colon cancer are increased. The high incidence of colon cancer may be associated with the sedentary nature of

the tasks of this occupational group. The low rates of smoking- and drinking-related cancers likely reflect lower-than-average alcohol and tobacco consumption.

Artistic workers: occupational group 10

Included in group 10 are authors (excluding journalists, see occupational group 11), sculptors, painters and related artists, painting restorers, composers, singers, musicians, dancers, and other types of artists.

Results

A high risk of primary liver cancer was found for both genders (tables 18 and 19). The SIR value for all alcohol-related cancers among the men was 150, and for the

Table 16. Religious, juridical and other social-science-related workers, men (N=74 355) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	10	57	6	31	9	49	16	49	41	47	33—63
141	Tongue	4	107	4	100	6	88	10	72	24	84	54—125
143—144	Mouth	6	79	4	106	14	148	17	81	41	98	70—133
145—148	Pharynx	7	72	13	185	14	124	26	88	60	104	80—134
150	Esophagus	15	95	8	62	11	63	24	63	58	69	52—89
151	Stomach	43	73	51	59	59	58	118	72	271	66	59—74
153	Colon	119	135	60	136	166	138	283	124	628	130	121—141
154	Rectum	90	124	55	138	87	105	168	103	400	111	101—123
155.0	Liver	10	68	13	86	10	92	36	77	69	79	61—100
155.1	Gall bladder	13	143	6	73	9	132	15	83	43	102	74—138
157	Pancreas	38	89	40	100	58	111	109	93	245	97	86—110
160	Nose	5	129	4	138	2	45	8	95	19	97	58—151
161	Larynx	22	86	14	67	13	62	33	75	82	74	59—91
162	Lung	165	58	136	47	126	59	297	79	724	62	58—67
162.2	Pleura	6	96	5	127	1	16	8	64	20	69	42—107
170	Breast	1	48	1	89	3	153	9	160	14	130	71—218
177	Prostate	119	106	134	110	302	118	638	103	1193	108	102—114
178	Testis	20	101	9	171	13	94	22	75	64	94	72—119
180.0	Kidney	44	132	39	101	55	116	129	97	267	106	94—119
181	Bladder	92	82	43	80	110	97	247	102	492	94	86—103
190	Melanoma	35	135	49	186	86	161	200	166	370	164	148—181
191	Other skin ^b	210	128	29	131	61	139	124	114	424	125	114—138
193	Brain	31	83	32	102	49	121	137	112	249	107	95—122
194	Thyroid	4	103	6	90	5	60	19	88	34	84	58—117
197	Connective tissue	6	134	13	184	4	57	20	74	43	94	68—127
201	Hodgkin's disease	11	133	6	73	10	124	17	64	44	86	62—115
200, 202	Non-Hodgkin's lymphoma	20	73	13	59	45	109	134	119	212	104	91—119
203	Multiple myeloma	17	119	18	131	24	93	49	93	108	101	84—122
204.3	Acute leukemia	11	86	17	173	13	98	34	94	75	104	82—130
204.0—2,4	Other leukemia	28	128	17	99	29	164	53	93	127	112	94—133
199	Unknown	4	42	10	54	44	82	92	97	150	85	72—100
140—204	All sites ^c	1011	90	848	84	1409	99	3167	98	6435	95	93—97

^a International Classification of Diseases (7th revision).
^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.

Table 17. Religious, juridical and other social-science-related workers, women (N=40 374) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.4]	0	[1.7]	0	1	116	3	114	4	72	20—184
141	Tongue	[0.5]	0		98	3	267	3	81	8	109	47—214
143—144	Mouth	[1.1]	0	[2.0]	0	[1.8]	0	5	90	5	48	15—111
145—148	Pharynx	1	98	1	39	[1.3]	0	4	70	6	56	21—123
150	Esophagus	[1.3]	0	1	15	2	105	[5.9]	0	3	19	4—55
151	Stomach	7	106	23	58	19	92	36	75	85	74	59—91
153	Colon	27	123	39	108	63	133	122	95	251	107	95—121
154	Rectum	7	61	13	54	22	94	64	93	106	83	69—100
155.0	Liver	[2.0]	0	4	61	3	131	8	55	15	59	33—98
155.1	Gall bladder	1	29	15	121	1	28	18	68	35	76	53—106
157	Pancreas	7	92	21	93	15	104	61	120	104	109	90—132
160	Nose	[0.5]	0	[1.3]	0	[0.9]	0	3	128	3	59	12—172
161	Larynx	1	75	2	151	[0.7]	0	4	126	7	107	43—220
162	Lung	18	75	23	82	18	76	67	87	126	83	69—98
162.2	Pleura	[0.5]	0	[1.2]	0	[0.3]	0	[1.4]	0	[3.4]	0	0—108
170	Breast	111	127	314	141	196	150	726	125	1347	132	125—139
171	Cervix uteri	18	67	10	47	12	38	44	52	84	51	41—63
172	Corpus uteri	22	107	65	130	53	167	177	137	317	137	122—152
175	Ovary	17	84	45	111	41	118	175	125	278	118	105—133

(continued)

Table 17. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	4	70	18	94	4	39	35	77	61	75	58—97
181	Bladder	10	136	13	138	14	114	55	135	92	132	106—161
190	Melanoma	12	113	28	135	31	132	71	103	142	115	98—136
191	Other skin ^b	50	156	11	93	14	137	32	107	107	127	105—154
193	Brain	12	118	40	124	18	117	80	108	150	114	97—134
194	Thyroid	2	106	15	83	6	69	32	107	55	94	71—122
197	Connective tissue	[0.9]	0	4	81	5	215	10	75	19	88	53—138
201	Hodgkin's disease	[1.4]	0	3	71	2	105	5	59	10	63	30—115
200, 202	Non-Hodgkin's lymphoma	12	228	18	129	20	153	41	90	91	117	94—144
203	Multiple myeloma	1	40	7	74	11	149	17	78	36	87	61—121
204.3	Acute leukemia	6	210	15	207	4	99	19	113	44	142	103—190
204.0—2.4	Other leukemia	3	108	9	107	7	172	20	114	39	119	85—163
199	Unknown	2	86	13	97	15	86	40	74	70	81	63—102
140—204	All sites ^c	298	101	786	111	608	120	2108	107	3800	109	106—113

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 18. Artistic workers, men (N=23 162) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	2	35	2	29	[4.3]	0	2	21	6	23	8—50
141	Tongue	5	402	2	134	6	355	10	249	23	272	173—408
143—144	Mouth	5	202	4	283	4	172	7	115	20	163	99—251
145—148	Pharynx	6	186	6	232	8	288	13	152	33	192	132—270
150	Esophagus	4	78	3	66	7	170	15	139	29	118	79—169
151	Stomach	21	111	27	88	18	77	44	96	110	93	77—112
153	Colon	31	109	24	154	39	139	64	99	158	116	99—135
154	Rectum	30	128	25	180	36	185	39	84	130	126	106—150
155.0	Liver	11	232	9	174	4	159	18	137	42	165	119—222
155.1	Gall bladder	5	171	3	104	1	64	6	118	15	121	68—199
157	Pancreas	11	80	16	114	20	166	33	100	80	110	87—136
160	Nose	[1.3]	0	1	94	[1.1]	0	1	42	2	34	4—124
161	Larynx	10	119	10	134	5	99	11	87	36	107	75—149
162	Lung	89	97	67	67	41	83	102	96	299	86	77—96
162.2	Pleura	4	197	1	69	2	138	1	28	8	95	41—186
170	Breast	1	147	[0.4]	0	2	417	2	125	5	158	51—369
177	Prostate	40	114	45	114	62	111	177	104	324	108	97—120
178	Testis	6	89	2	96	5	116	17	213	30	142	96—203
180.0	Kidney	12	110	20	142	17	150	37	97	86	115	92—143
181	Bladder	30	83	21	112	28	106	96	140	175	117	101—136
190	Melanoma	10	116	12	119	22	152	44	128	88	130	105—161
191	Other skin ^b	62	116	10	132	15	149	36	120	123	122	102—146
193	Brain	11	89	14	117	11	105	24	68	60	86	65—110
194	Thyroid	1	78	5	199	2	93	2	33	10	83	40—153
197	Connective tissue	1	67	[2.6]	0	1	57	9	118	11	81	41—146
201	Hodgkin's disease	1	36	3	95	2	92	8	108	14	90	49—152
200, 202	Non-Hodgkin's lymphoma	7	79	14	174	12	118	32	100	65	110	85—140
203	Multiple myeloma	4	87	3	62	7	117	19	127	33	109	75—152
204.3	Acute leukemia	4	96	5	139	2	62	9	88	20	95	58—146
204.0—2.4	Other leukemia	7	99	7	115	3	73	13	81	30	90	61—129
199	Unknown	2	65	5	77	15	121	26	97	48	98	73—130
140—204	All sites ^c	373	103	360	102	388	116	958	105	2079	106	101—111

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 19. Artistic workers, women (N=10 392) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.2]	0	[0.3]	0	[0.3]	0	[0.5]	0	[1.3]	0	0–277
141	Tongue	3	1026	[0.4]	0	[0.3]	0	1	134	4	223	61–571
143–144	Mouth	[0.7]	0	2	475	1	194	3	270	6	222	81–483
145–148	Pharynx	[0.5]	0	1	186	[0.4]	0	2	175	3	116	24–339
150	Esophagus	1	127	[1.4]	0	2	379	1	87	4	104	28–267
151	Stomach	3	73	3	37	6	104	6	63	18	65	39–103
153	Colon	10	73	9	120	7	53	28	110	54	90	68–118
154	Rectum	7	100	3	61	4	61	15	110	29	90	60–129
155.0	Liver	3	244	2	148	2	310	7	246	14	231	126–387
155.1	Gall bladder	[2.2]	0	2	80	1	101	1	19	4	37	10–94
157	Pancreas	2	41	9	197	3	76	6	60	20	86	52–132
160	Nose	[0.3]	0	[0.3]	0	[0.3]	0	[0.5]	0	[1.3]	0	0–286
161	Larynx	1	142	[0.3]	0	[0.2]	0	1	158	2	110	13–398
162	Lung	8	60	9	158	7	102	19	125	43	105	76–141
162.2	Pleura	[0.3]	0	[0.3]	0	[0.1]	0	[0.3]	0	[0.9]	0	0–396
170	Breast	61	135	78	162	50	126	128	109	317	127	113–141
171	Cervix uteri	16	120	5	109	11	108	25	144	57	125	95–162
172	Corpus uteri	12	105	16	155	9	97	29	114	66	117	90–148
175	Ovary	20	183	11	128	8	76	26	93	65	112	87–143
180.0	Kidney	5	148	3	76	3	102	8	89	19	98	59–154
181	Bladder	4	89	4	210	2	58	9	112	19	107	64–167
190	Melanoma	3	58	5	109	17	222	14	99	39	124	88–169
191	Other skin ^b	22	122	2	83	6	209	9	152	39	134	95–183
193	Brain	4	75	5	71	9	189	17	114	35	109	76–152
194	Thyroid	[1.0]	0	4	99	4	140	8	130	16	113	65–184
197	Connective tissue	[0.5]	0	2	188	[0.7]	0	2	74	4	81	22–207
201	Hodgkin's disease	2	284	1	104	[0.6]	0	1	58	4	100	27–256
200, 202	Non-Hodgkin's lymphoma	5	164	4	135	1	26	9	99	19	100	61–157
203	Multiple myeloma	3	189	[1.9]	0	2	98	3	70	8	81	35–160
204.3	Acute leukemia	[1.6]	0	2	129	[1.2]	0	4	118	6	77	28–168
204.0–2.4	Other leukemia	1	58	4	227	3	264	2	58	10	124	59–227
199	Unknown	2	137	3	109	6	124	6	57	17	87	50–139
140–204	All sites ^c	181	111	190	127	159	106	411	104	941	110	103–117

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

women it was 175, whereas most of the smoking-related cancers were not in excess. For the men, moderate excess risks were also found for cancer of the colon and rectum and for the women also for breast cancer.

Comments

The high SIR values for cancers of the tongue, mouth, pharynx, and liver may partially be attributable to occupational exposures to such agents as solvents, as for the other alcohol-related cancers; cancer of the esophagus and larynx were not in excess.

Journalists: occupational group 11

Included in group 11 are all types of journalistic workers. The tasks include collecting, reporting and commenting on news and current affairs for publication in news-

papers and periodicals or for broadcasting by radio or television.

Results

A small but significant excess risk for all cancers combined among the men was attributable to Swedish journalists (table 20), whereas the excess for women came mainly from Norway and Finland (table 21). An excess risk of malignant melanoma was found for both genders. For the men, there was a very high SIR for primary liver cancer and other alcohol-associated cancers combined. The SIR values for cancers of the colon, testis, and bladder and for acute leukemia were significantly high, and the SIR for stomach cancer was significantly low for the men. For female journalists, excess risks were observed for cancers of the lung, breast, and corpus uteri.

Comments

In Western countries a high risk of liver cancer has been

Table 20. Journalists, men (N=11 613) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	2	78	2	59	2	85	[4.9]	0	6	45	17—99
141	Tongue	1	172	4	550	[0.9]	0	5	240	10	231	111—425
143—144	Mouth	3	265	1	146	1	78	3	95	8	128	55—252
145—148	Pharynx	1	67	3	238	1	65	7	158	12	138	71—240
150	Esophagus	3	135	1	46	1	44	6	105	11	89	44—159
151	Stomach	4	49	9	61	7	56	18	74	38	63	45—87
153	Colon	18	149	11	146	18	118	52	153	99	144	117—175
154	Rectum	10	100	10	148	7	66	21	86	48	93	68—123
155.0	Liver	6	297	6	237	4	294	19	274	35	272	190—379
155.1	Gall bladder	[1.2]	0	2	143	1	120	3	112	6	98	36—213
157	Pancreas	3	51	4	58	8	122	19	108	34	92	64—129
160	Nose	[0.6]	0	[0.5]	0	[0.6]	0	[1.3]	0	[2.9]	0	0—126
161	Larynx	4	106	6	163	1	36	15	227	26	155	101—226
162	Lung	36	92	30	61	21	76	65	116	152	88	75—104
162.2	Pleura	[0.9]	0	1	143	[0.8]	0	[1.8]	0	1	24	1—133
170	Breast	[0.3]	0	[0.2]	0	1	386	2	239	3	190	39—557
177	Prostate	15	108	16	84	25	84	91	100	147	96	81—112
178	Testis	6	169	1	102	4	184	9	229	20	188	115—290
180.0	Kidney	4	83	9	131	4	64	19	95	36	95	67—132
181	Bladder	15	97	12	132	23	160	44	122	94	126	101—154
190	Melanoma	4	95	4	83	18	233	29	166	55	161	121—209
191	Other skin ^b	31	132	4	110	4	74	16	101	55	114	86—148
193	Brain	4	69	9	156	8	141	24	133	45	128	93—171
194	Thyroid	1	171	[1.2]	0	1	87	4	128	6	99	36—216
197	Connective tissue	1	145	1	79	2	212	5	127	9	132	60—250
201	Hodgkin's disease	[1.4]	0	1	66	3	263	3	79	7	90	36—185
200, 202	Non-Hodgkin's lymphoma	6	150	2	52	8	144	14	84	30	100	67—143
203	Multiple myeloma	1	51	2	84	2	62	8	102	13	84	45—144
204.3	Acute leukemia	3	161	2	116	5	290	8	151	18	170	101—268
204.0—2,4	Other leukemia	1	33	5	169	2	90	8	95	16	96	55—156
199	Unknown	2	151	3	95	2	30	30	213	37	147	103—202
140—204	All sites ^c	156	100	166	96	184	102	569	119	1075	109	102—115

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

associated with a high consumption of alcoholic beverages. Judged from the lung cancer rates, female journalists, especially in Finland, seem to have smoked more than the average population, whereas the men probably smoked less. The increased incidence of breast cancer and endometrial cancer indicates low parity among female journalists.

Administrators and managers: occupational group 12

Group 12 includes senior officials, managers and legislators working on behalf of governments, regional or local administrators, political parties, trade unions, and other organizations and enterprises. Almost 90% of the people in this occupational group are men.

Results

Both genders showed excess risks of skin and colon cancer and decreased risks of cancers of the lip, esophagus, and stomach. A significantly low risk of lung cancer was observed for the men (table 22), but the lung cancer risk for the women was significantly elevated (table 23). For the women, excess risks of breast cancer and ovarian cancer were observed, whereas the risk of cancer of the gallbladder was consistently decreased.

Comments

This occupational group shows the same cancer pattern as most other occupations with a higher social status. A diet rich in fruit, vegetables, and meat is supposed to produce a pattern of decreased incidence for cancers of the esophagus and stomach and a pattern of increased risk for colon cancer. Elevated risks of colon cancer and breast cancer have furthermore been found for people with low physical activity at work and in leisure time.

Table 21. Journalists, women (N=4883) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.1]	0	[0.2]	0	[0.1]	0	[0.3]	0	[0.6]	0	0—608
141	Tongue	[0.1]	0	1	340	[0.1]	0	1	264	2	245	30—885
143—144	Mouth	[0.1]	0	1	346	1	806	1	178	3	269	56—788
145—148	Pharynx	1	789	[0.4]	0	[0.1]	0	[0.6]	0	1	84	2—471
150	Esophagus	[0.2]	0	[0.9]	0	[0.1]	0	1	172	1	56	1—310
151	Stomach	[0.8]	0	4	71	3	217	4	83	11	87	43—155
153	Colon	4	149	6	116	4	125	10	78	24	100	64—149
154	Rectum	1	71	4	117	1	63	3	43	9	67	31—128
155.0	Liver	[0.3]	0	[0.9]	0	[0.2]	0	[1.4]	0	[2.8]	0	0—133
155.1	Gall bladder	[0.4]	0	1	58	[0.2]	0	1	38	2	40	5—144
157	Pancreas	1	108	2	63	[0.9]	0	2	40	5	50	16—116
160	Nose	[0.1]	0	[0.2]	0	[0.1]	0	[0.2]	0	[0.6]	0	0—661
161	Larynx	[0.2]	0	[0.2]	0	[0.1]	0	[0.3]	0	[0.7]	0	0—502
162	Lung	3	101	14	345	2	120	15	193	34	206	143—289
162.2	Pleura	[0.1]	0	[0.2]	0	[0.0]	0	[0.1]	0	[0.4]	0	0—922
170	Breast	17	152	49	145	23	241	77	128	166	145	124—169
171	Cervix uteri	3	85	6	186	[2.4]	0	11	121	20	109	67—169
172	Corpus uteri	3	118	15	201	2	88	20	154	40	158	113—215
175	Ovary	1	39	8	131	3	118	16	111	28	110	73—158
180.0	Kidney	[0.7]	0	4	143	1	140	6	131	11	125	62—223
181	Bladder	[0.9]	0	1	75	2	242	4	98	7	98	39—202
190	Melanoma	2	142	7	219	4	222	9	123	22	160	100—242
191	Other skin ^b	2	50	2	123	1	146	7	233	12	129	67—225
193	Brain	1	77	5	101	1	88	10	130	17	113	66—181
194	Thyroid	[0.3]	0	[2.8]	0	[0.7]	0	5	157	5	72	23—169
197	Connective tissue	[0.1]	0	[0.8]	0	[0.2]	0	1	72	1	41	1—230
201	Hodgkin's disease	[0.2]	0	1	152	[0.1]	0	1	112	2	106	13—385
200, 202	Non-Hodgkin's lymphoma	[0.7]	0	3	145	3	329	5	108	11	133	66—238
203	Multiple myeloma	[0.3]	0	3	223	[0.5]	0	3	139	6	139	51—303
204.3	Acute leukemia	[0.4]	0	1	93	[0.3]	0	1	57	2	58	7—208
204.0—2.4	Other leukemia	[0.3]	0	[1.2]	0	[0.3]	0	[1.8]	0	[3.6]	0	0—103
199	Unknown	1	351	2	105	1	86	4	74	8	92	40—181
140—204	All sites ^c	39	104	146	139	53	147	228	113	466	122	112—134

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 22.** Administrators and managers, men (N=207 596) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	38	36	12	21	30	40	30	41	110	35	29—43
141	Tongue	31	135	14	123	25	92	26	89	96	106	86—129
143—144	Mouth	44	96	9	80	33	86	45	100	131	94	79—111
145—148	Pharynx	60	102	15	73	43	93	65	102	183	97	84—112
150	Esophagus	87	93	32	84	58	80	74	86	251	87	76—98
151	Stomach	267	79	164	65	341	83	250	69	1022	75	70—79
153	Colon	650	128	186	147	560	115	611	121	2007	123	118—129
154	Rectum	465	110	127	109	409	120	348	95	1349	108	103—114
155.0	Liver	82	96	47	106	52	118	101	96	282	101	90—114
155.1	Gall bladder	45	87	23	96	30	110	45	111	143	100	85—118
157	Pancreas	241	97	121	103	213	99	235	90	810	96	90—103
160	Nose	28	123	12	139	11	60	17	95	68	100	78—127
161	Larynx	138	89	58	92	96	110	95	98	387	96	87—106
162	Lung	1521	92	455	53	713	81	621	74	3310	78	75—81
162.2	Pleura	27	74	12	107	24	97	12	47	75	77	60—96
170	Breast	14	116	4	129	4	50	13	108	35	100	69—138
177	Prostate	654	106	455	130	1206	115	1593	111	3908	113	110—117
178	Testis	108	105	21	180	43	102	52	139	224	115	101—132

(continued)

Table 22. Continued.

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	207	105	157	138	188	97	325	113	877	111	104—118
181	Bladder	670	103	161	102	508	109	636	119	1975	109	104—114
190	Melanoma	224	148	114	161	299	151	331	147	968	150	141—160
191	Other skin ^b	1210	126	66	104	215	121	333	138	1824	127	121—133
193	Brain	261	118	88	104	185	118	244	102	778	111	103—119
194	Thyroid	27	123	23	127	26	83	40	98	116	103	86—124
197	Connective tissue	31	120	28	145	33	121	53	99	145	115	98—135
201	Hodgkin's disease	43	93	17	82	35	119	44	95	139	97	82—115
200, 202	Non-Hodgkin's lymphoma	153	97	85	139	196	120	201	86	635	103	95—111
203	Multiple myeloma	91	110	50	123	95	90	105	90	341	99	89—110
204.3	Acute leukemia	66	90	38	141	61	117	86	117	251	111	98—126
204.0—2.4	Other leukemia	122	98	51	103	70	99	122	99	365	99	89—110
199	Unknown	57	103	37	69	184	84	182	88	460	86	79—94
140—204	All sites ^c	6514	101	2712	92	5892	103	7097	100	22215	100	99—101

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 23. Administrators and managers, women (N=28 469) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[1.3]	0	1	119	[0.8]	0	[1.6]	0	1	22	1—124
141	Tongue	2	115	[0.9]	0	1	100	3	138	6	103	38—225
143—144	Mouth	3	78	1	109	1	61	4	116	9	91	42—173
145—148	Pharynx	5	158	3	260	1	86	6	173	15	167	94—276
150	Esophagus	2	43	3	91	5	270	4	106	14	103	56—173
151	Stomach	17	72	16	89	15	75	25	84	73	80	63—101
153	Colon	88	112	20	123	49	109	94	117	251	114	101—129
154	Rectum	37	90	10	91	22	99	48	111	117	100	83—119
155.0	Liver	7	98	1	33	3	138	7	77	18	84	50—132
155.1	Gall bladder	8	63	2	34	2	56	11	66	23	59	38—89
157	Pancreas	26	93	10	93	13	93	29	90	78	92	73—114
160	Nose	[1.5]	0	1	170	[0.9]	0	1	71	2	45	5—164
161	Larynx	9	208	[0.6]	0	[0.7]	0	1	52	10	133	64—245
162	Lung	90	112	19	148	28	129	55	116	192	118	102—136
162.2	Pleura	[1.8]	0	[0.5]	0	[0.3]	0	[0.8]	0	[3.5]	0	0—107
170	Breast	353	135	132	152	134	119	416	123	1035	130	122—138
171	Cervix uteri	65	87	7	77	32	128	59	128	163	105	90—123
172	Corpus uteri	76	107	27	121	35	122	92	112	230	113	99—128
175	Ovary	79	121	22	129	31	102	99	118	231	117	103—134
180.0	Kidney	12	60	7	81	9	93	21	73	49	73	54—97
181	Bladder	29	110	4	89	14	118	43	167	90	131	106—162
190	Melanoma	35	124	11	141	23	130	38	103	107	118	98—143
191	Other skin ^b	124	120	8	145	9	93	27	145	168	123	105—143
193	Brain	28	92	18	143	18	140	48	112	112	114	94—137
194	Thyroid	4	71	3	46	9	136	14	85	30	85	57—122
197	Connective tissue	1	36	2	99	2	100	5	65	10	69	33—127
201	Hodgkin's disease	1	27	2	128	3	197	5	109	11	97	48—174
200, 202	Non-Hodgkin's lymphoma	19	110	2	33	10	85	26	95	57	91	69—118
203	Multiple myeloma	5	54	4	90	11	152	16	115	36	103	72—143
204.3	Acute leukemia	7	77	3	99	3	83	9	91	22	86	54—130
204.0—2.4	Other leukemia	8	81	4	106	5	127	7	65	24	85	54—126
199	Unknown	8	96	2	32	16	95	27	80	53	82	61—107
140—204	All sites ^c	1019	108	344	115	509	113	1290	109	3162	110	106—114

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Clerical workers: occupational group 13

Clerical workers include secretaries and clerical workers in banks and insurance companies, accounting and book-keeping clerks, keyboard-operating clerks, and other types of office workers.

Results

With more than 500 000 employees, the group of clerical workers is the largest single occupational group of women included in this study. There was a roughly 20% excess risk of skin melanoma in all 4 countries, for both the men and the women (tables 24 and 25). There was an excess risk of breast cancer among the women. For the men, the SIR for colon cancer was slightly elevated, whereas the SIR for stomach cancer was reduced. Table 25 also shows an excess risk of lung cancer for women in all countries except Denmark. The risk of testicular cancer was significantly elevated in Denmark and Sweden, but not in the 2 other countries. Lip cancer was ex-

remely rare for male clerical workers in all the Nordic countries.

Comments

A low risk of stomach cancer has usually been explained by a diet rich in fruit and vegetables. A high risk of colon cancer has been associated with sedentary work. It is difficult to assess whether passive smoking plays any role in the excess of lung cancer observed for the women. Finland, the country with highest SIR, had also the highest proportion of female smokers around 1970. Indoor work obviously gives protection against lip cancer. There is no evident explanation why clerical workers have an increased risk of testicular cancer in Denmark and Sweden.

Sale and agents: occupational group 14

Included in this group are finance and sales associate pro-

Table 24. Clerical workers, men (N=184 980) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	19	40	20	45	21	36	33	41	93	40	33–49
141	Tongue	9	85	15	170	29	130	26	81	79	107	85–133
143–144	Mouth	22	106	8	94	34	110	49	100	113	104	86–125
145–148	Pharynx	38	138	13	82	28	76	66	96	145	97	83–115
150	Esophagus	38	91	29	97	49	88	103	110	219	99	87–113
151	Stomach	141	91	181	91	276	87	354	88	952	89	83–94
153	Colon	263	114	118	119	427	113	633	114	1441	114	108–120
154	Rectum	184	97	100	110	289	110	407	102	980	104	98–111
155.0	Liver	43	113	38	109	40	117	124	108	245	110	97–125
155.1	Gall bladder	15	64	23	123	21	99	62	141	121	112	94–134
157	Pancreas	110	99	98	107	141	86	289	101	638	98	90–106
160	Nose	10	94	10	152	9	62	15	77	44	86	62–115
161	Larynx	62	90	29	60	64	94	124	119	279	96	86–109
162	Lung	687	94	516	77	579	86	982	108	2764	92	89–96
162.2	Pleura	15	90	7	80	16	82	22	77	60	82	62–105
170	Breast	5	90	2	81	6	95	18	136	31	112	76–159
177	Prostate	294	107	313	111	773	100	1646	105	3026	105	101–108
178	Testis	97	134	6	59	53	106	71	136	227	123	108–140
180.0	Kidney	104	116	94	108	151	99	352	112	701	109	101–118
181	Bladder	345	118	142	115	343	96	652	112	1482	109	104–115
190	Melanoma	91	114	68	122	253	139	325	127	737	128	119–138
191	Other skin ^b	564	127	54	108	151	111	295	111	1064	119	112–126
193	Brain	111	102	76	113	140	103	271	101	598	103	95–112
194	Thyroid	11	96	21	147	22	80	45	95	99	98	80–120
197	Connective tissue	9	68	13	85	17	74	65	107	104	93	77–113
201	Hodgkin's disease	30	113	11	64	28	103	55	98	124	98	82–116
200, 202	Non-Hodgkin's lymphoma	78	102	44	91	159	118	281	109	562	108	100–118
203	Multiple myeloma	40	107	25	80	78	96	122	96	265	96	85–108
204.3	Acute leukemia	42	118	21	98	32	75	84	101	179	98	85–114
204.0–2,4	Other leukemia	62	107	53	136	65	117	134	99	314	109	98–122
199	Unknown	28	112	31	73	133	79	216	96	408	89	80–98
140–204	All sites ^c	3049	102	2196	96	4415	99	8203	106	17863	102	100–103

^a International Classification of Diseases (7th revision). Sweden.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.

^c Excludes nonmelanoma skin cancer.

professionals and business service agents and trade brokers. They sell different types of insurance, real estate, travel services, and other business services and act as whole-sale representatives.

Results

This group had an excess risk of kidney cancer among the men in all 4 countries (table 26) and a low risk for women for all 4 countries combined (table 27). For men, there was also an excess risk for cancers of the colon, rectum, liver, larynx, and connective tissue, as well as for skin melanoma and acute leukemia. For the women, there was an excess risk of cancers of the breast, lung, and bladder.

Comments

This group showed different cancer profiles for the men and women. Among the men 20 out of 31 types of cancer showed an SIR higher than 100. Exposure to gasoline is suggested to increase the risk of kidney cancer,

and sales agents driving cars may have been exposed to gasoline. According to the SIR values in this study, male sales agents seem to consume more alcohol, and female sales agents more tobacco, than the general population. The results of an increased risk for soft tissue sarcoma and acute leukemia could be a basis for further investigation.

Shop managers and assistants: occupational group 15

Group 15 includes shop managers and shop sales persons who sell goods in retail establishments and explain the functions of these goods.

Results

For men, elevated risks were seen for cancers of the esophagus and liver (table 28). For women, low risks for cancers of the pharynx and larynx were seen (table 29).

Table 25. Clerical workers, women (N=499 422) — observed numbers (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	12	103	12	78	12	113	19	82	55	90	68—118
141	Tongue	14	88	31	164	17	116	32	97	94	114	92—139
143—144	Mouth	41	121	19	101	24	106	49	96	133	105	89—125
145—148	Pharynx	33	105	20	84	20	116	53	99	126	100	84—119
150	Esophagus	34	86	44	74	26	112	62	120	166	95	82—111
151	Stomach	152	76	304	84	208	83	396	93	1060	86	81—91
153	Colon	662	100	356	107	662	112	1158	101	2838	104	100—108
154	Rectum	361	104	255	116	335	114	624	100	1575	106	101—111
155.0	Liver	50	82	62	104	23	80	110	86	245	88	78—100
155.1	Gall bladder	82	81	86	77	39	90	173	74	380	78	70—86
157	Pancreas	214	94	224	110	176	102	479	107	1093	104	98—110
160	Nose	12	85	14	112	11	92	27	128	64	107	82—137
161	Larynx	32	76	13	104	9	96	32	105	86	91	73—113
162	Lung	739	99	360	138	376	119	820	115	2295	113	108—117
162.2	Pleura	16	102	13	117	8	179	10	80	47	107	79—143
170	Breast	3307	121	2819	130	2271	127	6198	113	14595	120	118—122
171	Cervix uteri	709	83	222	109	395	87	754	94	2080	90	86—94
172	Corpus uteri	770	121	602	125	475	109	1343	107	3190	114	110—118
175	Ovary	723	115	444	114	543	114	1404	106	3114	110	107—114
180.0	Kidney	173	100	193	107	136	102	362	87	864	96	89—102
181	Bladder	258	116	100	117	184	121	407	112	949	115	108—123
190	Melanoma	395	118	245	121	435	128	752	115	1827	120	114—125
191	Other skin ^b	1281	131	103	99	165	133	289	110	1838	125	119—131
193	Brain	311	98	314	100	233	109	712	102	1570	102	97—107
194	Thyroid	47	81	166	94	130	105	251	89	594	93	85—100
197	Connective tissue	35	119	48	102	30	96	115	94	228	99	87—113
201	Hodgkin's disease	54	126	37	91	27	103	76	98	194	104	90—119
200, 202	Non-Hodgkin's lymphoma	172	107	148	112	165	97	385	93	870	99	93—106
203	Multiple myeloma	62	82	84	97	80	90	182	94	408	92	83—101
204.3	Acute leukemia	77	88	59	86	54	103	142	92	332	92	82—102
204.0—2,4	Other leukemia	86	102	93	120	33	67	147	94	359	97	88—108
199	Unknown	75	108	106	87	190	90	444	92	815	92	86—99
140—204	All sites ^c	9688	106	7719	115	7487	111	19142	105	44036	108	107—109

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 26. Sale and agents, men (N=147 270) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	17	69	22	38	28	51	24	40	91	46	37–57
141	Tongue	2	36	15	125	20	98	31	127	68	109	85–138
143–144	Mouth	10	93	7	60	35	123	54	146	106	120	100–146
145–148	Pharynx	8	56	24	113	27	79	51	98	110	90	75–109
150	Esophagus	17	79	25	66	56	106	65	92	163	89	77–104
151	Stomach	63	81	187	74	287	95	229	76	766	82	76–88
153	Colon	145	125	156	122	436	122	437	105	1174	116	109–122
154	Rectum	113	117	131	113	286	115	316	106	846	111	104–119
155.0	Liver	22	113	62	143	36	111	97	113	217	120	105–137
155.1	Gall bladder	12	102	21	88	22	110	30	91	85	96	77–118
157	Pancreas	74	131	117	100	161	103	245	114	597	110	101–119
160	Nose	7	130	7	79	15	110	10	68	39	92	65–125
161	Larynx	38	106	61	97	90	141	100	126	289	120	107–134
162	Lung	367	98	660	78	605	95	725	106	2357	93	89–96
162.2	Pleura	6	71	8	68	9	49	7	33	30	50	34–72
170	Breast	4	143	8	249	4	67	6	60	22	100	63–152
177	Prostate	171	126	379	115	785	105	1192	102	2527	106	102–110
178	Testis	43	131	19	128	32	82	34	92	128	103	87–123
180.0	Kidney	70	152	145	125	176	123	273	115	664	122	113–132
181	Bladder	173	116	174	112	398	117	479	109	1224	113	107–120
190	Melanoma	44	111	87	110	202	128	227	118	560	119	110–130
191	Other skin ^b	297	132	56	90	144	112	190	96	687	112	104–121
193	Brain	55	100	106	113	142	117	218	108	521	110	101–120
194	Thyroid	4	72	15	76	23	94	33	94	75	88	69–111
197	Connective tissue	7	108	29	139	24	115	56	123	116	124	103–149
201	Hodgkin's disease	8	63	23	96	15	63	34	82	80	79	63–98
200, 202	Non-Hodgkin's lymphoma	32	84	75	116	130	106	203	104	440	105	95–115
203	Multiple myeloma	14	74	44	108	82	107	89	93	229	99	87–112
204.3	Acute leukemia	22	125	31	108	53	135	73	118	179	122	105–141
204.0–2,4	Other leukemia	29	100	55	109	64	122	102	100	250	107	95–121
199	Unknown	17	134	49	92	156	98	194	114	416	105	95–116
140–204	All sites ^c	1606	107	2819	96	4499	107	6067	104	14991	104	102–105

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 27.** Sale and agents, women (N=34 179) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.1]	0	4	116	1	69	3	129	8	109	47–215
141	Tongue	[0.2]	0	[3.5]	0	1	55	3	97	4	46	13–119
143–144	Mouth	1	315	5	136	6	201	5	103	17	143	84–230
145–148	Pharynx	1	362	4	87	1	48	3	63	9	77	35–146
150	Esophagus	[0.4]	0	7	51	2	59	1	18	10	43	21–79
151	Stomach	2	105	70	96	33	89	43	97	148	95	81–111
153	Colon	6	93	69	105	88	108	98	84	261	96	85–109
154	Rectum	7	207	46	104	41	101	73	118	167	112	96–130
155.0	Liver	[0.6]	0	9	72	2	50	13	97	24	79	51–117
155.1	Gall bladder	[1.0]	0	25	104	4	61	26	104	55	97	73–126
157	Pancreas	[2.3]	0	44	100	29	112	43	90	116	97	81–116
160	Nose	[0.1]	0	1	43	[1.6]	0	[2.0]	0	1	16	0–91
161	Larynx	[0.4]	0	3	130	1	84	2	78	6	93	34–203
162	Lung	5	73	66	130	45	117	83	127	199	123	107–142
162.2	Pleura	[0.2]	0	3	150	[0.5]	0	[1.2]	0	3	78	16–227
170	Breast	23	100	368	112	249	124	452	101	1092	109	103–116
171	Cervix uteri	8	118	19	53	44	101	56	95	127	88	74–104
172	Corpus uteri	7	116	101	117	53	105	107	98	268	106	94–120
175	Ovary	5	89	70	107	51	95	124	111	250	105	93–119

(continued)

Table 27. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	1	61	33	97	12	68	28	69	74	79	62—99
181	Bladder	4	186	20	110	29	133	47	125	100	125	103—152
190	Melanoma	3	118	29	100	36	115	39	83	107	98	81—118
191	Other skin ^b	10	114	21	92	24	135	33	119	88	114	91—140
193	Brain	3	113	50	106	23	101	42	74	118	91	76—109
194	Thyroid	[0.5]	0	28	115	10	84	16	75	54	93	70—122
197	Connective tissue	[0.3]	0	6	77	5	139	7	67	18	81	48—128
201	Hodgkin's disease	1	311	3	51	2	72	6	96	12	79	41—137
200, 202	Non-Hodgkin's lymphoma	2	138	30	128	32	151	35	91	99	117	95—143
203	Multiple myeloma	1	133	15	84	14	105	22	107	52	99	74—129
204.3	Acute leukemia	1	131	10	84	7	106	17	124	35	106	74—148
204.0—2.4	Other leukemia	[0.8]	0	13	85	8	110	6	38	27	69	46—101
199	Unknown	[0.7]	0	31	123	30	97	46	95	107	101	84—122
140—204	All sites ^c	80	99	1221	105	879	108	1560	96	3740	102	99—105

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 28. Shop managers and assistants, men (N=193 321) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	47	42	13	64	17	65	32	46	109	48	39—57
141	Tongue	24	100	9	183	4	39	39	129	76	109	86—137
143—144	Mouth	51	105	8	171	17	119	47	103	123	109	91—130
145—148	Pharynx	82	131	10	123	16	94	68	105	176	116	100—134
150	Esophagus	118	116	15	114	38	153	82	101	253	114	101—129
151	Stomach	335	89	63	71	131	93	291	85	820	86	81—93
153	Colon	638	113	52	110	173	102	463	96	1326	105	99—111
154	Rectum	489	104	50	123	128	109	350	101	1017	104	98—111
155.0	Liver	115	122	19	127	13	86	120	123	267	120	107—136
155.1	Gall bladder	61	105	8	95	10	107	32	85	111	97	81—117
157	Pancreas	296	108	38	91	72	99	226	91	632	99	92—107
160	Nose	20	81	1	29	6	91	13	72	40	76	54—103
161	Larynx	182	110	31	137	27	88	84	88	324	103	92—115
162	Lung	1819	99	196	68	296	98	778	97	3089	96	92—99
162.2	Pleura	35	88	4	85	4	45	17	65	60	75	57—97
170	Breast	16	120	3	243	3	104	10	84	32	109	74—154
177	Prostate	735	103	100	98	343	103	1339	106	2517	104	100—109
178	Testis	134	123	4	51	31	118	62	108	231	115	101—131
180.0	Kidney	253	118	57	127	70	101	305	106	685	111	103—120
181	Bladder	803	111	47	87	182	114	624	122	1656	114	109—120
190	Melanoma	176	111	42	119	100	113	330	128	648	120	111—130
191	Other skin ^b	1123	108	12	55	49	81	220	99	1404	104	99—110
193	Brain	248	105	39	94	72	112	228	87	587	97	90—106
194	Thyroid	21	87	6	70	17	130	41	91	85	93	75—115
197	Connective tissue	24	86	10	115	16	150	65	114	115	110	92—132
201	Hodgkin's disease	51	103	3	27	20	152	42	77	116	91	75—109
200, 202	Non-Hodgkin's lymphoma	164	96	23	89	59	95	241	101	487	98	89—107
203	Multiple myeloma	103	112	15	102	31	86	116	104	265	104	92—118
204.3	Acute leukemia	67	84	11	95	19	97	74	98	171	91	79—106
204.0—2.4	Other leukemia	146	105	15	82	31	125	109	91	301	100	89—112
199	Unknown	55	90	16	84	86	115	195	97	352	99	89—110
140—204	All sites ^c	7413	104	934	89	2080	103	6939	102	17366	102	100—103

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 29. Shop managers and assistants, women (N=291 803) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	9	110	6	60	11	115	19	111	45	100	73–134
141	Tongue	14	124	11	94	13	103	16	68	54	91	69–119
143–144	Mouth	21	85	12	102	16	79	29	78	78	83	66–104
145–148	Pharynx	18	86	9	61	8	53	29	78	64	73	56–93
150	Esophagus	35	118	39	103	19	85	39	96	132	101	85–120
151	Stomach	160	108	198	88	243	102	260	81	861	92	86–99
153	Colon	513	103	247	119	569	103	816	94	2145	101	97–105
154	Rectum	278	106	150	108	316	115	454	98	1198	105	99–111
155.0	Liver	40	88	30	80	28	105	93	95	191	92	80–106
155.1	Gall bladder	69	87	68	96	36	85	181	100	354	95	85–105
157	Pancreas	168	95	117	91	167	99	356	102	808	98	92–105
160	Nose	6	60	8	102	10	93	7	46	31	71	48–101
161	Larynx	25	88	3	38	6	71	14	67	48	73	54–97
162	Lung	535	102	176	106	312	112	539	106	1562	106	100–111
162.2	Pleura	12	104	7	103	7	188	15	166	41	132	95–179
170	Breast	1844	106	1400	107	1417	98	3430	95	8091	100	98–102
171	Cervix uteri	537	106	114	91	363	108	539	110	1553	107	101–112
172	Corpus uteri	485	105	310	101	343	92	831	94	1969	97	93–102
175	Ovary	469	110	245	101	435	111	952	106	2101	107	102–112
180.0	Kidney	127	100	118	103	97	80	266	86	608	90	84–98
181	Bladder	157	94	47	86	137	95	280	101	621	96	89–104
190	Melanoma	205	107	105	89	248	103	416	106	974	103	97–110
191	Other skin ^b	661	98	50	77	133	114	193	96	1037	98	93–105
193	Brain	190	94	177	95	177	105	436	95	980	96	91–103
194	Thyroid	27	73	90	89	75	84	181	103	373	93	84–103
197	Connective tissue	15	81	22	77	23	90	70	85	130	84	71–100
201	Hodgkin's disease	24	98	14	61	16	82	40	81	94	81	65–99
200, 202	Non-Hodgkin's lymphoma	118	105	71	88	149	101	306	104	644	101	94–110
203	Multiple myeloma	52	88	46	83	79	91	139	92	316	90	80–100
204.3	Acute leukemia	59	100	52	125	27	60	102	96	240	95	84–108
204.0–2.4	Other leukemia	60	96	39	80	44	93	112	96	255	93	82–105
199	Unknown	46	87	53	69	173	86	350	97	622	90	83–97
140–204	All sites ^c	6338	102	4117	100	5716	100	12259	97	28430	99	98–100

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Comments

The alcohol-related cancers showed an excess among men and a reduced risk among women, a finding which indicates a different type of work for each gender.

Farmers: occupational group 16

Group 16 includes field crop and vegetable growers, market-oriented animal producers, and related workers. The tasks performed include purchasing of seeds, fertilizer, and other supplies; maintenance of buildings and machinery; performance of farm operations; sowing, cultivating and harvesting crops; breeding, raising and tending animals; maintaining farm buildings, machinery and equipment.

Results

Male farmers represented the largest single occupational group in the present study. The risk of lip cancer was

elevated in all 4 countries, whereas almost all other types of cancer showed deficit risks (table 30). For the women, the incidence of multiple myeloma was elevated in all countries (table 31). For both genders, lung cancer and alcohol-associated cancers were among the lowest found for all the occupational groups included in our study. The study also showed low risks of colon cancer and rectum cancer among both genders.

Comments

The majority of the male farmers included in our study are self-employed. The female farmers are predominantly wives taking part in the activities of the family farm. Female farmers from Sweden represent less than 4% of the total number of persons; this finding indicates that female farmers in the 4 countries may have been defined differently across the 4 countries. About a 20% cancer deficit is seen in the overall cancer incidence for both male and female farmers. Such a low cancer incidence

Table 30. Farmers, men (N=436 387) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	358	176	617	150	237	151	270	181	1482	161	153–169
141	Tongue	16	39	57	82	13	25	16	29	102	47	39–57
143–144	Mouth	39	45	42	62	35	48	32	38	148	47	40–56
145–148	Pharynx	39	36	83	62	33	38	47	40	202	45	39–51
150	Esophagus	101	53	234	84	69	46	90	50	494	62	57–68
151	Stomach	700	98	1899	103	801	87	757	97	4157	98	95–101
153	Colon	757	70	664	75	780	75	861	82	3062	76	73–78
154	Rectum	743	84	732	86	565	79	646	86	2686	84	81–87
155.0	Liver	62	35	174	53	44	45	84	38	364	44	40–49
155.1	Gall bladder	77	69	149	86	47	76	49	57	322	75	67–83
157	Pancreas	375	72	684	82	350	75	378	70	1787	76	72–79
160	Nose	33	74	46	83	25	68	37	110	141	83	70–98
161	Larynx	108	36	292	68	59	34	58	31	517	47	43–52
162	Lung	1501	43	4757	75	755	42	673	40	7686	58	56–59
162.2	Pleura	18	24	36	51	9	18	7	14	70	29	22–36
170	Breast	19	76	13	61	15	94	20	84	67	78	60–99
177	Prostate	1277	89	2782	97	2474	99	3084	95	9617	96	94–98
178	Testis	130	90	53	99	76	119	45	98	304	99	88–111
180.0	Kidney	243	62	543	74	289	74	429	78	1504	73	69–76
181	Bladder	744	54	916	79	700	70	652	60	3012	65	63–68
190	Melanoma	179	69	392	100	244	70	298	79	1113	81	76–86
191	Other skin ^b	1303	68	480	102	405	101	510	97	2698	81	78–85
193	Brain	394	98	427	89	268	93	406	97	1495	94	90–99
194	Thyroid	34	81	99	94	68	113	74	102	275	98	87–110
197	Connective tissue	52	108	106	89	46	85	94	95	298	93	83–104
201	Hodgkin's disease	61	78	134	115	62	112	85	104	342	103	93–115
200, 202	Non-Hodgkin's lymphoma	318	103	363	92	314	96	436	98	1431	97	92–102
203	Multiple myeloma	170	98	292	103	215	94	285	120	962	104	98–111
204.3	Acute leukemia	175	121	173	99	107	97	135	95	590	103	95–112
204.0–2,4	Other leukemia	240	92	357	102	164	105	245	99	1006	99	93–106
199	Unknown	93	81	378	97	341	71	293	71	1105	79	74–84
140–204	All sites ^c	9276	70	17983	86	9397	77	11290	79	47946	79	78–79

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

is exceptional. Farmers have a lower prevalence of smokers and a lower intake of alcohol (23), and they are more physically active at work than the general population. An increased risk of multiple myeloma for female farmers is not known, but the lack of an excess among gardeners, who otherwise have a cancer pattern similar to that of farmers, suggests that etiologic factors in farming may be of importance (67).

Gardeners and related workers: occupational group 17

Group 17 includes gardeners and horticultural and nursery growers. They plan and carry out the necessary operations to grow vegetables, cultivate trees, shrubs, flowers, and other plants and to produce saplings, bulbs, and seeds for sale.

Results

Gardeners had a significantly low risk of all cancers combined for both men and women (tables 32 and 33). Lip cancer among men was the only type of cancer which showed an excess risk. Very low relative risks were found for both genders for lung cancer and alcohol-associated cancers. For women, low risks were seen for cancers of the breast and the genital organs.

Comments

Gardeners and farmers probably have a similar life-style, and gardeners also have the same cancer profile as farmers. They live mostly in rural districts with a lower incidence of cancer when compared with the urban population. Gardeners are physically active during their work, and the present study showed a low risk of colon cancer for both genders. Parity among agricultural workers is higher than among other women; this finding is reflected as low risks of cancers of the breast and, to some extent, also ovary and corpus uteri.

Table 31. Farmers, women (N =112 235) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	19	18	147	9	103	1	124	29	107	72—154
141	Tongue	2	27	8	71	15	138	1	97	26	85	55—124
143—144	Mouth	5	31	11	91	15	84	[1.6]	0	31	65	44—92
145—148	Pharynx	9	66	20	136	11	88	2	133	42	99	71—134
150	Esophagus	10	52	55	107	12	58	1	50	78	84	66—105
151	Stomach	72	75	257	106	188	85	19	121	536	93	86—101
153	Colon	283	87	164	75	426	86	36	89	909	84	79—90
154	Rectum	136	80	124	85	180	74	17	82	457	79	72—86
155.0	Liver	15	51	26	61	19	79	5	106	65	64	50—82
155.1	Gall bladder	54	105	78	93	32	81	9	101	173	94	81—110
157	Pancreas	84	74	117	76	114	73	17	101	332	75	68—84
160	Nose	2	32	7	96	5	53	[0.7]	0	14	59	32—99
161	Larynx	6	32	4	56	1	14	[0.8]	0	11	33	16—58
162	Lung	148	43	84	52	92	39	15	73	339	44	40—49
162.2	Pleura	3	40	3	49	3	95	[0.4]	0	9	52	24—100
170	Breast	869	77	614	74	998	83	106	79	2587	79	76—82
171	Cervix uteri	167	51	98	93	135	52	10	60	410	58	53—64
172	Corpus uteri	252	85	221	89	312	102	34	103	819	92	86—99
175	Ovary	231	84	183	100	308	95	36	107	758	93	86—100
180.0	Kidney	73	89	103	97	128	121	12	88	316	103	92—115
181	Bladder	56	51	51	83	93	71	8	61	208	66	58—76
190	Melanoma	96	79	71	99	170	92	10	77	347	89	80—99
191	Other skin ^b	281	65	75	91	87	81	8	81	451	71	65—78
193	Brain	116	90	109	91	130	95	19	112	374	93	84—103
194	Thyroid	27	116	47	81	78	112	7	115	159	101	87—118
197	Connective tissue	7	59	30	136	16	75	1	30	54	92	69—120
201	Hodgkin's disease	13	86	20	128	24	150	2	102	59	121	92—156
200, 202	Non-Hodgkin's lymphoma	49	68	73	103	109	86	7	56	238	84	74—96
203	Multiple myeloma	51	134	72	119	108	134	13	178	244	131	116—149
204.3	Acute leukemia	34	90	29	82	38	97	3	68	104	89	74—108
204.0—2,4	Other leukemia	38	95	56	113	48	110	6	113	148	107	91—125
199	Unknown	32	94	98	114	186	100	16	97	332	103	92—115
140—204	All sites ^c	3016	75	2970	87	4136	85	455	89	10577	83	81—84

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 32.** Gardeners and related workers, men (N=96 150) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	33	108	76	174	16	101	107	211	232	165	145—187
141	Tongue	5	80	9	98	5	90	9	46	28	69	46—100
143—144	Mouth	8	61	6	69	7	90	22	74	43	73	53—98
145—148	Pharynx	7	42	17	106	5	53	35	84	64	77	59—98
150	Esophagus	34	120	23	79	10	65	43	72	110	83	69—100
151	Stomach	95	89	184	94	73	81	280	107	632	97	90—105
153	Colon	124	77	75	76	85	81	288	81	572	80	74—87
154	Rectum	114	86	69	78	64	88	262	104	509	93	85—102
155.0	Liver	20	75	27	81	7	73	52	70	106	74	61—89
155.1	Gall bladder	13	78	17	93	6	99	24	84	60	86	66—111
157	Pancreas	58	75	84	94	34	74	166	91	342	86	78—96
160	Nose	[6.7]	0	5	75	3	79	8	68	16	55	31—89
161	Larynx	23	51	36	76	7	39	38	59	104	59	49—72
162	Lung	384	74	569	88	127	69	349	61	1429	74	71—78
162.2	Pleura	4	36	3	34	6	116	3	17	16	37	21—61
170	Breast	4	107	1	40	2	120	8	97	15	93	52—153
177	Prostate	185	87	245	94	210	89	949	91	1589	90	86—95
178	Testis	24	103	12	101	11	123	22	86	69	99	77—125

(continued)

Table 32. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	54	92	59	67	44	109	176	91	333	88	79—98
181	Bladder	152	74	104	87	82	82	292	79	630	80	74—86
190	Melanoma	39	98	57	94	36	89	113	78	245	86	75—97
191	Other skin ^b	284	99	45	93	50	128	157	90	536	98	90—106
193	Brain	48	79	64	89	24	75	174	111	310	96	86—108
194	Thyroid	4	63	9	59	4	61	19	69	36	65	45—89
197	Connective tissue	9	123	16	100	9	157	29	80	63	97	74—124
201	Hodgkin's disease	8	66	18	96	10	160	35	109	71	102	80—129
200, 202	Non-Hodgkin's lymphoma	41	88	62	125	33	96	136	86	272	95	84—106
203	Multiple myeloma	30	116	38	123	20	88	88	109	176	110	95—128
204.3	Acute leukemia	16	73	15	68	12	106	44	87	87	82	66—101
204.0—2,4	Other leukemia	40	103	42	109	16	103	80	94	178	100	86—116
199	Unknown	16	93	35	85	32	67	135	95	218	88	77—100
140—204	All sites ^c	1606	81	2029	90	1024	83	4268	87	8927	86	84—88

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 33. Gardeners and related workers, women (N=172 447) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	144	35	130	4	71	6	75	46	111	82—149
141	Tongue	1	102	27	98	4	56	4	37	36	78	54—108
143—144	Mouth	1	47	23	81	6	51	11	65	41	69	50—94
145—148	Pharynx	2	110	29	81	4	48	9	54	44	70	51—94
150	Esophagus	2	78	106	100	3	22	14	71	125	88	74—105
151	Stomach	14	110	541	97	154	108	154	101	863	100	93—107
153	Colon	31	73	403	80	265	82	360	88	1059	83	78—88
154	Rectum	21	93	270	79	142	89	189	88	622	84	78—91
155.0	Liver	3	76	73	76	13	83	40	86	129	80	67—95
155.1	Gall bladder	2	29	155	83	32	125	90	104	279	91	81—103
157	Pancreas	15	99	306	90	75	74	145	87	541	87	80—95
160	Nose	[0.9]	0	16	89	4	64	8	114	28	87	58—126
161	Larynx	2	80	12	64	3	63	1	11	18	52	31—81
162	Lung	26	57	199	49	61	39	110	48	396	47	43—52
162.2	Pleura	1	101	12	77	3	145	2	48	18	79	47—124
170	Breast	116	78	1841	73	595	75	1250	80	3802	76	73—78
171	Cervix uteri	32	75	186	68	103	59	100	50	421	61	55—67
172	Corpus uteri	31	76	607	88	173	85	365	93	1176	89	84—94
175	Ovary	25	68	457	89	227	105	349	89	1058	91	86—97
180.0	Kidney	8	73	258	95	83	119	126	88	475	96	88—105
181	Bladder	9	62	113	80	50	59	73	55	245	66	58—74
190	Melanoma	17	106	215	97	97	78	156	97	485	93	85—102
191	Other skin ^b	45	78	189	109	44	64	90	94	368	93	84—103
193	Brain	12	70	333	92	82	90	186	94	613	92	85—99
194	Thyroid	1	33	180	98	45	97	74	101	300	98	88—110
197	Connective tissue	3	191	68	113	8	56	28	77	107	96	79—115
201	Hodgkin's disease	4	202	50	114	7	66	24	113	85	110	88—136
200, 202	Non-Hodgkin's lymphoma	8	84	178	99	81	97	120	89	387	95	86—105
203	Multiple myeloma	5	99	143	101	60	115	69	96	277	103	91—115
204.3	Acute leukemia	7	140	89	98	38	148	43	91	177	105	90—121
204.0—2,4	Other leukemia	9	170	121	103	32	113	48	89	210	102	90—117
199	Unknown	9	201	185	95	112	93	159	94	465	95	87—104
140—204	All sites ^c	431	81	7509	83	2641	82	4725	84	15306	83	82—84

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Fishermen, whalers and sealers: occupational group 18

Group 18 includes fishermen and whale and seal hunters. They catch fish and gather other forms of aquatic life in coastal waters for sale or delivery to wholesale buyers or at markets. Whale and seal hunters are found only in Norway. They catch animals for meat, skin, and other products for sale. Due to the small numbers, the women have been included in occupational group 53.

Results

More than 60% of the persons included in our study came from Norway. A very high excess risk of lip cancer was found in all the Nordic countries (table 34). The risk of stomach cancer was elevated, whereas a low risk was found for malignant melanoma.

Comments

A high risk of lip cancer among outdoor workers and, in particular, fishermen and a low risk of malignant melanoma have been reported previously (68). Lack of vegetables in the diet may be one of the reasons for the increased incidence of stomach cancer.

Forestry workers: occupational group 19

Group 19 includes forestry workers and loggers. Forestry workers cultivate, conserve, and exploit forests for the delivery of forestry products to wholesale buyers. Due to the small numbers, the women have been included in occupational group 53.

Results

A significantly low risk of all cancers combined was found for forestry workers in all countries except Finland, mainly because of the low risks of lung cancer and all alcohol-associated cancers (table 35). Forestry workers show a significantly low risk for malignant melanoma and other skin cancer. A low risk was found for cancers of colon, prostate, testis, kidney, bladder, liver,

Table 34. Fishermen whalers and sealers, men (N=34 826) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	34	323	13	276	62	190	22	403	131	245	207–291
141	Tongue	1	43	[0.8]	0	10	85	1	48	12	71	37–123
143–144	Mouth	2	43	[0.8]	0	12	73	2	63	16	64	37–104
145–148	Pharynx	10	166	3	193	12	61	2	45	27	85	56–124
150	Esophagus	9	97	2	62	27	87	2	31	40	80	57–109
151	Stomach	37	110	23	108	293	161	38	135	391	148	134–163
153	Colon	53	105	7	69	178	84	37	97	275	89	79–100
154	Rectum	41	98	5	51	122	83	28	102	196	87	75–100
155.0	Liver	7	83	2	53	15	78	9	112	33	83	57–117
155.1	Gall bladder	[5.1]	0	2	101	16	132	1	32	19	85	51–133
157	Pancreas	33	135	10	104	117	126	14	71	174	118	102–137
160	Nose	4	173	1	158	8	101	4	313	17	140	81–224
161	Larynx	25	163	3	61	28	75	9	130	65	101	78–129
162	Lung	182	112	72	100	436	116	52	84	742	110	103–119
162.2	Pleura	1	27	[0.8]	0	2	19	1	53	4	24	6–60
170	Breast	2	164	1	404	3	87	1	113	7	121	49–249
177	Prostate	61	102	44	133	390	85	108	95	603	90	84–98
178	Testis	12	90	[0.7]	0	17	80	1	40	30	79	53–113
180.0	Kidney	27	137	8	95	98	118	19	91	152	115	98–135
181	Bladder	65	100	10	76	235	117	33	83	343	107	97–119
190	Melanoma	15	91	1	21	32	36	11	71	59	47	36–61
191	Other skin ^b	118	122	8	147	52	67	31	165	209	105	92–121
193	Brain	28	120	8	140	54	78	9	54	99	86	70–105
194	Thyroid	2	84	[1.3]	0	24	171	1	34	27	131	86–191
197	Connective tissue	4	146	3	213	6	50	4	104	17	84	49–135
201	Hodgkin's disease	5	94	1	71	18	132	3	90	27	114	75–166
200, 202	Non-Hodgkin's lymphoma	19	116	6	131	73	103	15	89	113	104	86–125
203	Multiple myeloma	6	73	4	123	39	85	11	127	60	91	69–117
204.3	Acute leukemia	3	40	2	97	17	73	5	93	27	71	47–103
204.0–2.4	Other leukemia	10	80	7	173	24	76	7	76	48	84	62–111
199	Unknown	8	145	6	134	119	124	11	72	144	119	101–140
140–204	All sites ^c	713	110	252	105	2539	102	497	94	4001	102	99–105

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

mouth and pharynx, pleura, and brain. Only the risk of cancer of the lip and stomach was markedly elevated.

Comments

Evidently forestry workers have a life-style which is protective against cancer causation, with the exception of the Finns, who are known to smoke a great deal. Forestry work is physically very hard, and therefore the relatively low risk of colon cancer in this study was expected. The typical cancer of outdoor workers – an increased risk of lip cancer and a decreased risk of skin melanoma – was observed also for forestry workers.

Miners and quarry workers: occupational group 20

Miners and quarry workers extract coal and solid minerals from underground or surface mines and granite, limestone, and other kinds of rocks from quarries. They set

up and operate machines which cut channels or drill blasting holes into the open face of mines and quarries. Due to the small numbers, women have been included in occupational group 53.

Results

The highest SIR for this occupational group was observed for lung cancer, and the lowest SIR occurred for pleural cancer (table 36). Except for Denmark, the table shows an elevated risk of stomach cancer and low risks of intestinal cancer. An excess risk was also found for lip cancer and nonacute leukemia.

Comments

The increased risk of lip cancer and decreased risk of skin melanoma suggest that miners in the Nordic countries mainly work in open quarries. Persons exposed to silica dust are known to be at increased risk of cancers of the stomach and lung, both of which showed an excess in our study. The small cohort of anthophyllite asbestos miners in Finland, with significant excess of both

Table 35. Forestry workers, men (N=75 177) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	10	218	75	144	18	112	49	124	152	135	115–158
141	Tongue	[0.9]	0	9	83	4	73	9	58	22	67	42–102
143–144	Mouth	[2.0]	0	12	114	5	65	14	59	31	71	48–100
145–148	Pharynx	[2.4]	0	9	47	7	76	20	60	36	56	39–78
150	Esophagus	3	70	47	140	13	84	26	55	89	89	71–109
151	Stomach	14	86	289	127	79	85	222	109	604	112	104–121
153	Colon	14	57	62	55	66	62	206	75	348	67	60–74
154	Rectum	15	74	75	73	67	91	194	98	351	89	80–99
155.0	Liver	[4.1]	0	20	52	6	61	40	69	66	60	46–76
155.1	Gall bladder	3	118	17	80	7	112	14	63	41	78	56–106
157	Pancreas	7	59	109	104	23	48	153	107	292	95	85–107
160	Nose	1	99	9	112	3	78	6	64	19	85	51–133
161	Larynx	6	88	66	116	9	50	36	70	117	88	73–106
162	Lung	65	82	1079	142	88	47	217	48	1449	98	93–103
162.2	Pleura	[1.7]	0	4	38	[5.2]	0	1	7	5	16	5–38
170	Breast	1	177	2	70	1	60	3	46	7	60	24–125
177	Prostate	25	76	200	69	196	78	706	88	1127	82	77–87
178	Testis	1	35	9	68	3	41	16	81	29	67	45–97
180.0	Kidney	2	23	72	69	35	86	124	81	233	76	67–86
181	Bladder	23	74	149	107	65	63	195	67	432	77	70–85
190	Melanoma	6	106	40	57	22	58	60	51	128	56	47–66
191	Other skin ^b	25	58	46	83	33	81	83	62	187	69	59–79
193	Brain	4	45	73	86	22	72	102	82	201	81	70–93
194	Thyroid	[0.9]	0	7	39	5	79	28	129	40	86	61–116
197	Connective tissue	[1.1]	0	15	80	7	124	29	102	51	95	70–124
201	Hodgkin's disease	1	59	21	98	9	153	35	140	66	122	94–155
200, 202	Non-Hodgkin's lymphoma	5	73	46	80	31	91	96	77	178	80	69–92
203	Multiple myeloma	2	51	24	66	26	112	63	100	115	91	76–109
204.3	Acute leukemia	5	154	22	86	10	88	34	86	71	89	70–112
204.0–2,4	Other leukemia	2	34	46	102	19	120	59	89	126	94	79–113
199	Unknown	4	153	62	130	36	74	98	88	200	95	83–109
140–204	All sites ^c	218	72	2734	104	905	72	3033	79	6890	86	84–88

^a International Classification of Diseases (7th revision).
Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and

Table 36. Miners and quarry workers, men (N=22 555) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	3	194	12	135	18	178	15	141	48	154	114–204
141	Tongue	[0.3]	0	[1.8]	0	5	138	3	70	8	80	34–157
143–144	Mouth	[0.7]	0	3	168	4	79	5	77	12	86	44–149
145–148	Pharynx	2	240	5	154	5	82	1	11	13	67	36–115
150	Esophagus	1	70	10	174	8	83	10	80	29	99	66–142
151	Stomach	3	56	56	145	82	148	83	155	224	146	128–167
153	Colon	9	112	17	88	59	91	63	86	148	89	76–105
154	Rectum	8	119	13	74	35	77	48	91	104	85	70–103
155.0	Liver	1	74	6	91	7	118	15	99	29	100	67–143
155.1	Gall bladder	2	238	4	111	3	82	2	34	11	79	39–141
157	Pancreas	2	51	24	134	32	112	32	84	90	102	82–125
160	Nose	[0.3]	0	1	73	1	41	2	77	4	59	16–151
161	Larynx	3	131	10	102	9	77	16	115	38	101	72–139
162	Lung	19	72	266	203	162	139	179	149	626	159	147–172
162.2	Pleura	[0.6]	0	1	57	[3.3]	0	1	26	2	21	3–77
170	Breast	1	533	[0.5]	0	[1.1]	0	1	57	2	57	7–206
177	Prostate	8	75	49	100	134	96	183	89	374	92	84–102
178	Testis	[1.1]	0	[2.1]	0	9	138	3	45	12	73	38–127
180.0	Kidney	[3.0]	0	15	85	35	135	50	120	100	113	93–138
181	Bladder	8	77	22	93	50	81	66	86	146	84	72–99
190	Melanoma	1	50	4	34	19	69	19	56	43	57	41–77
191	Other skin ^b	5	35	12	129	26	110	33	95	76	92	73–116
193	Brain	3	97	7	50	14	65	32	90	56	75	57–98
194	Thyroid	[0.3]	0	2	67	4	92	5	80	11	79	40–142
197	Connective tissue	1	273	[3.1]	0	4	107	8	100	13	85	45–146
201	Hodgkin's disease	[0.6]	0	2	57	4	96	12	163	18	115	68–181
200, 202	Non-Hodgkin's lymphoma	2	85	11	113	21	95	33	96	67	98	76–125
203	Multiple myeloma	[1.3]	0	10	162	10	71	22	131	42	109	79–148
204.3	Acute leukemia	1	91	9	209	5	70	4	37	19	81	49–127
204.0–2,4	Other leukemia	2	102	15	197	9	94	31	173	57	154	116–199
199	Unknown	[0.9]	0	10	123	39	133	32	107	81	119	94–148
140–204	All sites ^c	90	89	599	135	806	105	1042	102	2537	108	104–113

^a International Classification of Diseases (7th revision).
^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.
^c Excludes nonmelanoma skin cancer.

mesothelioma and lung cancer, seems to have had a negligible effect on the joint Nordic results (47).

Seamen: occupational group 21

All types of seamen are included in group 21, both sailors working on deck and in engine rooms. Ship deck crews and related workers carry out deck duties on board ships. The ship deck officers command and navigate ships. Ship engineers control and participate in the operation, maintenance, and repair of the mechanical and electrical machinery on board. Due to the small numbers, women have been included in occupational group 53.

Results

More than 50% of the seamen in our study were from Norway. For all cancers combined, the risk was similarly increased in all countries except Finland (table 37).

The excess was attributable to lung cancer and alcohol-associated cancers. There was a high excess risk of pleural cancer in all 4 countries, whereas an excess of kidney cancer was seen only for Finland. The SIR for non-melanoma skin cancer tended to be above 100 and that for nonacute leukemia below 100.

Comments

Excess risk of lung cancer and alcohol-associated cancers among seamen have been attributed to a high consumption of smoking and alcoholic beverages (69). Asbestos has been widely used in almost all types of ships, where the engineers in particular have been exposed. Previously, seamen often had a diet that differed from that of the general population, with a tendency towards more hot meals, which might be an explanation for the excess risk of cancer of the digestive tract. The different cancer pattern for Finnish seamen in comparison with that of seamen from the other countries may be due to different

Table 37. Seamen, men (N=55 580) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	18	159	14	132	30	98	10	129	72	120	94–151
141	Tongue	7	263	[2.3]	0	15	120	3	91	25	121	78–179
143–144	Mouth	11	220	2	94	34	199	9	183	56	192	145–249
145–148	Pharynx	12	179	5	127	35	172	11	158	63	166	127–212
150	Esophagus	11	116	13	188	39	137	15	166	78	144	114–180
151	Stomach	41	122	46	99	213	135	38	98	338	122	110–136
153	Colon	63	125	23	97	216	112	59	110	361	112	101–125
154	Rectum	44	106	23	108	150	111	40	104	257	109	96–123
155.0	Liver	19	226	8	100	36	212	18	163	81	182	145–226
155.1	Gall bladder	2	40	4	91	10	96	2	47	18	75	44–118
157	Pancreas	30	123	21	97	94	115	33	119	178	114	99–133
160	Nose	2	81	[1.6]	0	3	38	2	100	7	50	20–104
161	Larynx	21	130	12	104	70	193	22	212	125	168	141–201
162	Lung	239	148	163	105	585	169	150	169	1137	151	143–160
162.2	Pleura	8	210	5	230	16	155	8	275	37	193	136–266
170	Breast	3	240	[0.6]	0	1	29	2	153	6	90	33–196
177	Prostate	65	121	81	132	362	103	177	122	685	112	104–121
178	Testis	16	85	2	67	31	81	3	45	52	78	58–102
180.0	Kidney	20	97	36	168	87	107	29	92	172	111	96–129
181	Bladder	64	99	36	126	218	121	70	123	388	117	106–130
190	Melanoma	17	85	14	93	118	102	30	107	179	100	86–116
191	Other skin ^b	134	132	13	112	82	122	41	162	270	131	117–148
193	Brain	24	89	19	106	83	102	25	87	151	97	83–114
194	Thyroid	[2.7]	0	2	53	20	122	4	79	26	93	61–136
197	Connective tissue	5	159	2	51	9	69	13	206	29	109	73–157
201	Hodgkin's disease	4	60	7	151	23	134	7	113	41	118	85–160
200, 202	Non-Hodgkin's lymphoma	16	90	10	83	59	79	31	117	116	88	74–106
203	Multiple myeloma	5	61	7	94	42	103	11	89	65	94	73–120
204.3	Acute leukemia	8	98	7	129	26	113	3	35	44	97	71–131
204.0–2.4	Other leukemia	8	63	6	65	15	53	13	97	42	66	47–89
199	Unknown	8	143	10	101	114	136	26	117	158	130	111–152
140–204	All sites ^c	807	121	593	110	2832	122	928	122	5160	120	117–124

^a International Classification of Diseases (7th revision).
^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.

types of ships; Finland does not border on an ocean like the other countries do. The high risk of kidney cancer among Finnish seamen may be due to exposure to gasoline and other carcinogenic agents.

Transport workers: occupational group 22

Group 22 includes railway staff, bus and train staff, except drivers and operators, aircraft pilots, traffic supervisors and other transport and communication workers.

Results

Ninety-five percent of the employees in this group were men. They tended to have cancers of the esophagus and pharynx, whereas the incidence of the other cancers was close to the national average (table 38). For the women,

excess risks were seen for cancer of the pancreas, lung, and breast and for malignant melanoma (table 39).

Comments

The majority of men in this occupational category belong to the group of railway and bus staff. The low risks of lung and alcohol-associated cancers are probably related to workplace restrictions on smoking and the consumption of alcohol. The results for the women were based on 445 cancer cases only, and therefore they were difficult to evaluate.

Drivers: occupational group 23

Group 23 includes drivers of cars, taxis, vans, buses, motorcycles, trams, and light and heavy trucks. Their tasks include driving and tending their vehicles in order to transport materials, goods, and passengers.

Table 38. Transport workers, men (N=78 684) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	22	96	23	69	32	123	31	84	108	90	75–109
141	Tongue	3	58	4	61	10	108	12	77	29	79	53–114
143–144	Mouth	10	97	6	91	16	122	20	83	52	96	72–126
145–148	Pharynx	9	68	7	58	14	89	25	72	55	73	55–95
150	Esophagus	8	39	12	56	28	113	23	51	71	63	50–80
151	Stomach	65	90	120	84	138	99	164	90	487	91	83–99
153	Colon	93	85	70	97	182	110	259	101	604	100	93–109
154	Rectum	85	93	71	108	116	100	184	98	456	99	90–108
155.0	Liver	16	86	23	91	13	87	45	86	97	87	71–106
155.1	Gall bladder	13	120	13	95	10	110	22	109	58	108	82–139
157	Pancreas	46	86	68	101	93	128	125	92	332	101	91–112
160	Nose	5	99	5	97	8	126	9	92	27	103	68–149
161	Larynx	36	102	30	80	29	95	54	102	149	95	81–112
162	Lung	410	113	360	72	275	90	406	91	1451	90	85–94
162.2	Pleura	10	126	8	125	5	60	15	116	38	106	75–146
170	Breast	2	79	4	228	3	107	7	115	16	121	69–197
177	Prostate	130	104	187	100	347	100	715	103	1379	102	96–107
178	Testis	16	76	4	63	16	112	18	108	54	93	70–121
180.0	Kidney	55	127	71	107	68	102	165	106	359	108	98–120
181	Bladder	177	124	90	100	157	99	274	98	698	104	97–112
190	Melanoma	35	104	36	88	77	112	138	114	286	109	97–122
191	Other skin ^b	240	114	39	111	63	107	119	102	461	110	100–120
193	Brain	61	124	43	87	57	104	150	118	311	111	99–124
194	Thyroid	8	168	14	135	11	102	21	99	54	115	86–150
197	Connective tissue	6	107	10	92	9	96	20	72	45	84	61–112
201	Hodgkin's disease	11	110	12	102	9	90	15	66	47	86	63–115
200, 202	Non-Hodgkin's lymphoma	28	82	32	92	46	82	107	87	213	86	75–98
203	Multiple myeloma	18	101	26	111	40	112	47	78	131	95	80–113
204.3	Acute leukemia	16	101	13	86	20	114	29	78	78	91	72–113
204.0–2,4	Other leukemia	29	109	30	106	23	96	68	108	150	106	90–124
199	Unknown	16	133	19	63	73	99	88	82	196	88	76–101
140–204	All sites ^c	1463	104	1457	87	1969	101	3502	97	8391	97	95–99

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Results

This group of workers consisted predominantly of men. Male drivers in most countries had elevated risks of cancers of the larynx and the lung and low risks of malignant melanoma, pleural cancer, and connective tissue (table 40). Among the women, an excess risk of alcohol-associated cancer was found for Denmark and Norway, and cancers of the rectum and cervix were in excess particularly in Finland (table 41).

Comments

Many drivers in cities are exposed to exhaust, and they probably smoke more than the general population. It seems that women in this traditionally male profession tend to have adopted male drinking habits and therefore have an increased risk of alcohol-related types of cancer. An excess of cervical cancer is often linked with a higher-than-average number of sexual partners.

Postal and communication workers: occupational group 24

Group 24 includes all postal workers such as mail carriers, sorting clerks, and telephone switchboard operators. Communication workers include telegraph operators and other types of communication workers.

Results

For the men, an excess risk of malignant melanoma and other skin cancer, and a low risk of lip cancer, was observed (table 42). For the women, an excess risk of breast cancer could be seen (table 43).

Comments

Generally the SIR values for this occupational group were close to unity. Post and telecommunication workers apparently lead a way of life which is close to the Nordic average in terms of prevalence of factors contributing to cancer causation. The majority of men are prob-

Table 39. Transport workers, women (N=4214) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.0]	0	[0.6]	0	[0.1]	0	1	612	1	117	3—651
141	Tongue	[0.0]	0	[0.7]	0	[0.1]	0	1	458	1	102	3—566
143—144	Mouth	[0.0]	0	2	295	[0.1]	0	[0.3]	0	2	171	21—619
145—148	Pharynx	[0.0]	0	[0.9]	0	[0.1]	0	[0.4]	0	[1.4]	0	0—267
150	Esophagus	[0.0]	0	[2.4]	0	[0.1]	0	[0.4]	0	[2.9]	0	0—127
151	Stomach	[0.1]	0	13	99	2	165	3	98	18	102	61—162
153	Colon	[0.5]	0	16	133	3	105	11	132	30	126	85—180
154	Rectum	1	396	11	132	2	141	6	133	20	138	84—213
155.0	Liver	[0.0]	0	2	89	[0.1]	0	1	106	3	89	18—260
155.1	Gall bladder	[0.1]	0	5	115	1	470	1	58	7	110	44—227
157	Pancreas	[0.2]	0	12	151	[0.8]	0	9	267	21	170	105—260
160	Nose	[0.0]	0	[0.4]	0	[0.1]	0	[0.1]	0	[0.6]	0	0—566
161	Larynx	[0.0]	0	2	404	[0.1]	0	[0.2]	0	2	259	31—936
162	Lung	2	381	19	185	2	128	5	100	28	161	107—233
162.2	Pleura	[0.0]	0	1	252	[0.0]	0	[0.1]	0	1	193	5—1075
170	Breast	1	55	96	142	9	105	30	87	136	121	102—143
171	Cervix uteri	[0.6]	0	12	168	3	137	4	85	19	130	78—203
172	Corpus uteri	[0.4]	0	21	114	2	93	6	69	29	97	65—140
175	Ovary	1	232	12	88	3	129	9	103	25	99	64—147
180.0	Kidney	[0.1]	0	11	157	[0.6]	0	2	66	13	121	64—206
181	Bladder	[0.2]	0	3	88	[0.7]	0	3	111	6	86	31—186
190	Melanoma	[0.2]	0	6	100	4	248	10	268	20	173	106—267
191	Other skin ^b	1	146	4	104	[0.6]	0	[1.9]	0	5	71	23—166
193	Brain	[0.2]	0	4	40	1	97	6	136	11	71	35—126
194	Thyroid	[0.0]	0	5	100	1	169	1	60	7	96	39—198
197	Connective tissue	[0.0]	0	1	64	[0.2]	0	[0.8]	0	1	40	1—222
201	Hodgkin's disease	[0.0]	0	[1.1]	0	[0.1]	0	1	214	1	57	1—316
200, 202	Non-Hodgkin's lymphoma	[0.1]	0	7	153	3	366	2	70	12	144	74—251
203	Multiple myeloma	[0.1]	0	[3.5]	0	[0.4]	0	[1.5]	0	[5.4]	0	0—68
204.3	Acute leukemia	[0.1]	0	3	130	1	395	2	199	6	165	61—359
204.0—2.4	Other leukemia	[0.1]	0	2	70	1	420	[1.1]	0	3	70	15—206
199	Unknown	[0.1]	0	5	108	2	194	1	28	8	87	37—171
140—204	All sites ^c	7	111	275	119	41	126	122	100	445	113	103—124

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

ably mail carriers, while a higher proportion of women are telephone and telegraph operators. A report of an excess risk of breast cancer among telegraph operators has been published (70), but in the present study only a 10% excess was found.

Textile workers: occupational group 25

Occupational group 25 includes all types of textile work, such as operators of fiber-preparing, spinning, winding, weaving, knitting, sewing, bleaching, dyeing and fur-preparing machines.

Results

Generally, the cancer incidence for this occupational group was close to the national averages (tables 44 and 45). For the men a low risk of cancers of the lip and larynx was observed across the countries. For the women,

there was an elevated risk for cervical cancer, whereas the risk for nasal cancer was significantly low.

Comments

The low risk of nasal cancer among textile workers suggests that textile dust probably does not have as carcinogenic an effect as wood dust does in the nose. Sewing work is sedentary, and this characteristic may be linked with the slightly increased risk of cancer among the women.

Shoe and leather workers: occupational group 26

Shoe and leather workers produce and repair footwear, handbags, and the like. Leather workers treat hides and skins in solutions and apply finishing products to convert them into leather.

Table 40. Drivers, men (N=259 696) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	107	133	83	89	58	98	100	132	348	113	102—125
141	Tongue	16	88	25	122	31	135	34	104	106	113	93—136
143—144	Mouth	35	99	16	81	31	98	49	100	131	96	81—114
145—148	Pharynx	45	97	37	104	42	111	72	104	196	104	90—119
150	Esophagus	76	108	50	84	73	130	95	109	294	107	96—121
151	Stomach	297	117	400	100	353	111	405	109	1455	108	103—114
153	Colon	406	107	226	110	406	107	545	104	1583	106	101—112
154	Rectum	310	98	215	117	297	112	375	100	1197	105	99—111
155.0	Liver	70	110	64	95	41	120	120	113	295	109	97—122
155.1	Gall bladder	46	119	48	127	20	95	48	117	162	117	100—137
157	Pancreas	233	126	196	105	150	91	291	108	870	108	101—116
160	Nose	14	80	16	108	22	148	19	97	71	106	83—134
161	Larynx	154	131	125	122	91	131	113	111	483	123	113—135
162	Lung	1665	135	1284	96	940	138	1042	121	4931	120	117—123
162.2	Pleura	23	83	17	86	13	66	14	49	67	70	54—89
170	Breast	8	87	2	38	6	92	10	77	26	77	50—112
177	Prostate	409	92	495	102	736	97	1351	99	2991	98	94—102
178	Testis	76	76	26	97	51	92	46	68	199	80	69—92
180.0	Kidney	147	98	255	131	171	110	322	104	895	111	104—118
181	Bladder	546	112	256	104	376	105	625	113	1803	110	105—115
190	Melanoma	99	79	105	76	129	67	220	78	553	75	69—81
191	Other skin ^b	655	89	72	74	126	93	239	99	1092	90	85—96
193	Brain	171	96	178	108	124	87	224	78	697	90	84—97
194	Thyroid	16	90	36	105	22	77	54	108	128	98	82—116
197	Connective tissue	16	77	30	84	12	51	54	86	112	79	65—95
201	Hodgkin's disease	39	98	34	81	30	104	59	96	162	94	81—110
200, 202	Non-Hodgkin's lymphoma	131	106	100	93	137	99	258	99	626	100	92—108
203	Multiple myeloma	58	94	55	84	77	94	128	106	318	96	86—108
204.3	Acute leukemia	65	114	56	117	41	94	93	112	255	110	97—125
204.0—2,4	Other leukemia	84	89	83	103	65	116	135	104	367	101	92—112
199	Unknown	38	91	74	88	171	101	217	100	500	98	89—107
140—204	All sites ^c	5456	111	4720	101	4824	107	7682	104	22682	105	104—107

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 41.** Drivers, women (N=9911) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.2]	0	[0.2]	0	[0.2]	0	[0.7]	0	[1.3]	0	0—281
141	Tongue	1	354	2	1003	[0.3]	0	[1.1]	0	3	165	34—484
143—144	Mouth	[0.6]	0	[0.2]	0	2	485	3	181	5	174	56—406
145—148	Pharynx	3	556	1	397	[0.3]	0	[1.7]	0	4	143	39—366
150	Esophagus	[0.7]	0	[0.7]	0	1	221	4	238	5	141	46—329
151	Stomach	3	84	7	178	2	41	12	87	24	92	59—137
153	Colon	9	75	7	196	12	108	38	103	66	104	80—132
154	Rectum	9	143	8	333	10	181	22	109	49	143	105—188
155.0	Liver	[1.1]	0	[0.7]	0	1	186	6	145	7	109	44—225
155.1	Gall bladder	[1.9]	0	[1.3]	0	[0.9]	0	10	131	10	86	41—158
157	Pancreas	2	48	1	44	5	146	15	103	23	94	60—142
160	Nose	[0.2]	0	[0.1]	0	[0.2]	0	2	295	2	157	19—567
161	Larynx	3	410	[0.1]	0	[0.2]	0	3	312	6	301	110—654
162	Lung	9	68	2	71	7	126	28	123	46	103	76—138
162.2	Pleura	1	359	[0.1]	0	[0.1]	0	[0.4]	0	1	116	3—648
170	Breast	32	71	19	90	33	112	141	82	225	84	73—95
171	Cervix uteri	18	134	6	284	8	117	35	144	67	143	111—182
172	Corpus uteri	10	87	6	117	7	94	33	83	56	88	66—114
175	Ovary	7	65	6	150	11	138	32	76	56	86	65—112

(continued)

Table 41. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	1	32	1	52	[2.4]	0	15	112	17	81	47—130
181	Bladder	6	148	[1.0]	0	5	171	16	136	27	137	90—200
190	Melanoma	3	60	3	158	[4.9]	0	19	96	25	79	51—117
191	Other skin ^b	22	131	2	172	2	85	7	83	33	115	79—161
193	Brain	5	97	2	66	1	29	30	138	38	114	81—157
194	Thyroid	[0.9]	0	2	124	2	110	6	69	10	77	37—141
197	Connective tissue	[0.5]	0	[0.5]	0	[0.5]	0	5	131	5	94	31—220
201	Hodgkin's disease	[0.6]	0	1	267	[0.4]	0	2	86	3	80	17—234
200, 202	Non-Hodgkin's lymphoma	1	36	1	74	2	68	17	130	21	104	64—159
203	Multiple myeloma	2	144	2	209	2	113	5	80	11	106	53—189
204.3	Acute leukemia	2	138	[0.7]	0	3	325	6	123	11	139	69—248
204.0—2.4	Other leukemia	2	134	[0.8]	0	[1.0]	0	2	40	4	48	13—123
199	Unknown	[1.3]	0	[1.3]	0	6	146	23	148	29	130	87—187
140—204	All sites ^c	131	84	81	117	124	107	581	100	917	99	93—106

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 42. Postal and communication workers, men (N=47 491) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	11	83	4	27	8	68	10	45	33	53	37—75
141	Tongue	2	62	5	170	2	45	13	150	22	114	71—172
143—144	Mouth	11	183	3	105	2	33	20	151	36	128	89—177
145—148	Pharynx	6	74	4	75	9	123	19	102	38	97	69—133
150	Esophagus	7	63	7	73	10	89	32	121	56	96	72—124
151	Stomach	37	97	62	97	71	107	104	90	274	97	86—109
153	Colon	48	83	39	121	90	116	169	109	346	107	96—119
154	Rectum	39	81	37	126	50	93	117	105	243	100	88—114
155.0	Liver	10	102	17	153	8	113	39	119	74	122	96—153
155.1	Gall bladder	4	71	9	149	1	22	18	144	32	112	76—158
157	Pancreas	37	132	32	108	44	130	86	107	199	116	101—133
160	Nose	[2.9]	0	2	90	4	138	8	151	14	105	58—177
161	Larynx	12	62	18	113	13	97	31	108	74	95	75—120
162	Lung	196	104	163	75	107	79	308	121	774	97	91—104
162.2	Pleura	5	112	4	139	[3.9]	0	4	51	13	68	36—117
170	Breast	[1.4]	0	1	124	1	80	4	109	6	84	31—183
177	Prostate	67	114	83	96	162	98	464	102	776	101	94—109
178	Testis	22	110	3	89	12	124	10	82	47	104	76—138
180.0	Kidney	22	91	30	104	24	78	87	101	163	96	82—112
181	Bladder	68	91	48	121	79	108	180	111	375	107	97—118
190	Melanoma	29	125	19	101	37	105	92	139	177	123	106—143
191	Other skin ^b	146	123	10	63	36	126	102	135	294	123	110—138
193	Brain	27	86	14	62	27	102	80	113	148	98	83—115
194	Thyroid	5	166	3	63	2	36	14	112	24	93	60—139
197	Connective tissue	5	141	5	99	5	108	14	86	29	98	66—141
201	Hodgkin's disease	10	137	4	70	1	18	19	130	34	103	71—144
200, 202	Non-Hodgkin's lymphoma	11	54	22	139	31	115	86	122	150	112	96—132
203	Multiple myeloma	7	75	8	78	19	114	38	107	72	100	78—126
204.3	Acute leukemia	11	118	4	57	6	69	19	84	40	84	60—114
204.0—2.4	Other leukemia	15	104	10	79	18	156	33	87	76	99	78—124
199	Unknown	5	76	17	125	38	109	63	100	123	104	88—125
140—204	All sites ^c	743	97	699	94	905	99	2340	108	4687	102	99—105

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 43. Postal and communication workers, women (N=63 017) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	228	1	25	3	154	2	54	7	69	28—143
141	Tongue	[0.6]	0	5	115	2	76	6	115	13	101	54—173
143—144	Mouth	1	75	3	67	2	49	8	96	14	77	42—128
145—148	Pharynx	[1.1]	0	4	71	3	97	9	104	16	87	50—141
150	Esophagus	2	124	17	109	3	70	7	82	29	97	65—139
151	Stomach	6	74	65	75	33	72	66	97	170	81	70—95
153	Colon	28	104	101	128	103	96	193	103	425	106	97—117
154	Rectum	12	85	48	90	59	111	104	102	223	100	88—114
155.0	Liver	3	122	21	143	7	136	23	111	54	125	94—163
155.1	Gall bladder	7	161	33	117	9	113	32	84	81	103	82—128
157	Pancreas	11	115	58	113	31	98	70	95	170	102	88—119
160	Nose	[0.5]	0	4	137	4	186	3	89	11	122	61—219
161	Larynx	2	131	3	100	5	293	2	40	12	107	55—187
162	Lung	27	96	65	102	66	116	108	92	266	100	89—113
162.2	Pleura	2	328	5	197	1	128	1	50	9	152	70—289
170	Breast	102	112	472	106	382	121	938	108	1894	110	105—115
171	Cervix uteri	20	77	38	83	67	85	122	102	247	91	81—103
172	Corpus uteri	26	106	99	87	81	104	207	99	413	97	88—107
175	Ovary	27	119	105	121	99	117	201	94	432	106	96—116
180.0	Kidney	7	102	44	102	28	117	68	99	147	103	88—121
181	Bladder	11	121	23	106	40	144	63	106	137	116	98—137
190	Melanoma	10	103	47	119	63	108	106	109	226	110	97—125
191	Other skin ^b	44	124	26	100	18	80	41	97	129	102	86—122
193	Brain	10	96	68	106	31	83	122	112	231	104	92—119
194	Thyroid	[1.9]	0	33	99	25	117	37	86	95	96	77—117
197	Connective tissue	1	104	10	99	6	109	19	100	36	101	71—140
201	Hodgkin's disease	2	161	11	142	2	44	9	79	24	96	62—143
200, 202	Non-Hodgkin's lymphoma	3	50	28	95	26	86	50	76	107	81	67—98
203	Multiple myeloma	1	32	26	120	17	104	32	100	76	104	82—130
204.3	Acute leukemia	3	97	18	120	3	32	20	83	44	85	62—114
204.0—2,4	Other leukemia	1	30	16	87	9	100	29	114	55	98	74—127
199	Unknown	1	35	31	103	32	83	69	88	133	89	75—105
140—204	All sites ^c	333	102	1557	104	1271	106	2954	101	6115	103	100—105

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 44.** Textile workers, men (N=36 615) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	9	61	4	34	8	66	14	72	35	60	42—84
141	Tongue	3	98	2	89	1	24	7	97	13	78	41—133
143—144	Mouth	7	110	3	138	7	120	11	99	28	110	73—159
145—148	Pharynx	2	25	3	73	5	71	11	71	21	60	37—92
150	Esophagus	17	124	6	78	5	43	17	74	45	80	59—108
151	Stomach	57	111	39	76	62	92	103	102	261	96	85—109
153	Colon	67	87	36	142	75	96	147	109	325	103	92—115
154	Rectum	86	135	23	98	62	114	104	107	275	115	103—130
155.0	Liver	10	78	8	90	6	84	29	101	53	92	69—120
155.1	Gall bladder	8	101	3	62	6	133	9	82	26	92	60—135
157	Pancreas	34	91	24	102	39	112	59	84	156	94	81—110
160	Nose	2	61	2	118	2	69	2	45	8	65	28—128
161	Larynx	18	82	12	97	14	103	24	99	68	94	73—119
162	Lung	254	102	170	98	103	74	195	89	722	92	86—99
162.2	Pleura	6	113	1	45	2	51	2	30	11	61	31—110
170	Breast	1	56	[0.6]	0	1	79	4	128	6	88	32—192
177	Prostate	69	69	83	114	183	104	390	95	725	96	89—103
178	Testis	16	130	3	124	2	33	13	159	34	117	81—164

(continued)

Table 44. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	34	119	23	104	25	82	62	85	144	94	80—110
181	Bladder	118	121	30	94	81	108	149	106	378	109	99—121
190	Melanoma	11	56	10	72	21	71	69	131	111	96	80—115
191	Other skin ^b	173	125	8	62	22	76	78	117	281	114	101—128
193	Brain	31	103	19	113	29	121	54	94	133	104	88—123
194	Thyroid	1	32	3	84	5	103	12	119	21	97	60—149
197	Connective tissue	2	56	3	77	5	117	24	179	34	135	94—189
201	Hodgkin's disease	8	131	7	166	2	44	11	95	28	106	70—153
200, 202	Non-Hodgkin's lymphoma	21	93	12	98	27	106	72	122	132	111	93—131
203	Multiple myeloma	14	113	11	136	18	106	29	94	72	106	83—133
204.3	Acute leukemia	9	85	8	147	8	95	16	85	41	95	68—129
204.0—2.4	Other leukemia	17	91	9	90	9	78	25	77	60	82	63—106
199	Unknown	8	98	10	92	33	92	58	108	109	100	83—121
140—204	All sites ^c	961	100	578	98	871	94	1874	100	4284	99	96—102

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 45. Textile workers, women (N =114 155) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	2	72	6	70	3	99	4	61	15	72	40—118
141	Tongue	5	129	5	55	5	128	10	116	25	98	63—144
143—144	Mouth	11	132	15	158	6	95	13	96	45	119	87—160
145—148	Pharynx	11	150	19	160	2	44	12	91	44	119	86—160
150	Esophagus	10	100	40	118	6	85	16	100	72	108	84—135
151	Stomach	51	102	203	110	84	111	100	80	438	101	92—111
153	Colon	190	113	199	119	197	114	356	108	942	113	106—120
154	Rectum	103	116	108	96	116	135	193	112	520	113	104—123
155.0	Liver	16	104	30	96	9	107	38	101	93	100	81—123
155.1	Gall bladder	27	102	61	102	18	133	75	107	181	106	92—123
157	Pancreas	64	109	96	88	57	106	145	107	362	101	91—112
160	Nose	3	88	2	33	2	60	3	53	10	54	26—99
161	Larynx	6	60	3	49	2	77	7	99	18	70	41—110
162	Lung	244	134	120	91	79	93	160	88	603	104	96—113
162.2	Pleura	5	127	6	114	1	87	9	269	21	153	95—234
170	Breast	603	98	986	109	455	103	1175	95	3219	101	97—104
171	Cervix uteri	233	127	117	124	121	121	171	106	642	119	111—129
172	Corpus uteri	144	90	262	114	108	96	353	116	867	107	100—115
175	Ovary	154	103	191	108	152	127	342	111	839	111	104—119
180.0	Kidney	45	104	85	95	36	96	110	96	276	97	86—109
181	Bladder	62	110	52	114	49	108	101	95	264	104	92—117
190	Melanoma	64	92	75	93	84	116	149	117	372	106	96—118
191	Other skin ^b	206	89	51	91	39	105	51	65	347	86	77—96
193	Brain	80	112	130	100	50	98	156	100	416	102	92—112
194	Thyroid	8	62	77	113	23	85	61	105	169	102	87—118
197	Connective tissue	4	61	23	110	6	76	27	93	60	93	71—120
201	Hodgkin's disease	5	56	16	99	9	149	16	93	46	95	70—127
200, 202	Non-Hodgkin's lymphoma	35	91	56	91	41	90	93	86	225	89	78—101
203	Multiple myeloma	21	106	31	68	34	123	50	86	136	90	76—106
204.3	Acute leukemia	19	93	25	80	8	57	36	95	88	85	68—105
204.0—2.4	Other leukemia	23	109	25	64	12	80	39	89	99	83	68—101
199	Unknown	20	114	63	99	54	84	127	93	264	94	83—106
140—204	All sites ^c	2299	107	3223	104	1873	106	4517	101	11912	104	102—105

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Results

For the men, an excess risk of cancer of the gallbladder and nasal cancer was found (table 46). For the women none of the SIR values deviated significantly from 100 (table 47).

Comments

The excess risk of nasal cancer could be due to occupational exposure to leather dust (71), while the increase in gallbladder cancer has not been reported earlier and may be a chance finding.

Smelters and metal foundry workers: occupational group 27

Group 27 includes ore and metal furnace operators, metal smelters, casters and rolling-mill operators,

metal-heat-treating-plant operators and metal drawers, and extruders. Their tasks include operating and monitoring furnaces for ore smelting, refining, converting, or reheating metal.

Results

Among the men, an excess risk of lung cancer and, especially in Denmark, a very high risk of pleural cancer was found (table 48). Cancers of the liver and skin were rarer than in the general population. Very few women work as metal foundry workers, and only the increase in lung cancer and decrease in breast cancer reached statistical significance (table 49).

Comments

An excess risk of lung cancer has previously been reported for workers in the smelting and foundry industry (72). This finding can be explained by exposure to asbestos in combination with smoking. The excess of pleural cancer

Table 46. Shoe and leather workers, men (N=10 755) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	2	52	[5.2]	0	2	56	7	117	11	59	30–106
141	Tongue	1	130	[0.9]	0	3	251	3	138	7	138	55–283
143–144	Mouth	2	123	[0.9]	0	1	60	3	90	6	79	29–173
145–148	Pharynx	1	49	3	172	[2.0]	0	4	85	8	76	33–150
150	Esophagus	3	84	3	86	5	148	12	168	23	130	83–196
151	Stomach	17	125	18	77	19	94	38	120	92	104	84–127
153	Colon	18	89	9	80	29	126	51	122	107	111	92–135
154	Rectum	20	119	11	103	17	107	32	107	80	109	87–136
155.0	Liver	3	89	6	148	1	47	11	123	21	114	70–174
155.1	Gall bladder	4	188	2	92	5	372	5	147	16	177	101–287
157	Pancreas	12	121	9	86	12	117	20	92	53	101	76–133
160	Nose	4	475	1	139	1	119	5	373	11	294	147–526
161	Larynx	6	105	8	148	4	101	7	95	25	111	72–164
162	Lung	80	121	90	115	36	89	58	86	264	105	93–118
162.2	Pleura	1	72	[0.9]	0	3	267	2	101	6	110	41–240
170	Breast	[0.5]	0	[0.3]	0	[0.4]	0	3	315	3	145	30–424
177	Prostate	26	96	37	106	60	113	140	109	263	108	96–122
178	Testis	2	76	1	101	2	120	3	146	8	109	47–214
180.0	Kidney	8	108	10	105	6	68	17	77	41	86	62–116
181	Bladder	23	89	13	90	29	131	49	113	114	108	90–130
190	Melanoma	5	104	6	105	9	109	19	126	39	115	82–157
191	Other skin ^b	32	89	7	118	9	105	25	120	73	103	80–129
193	Brain	4	53	11	159	9	133	17	101	41	108	77–146
194	Thyroid	[0.8]	0	3	199	2	143	4	135	9	135	62–256
197	Connective tissue	[0.9]	0	[1.7]	0	2	161	3	75	5	64	21–149
201	Hodgkin's disease	[1.5]	0	2	113	3	227	1	30	6	75	28–164
200, 202	Non-Hodgkin's lymphoma	2	35	10	189	8	109	20	113	40	111	79–151
203	Multiple myeloma	1	30	3	84	6	119	12	127	22	103	65–156
204.3	Acute leukemia	1	37	[2.4]	0	4	163	7	123	12	90	47–158
204.0–2,4	Other leukemia	6	122	4	89	1	29	11	111	22	97	60–146
199	Unknown	3	141	4	81	14	132	10	61	31	91	62–129
140–204	All sites ^c	255	101	273	103	299	110	609	106	1436	105	100–111

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

further points to probable asbestos exposure, especially in Denmark.

Mechanics and iron and metalware workers: occupational group 28

Workers included in group 28 make products of metal and other materials and assemble and repair machines and motors. (The Danish data also include welders in this category; see occupational group 30).

Results

An elevated risk of lung cancer was observed for both the men (table 50) and the women (table 51). For the men, the risk of pleural mesothelioma was increased in all 4 countries. Cancers of the larynx, pancreas, and bladder were more elevated among the women than the men.

The risk of malignant melanoma was lower than expected for both genders in all 4 countries. An excess number of cervical cancer cases was observed among the women in all 4 countries.

Comments

The mesothelioma risk found for the men in this group is related to occupational exposure to asbestos. Asbestos exposure also increases the risk of lung cancer, especially among smokers. The elevated risks of cancer of the larynx, bladder, and kidney can also be viewed as an indication of occupational exposures. Low risks of malignant melanoma and nonmelanoma skin cancer are often found in lower socioeconomic groups, and they have been related to leisure-time activities (64). Women surrounded mainly by men seem to have been exposed to an excessive use of alcohol and tobacco, and possibly also sexual partners, since cancers related to these factors tended to be elevated.

Table 47. Shoe and leather workers, women (N=10 276) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.2]	0	1	104	[0.2]	0	[0.4]	0	1	55	1–307
141	Tongue	1	353	1	96	1	372	[0.6]	0	3	136	28–399
143–144	Mouth	[0.6]	0	[1.1]	0	[0.4]	0	1	104	1	33	1–181
145–148	Pharynx	[0.5]	0	4	296	[0.3]	0	[1.0]	0	4	125	34–321
150	Esophagus	2	278	4	107	[0.5]	0	1	90	7	116	47–239
151	Stomach	6	168	23	110	6	120	11	129	46	121	89–162
153	Colon	7	59	19	100	11	95	18	78	55	84	63–109
154	Rectum	10	159	9	70	7	121	19	155	45	121	88–162
155.0	Liver	[1.1]	0	5	142	1	177	1	38	7	90	36–185
155.1	Gall bladder	1	54	8	118	2	225	6	124	17	118	69–190
157	Pancreas	3	72	10	81	7	198	10	107	30	102	69–146
160	Nose	1	398	[0.7]	0	1	438	[0.4]	0	2	127	15–458
161	Larynx	1	134	3	423	[0.2]	0	[0.5]	0	4	185	50–473
162	Lung	16	120	10	66	3	51	16	120	45	94	69–126
162.2	Pleura	1	357	3	496	[0.1]	0	[0.2]	0	4	333	91–852
170	Breast	40	87	118	111	26	83	99	108	283	103	91–115
171	Cervix uteri	17	122	14	128	13	177	9	74	53	120	90–157
172	Corpus uteri	13	111	35	130	9	114	29	126	86	123	99–152
175	Ovary	12	109	17	82	10	119	24	104	63	99	76–127
180.0	Kidney	[3.1]	0	10	97	2	78	4	49	16	66	38–108
181	Bladder	3	74	10	193	3	99	6	81	22	112	70–169
190	Melanoma	3	56	7	73	5	94	8	83	23	77	49–116
191	Other skin ^b	24	142	5	80	2	81	5	94	36	116	81–161
193	Brain	5	94	17	111	3	82	14	120	39	108	77–148
194	Thyroid	[1.0]	0	8	99	[2.0]	0	8	184	16	104	60–169
197	Connective tissue	[0.5]	0	2	82	1	181	3	142	6	108	39–234
201	Hodgkin's disease	[0.7]	0	1	53	1	233	1	80	3	71	15–207
200, 202	Non-Hodgkin's lymphoma	2	72	7	99	3	95	8	104	20	97	59–149
203	Multiple myeloma	3	216	7	135	1	55	4	100	15	121	68–199
204.3	Acute leukemia	3	201	[3.6]	0	1	104	4	147	8	91	39–179
204.0–2,4	Other leukemia	[1.5]	0	2	45	[1.0]	0	5	163	7	70	28–144
199	Unknown	2	160	8	111	5	118	15	156	30	135	91–192
140–204	All sites ^c	155	98	380	106	125	102	354	108	1014	105	99–112

^a International Classification of Diseases (7th revision).
Sweden. ^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.

Table 48. Smelters and metal foundry workers, men (N=77 288) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	34	105	19	114	25	123	38	116	116	114	95–136
141	Tongue	8	110	1	30	3	41	9	71	21	69	43–105
143–144	Mouth	12	85	1	31	11	108	20	104	44	94	68–126
145–148	Pharynx	26	140	2	34	15	122	20	74	63	99	76–126
150	Esophagus	30	107	11	100	25	129	33	84	99	102	83–124
151	Stomach	118	116	89	121	109	98	182	107	498	109	100–119
153	Colon	145	95	41	113	141	108	222	97	549	100	92–109
154	Rectum	119	94	39	116	102	112	183	112	443	107	97–117
155.0	Liver	21	83	9	71	12	101	35	73	77	78	62–98
155.1	Gall bladder	15	97	13	189	10	135	18	98	56	116	88–151
157	Pancreas	88	119	30	89	57	99	113	95	288	102	90–114
160	Nose	10	141	2	81	13	263	7	90	32	144	98–203
161	Larynx	56	121	22	121	24	103	47	112	149	115	98–135
162	Lung	663	136	321	129	326	139	436	117	1746	130	124–136
162.2	Pleura	35	313	2	62	11	167	11	97	59	182	139–235
170	Breast	4	108	1	110	3	139	6	113	14	116	63–194
177	Prostate	202	113	103	103	306	109	657	97	1268	103	97–109
178	Testis	38	80	1	27	9	68	15	94	63	78	60–100
180.0	Kidney	88	147	23	71	47	91	137	109	295	109	98–123
181	Bladder	248	127	59	130	127	102	224	94	658	109	101–118
190	Melanoma	41	77	17	82	44	79	73	77	175	78	67–91
191	Other skin ^b	261	88	19	105	48	101	82	74	410	87	79–96
193	Brain	64	87	25	100	40	92	91	89	220	90	79–103
194	Thyroid	7	92	5	94	5	57	18	101	35	89	62–123
197	Connective tissue	10	114	4	71	4	53	16	68	34	75	52–105
201	Hodgkin's disease	22	125	8	127	11	130	21	102	62	117	90–150
200, 202	Non-Hodgkin's lymphoma	53	104	25	140	41	93	99	97	218	101	89–116
203	Multiple myeloma	39	157	11	95	25	88	53	102	128	109	92–130
204.3	Acute leukemia	28	119	9	114	12	84	29	89	78	99	79–124
204.0–2,4	Other leukemia	29	76	14	97	16	83	48	87	107	84	70–102
199	Unknown	18	108	26	168	72	122	109	119	225	123	108–140
140–204	All sites ^c	2283	116	959	113	1696	110	3150	99	8088	107	105–110

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 49.** Smelters and metal foundry workers, women (N=2874) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.1]	0	[0.2]	0	[0.0]	0	[0.2]	0	[0.4]	0	0–825
141	Tongue	[0.1]	0	[0.2]	0	[0.0]	0	[0.2]	0	[0.6]	0	0–651
143–144	Mouth	1	643	[0.2]	0	[0.1]	0	[0.4]	0	1	123	3–684
145–148	Pharynx	[0.1]	0	[0.3]	0	[0.0]	0	[0.4]	0	[0.9]	0	0–430
150	Esophagus	[0.2]	0	2	241	[0.1]	0	1	269	3	209	43–609
151	Stomach	3	329	4	86	[0.6]	0	7	238	14	154	84–258
153	Colon	4	130	4	94	[1.3]	0	6	74	14	83	46–140
154	Rectum	2	123	3	104	[0.7]	0	3	67	8	83	36–163
155.0	Liver	1	351	2	253	[0.1]	0	2	222	5	245	80–572
155.1	Gall bladder	[0.5]	0	1	66	[0.1]	0	1	61	2	53	6–193
157	Pancreas	1	93	5	181	[0.4]	0	7	220	13	175	93–299
160	Nose	[0.1]	0	[0.2]	0	[0.0]	0	[0.2]	0	[0.4]	0	0–939
161	Larynx	[0.2]	0	[0.2]	0	[0.0]	0	[0.2]	0	[0.6]	0	0–618
162	Lung	9	262	3	86	[0.7]	0	9	174	21	165	102–252
162.2	Pleura	[0.1]	0	[0.1]	0	[0.0]	0	[0.1]	0	[0.3]	0	0–1203
170	Breast	9	77	13	53	3	85	30	79	55	71	53–92
171	Cervix uteri	9	257	3	121	2	244	5	97	19	159	95–248
172	Corpus uteri	3	99	7	112	[0.9]	0	9	96	19	97	59–152
175	Ovary	4	142	1	21	[0.9]	0	12	127	17	94	55–151

(continued)

Table 49. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	2	249	5	212	[0.3]	0	5	166	12	186	96—325
181	Bladder	[1.0]	0	[1.2]	0	2	568	2	77	4	78	21—199
190	Melanoma	[1.3]	0	2	92	[0.6]	0	2	48	4	48	13—123
191	Other skin ^b	5	116	3	218	[0.3]	0	[1.8]	0	8	103	44—202
193	Brain	1	74	4	114	1	245	5	105	11	110	55—196
194	Thyroid	1	415	2	109	[0.2]	0	4	217	7	169	68—349
197	Connective tissue	[0.1]	0	1	180	[0.1]	0	2	243	3	192	40—561
201	Hodgkin's disease	[0.2]	0	[0.4]	0	[0.1]	0	[0.5]	0	[1.1]	0	0—330
200, 202	Non-Hodgkin's lymphoma	1	141	2	125	1	282	2	70	6	108	40—236
203	Multiple myeloma	[0.4]	0	[1.2]	0	[0.2]	0	4	289	4	128	35—327
204.3	Acute leukemia	[0.4]	0	[0.8]	0	[0.1]	0	1	96	1	43	1—237
204.0—2,4	Other leukemia	[0.4]	0	2	202	[0.1]	0	3	272	5	193	63—450
199	Unknown	[0.3]	0	[1.6]	0	[0.5]	0	2	58	2	34	4—123
140—204	All sites ^c	48	119	72	88	10	72	137	107	267	101	90—114

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 50. Mechanics and iron and metalware workers, men (N=353 757) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	74	86	52	58	58	70	135	87	319	77	69—86
141	Tongue	19	100	20	103	36	111	59	91	134	99	84—117
143—144	Mouth	32	86	19	102	44	98	90	92	185	93	81—108
145—148	Pharynx	55	112	28	83	52	97	123	89	258	94	83—106
150	Esophagus	79	105	42	72	86	109	192	105	399	101	92—111
151	Stomach	283	103	406	103	473	107	811	105	1973	105	100—109
153	Colon	411	100	214	107	531	99	1076	100	2232	101	96—105
154	Rectum	304	89	161	89	358	96	782	101	1605	96	92—101
155.0	Liver	72	105	67	99	48	101	195	88	382	94	85—104
155.1	Gall bladder	44	104	39	105	35	119	85	100	203	105	91—120
157	Pancreas	223	112	172	94	268	117	583	105	1246	107	101—113
160	Nose	18	95	15	107	23	110	38	97	94	101	82—124
161	Larynx	137	110	124	126	114	116	216	104	591	112	103—121
162	Lung	1656	125	1468	111	1254	131	2136	120	6514	121	118—124
162.2	Pleura	64	214	26	139	71	254	126	222	287	215	192—242
170	Breast	12	121	8	157	9	98	35	135	64	128	98—163
177	Prostate	494	100	475	94	1010	97	2970	101	4949	99	97—102
178	Testis	114	100	25	99	82	105	97	84	318	96	86—107
180.0	Kidney	143	89	197	107	234	107	659	106	1233	104	98—110
181	Bladder	579	110	266	110	556	111	1236	109	2637	109	105—114
190	Melanoma	117	86	120	93	242	88	422	79	901	84	79—90
191	Other skin ^b	757	96	106	109	170	90	413	82	1446	92	87—96
193	Brain	182	96	158	103	187	93	590	107	1117	102	96—108
194	Thyroid	18	92	42	131	34	84	84	87	178	94	81—109
197	Connective tissue	20	88	40	120	38	114	118	97	216	102	89—117
201	Hodgkin's disease	54	122	41	104	43	106	104	90	242	101	89—115
200, 202	Non-Hodgkin's lymphoma	139	104	113	110	160	82	515	100	927	98	92—104
203	Multiple myeloma	69	103	50	79	111	97	226	91	456	93	84—101
204.3	Acute leukemia	57	92	37	81	50	82	158	96	302	91	81—101
204.0—2,4	Other leukemia	101	98	78	99	72	92	273	103	524	100	92—109
199	Unknown	43	96	83	99	234	99	467	106	827	103	96—110
140—204	All sites ^c	5669	107	4712	103	6665	105	15653	103	32699	104	103—105

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 51. Mechanics and iron and metalware workers, women (N =24 102) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.5]	0	1	108	[0.3]	0	3	163	4	114	31–293
141	Tongue	[0.7]	0	[1.0]	0	[0.3]	0	1	39	1	22	1–122
143–144	Mouth	4	282	[1.0]	0	2	362	5	123	11	155	78–278
145–148	Pharynx	2	147	2	154	1	238	6	144	11	152	76–272
150	Esophagus	1	60	1	28	1	167	9	205	12	117	61–205
151	Stomach	13	159	15	75	6	95	55	160	89	129	104–159
153	Colon	27	99	20	110	20	135	91	97	158	103	88–120
154	Rectum	11	76	19	155	3	41	55	109	88	104	83–128
155.0	Liver	2	79	3	89	1	139	9	86	15	88	49–144
155.1	Gall bladder	3	72	3	46	1	89	20	104	27	87	57–126
157	Pancreas	10	107	20	169	5	112	45	121	80	127	101–158
160	Nose	1	171	[0.7]	0	[0.3]	0	4	241	5	156	51–364
161	Larynx	4	218	3	438	[0.2]	0	5	212	12	235	121–410
162	Lung	65	201	29	198	8	103	77	136	179	161	139–186
162.2	Pleura	1	154	1	173	[0.1]	0	1	101	3	129	27–378
170	Breast	102	88	86	85	45	110	427	105	660	99	92–107
171	Cervix uteri	47	132	15	144	11	112	74	133	147	132	112–155
172	Corpus uteri	20	71	22	84	12	113	93	92	147	89	76–104
175	Ovary	28	104	19	96	14	125	116	114	177	111	96–128
180.0	Kidney	6	82	8	81	7	211	43	127	64	118	91–150
181	Bladder	14	149	9	180	5	129	47	157	75	156	122–195
190	Melanoma	13	97	2	22	4	57	31	69	50	67	50–89
191	Other skin ^b	32	79	8	134	3	98	27	127	70	99	77–125
193	Brain	18	137	12	82	1	21	64	124	95	113	91–138
194	Thyroid	5	218	6	79	1	39	16	81	28	87	58–125
197	Connective tissue	1	83	1	43	[0.7]	0	12	132	14	105	57–176
201	Hodgkin's disease	5	304	1	56	[0.6]	0	8	147	14	149	81–249
200, 202	Non-Hodgkin's lymphoma	13	198	7	103	1	25	41	127	62	125	96–160
203	Multiple myeloma	2	64	7	140	[2.3]	0	27	167	36	135	95–188
204.3	Acute leukemia	[3.5]	0	4	116	2	162	9	77	15	76	42–125
204.0–2.4	Other leukemia	1	29	2	47	[1.3]	0	16	127	19	88	53–138
199	Unknown	3	106	7	102	6	112	51	130	67	123	96–157
140–204	All sites ^c	426	111	336	98	160	100	1555	110	2477	108	104–112

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Plumbers: occupational group 29

Workers in group 29 assemble, fit, install, and repair pipes and pipeline systems for drainage, heating, water supply, and sanitary systems. Their work can be performed in private houses, industrial plants, ships, and aircrafts and on building construction sites. Due to the small numbers, the women have been included in occupational group 53.

Results

In all 4 countries, excess numbers of cases of pleural and lung cancer were observed (table 52). Testicular cancer, malignant melanoma, and lip cancer occurred less frequently than expected.

Comments

Plumbers have the highest SIR for mesothelioma of all the occupational groups included in our study. The risk

of mesothelioma is associated with exposure to asbestos. The combined exposure of asbestos and tobacco further elevates lung cancer risk. The risk of other smoking-related cancers is not systematically elevated and therefore indicate that the prevalence of smoking in this occupational group is probably not greater than in the general population.

Welders: occupational group 30

Workers in group 30 join and cut metal parts using flame, electric-arc, and other sources of heat to melt and cut or fuse metal. The Danish welders are included in the mechanic workers (occupational group 28). Due to the small numbers, the women have been included in occupational group 53.

Table 52. Plumbers, men (N=43 531) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	6	80	9	60	6	60	13	75	34	68	47–95
141	Tongue	4	231	2	61	6	152	6	82	18	110	65–174
143–144	Mouth	8	241	3	94	7	129	6	54	24	104	67–155
145–148	Pharynx	3	68	6	105	8	123	11	70	28	87	58–125
150	Esophagus	8	122	13	136	9	96	27	133	57	125	94–161
151	Stomach	21	89	63	97	48	92	74	86	206	91	79–104
153	Colon	43	121	38	114	58	92	119	99	258	102	91–116
154	Rectum	33	112	30	102	47	106	81	94	191	101	87–116
155.0	Liver	9	151	14	128	10	178	26	106	59	125	95–162
155.1	Gall bladder	5	139	5	82	6	175	10	105	26	115	75–168
157	Pancreas	15	87	48	159	20	74	66	106	149	109	93–128
160	Nose	2	119	2	83	[2.5]	0	5	113	9	82	37–155
161	Larynx	10	92	16	97	11	93	23	99	60	96	73–124
162	Lung	171	150	300	139	153	134	235	118	859	134	125–143
162.2	Pleura	11	419	6	190	18	540	35	543	70	450	351–568
170	Breast	[0.9]	0	[0.9]	0	1	90	2	68	3	52	11–152
177	Prostate	56	137	86	110	108	90	322	99	572	102	94–110
178	Testis	5	42	1	23	8	80	11	82	25	63	41–93
180.0	Kidney	20	142	29	93	32	122	71	101	152	107	91–126
181	Bladder	57	126	47	119	77	130	129	101	310	114	102–128
190	Melanoma	7	55	25	112	30	88	42	69	104	80	66–97
191	Other skin ^b	77	111	17	108	15	68	52	92	161	98	84–115
193	Brain	15	85	33	124	24	97	58	92	130	99	83–117
194	Thyroid	2	111	4	73	7	142	13	119	26	112	73–164
197	Connective tissue	3	144	4	70	2	50	19	137	28	109	73–158
201	Hodgkin's disease	4	94	7	103	5	101	11	84	27	93	61–135
200, 202	Non-Hodgkin's lymphoma	17	142	16	92	26	111	57	98	116	104	87–125
203	Multiple myeloma	6	103	15	143	13	97	25	90	59	102	78–132
204.3	Acute leukemia	4	72	9	117	8	111	14	75	35	90	62–125
204.0–2,4	Other leukemia	10	112	11	84	9	98	31	104	61	100	77–129
199	Unknown	2	52	16	117	23	83	58	117	99	104	85–127
140–204	All sites ^c	557	120	883	117	801	107	1732	102	3973	108	105–112

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Results

An elevated risk of cancer of the lung and pleura was observed in all 4 countries (table 53). The combined SIR values for kidney and bladder cancer also indicate increased cancer risks, but these results were not consistent for all the countries. The risk of gallbladder cancer was elevated in Finland and Sweden. The number of cases of malignant melanoma was lower than expected in all 4 countries.

Comments

The observed risk of pleural mesothelioma is associated with occupational asbestos exposure, particularly for mild-steel welders (73). Generally, the most important cause of lung cancer is smoking, but in the present group there were also several other exposures to lung carcinogens. Asbestos exposure, especially among smokers, adds to lung cancer risk, and welding fumes may contain human carcinogens such as hexavalent chromium and nickel

(73–75). The excess of cancers of the urinary organs may be explained by smoking, but there is suggestive evidence that several occupational exposures may be related to the risk of these cancers. The high risk of cancer in the gallbladder is a new finding, but it is based on 12 excess cases only and may be due to chance.

Electrical workers: occupational group 31

Workers in group 31 fit, assemble, install, maintain, and repair electrical and electronic equipment such as electrical motors, generators, instruments, signal transmitters and receivers, domestic appliances, switchgear, and control apparatus. They install and service electrical wiring systems in homes, industrial plants, ships, motor vehicles, and aircraft and install and service electrical power transmission cables, telephone and telegraph lines, and related equipment.

Table 53. Welders, men (N=44 734) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip			4	36	14	101	13	71	31	71	49–101
141	Tongue			4	141	6	106	10	122	20	119	73–185
143–144	Mouth			2	74	2	26	12	97	16	70	40–114
145–148	Pharynx			6	131	9	96	19	109	34	108	75–151
150	Esophagus			7	99	15	114	20	93	42	101	73–137
151	Stomach			58	120	71	99	96	107	225	107	94–122
153	Colon			22	85	75	85	118	93	215	89	78–102
154	Rectum			16	73	55	89	90	98	161	92	79–107
155.0	Liver			8	101	6	77	18	70	32	77	53–109
155.1	Gall bladder			10	219	3	63	18	182	31	162	110–229
157	Pancreas			28	124	40	107	72	110	140	111	94–131
160	Nose			3	155	4	113	4	81	11	105	53–189
161	Larynx			12	96	15	90	31	121	58	106	80–137
162	Lung			188	122	211	131	251	118	650	123	114–133
162.2	Pleura			5	187	15	317	12	168	32	220	150–310
170	Breast			[0.7]	0	1	64	5	157	6	110	40–240
177	Prostate			67	131	133	83	345	106	545	102	94–111
178	Testis			10	208	11	72	18	100	39	102	73–140
180.0	Kidney			21	83	56	151	97	125	174	124	107–144
181	Bladder			34	117	121	146	134	98	289	117	104–131
190	Melanoma			13	62	42	84	64	88	119	83	69–99
191	Other skin ^b			10	86	28	92	52	89	90	90	72–110
193	Brain			23	94	35	97	79	108	137	102	87–121
194	Thyroid			5	99	4	56	15	118	24	96	62–143
197	Connective tissue			4	79	9	156	14	89	27	101	67–148
201	Hodgkin's disease			4	61	9	124	17	108	30	102	69–145
200, 202	Non-Hodgkin's lymphoma			19	129	33	98	61	93	113	99	83–120
203	Multiple myeloma			6	75	21	112	24	81	51	90	67–119
204.3	Acute leukemia			12	182	9	88	15	72	36	96	67–132
204.0–2,4	Other leukemia			10	99	14	109	40	125	64	116	90–149
199	Unknown			15	146	35	91	57	106	107	105	87–127
140–204	All sites ^c			644	113	1099	104	1935	106	3678	107	103–110

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Results

An elevated risk of pleural mesothelioma and a low risk of Hodgkin's lymphoma were found for men in all 4 countries, while the overall cancer incidence was exactly at the same level as that of the general population (table 54). For the women, high risks of cancer of the lung, larynx, stomach, and cervix uteri and a reduced risk of malignant melanoma were observed in at least 3 of the 4 countries (table 55).

Comments

The elevated risk of pleural mesothelioma among the men can be linked to asbestos exposure. A possible relation between electromagnetic fields and cancer risk has been debated, especially for brain cancer, lymphomas, and leukemia (36, 76), but the results have been inconsistent. No evidence of such an association was found in the present results. The elevated risk of cancers of the lung and cervix uteri is typical among women in practically all blue-collar occupations in which most of the

workers are male, and they are probably related to life-style factors.

Wood workers: occupational group 32

The workers included in group 32 prepare and treat wood and make, assemble, and repair constructions and products of wood.

Results

Among the men, an excess risk of nasal cancer was observed in all 4 countries (table 56). Alcohol- and smoking-associated cancers tended to occur less frequently than expected. The lung cancer risk was decreased among the men, but elevated among the women (table 57). In all 4 countries combined, the SIR for pleural mesothelioma exceeded the expected number. A low risk of breast cancer and a high risk of cervical cancer were observed among the women.

Table 54. Electrical workers, men (N=130 383) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	13	67	19	55	29	83	48	102	109	80	66—97
141	Tongue	4	88	6	77	9	64	25	120	44	93	68—125
143—144	Mouth	13	152	14	187	17	88	23	74	67	100	78—128
145—148	Pharynx	11	95	17	126	13	56	43	97	84	91	73—113
150	Esophagus	25	152	19	85	28	84	47	87	119	94	79—113
151	Stomach	57	96	145	96	174	94	224	98	600	96	89—104
153	Colon	86	97	72	92	205	91	303	93	666	93	86—100
154	Rectum	84	115	67	97	156	99	238	102	545	102	94—111
155.0	Liver	13	88	20	78	14	70	68	104	115	91	76—110
155.1	Gall bladder	11	123	17	119	9	73	30	119	67	110	85—140
157	Pancreas	41	95	75	106	90	94	175	105	381	101	92—112
160	Nose	5	116	7	125	12	135	14	112	38	121	86—166
161	Larynx	31	112	45	117	41	98	70	108	187	108	94—125
162	Lung	361	128	500	100	429	106	551	102	1841	106	102—111
162.2	Pleura	10	150	17	226	25	210	28	153	80	180	143—224
170	Breast	1	46	1	50	6	154	6	74	14	86	47—145
177	Prostate	104	105	178	97	398	93	836	101	1516	99	94—104
178	Testis	34	100	13	118	31	88	46	97	124	97	82—116
180.0	Kidney	42	117	58	79	86	92	203	103	389	98	88—108
181	Bladder	136	120	91	98	203	96	385	111	815	107	100—114
190	Melanoma	26	75	49	91	117	97	192	103	384	97	88—107
191	Other skin ^b	167	94	40	109	76	96	145	97	428	97	88—106
193	Brain	45	97	50	78	89	102	179	96	363	94	85—105
194	Thyroid	3	63	14	106	22	126	42	128	81	119	94—147
197	Connective tissue	6	108	14	103	18	126	42	104	80	108	86—135
201	Hodgkin's disease	6	51	15	91	15	85	30	74	66	76	59—97
200, 202	Non-Hodgkin's lymphoma	36	115	43	104	77	92	168	101	324	100	90—112
203	Multiple myeloma	7	48	29	118	60	126	71	94	167	103	88—120
204.3	Acute leukemia	19	133	19	104	28	108	46	86	112	100	83—121
204.0—2,4	Other leukemia	28	124	21	69	41	125	92	112	182	108	94—125
199	Unknown	13	132	28	87	91	92	126	93	258	93	83—105
140—204	All sites ^c	1293	111	1703	96	2602	97	4683	101	10281	100	98—102

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Comments

There is sufficient evidence of the carcinogenicity of wood dust exposure to humans, and it has been related to an increased risk of nasal adenocarcinoma (77). The decreased risks of cancers of the upper aerogastric tract, liver, lung, bladder, and kidney among the men in this group indicate a lower proportion of daily smokers, and also a lower alcohol consumption, as compared with the general population.

Painters and wall paperhangers: occupational group 33

Painters prepare structural surfaces for painting and apply decorative and protective coatings to buildings, ships, motor vehicles and articles of wood, metal, textile and other materials. Wall paperhangers cover interior walls and ceilings.

Results

A low risk of cancer of the lip was observed for the men in all 4 countries (table 58). An elevated risk of lung cancer was observed in all 4 countries, and also for pleural cancer in all 4 countries combined. For the Nordic countries combined, elevated risks were also shown for rectal and bladder cancer. The cervical cancer risk was higher than expected in all 4 countries also (table 59).

Comments

The elevated risk of lung cancer can be considered an indication of heavier smoking in the present occupational group than in the reference populations, but the high risk of mesothelioma also points to the asbestos exposure present on many building sites. The risk profile, with a high incidence of cervical cancer and low incidence of breast cancer, is consistent with what is usually found in groups of women with active sex lives in connection with a low age at first delivery.

Table 55. Electrical workers, women (N=19 295) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.7]	0	[0.4]	0	[0.3]	0	1	112	1	44	1—247
141	Tongue	[1.0]	0	1	198	1	247	2	159	4	128	35—328
143—144	Mouth	4	201	[0.5]	0	[0.6]	0	3	150	7	136	55—281
145—148	Pharynx	3	156	[0.6]	0	[0.5]	0	1	48	4	78	21—199
150	Esophagus	3	129	1	67	2	301	1	48	7	107	43—220
151	Stomach	17	148	8	84	9	129	26	158	60	135	103—174
153	Colon	43	112	7	80	16	95	38	84	104	95	79—116
154	Rectum	22	108	9	154	9	107	27	110	67	113	88—143
155.0	Liver	3	84	3	194	3	365	5	100	14	128	70—214
155.1	Gall bladder	8	136	5	173	[1.2]	0	4	44	17	89	52—142
157	Pancreas	13	99	3	57	7	142	31	175	54	132	99—172
160	Nose	1	121	[0.3]	0	1	298	2	245	4	172	47—441
161	Larynx	7	271	1	293	1	365	1	84	10	228	109—419
162	Lung	76	168	10	141	15	163	49	174	150	167	142—196
162.2	Pleura	[0.9]	0	[0.3]	0	[0.1]	0	[0.5]	0	[1.8]	0	0—202
170	Breast	138	84	55	90	49	99	207	99	449	93	85—102
171	Cervix uteri	82	161	6	107	20	161	32	108	140	142	120—168
172	Corpus uteri	37	94	6	44	16	125	59	117	118	102	85—122
175	Ovary	34	89	8	73	12	89	58	112	112	98	81—118
180.0	Kidney	7	68	4	81	2	52	20	121	33	93	64—130
181	Bladder	15	114	[2.3]	0	5	115	16	111	36	106	74—146
190	Melanoma	17	88	6	107	6	67	13	54	42	73	52—98
191	Other skin ^b	53	92	[2.6]	0	1	29	9	89	63	85	66—109
193	Brain	16	86	10	114	7	118	25	94	58	97	73—125
194	Thyroid	9	274	7	143	1	31	9	86	26	119	78—174
197	Connective tissue	1	58	1	77	1	115	5	108	8	94	41—185
201	Hodgkin's disease	2	83	2	182	[0.7]	0	2	70	6	86	31—186
200, 202	Non-Hodgkin's lymphoma	13	139	6	168	5	106	20	125	44	131	95—176
203	Multiple myeloma	2	45	1	43	3	118	4	52	10	59	28—109
204.3	Acute leukemia	6	119	2	107	1	70	7	119	16	113	64—183
204.0—2,4	Other leukemia	4	83	1	48	1	71	2	33	8	55	24—109
199	Unknown	1	25	3	95	9	151	24	126	37	115	81—159
140—204	All sites ^c	605	111	170	92	205	109	747	105	1727	106	101—111

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 56.** Wood workers, men (N=260 097) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	57	99	135	109	161	139	133	107	486	115	105—126
141	Tongue	7	56	13	57	23	57	28	60	71	58	45—73
143—144	Mouth	13	52	21	93	45	79	40	56	119	68	57—81
145—148	Pharynx	22	68	33	77	55	80	63	63	173	71	61—83
150	Esophagus	39	75	83	101	88	79	102	69	312	80	71—89
151	Stomach	190	99	581	107	654	101	647	100	2072	102	98—107
153	Colon	270	94	247	93	675	89	735	85	1927	89	85—93
154	Rectum	230	97	242	97	486	93	590	95	1548	95	90—100
155.0	Liver	43	90	85	89	39	57	105	57	272	69	61—77
155.1	Gall bladder	25	84	53	103	35	81	53	75	166	85	73—99
157	Pancreas	144	103	245	97	316	95	406	91	1111	95	89—101
160	Nose	38	298	28	157	39	139	60	210	165	189	162—220
161	Larynx	81	96	124	93	111	84	113	73	429	85	77—93
162	Lung	949	103	2112	112	1118	83	976	70	5155	93	90—95
162.2	Pleura	26	127	31	137	60	159	36	84	153	124	106—145
170	Breast	7	102	6	92	10	81	12	60	35	77	53—107
177	Prostate	339	94	761	97	1641	98	2496	95	5237	96	94—99
178	Testis	63	92	12	57	57	90	52	91	184	88	76—101

(continued)

Table 56. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	110	101	225	97	246	83	386	83	967	88	82—93
181	Bladder	357	97	359	106	679	94	737	82	2132	92	88—95
190	Melanoma	74	85	111	81	256	86	268	78	709	82	76—88
191	Other skin ^b	495	92	136	100	250	90	396	92	1277	92	87—98
193	Brain	131	105	189	114	253	107	372	100	945	105	99—112
194	Thyroid	10	77	39	110	47	98	73	111	169	104	90—121
197	Connective tissue	17	114	39	101	41	99	66	76	163	90	77—104
201	Hodgkin's disease	34	122	49	121	40	89	73	96	196	103	90—119
200, 202	Non-Hodgkin's lymphoma	90	100	96	77	218	88	370	97	774	92	85—98
203	Multiple myeloma	42	90	76	88	173	106	203	103	494	100	92—109
204.3	Acute leukemia	44	105	56	102	81	100	121	99	302	101	90—113
204.0—2,4	Other leukemia	65	91	103	98	91	82	175	84	434	88	80—96
199	Unknown	35	113	96	83	302	89	299	87	732	88	82—94
140—204	All sites ^c	3579	98	6400	102	8230	93	10487	87	28696	93	92—94

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 57. Wood workers, women (N=14 574) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.2]	0	3	145	[0.1]	0	[0.4]	0	3	108	22—314
141	Tongue	[0.3]	0	3	133	[0.1]	0	[0.6]	0	3	93	19—271
143—144	Mouth	[0.6]	0	1	43	[0.1]	0	[1.0]	0	1	25	1—137
145—148	Pharynx	1	165	2	68	[0.1]	0	1	100	4	86	24—221
150	Esophagus	2	260	6	75	[0.1]	0	[1.1]	0	8	80	35—158
151	Stomach	1	27	34	76	3	205	14	169	52	90	67—118
153	Colon	19	150	39	96	2	57	21	93	81	102	81—127
154	Rectum	7	104	24	87	3	172	11	90	45	93	68—125
155.0	Liver	1	85	9	119	[0.2]	0	2	79	12	105	54—183
155.1	Gall bladder	5	254	13	89	1	378	6	128	25	117	75—172
157	Pancreas	4	91	28	106	1	96	12	132	45	110	80—147
160	Nose	[0.3]	0	2	133	[0.1]	0	[0.4]	0	2	89	11—323
161	Larynx	[0.8]	0	3	190	[0.1]	0	2	354	5	165	54—385
162	Lung	24	163	38	114	4	217	15	109	81	127	101—158
162.2	Pleura	[0.3]	0	4	305	[0.0]	0	[0.2]	0	4	214	58—547
170	Breast	44	87	173	76	12	126	79	82	308	80	72—89
171	Cervix uteri	24	157	37	157	2	88	14	109	77	143	113—178
172	Corpus uteri	18	139	59	99	4	159	25	102	106	106	88—129
175	Ovary	16	132	27	60	1	38	25	103	69	82	64—104
180.0	Kidney	[3.4]	0	23	102	1	127	6	73	30	86	58—123
181	Bladder	1	23	9	80	[0.9]	0	5	69	15	63	35—104
190	Melanoma	5	87	20	99	[1.6]	0	3	29	28	74	49—107
191	Other skin ^b	19	104	13	99	1	139	3	58	36	97	68—134
193	Brain	5	86	20	61	[1.1]	0	14	114	39	75	53—102
194	Thyroid	3	297	8	47	[0.6]	0	4	87	15	65	36—107
197	Connective tissue	[0.5]	0	4	77	[0.2]	0	3	139	7	87	35—179
201	Hodgkin's disease	2	287	2	51	1	799	2	158	7	117	47—241
200, 202	Non-Hodgkin's lymphoma	2	67	17	112	[0.9]	0	10	129	29	108	72—155
203	Multiple myeloma	1	68	10	88	2	373	5	127	18	104	62—165
204.3	Acute leukemia	1	63	6	78	[0.3]	0	5	181	12	97	50—170
204.0—2,4	Other leukemia	[1.6]	0	14	148	[0.3]	0	[3.0]	0	14	97	53—163
199	Unknown	[1.3]	0	23	150	2	160	13	136	38	138	98—190
140—204	All sites ^c	193	112	682	88	40	107	317	94	1232	94	88—99

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 58. Painters and wall paperhangers, men (N=65 868) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	13	68	12	52	16	98	12	38	53	59	44–77
141	Tongue	4	93	5	108	6	103	11	90	26	96	63–141
143–144	Mouth	12	142	5	111	8	98	23	124	48	121	89–160
145–148	Pharynx	17	154	11	133	14	143	30	115	72	131	102–164
150	Esophagus	22	129	16	105	18	115	39	104	95	111	90–136
151	Stomach	60	98	100	98	92	101	143	87	395	94	85–104
153	Colon	101	110	58	115	103	97	226	102	488	104	95–113
154	Rectum	87	113	43	92	79	107	197	124	406	114	104–126
155.0	Liver	21	135	34	195	10	103	35	75	100	112	92–136
155.1	Gall bladder	8	85	15	157	5	83	17	95	45	105	77–141
157	Pancreas	36	80	51	109	40	86	107	94	234	93	81–105
160	Nose	4	94	4	116	4	101	9	120	21	109	68–167
161	Larynx	25	88	32	129	19	102	40	99	116	103	86–124
162	Lung	392	131	396	116	260	138	402	112	1450	122	116–128
162.2	Pleura	7	104	14	310	8	151	18	161	47	170	125–226
170	Breast	1	45	1	79	2	115	3	58	7	67	27–139
177	Prostate	109	100	137	99	253	110	654	100	1153	102	96–108
178	Testis	27	112	9	168	11	108	13	73	60	104	80–134
180.0	Kidney	38	105	42	93	43	103	111	92	234	96	84–109
181	Bladder	165	139	49	78	109	108	243	105	566	110	101–120
190	Melanoma	36	119	30	102	49	112	87	93	202	103	89–118
191	Other skin ^b	208	117	24	95	38	98	77	71	347	99	89–110
193	Brain	38	89	47	133	38	111	97	97	220	104	91–118
194	Thyroid	5	115	7	93	6	86	21	118	39	107	76–146
197	Connective tissue	1	20	9	112	6	100	25	108	41	97	70–132
201	Hodgkin's disease	16	166	6	67	8	119	18	86	48	104	76–137
200, 202	Non-Hodgkin's lymphoma	28	94	22	88	27	76	107	107	184	97	84–112
203	Multiple myeloma	15	100	19	118	15	65	54	107	103	98	81–119
204.3	Acute leukemia	7	51	10	90	18	156	32	99	67	98	76–124
204.0–2,4	Other leukemia	27	118	19	95	10	64	52	97	108	96	79–116
199	Unknown	9	89	31	144	48	100	81	91	169	100	86–116
140–204	All sites ^c	1343	113	1280	109	1358	109	3089	100	7070	106	103–108

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Other construction workers: occupational group 34

Group 34 includes workers in the building and construction industry who do not constitute separate occupational groups in this study. Included are reinforcement concrete workers, cement finishers, terrazzo workers, insulators, glaziers, underwater workers, and other unspecified building and construction workers.

Results

There were relatively few women in this group. Altogether 365 cancer cases were expected, of which 345 were expected among Finnish women. For the men and women, an elevated risk for cancers of the lip, stomach, and lung was observed (tables 60 and 61). The risk for cancers of the colon, gallbladder, and testis, as well as for skin melanoma, was decreased for the men in all 4 countries. For the women, cervical and laryngeal cancer occurred more frequently than expected.

Comments

Although many of the exposures will be the same for different types of construction workers, subgroups with different exposures have been combined in this group, and it is therefore difficult to determine possible effects of specific exposures. Most of the workers in this category are building workers (78), and the observed cancer pattern is typical for unskilled workers in a low socioeconomic class. An effect of direct workplace exposures cannot be fully excluded.

Bricklayers: occupational group 35

Workers in group 35 erect and repair foundations, walls, and complete structures of brick, stone, and similar materials and cover and decorate walls, ceilings, and floors

Table 59. Painters and wall paperhangers, women (N=2121) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.0]	0	[0.3]	0	[0.0]	0	[0.1]	0	[0.4]	0	0–950
141	Tongue	[0.0]	0	1	341	[0.0]	0	2	1722	3	653	135–1908
143–144	Mouth	[0.0]	0	[0.3]	0	[0.1]	0	1	533	1	174	4–968
145–148	Pharynx	[0.0]	0	[0.4]	0	[0.1]	0	1	526	1	156	4–868
150	Esophagus	[0.0]	0	[1.0]	0	[0.1]	0	1	492	1	76	2–424
151	Stomach	[0.2]	0	6	104	1	155	2	126	9	110	50–209
153	Colon	1	170	6	114	1	64	6	139	14	119	65–200
154	Rectum	[0.3]	0	3	84	2	256	1	43	6	86	31–187
155.0	Liver	[0.1]	0	1	103	[0.1]	0	[0.5]	0	1	63	2–350
155.1	Gall bladder	[0.1]	0	[1.9]	0	[0.1]	0	2	224	2	67	8–244
157	Pancreas	[0.2]	0	5	148	1	217	4	232	10	173	83–318
160	Nose	[0.0]	0	[0.2]	0	[0.0]	0	[0.1]	0	[0.3]	0	0–1169
161	Larynx	[0.0]	0	[0.2]	0	[0.0]	0	2	1862	2	535	65–1933
162	Lung	1	165	8	185	2	239	2	77	13	155	83–265
162.2	Pleura	[0.0]	0	[0.2]	0	[0.0]	0	[0.1]	0	[0.2]	0	0–1528
170	Breast	3	122	20	65	8	186	15	81	46	82	60–110
171	Cervix uteri	[0.8]	0	8	259	1	97	6	239	15	201	113–332
172	Corpus uteri	[0.5]	0	8	102	4	346	3	65	15	106	59–175
175	Ovary	1	188	3	50	2	168	9	193	15	121	68–200
180.0	Kidney	[0.2]	0	[3.0]	0	[0.3]	0	2	128	2	40	5–144
181	Bladder	1	528	3	207	[0.4]	0	1	72	5	146	47–341
190	Melanoma	[0.3]	0	1	37	1	138	[2.0]	0	2	34	4–124
191	Other skin ^b	1	111	3	178	[0.3]	0	[1.0]	0	4	103	28–264
193	Brain	[0.3]	0	3	68	[0.5]	0	1	43	4	53	14–135
194	Thyroid	[0.1]	0	1	44	1	384	[0.9]	0	2	57	7–206
197	Connective tissue	[0.0]	0	1	145	[0.1]	0	[0.4]	0	1	83	2–461
201	Hodgkin's disease	[0.1]	0	[0.5]	0	[0.1]	0	[0.3]	0	[0.9]	0	0–423
200, 202	Non-Hodgkin's lymphoma	1	657	3	150	1	237	[1.5]	0	5	123	40–288
203	Multiple myeloma	[0.1]	0	1	68	[0.2]	0	1	134	2	80	10–288
204.3	Acute leukemia	[0.1]	0	2	196	[0.1]	0	[0.5]	0	2	113	14–410
204.0–2.4	Other leukemia	[0.1]	0	[1.2]	0	[0.1]	0	1	172	1	49	1–275
199	Unknown	[0.1]	0	1	50	[0.6]	0	2	110	3	68	14–199
140–204	All sites ^c	6	73	86	85	25	149	68	105	185	97	84–112

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

of buildings with tiles and mosaic panels. Due to the small numbers, the women have been included in occupational group 53.

Results

A high risk of lung cancer was observed in all countries except Sweden (table 62). In addition, an elevated risk of pharyngeal cancer was observed in all 4 countries.

Comments

Smoking is by far the most important cause of lung cancer, but it has been suggested that occupational exposure to silica dust from sand, which may be considerable in the present group, may increase lung cancer risk (79, 80). It is not known whether the pharyngeal cancer risk is related to occupational exposures in this group.

Printers and related workers: occupational group 36

Workers in group 36 compose type, cast, and engrave printing plates and operate printing presses to print text and illustrations and bind books. The occupational groups include type-setters, printers (not textile printers), and book binders.

Results

The risk of cancer of the mouth, pharynx, and liver was increased among the men of this group in all 4 countries, the only exception being the SIR below unity for pharyngeal cancer in Norway (table 63). For both genders elevated SIR values for cancer of the colon and rectum were found in all countries, except among Danish women (table 64). The risk of lung cancer was high in all the groups, except for Finnish men. Excess risks of kidney and bladder cancer were found among the men.

Table 60. Other construction workers (not otherwise stated), men (N=170 999) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	155	194	100	119	79	160	100	159	434	157	143–173
141	Tongue	17	105	14	88	14	84	27	111	72	98	77–124
143–144	Mouth	34	100	10	64	20	86	37	100	101	92	76–112
145–148	Pharynx	32	74	44	149	19	68	45	86	140	92	78–108
150	Esophagus	88	119	72	131	31	66	68	92	259	104	92–117
151	Stomach	316	114	417	113	301	107	416	129	1450	116	110–122
153	Colon	338	81	172	96	273	85	376	86	1159	86	81–91
154	Rectum	324	94	164	98	224	101	287	92	999	95	90–102
155.0	Liver	40	58	77	120	24	81	87	95	228	90	79–102
155.1	Gall bladder	32	74	29	84	18	96	21	60	100	76	62–92
157	Pancreas	208	103	178	105	142	99	222	98	750	101	94–109
160	Nose	18	103	22	178	12	103	16	107	68	120	93–152
161	Larynx	119	101	115	126	52	95	79	98	365	106	96–117
162	Lung	1407	105	1921	152	596	105	775	109	4699	121	117–124
162.2	Pleura	21	73	19	122	13	83	35	159	88	107	86–132
170	Breast	9	93	3	68	6	118	3	29	21	71	44–109
177	Prostate	479	88	481	94	753	101	1204	94	2917	95	91–98
178	Testis	50	78	10	63	16	70	29	87	105	77	64–93
180.0	Kidney	147	96	163	102	128	104	221	92	659	97	90–105
181	Bladder	496	94	264	116	282	91	407	89	1449	95	90–100
190	Melanoma	90	86	86	89	78	68	148	79	402	80	72–88
191	Other skin ^b	614	82	76	84	117	97	213	100	1020	87	82–93
193	Brain	149	93	115	97	85	90	179	90	528	92	85–101
194	Thyroid	25	149	20	80	18	93	15	43	78	81	64–101
197	Connective tissue	17	89	31	115	24	139	42	92	114	105	87–126
201	Hodgkin's disease	29	90	26	89	12	66	36	88	103	86	71–104
200, 202	Non-Hodgkin's lymphoma	117	97	74	86	93	91	178	90	462	91	83–100
203	Multiple myeloma	88	131	42	73	81	116	101	101	312	106	95–118
204.3	Acute leukemia	55	97	40	105	32	93	56	88	183	95	82–110
204.0–2,4	Other leukemia	110	109	67	94	43	90	108	102	328	100	90–112
199	Unknown	41	93	84	108	152	103	163	93	440	99	90–108
140–204	All sites ^c	5090	98	4965	118	3714	98	5867	96	19636	102	101–103

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 61.** Other construction workers (not otherwise stated), women (N=3910) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.0]	0	2	200	[0.0]	0	[0.0]	0	2	195	24–705
141	Tongue	[0.0]	0	2	192	[0.0]	0	[0.0]	0	2	186	23–673
143–144	Mouth	[0.0]	0	1	93	[0.0]	0	[0.0]	0	1	88	2–493
145–148	Pharynx	[0.0]	0	1	73	[0.0]	0	[0.0]	0	1	70	2–391
150	Esophagus	[0.0]	0	8	206	[0.0]	0	[0.0]	0	8	202	87–399
151	Stomach	[0.2]	0	32	154	[0.2]	0	[0.2]	0	32	150	103–212
153	Colon	2	398	16	85	1	228	[0.4]	0	19	94	57–147
154	Rectum	1	383	8	62	[0.2]	0	[0.2]	0	9	66	30–125
155.0	Liver	[0.1]	0	4	112	[0.0]	0	[0.1]	0	4	109	30–278
155.1	Gall bladder	[0.1]	0	5	72	[0.0]	0	[0.1]	0	5	70	23–164
157	Pancreas	[0.2]	0	15	119	[0.1]	0	[0.2]	0	15	114	64–189
160	Nose	[0.0]	0	[0.7]	0	[0.0]	0	[0.0]	0	[0.7]	0	0–521
161	Larynx	[0.0]	0	5	674	[0.0]	0	[0.0]	0	5	637	207–1486
162	Lung	[0.5]	0	37	237	[0.2]	0	1	379	38	229	162–314
162.2	Pleura	[0.0]	0	2	334	[0.0]	0	[0.0]	0	2	324	39–1171
170	Breast	[1.6]	0	86	88	1	89	1	54	88	86	69–106
171	Cervix uteri	[0.5]	0	25	233	[0.3]	0	[0.3]	0	25	214	138–316
172	Corpus uteri	[0.4]	0	25	91	2	672	[0.5]	0	27	94	62–137
175	Ovary	[0.4]	0	26	129	1	325	[0.5]	0	27	126	83–184

(continued)

Table 61. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	[0.1]	0	12	114	[0.1]	0	[0.2]	0	12	110	57—193
181	Bladder	[0.2]	0	4	75	[0.1]	0	[0.1]	0	4	69	19—177
190	Melanoma	[0.2]	0	11	129	[0.2]	0	[0.2]	0	11	121	60—217
191	Other skin ^b	1	156	5	80	[0.1]	0	[0.1]	0	6	85	31—184
193	Brain	[0.2]	0	13	92	[0.1]	0	[0.2]	0	13	88	47—151
194	Thyroid	[0.0]	0	6	85	[0.1]	0	[0.1]	0	6	83	30—181
197	Connective tissue	[0.0]	0	3	130	[0.0]	0	1	2416	4	168	46—429
201	Hodgkin's disease	[0.0]	0	2	122	[0.0]	0	[0.0]	0	2	117	14—424
200, 202	Non-Hodgkin's lymphoma	1	927	7	102	[0.1]	0	[0.2]	0	8	111	48—218
203	Multiple myeloma	[0.1]	0	8	149	[0.1]	0	[0.1]	0	8	143	62—283
204.3	Acute leukemia	[0.1]	0	5	144	[0.0]	0	[0.1]	0	5	138	45—323
204.0—2,4	Other leukemia	[0.1]	0	2	45	[0.0]	0	[0.1]	0	2	44	5—158
199	Unknown	[0.1]	0	13	179	1	622	[0.2]	0	14	183	100—306
140—204	All sites ^c	5	85	397	115	6	134	3	46	411	113	103—125

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 62.** Bricklayers, men (N=40 466) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	26	121	9	70	17	153	18	131	70	118	92—150
141	Tongue	5	107	3	127	3	77	3	57	14	87	47—145
143—144	Mouth	15	162	1	43	6	109	9	112	31	123	84—175
145—148	Pharynx	17	140	6	135	12	181	22	196	57	166	125—215
150	Esophagus	24	124	6	72	16	151	20	123	66	121	94—154
151	Stomach	70	98	54	97	72	118	75	106	271	105	93—118
153	Colon	92	86	21	78	68	95	85	89	266	88	78—99
154	Rectum	107	120	25	98	58	117	71	103	261	112	99—127
155.0	Liver	19	106	12	124	7	108	19	94	57	105	79—136
155.1	Gall bladder	11	99	4	76	6	149	9	117	30	107	72—152
157	Pancreas	50	96	21	82	38	121	43	87	152	96	82—112
160	Nose	3	63	[1.9]	0	1	37	2	62	6	48	18—104
161	Larynx	35	112	11	80	14	110	19	109	79	105	83—131
162	Lung	405	118	265	138	162	126	149	96	981	119	112—127
162.2	Pleura	9	118	3	130	2	56	7	146	21	114	71—175
170	Breast	4	156	[0.7]	0	1	85	3	135	8	120	52—237
177	Prostate	131	97	89	115	133	86	254	89	607	93	86—101
178	Testis	29	109	2	94	4	64	7	100	42	100	72—136
180.0	Kidney	49	120	23	96	30	107	48	92	150	103	88—121
181	Bladder	151	110	45	130	68	100	95	95	359	106	95—117
190	Melanoma	38	116	15	106	17	59	36	91	106	92	76—111
191	Other skin ^b	210	104	12	88	21	81	36	76	279	97	86—109
193	Brain	38	81	13	76	25	109	40	94	116	90	75—107
194	Thyroid	6	123	3	82	5	109	9	120	23	111	71—167
197	Connective tissue	7	125	5	127	4	99	10	101	26	111	72—162
201	Hodgkin's disease	6	57	9	218	3	69	11	125	29	104	70—150
200, 202	Non-Hodgkin's lymphoma	34	101	13	102	15	63	45	105	107	95	78—114
203	Multiple myeloma	13	74	11	126	21	136	20	92	65	102	79—130
204.3	Acute leukemia	15	96	3	53	7	91	10	73	35	82	57—114
204.0—2,4	Other leukemia	27	101	10	93	10	95	18	78	65	91	71—116
199	Unknown	16	138	11	94	41	127	43	112	111	118	98—142
140—204	All sites ^c	1446	106	700	110	879	105	1282	96	4307	103	100—106

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 63. Printers and related workers, men (N=44 002) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	8	2	24	6	66	11	66	20	42	26–65
141	Tongue	2	67	[2.0]	0	5	140	12	173	19	123	74–192
143–144	Mouth	11	190	3	165	10	206	15	144	39	170	121–233
145–148	Pharynx	10	130	4	125	4	69	32	218	50	159	118–210
150	Esophagus	11	95	3	55	15	174	13	67	42	93	67–126
151	Stomach	33	78	37	100	47	94	86	103	203	95	83–109
153	Colon	79	125	29	151	61	103	132	114	301	117	105–131
154	Rectum	56	107	22	132	53	129	91	110	222	115	101–132
155.0	Liver	18	172	9	147	8	149	26	109	61	133	102–171
155.1	Gall bladder	9	139	2	58	6	178	14	153	31	138	94–196
157	Pancreas	31	101	17	101	27	106	55	93	130	98	83–117
160	Nose	6	205	1	75	2	88	3	72	12	112	58–196
161	Larynx	23	121	11	123	9	86	30	137	73	121	95–152
162	Lung	248	123	86	73	122	118	218	115	674	110	102–119
162.2	Pleura	8	173	[1.9]	0	[3.1]	0	5	81	13	83	44–141
170	Breast	4	260	3	601	[1.0]	0	4	142	11	188	94–336
177	Prostate	82	110	50	111	123	102	301	95	556	100	92–109
178	Testis	23	113	3	95	12	125	19	141	57	122	93–159
180.0	Kidney	20	81	27	153	35	147	54	81	136	102	87–121
181	Bladder	108	135	26	117	76	137	142	117	352	126	114–140
190	Melanoma	25	112	17	122	36	117	75	129	153	123	105–144
191	Other skin ^b	143	117	12	132	18	84	61	111	234	113	99–128
193	Brain	28	92	14	86	22	100	71	119	135	105	89–124
194	Thyroid	5	159	6	175	3	65	7	67	21	97	60–148
197	Connective tissue	7	191	3	85	4	107	17	128	31	128	87–182
201	Hodgkin's disease	8	109	5	113	3	64	9	70	25	85	55–126
200, 202	Non-Hodgkin's lymphoma	17	80	9	87	20	93	60	108	106	97	81–118
203	Multiple myeloma	11	107	9	153	11	87	10	38	41	74	53–100
204.3	Acute leukemia	7	72	3	64	6	87	22	123	38	97	68–133
204.0–2,4	Other leukemia	14	88	7	93	8	90	37	129	66	108	84–138
199	Unknown	12	175	5	64	24	91	40	84	81	91	73–114
140–204	All sites ^c	929	114	428	100	780	111	1746	107	3883	108	105–112

^a International Classification of Diseases (7th revision).
^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.

Comments

The workers in this group can be exposed to a diversity of chemicals, such as carbon black, lead, aromatic solvents and printing dyes (81). Relatively little is known however about the effects of these chemicals on human cancer risk. Studies have indicated that lead exposure may be related to renal cancer (82, 83), and a relationship with gastrointestinal cancer has also been suggested (84). Solvents may affect both the kidney and the liver. For women, the high risks of cancer of the breast and ovary, combined with the elevated risk of cervical cancer, are an unusual finding and may also indicate an effect of occupational exposure. An association between solvents and breast cancer risk has been suggested (85, 86).

Chemical process workers: occupational group 37

Workers in group 37 distill, refine, cook, roast, and grind

chemicals, prepare pulp for paper production, and make paper.

Results

For men, the risks of cancers of the lung, larynx, lip and rectum were elevated in all countries (table 65). For women, the number of cases of pleural and cervical cancer and skin melanoma was higher than expected (table 66). Among the women leukemia was observed less frequently than expected in all 4 countries.

Comments

Little is known about specific work-related cancer risks in the present group with at least 3 distinguished subgroups of workers with different exposures. The risk of laryngeal cancer among the men, as compared with the lung cancer risk, is especially high. The pattern of elevated cervical cancer risk and lowered breast cancer risk

Table 64. Printers and related workers, women (N=14 321) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.3]	0	1	101	[0.3]	0	2	260	3	130	27–378
141	Tongue	2	542	1	93	1	266	2	190	6	208	76–454
143–144	Mouth	[0.8]	0	1	90	[0.6]	0	2	120	3	72	15–211
145–148	Pharynx	[0.7]	0	1	72	[0.4]	0	[1.7]	0	1	24	1–132
150	Esophagus	[0.9]	0	5	127	1	156	2	109	8	109	47–214
151	Stomach	6	128	24	110	10	144	9	62	49	102	76–135
153	Colon	14	89	30	151	21	133	43	111	108	120	99–145
154	Rectum	8	96	19	143	17	216	21	101	65	129	100–165
155.0	Liver	2	138	3	81	1	131	6	137	12	117	60–204
155.1	Gall bladder	2	81	6	84	2	165	1	12	11	58	29–104
157	Pancreas	5	91	15	116	7	145	19	122	46	119	87–158
160	Nose	[0.3]	0	[0.7]	0	1	317	[0.7]	0	1	49	1–270
161	Larynx	3	313	2	279	1	413	1	107	7	245	99–505
162	Lung	32	185	29	187	13	163	34	149	108	170	141–205
162.2	Pleura	[0.4]	0	1	159	[0.1]	0	[0.4]	0	1	66	2–368
170	Breast	83	138	133	120	69	157	163	99	448	118	108–130
171	Cervix uteri	25	137	10	89	14	133	43	190	92	147	118–180
172	Corpus uteri	12	80	28	102	6	56	47	118	93	100	81–122
175	Ovary	15	105	35	164	13	111	48	118	111	126	105–152
180.0	Kidney	4	98	8	76	3	86	17	123	32	100	68–141
181	Bladder	5	95	6	111	10	242	17	137	38	139	99–191
190	Melanoma	7	101	10	100	6	78	17	94	40	94	67–127
191	Other skin ^b	24	108	3	45	2	59	7	78	36	87	61–121
193	Brain	10	144	15	95	1	19	18	86	44	90	66–121
194	Thyroid	2	159	9	106	[2.9]	0	6	75	17	82	48–132
197	Connective tissue	1	156	1	39	[0.8]	0	4	107	6	78	29–170
201	Hodgkin's disease	2	225	3	151	1	159	[2.3]	0	6	104	38–226
200, 202	Non-Hodgkin's lymphoma	5	136	9	122	7	162	16	121	37	129	91–178
203	Multiple myeloma	3	164	5	94	1	40	9	134	18	110	65–174
204.3	Acute leukemia	[2.0]	0	2	53	1	74	4	83	7	59	24–121
204.0–2,4	Other leukemia	2	101	6	130	2	146	5	96	15	114	64–187
199	Unknown	3	183	6	80	8	137	18	111	35	112	78–156
140–204	All sites ^c	247	119	437	118	223	131	621	108	1528	116	110–122

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

is usually explained by a childbearing pattern with an active sex life and first child at a young age.

Food manufacture workers: occupational group 38

Workers in group 38 prepare food products of all kinds for human and animal consumption. The group includes occupations such as grain millers, butchers and meat preparers, food preservers, dairy product processors, bakers, pastry cooks, and confectionery makers.

Results

For the men, excess cases were observed for cancer of the larynx, lung, and pancreas (table 67). For the women, the risk of cervical cancer was increased, as was cancer of the lung and gallbladder in 3 of the countries (table 68). The risk of breast cancer was similarly decreased in all 4 countries. For both genders there was also a lower risk for skin cancers, whereas the very low SIR val-

ues for cancers of the mouth, nose, and pleura were observed only for the men.

Comments

It is unknown whether occupational exposures in the present group contributed additionally to the elevated risks of cancer of the lung, larynx, pancreas, and bladder. According to standard thinking, the systematically low breast cancer risk is explained by a childbearing pattern with a young age at birth of first child and a high number of children. However, there is no obvious explanation for the exceptionally low rates for cancers of the mouth, nose and pleura. Since these findings were found only for the men, the findings may be due to chance.

Beverage manufacture workers: occupational group 39

Workers in group 39 produce liquor, wine, beer, soft drinks, and mineral water.

Table 65. Chemical process workers, men (N=54 981) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	15	112	21	104	27	106	42	169	105	125	104–152
141	Tongue	5	180	4	93	7	80	3	32	19	75	45–118
143–144	Mouth	9	157	3	73	11	89	12	84	35	96	67–134
145–148	Pharynx	8	110	8	107	20	135	16	80	52	105	78–137
150	Esophagus	16	131	8	61	33	136	21	71	78	99	78–123
151	Stomach	56	124	90	102	140	98	155	120	441	109	99–120
153	Colon	69	102	45	100	171	104	160	93	445	99	90–109
154	Rectum	67	119	52	129	123	108	142	115	384	115	104–127
155.0	Liver	9	79	13	86	20	132	24	66	66	84	65–107
155.1	Gall bladder	8	114	11	132	7	74	11	79	37	95	67–132
157	Pancreas	29	88	35	86	76	104	91	102	231	98	86–111
160	Nose	3	102	3	96	6	99	7	122	19	106	64–166
161	Larynx	32	161	31	141	41	143	38	122	142	140	119–165
162	Lung	248	112	320	109	367	126	294	105	1229	113	107–119
162.2	Pleura	7	147	4	97	14	172	10	118	35	137	96–191
170	Breast	5	314	1	89	3	114	1	25	10	107	51–196
177	Prostate	91	105	96	84	311	84	501	97	999	92	86–98
178	Testis	11	97	6	109	15	111	11	100	43	104	75–140
180.0	Kidney	24	94	48	117	64	100	93	100	229	102	90–116
181	Bladder	91	104	61	112	156	99	188	105	496	104	95–113
190	Melanoma	16	89	28	99	65	103	54	79	163	92	79–107
191	Other skin ^b	110	89	27	124	58	95	65	77	260	89	79–101
193	Brain	28	103	45	133	42	83	75	101	190	102	89–118
194	Thyroid	1	36	9	127	9	87	19	145	38	114	81–156
197	Connective tissue	3	93	6	81	6	66	20	115	35	94	66–131
201	Hodgkin's disease	11	198	9	104	12	122	18	119	50	128	95–169
200, 202	Non-Hodgkin's lymphoma	26	129	24	105	66	123	66	87	182	105	91–122
203	Multiple myeloma	8	73	16	113	44	123	42	107	110	110	91–132
204.3	Acute leukemia	9	95	14	138	14	79	27	111	64	104	80–132
204.0–2,4	Other leukemia	14	84	19	108	20	82	46	111	99	99	80–120
199	Unknown	9	124	17	91	95	127	80	116	201	118	103–136
140–204	All sites ^c	945	111	1070	104	2031	105	2423	101	6469	104	102–107

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 66.** Chemical process workers, women (N=12 555) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.4]	0	2	225	[0.3]	0	1	165	3	138	29–404
141	Tongue	[0.6]	0	[0.9]	0	[0.3]	0	5	618	5	187	61–436
143–144	Mouth	[1.3]	0	[1.0]	0	[0.5]	0	1	77	1	25	1–137
145–148	Pharynx	[1.1]	0	[1.2]	0	[0.4]	0	1	78	1	25	1–139
150	Esophagus	1	65	2	57	[0.6]	0	[1.5]	0	3	42	9–124
151	Stomach	10	132	20	106	7	113	12	104	49	111	82–147
153	Colon	18	70	22	128	19	132	26	85	85	97	77–120
154	Rectum	17	125	13	113	10	140	16	98	56	115	87–150
155.0	Liver	1	42	5	155	3	428	6	172	15	154	86–253
155.1	Gall bladder	1	25	5	81	1	90	7	108	14	78	43–132
157	Pancreas	17	189	15	133	4	91	12	96	48	129	95–171
160	Nose	[0.5]	0	1	161	1	352	[0.5]	0	2	102	12–369
161	Larynx	[1.5]	0	[0.6]	0	[0.2]	0	1	142	1	32	1–179
162	Lung	47	168	5	37	11	149	17	97	80	120	95–150
162.2	Pleura	1	166	3	560	[0.1]	0	2	630	6	386	142–840
170	Breast	78	84	71	79	47	121	106	87	302	88	78–98
171	Cervix uteri	45	162	5	52	15	164	26	161	91	146	117–179
172	Corpus uteri	19	76	18	76	7	70	36	118	80	90	71–112
175	Ovary	29	127	26	145	5	47	33	108	93	113	92–139

(continued)

Table 66. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	9	135	10	109	5	157	13	120	37	124	87—171
181	Bladder	12	139	2	42	3	80	12	121	29	107	72—154
190	Melanoma	16	154	11	137	10	152	17	132	54	143	107—186
191	Other skin ^b	43	122	5	86	4	132	6	84	58	113	86—146
193	Brain	12	111	9	69	4	88	13	84	38	87	61—119
194	Thyroid	1	52	7	105	1	41	5	86	14	83	45—140
197	Connective tissue	1	101	2	95	[0.7]	0	1	36	4	61	17—156
201	Hodgkin's disease	1	76	[1.6]	0	[0.5]	0	1	60	2	39	5—142
200, 202	Non-Hodgkin's lymphoma	5	86	9	144	2	51	6	59	22	84	53—127
203	Multiple myeloma	1	33	4	85	1	44	5	93	11	71	36—128
204.3	Acute leukemia	1	32	3	95	[1.2]	0	1	28	5	45	15—105
204.0—2.4	Other leukemia	3	94	1	25	[1.3]	0	2	49	6	48	18—104
199	Unknown	1	38	4	61	7	133	25	195	37	136	96—187
140—204	All sites ^c	356	108	289	92	168	110	447	103	1260	102	97—108

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 67. Food manufacture workers, men (N=75 569) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	36	87	14	112	19	76	20	80	89	86	69—106
141	Tongue	11	122	[2.6]	0	3	33	12	124	26	86	56—126
143—144	Mouth	10	56	2	79	10	80	11	74	33	69	48—97
145—148	Pharynx	24	103	2	44	20	134	25	120	71	112	87—141
150	Esophagus	33	89	8	97	24	101	33	112	98	99	81—121
151	Stomach	157	115	58	105	146	105	138	108	499	109	100—119
153	Colon	205	100	35	126	145	90	150	87	535	94	87—103
154	Rectum	165	97	28	111	102	91	147	119	442	103	93—113
155.0	Liver	25	73	11	117	10	68	34	94	80	84	67—105
155.1	Gall bladder	31	147	3	58	13	140	14	101	61	124	95—159
157	Pancreas	97	97	35	138	89	125	113	127	334	117	105—130
160	Nose	6	66	2	105	4	66	1	17	13	57	30—97
161	Larynx	90	148	12	89	43	152	32	100	177	132	114—152
162	Lung	837	126	158	86	342	120	311	110	1648	117	111—122
162.2	Pleura	6	41	2	78	2	25	3	34	13	38	20—65
170	Breast	2	41	[0.7]	0	1	38	3	73	6	49	18—106
177	Prostate	267	106	65	89	360	102	510	102	1202	102	96—108
178	Testis	44	96	[3.3]	0	13	80	9	67	66	84	65—106
180.0	Kidney	80	102	41	163	72	114	99	104	292	111	99—125
181	Bladder	304	116	39	115	160	104	195	108	698	111	103—119
190	Melanoma	43	70	16	93	67	100	64	86	190	86	75—100
191	Other skin ^b	279	73	9	66	49	83	89	106	426	79	72—87
193	Brain	93	104	14	68	43	82	70	88	220	91	80—104
194	Thyroid	13	142	3	69	13	121	14	101	43	113	82—152
197	Connective tissue	9	85	5	109	10	108	18	100	42	99	71—134
201	Hodgkin's disease	22	113	6	114	9	87	17	105	54	105	79—137
200, 202	Non-Hodgkin's lymphoma	64	100	14	99	59	109	78	100	215	102	89—117
203	Multiple myeloma	22	66	7	79	32	91	50	127	111	95	79—115
204.3	Acute leukemia	32	108	6	96	18	101	21	84	77	98	77—122
204.0—2.4	Other leukemia	51	101	9	82	18	75	36	86	114	89	74—108
199	Unknown	22	99	4	34	79	108	60	86	165	93	80—109
140—204	All sites ^c	2794	107	617	97	1978	104	2462	102	7851	104	102—106

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 68. Food manufacture workers, women (N=48 220) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	51	1	34	3	185	3	170	8	97	42—191
141	Tongue	5	181	1	32	2	95	5	215	13	125	67—215
143—144	Mouth	9	153	2	61	4	117	8	217	23	142	90—212
145—148	Pharynx	7	133	5	123	3	120	5	138	20	129	79—200
150	Esophagus	6	85	10	88	6	153	3	69	25	94	61—138
151	Stomach	39	113	64	102	58	140	44	131	205	119	104—136
153	Colon	101	87	54	94	100	106	93	104	348	97	88—108
154	Rectum	61	99	42	109	39	83	50	106	192	99	86—114
155.0	Liver	10	93	12	113	3	65	15	147	40	110	79—150
155.1	Gall bladder	28	153	25	122	10	134	16	84	79	121	96—151
157	Pancreas	47	115	39	105	33	112	31	85	150	104	89—122
160	Nose	4	167	3	143	2	109	2	130	11	140	70—251
161	Larynx	11	153	2	93	2	141	2	102	17	134	78—214
162	Lung	148	114	43	94	53	115	66	132	310	114	102—127
162.2	Pleura	4	146	[1.8]	0	1	160	1	110	6	99	36—215
170	Breast	347	80	259	82	196	83	258	76	1060	80	75—85
171	Cervix uteri	195	151	30	92	53	102	47	106	325	126	113—140
172	Corpus uteri	102	89	78	96	63	103	80	95	323	95	85—106
175	Ovary	94	89	57	92	72	112	81	95	304	96	86—107
180.0	Kidney	23	75	29	93	30	146	27	87	109	96	80—116
181	Bladder	34	86	14	89	22	88	29	101	99	91	74—110
190	Melanoma	41	84	20	71	24	65	36	103	121	81	68—97
191	Other skin ^b	132	81	15	79	16	79	22	105	185	83	72—96
193	Brain	68	136	49	107	26	95	30	70	173	104	90—121
194	Thyroid	9	101	16	67	13	94	12	75	50	80	59—105
197	Connective tissue	2	43	7	97	2	47	6	76	17	71	41—113
201	Hodgkin's disease	9	150	8	145	2	64	4	85	23	119	75—178
200, 202	Non-Hodgkin's lymphoma	21	78	15	71	22	89	24	82	82	80	64—100
203	Multiple myeloma	12	87	10	63	14	92	23	146	59	98	74—126
204.3	Acute leukemia	12	85	13	120	7	93	9	87	41	96	69—130
204.0—2.4	Other leukemia	9	62	11	82	6	72	21	177	47	98	72—130
199	Unknown	6	49	19	88	33	94	31	84	89	84	67—103
140—204	All sites ^c	1489	98	964	90	922	97	1157	94	4532	95	92—98

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Results

More than 50% of the persons included in this group came from Denmark. An elevated SIR for cancer of all sites was found for both the men (table 69) and the women (table 70). The risks for lung and pancreatic cancer were high for both genders. Among the men excess risks for all alcohol-associated cancers were observed at the Nordic level. The risk of rectal cancer was also increased among the men. Based on 3 cases only (occurring in Denmark and Finland), the SIR for cancer of the nose for the women of all 4 countries combined was 618; for the men the SIR was 146, also based on 3 cases. For the women, the cervical cancer risk was highly elevated.

Comments

Rectal cancer has previously been related to beer consumption (87, 88). However, other studies have not confirmed this finding (89), and the issue therefore remains unsettled. All the other cancer sites which were observed in excess among the men in this group have an estab-

lished relation with alcohol or tobacco, either alone or in combination. A higher alcohol consumption in this group than in the average population can partly be explained by previous traditions of free beer, quotas of cheaper liquor, and other such perks given the workers. Alcohol consumption can thus be viewed as a work-related exposure. Specific occupational exposures that have contributed to the cancer risk are not known. For the women, tobacco exposure appears to be a more important factor than alcohol. The finding of nose cancer among the men and women was based on only 3 cases in each gender, and it may well be a chance finding.

Tobacco manufacture workers: occupational group 40

Workers in group 40 prepare and treat tobacco leaves and make cigarettes, cigars, and other tobacco products.

Table 69. Beverage manufacture workers, men (N=6485) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	7	121	[0.7]	0	[1.4]	0	1	61	8	84	36—166
141	Tongue	8	655	[0.1]	0	2	415	[0.6]	0	10	409	196—752
143—144	Mouth	5	203	[0.1]	0	3	446	1	109	9	215	98—408
145—148	Pharynx	10	316	[0.3]	0	3	373	5	390	18	327	194—517
150	Esophagus	23	441	1	212	5	383	1	52	30	336	227—480
151	Stomach	16	83	3	96	13	169	12	139	44	114	83—153
153	Colon	35	123	1	64	9	101	19	166	64	127	98—162
154	Rectum	31	130	1	69	10	163	14	172	56	141	107—184
155.0	Liver	11	229	[0.6]	0	[0.8]	0	5	205	16	186	106—302
155.1	Gall bladder	5	168	[0.3]	0	[0.5]	0	[0.9]	0	5	106	34—247
157	Pancreas	27	193	5	347	3	76	8	136	43	170	123—229
160	Nose	2	159	[0.1]	0	[0.3]	0	1	271	3	146	30—426
161	Larynx	23	270	2	265	2	130	3	149	30	234	158—334
162	Lung	140	149	9	86	30	192	23	126	202	146	127—168
162.2	Pleura	2	99	1	718	1	227	[0.6]	0	4	126	34—324
170	Breast	[0.7]	0	[0.0]	0	[0.1]	0	1	378	1	89	2—495
177	Prostate	41	114	[4.4]	0	22	112	31	89	94	99	80—121
178	Testis	6	116	[0.2]	0	2	232	1	136	9	130	59—246
180.0	Kidney	13	119	2	145	3	87	7	116	25	115	74—169
181	Bladder	43	117	[2.0]	0	11	130	11	93	65	110	85—140
190	Melanoma	6	76	1	111	3	83	1	23	11	66	33—117
191	Other skin ^b	47	89	[0.8]	0	4	122	3	53	54	86	65—113
193	Brain	7	59	3	279	3	106	4	84	17	83	48—132
194	Thyroid	4	330	[0.2]	0	[0.6]	0	[0.9]	0	4	139	38—356
197	Connective tissue	3	214	1	406	2	395	1	89	7	213	86—439
201	Hodgkin's disease	2	81	[0.3]	0	[0.6]	0	1	99	3	70	14—204
200, 202	Non-Hodgkin's lymphoma	10	116	1	130	[3.0]	0	5	102	16	93	53—151
203	Multiple myeloma	4	86	1	201	3	155	2	78	10	104	50—190
204.3	Acute leukemia	5	123	[0.3]	0	3	307	3	187	11	158	79—282
204.0—2,4	Other leukemia	8	114	1	163	1	75	3	110	13	111	59—190
199	Unknown	7	230	1	150	7	173	7	155	22	179	112—271
140—204	All sites ^c	503	139	36	100	143	136	187	119	869	131	123—140

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Results

The risk of cancer at all sites was elevated for both genders (tables 71 and 72). A large part of the excess was mainly an excess lung cancer risk, but there was also an excess for the remaining sites as well. For the women, elevated risks of liver, bladder, and cervical cancer were observed, and a low SIR for malignant melanoma was found.

Comments

Lung cancer is strongly associated with tobacco smoking. Bladder cancer is also related to smoking, but less strongly so. The role of tobacco in cervical cancer is, at present, unclear, while human papilloma virus has been found to play a key role in cervical carcinogenesis. It is consistently found that cervical cancer may share important risk factors with the cancers that are generally accepted as tobacco-related (90). For this occupational group it seems reasonable to consider tobacco smoking as a work-related exposure; for instance, the workers

were given a certain amount of free cigarettes for a long period.

Glass, ceramic and tile workers and others: occupational group 41

Workers from different industrial branches make up group 41, which includes glass formers and cutters, potters, glass and ceramics kilnmen, glass engravers and etchers, glass painters and decorators, rubber and plastic product makers, tanners, fellmongers and peltdressers, musical instrument makers and tuners, stonecutters and carvers, paper and paperboard products makers, and other small groups.

Results

For the men and women in all 4 countries, the risk of lung cancer was higher than expected (tables 73 and 74).

Table 70. Beverage manufacture workers, women (N =3190) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.2]	0	[0.1]	0	[0.0]	0	[0.1]	0	[0.5]	0	0–766
141	Tongue	[0.3]	0	[0.2]	0	[0.0]	0	[0.2]	0	[0.6]	0	0–591
143–144	Mouth	2	312	[0.2]	0	[0.1]	0	[0.2]	0	2	186	23–671
145–148	Pharynx	1	181	[0.2]	0	[0.0]	0	[0.2]	0	1	99	3–554
150	Esophagus	[0.8]	0	[0.5]	0	[0.1]	0	1	368	1	61	2–340
151	Stomach	8	206	4	138	1	145	5	235	18	188	111–297
153	Colon	14	107	1	38	1	63	6	108	22	96	60–145
154	Rectum	4	58	1	56	[0.8]	0	2	68	7	56	23–116
155.0	Liver	[1.2]	0	[0.5]	0	[0.1]	0	3	469	3	125	26–365
155.1	Gall bladder	4	191	1	106	[0.1]	0	[1.2]	0	5	115	37–268
157	Pancreas	11	237	3	175	[0.5]	0	2	87	16	175	100–284
160	Nose	2	767	1	1017	[0.0]	0	[0.1]	0	3	618	128–1807
161	Larynx	1	131	[0.1]	0	[0.0]	0	[0.1]	0	1	100	3–556
162	Lung	37	265	1	48	1	129	4	130	43	216	156–291
162.2	Pleura	[0.3]	0	[0.1]	0	[0.0]	0	[0.1]	0	[0.5]	0	0–807
170	Breast	38	83	18	120	4	101	21	101	81	95	75–118
171	Cervix uteri	26	195	3	198	[0.9]	0	9	336	38	206	146–283
172	Corpus uteri	8	64	3	80	2	193	3	58	16	71	41–116
175	Ovary	15	132	3	103	2	186	6	115	26	126	83–185
180.0	Kidney	4	118	[1.4]	0	1	289	1	52	6	85	31–184
181	Bladder	10	227	[0.7]	0	[0.4]	0	1	56	11	150	75–268
190	Melanoma	2	40	1	75	1	164	[2.1]	0	4	44	12–114
191	Other skin ^b	17	97	[0.9]	0	1	302	[1.3]	0	18	90	53–142
193	Brain	3	57	2	93	[0.5]	0	1	38	6	57	21–124
194	Thyroid	1	105	2	178	[0.2]	0	1	103	4	122	33–312
197	Connective tissue	[0.5]	0	1	295	1	1426	[0.5]	0	2	144	17–522
201	Hodgkin's disease	[0.6]	0	2	769	[0.1]	0	[0.3]	0	2	162	20–585
200, 202	Non-Hodgkin's lymphoma	[2.9]	0	1	101	3	725	1	55	5	81	26–190
203	Multiple myeloma	2	128	1	140	[0.3]	0	[1.0]	0	3	85	18–249
204.3	Acute leukemia	[1.5]	0	[0.5]	0	[0.1]	0	[0.6]	0	[2.8]	0	0–131
204.0–2.4	Other leukemia	3	183	1	163	[0.1]	0	2	270	6	191	70–417
199	Unknown	2	147	1	100	1	172	[2.3]	0	4	76	21–195
140–204	All sites ^c	201	123	52	104	18	113	76	100	347	114	102–126

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 71.** Tobacco manufacture workers, men (N=929) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	105	[0.2]	0	1	302	[0.1]	0	2	124	15–447
141	Tongue	2	1096	[0.0]	0	[0.1]	0	[0.1]	0	2	527	64–1905
143–144	Mouth	1	253	[0.0]	0	[0.2]	0	[0.1]	0	1	151	4–841
145–148	Pharynx	[0.5]	0	[0.1]	0	[0.2]	0	[0.1]	0	[0.9]	0	0–431
150	Esophagus	[0.9]	0	[0.1]	0	[0.3]	0	[0.1]	0	[1.5]	0	0–247
151	Stomach	1	29	1	108	1	54	1	161	4	58	16–149
153	Colon	7	136	1	220	2	95	1	119	11	129	64–231
154	Rectum	4	94	[0.4]	0	1	68	1	165	6	89	33–193
155.0	Liver	1	118	1	615	[0.2]	0	[0.2]	0	2	145	18–522
155.1	Gall bladder	[0.5]	0	[0.1]	0	[0.1]	0	[0.1]	0	[0.8]	0	0–451
157	Pancreas	1	40	1	235	3	317	1	229	6	139	51–302
160	Nose	1	479	[0.0]	0	[0.1]	0	[0.0]	0	1	288	7–1606
161	Larynx	2	141	[0.2]	0	1	271	[0.2]	0	3	138	28–404
162	Lung	28	167	7	222	8	212	1	72	44	176	128–236
162.2	Pleura	2	584	[0.0]	0	[0.1]	0	[0.0]	0	2	379	46–1371
170	Breast	[0.1]	0	[0.0]	0	[0.0]	0	[0.0]	0	[0.2]	0	0–2030
177	Prostate	6	85	1	77	3	63	5	208	15	97	54–159
178	Testis	1	183	[0.0]	0	[0.2]	0	[0.1]	0	1	123	3–685

(continued)

Table 71. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	2	108	1	250	1	122	[0.5]	0	4	113	31—289
181	Bladder	4	61	1	177	4	197	2	226	11	110	55—196
190	Melanoma	3	269	[0.3]	0	[0.8]	0	[0.4]	0	3	120	25—350
191	Other skin ^b	8	90	[0.2]	0	1	129	2	499	11	107	53—191
193	Brain	3	167	1	335	[0.6]	0	[0.4]	0	4	128	35—327
194	Thyroid	1	522	[0.1]	0	[0.1]	0	[0.1]	0	1	220	6—1224
197	Connective tissue	1	451	[0.1]	0	[0.1]	0	[0.1]	0	1	201	5—1120
201	Hodgkin's disease	1	293	[0.1]	0	[0.1]	0	[0.1]	0	1	162	4—901
200, 202	Non-Hodgkin's lymphoma	2	141	[0.2]	0	1	147	[0.4]	0	3	111	23—324
203	Multiple myeloma	1	120	1	685	[0.5]	0	[0.2]	0	2	122	15—442
204.3	Acute leukemia	1	149	[0.1]	0	[0.2]	0	[0.1]	0	1	89	2—498
204.0—2.4	Other leukemia	[1.2]	0	[0.2]	0	[0.3]	0	[0.2]	0	[1.9]	0	0—190
199	Unknown	[0.5]	0	[0.2]	0	1	103	[0.3]	0	1	49	1—273
140—204	All sites ^c	79	125	16	151	28	112	12	102	135	122	103—144

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 72. Tobacco manufacture workers, women (N=3699) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	2	679	[0.1]	0	[0.1]	0	[0.0]	0	2	413	50—1493
141	Tongue	[0.4]	0	[0.1]	0	[0.1]	0	[0.1]	0	[0.6]	0	0—584
143—144	Mouth	3	342	[0.1]	0	[0.1]	0	[0.1]	0	3	254	52—742
145—148	Pharynx	3	397	[0.1]	0	[0.1]	0	[0.1]	0	3	282	58—823
150	Esophagus	[1.0]	0	[0.4]	0	2	1668	[0.1]	0	2	121	15—437
151	Stomach	6	113	3	139	2	155	[0.6]	0	11	117	58—210
153	Colon	19	108	1	51	2	69	[1.8]	0	22	90	57—137
154	Rectum	17	183	1	74	2	139	[1.0]	0	20	153	93—236
155.0	Liver	6	370	1	268	[0.1]	0	[0.2]	0	7	300	121—619
155.1	Gall bladder	4	142	[0.7]	0	[0.2]	0	[0.3]	0	4	97	27—250
157	Pancreas	10	160	1	77	2	221	[0.7]	0	13	142	76—244
160	Nose	[0.4]	0	[0.1]	0	[0.1]	0	[0.0]	0	[0.5]	0	0—706
161	Larynx	1	97	[0.1]	0	[0.0]	0	[0.1]	0	1	83	2—460
162	Lung	50	265	[1.6]	0	4	283	5	412	59	255	194—329
162.2	Pleura	[0.4]	0	1	1585	[0.0]	0	[0.0]	0	1	195	5—1086
170	Breast	76	119	11	105	9	123	9	96	105	115	95—139
171	Cervix uteri	27	142	[1.1]	0	6	371	4	296	37	160	113—220
172	Corpus uteri	17	103	2	70	4	214	1	45	24	102	65—152
175	Ovary	13	84	[2.1]	0	3	152	3	130	19	87	52—135
180.0	Kidney	4	88	[1.1]	0	1	159	1	147	6	86	32—188
181	Bladder	10	168	2	361	2	260	1	175	15	192	107—316
190	Melanoma	3	41	1	110	[1.1]	0	[1.1]	0	4	38	10—98
191	Other skin ^b	30	124	[0.6]	0	[0.6]	0	1	258	31	120	81—170
193	Brain	8	107	7	461	2	241	1	84	18	164	97—259
194	Thyroid	1	73	2	265	[0.4]	0	[0.5]	0	3	99	20—290
197	Connective tissue	[0.7]	0	[0.2]	0	[0.1]	0	1	499	1	79	2—441
201	Hodgkin's disease	1	106	[0.2]	0	2	2021	[0.1]	0	3	225	46—656
200, 202	Non-Hodgkin's lymphoma	3	74	1	138	1	132	[0.7]	0	5	81	26—188
203	Multiple myeloma	3	145	1	178	[0.5]	0	1	337	5	147	48—343
204.3	Acute leukemia	2	93	[0.4]	0	[0.2]	0	[0.3]	0	2	67	8—242
204.0—2.4	Other leukemia	6	269	[0.5]	0	1	390	[0.3]	0	7	219	88—452
199	Unknown	4	216	1	134	1	92	2	261	8	180	78—354
140—204	All sites ^c	302	134	37	101	46	157	30	98	415	129	117—142

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 73. Glass, ceramic and tile workers and others, men (N=67 150) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	39	157	16	93	15	78	43	135	113	121	101–146
141	Tongue	4	76	4	112	7	101	8	65	23	82	52–123
143–144	Mouth	10	93	5	145	14	144	16	85	45	105	77–141
145–148	Pharynx	11	80	7	111	9	77	20	76	47	81	59–108
150	Esophagus	21	93	14	124	29	159	32	85	96	107	87–131
151	Stomach	97	117	88	116	111	106	183	112	479	112	103–123
153	Colon	107	86	38	99	129	105	244	110	518	102	94–111
154	Rectum	111	107	37	107	94	110	168	106	410	107	97–118
155.0	Liver	25	119	11	84	9	81	43	92	88	96	77–118
155.1	Gall bladder	15	116	7	98	7	101	13	73	42	94	68–127
157	Pancreas	65	107	45	129	60	111	114	100	284	108	96–121
160	Nose	2	37	2	76	9	193	9	119	22	108	68–164
161	Larynx	42	114	19	101	28	127	38	94	127	107	90–128
162	Lung	477	117	284	112	286	130	402	112	1449	117	111–123
162.2	Pleura	9	102	3	86	10	160	13	117	35	118	82–164
170	Breast	1	34	[1.0]	0	1	49	2	38	4	36	10–92
177	Prostate	150	95	98	98	254	98	642	99	1144	98	93–104
178	Testis	18	79	5	112	8	59	11	63	42	72	52–98
180.0	Kidney	42	89	24	70	55	112	100	82	221	87	77–100
181	Bladder	161	100	41	88	105	90	264	114	571	103	95–112
190	Melanoma	22	64	22	94	49	90	86	91	179	87	75–100
191	Other skin ^b	193	84	19	101	42	94	97	90	351	87	79–97
193	Brain	47	91	33	118	45	108	105	104	230	104	91–118
194	Thyroid	6	113	5	85	5	59	17	96	33	88	61–124
197	Connective tissue	5	82	8	129	9	125	22	95	44	103	75–139
201	Hodgkin's disease	9	84	6	84	14	171	15	72	44	94	68–126
200, 202	Non-Hodgkin's lymphoma	29	77	13	68	49	116	111	111	202	101	88–116
203	Multiple myeloma	14	69	11	91	35	132	61	121	121	111	93–132
204.3	Acute leukemia	16	91	2	23	19	140	36	112	73	102	80–128
204.0–2.4	Other leukemia	25	82	7	47	24	132	50	93	106	90	75–109
199	Unknown	8	59	13	81	58	105	115	129	194	112	97–128
140–204	All sites ^c	1589	101	887	101	1584	109	3192	104	7252	104	101–106

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

For the men, the risks of cancer of the breast and testis were lower than expected, while the risk of lip cancer was higher than expected. For the women, the risk of nasal cancer was elevated due to the high SIR values of Denmark and Sweden. The risk of malignant melanoma was decreased, mainly due to the very low SIR in Denmark.

Comments

As this group consists of several very different occupations with presumably very different exposures, an evaluation of cancer risk in relation to occupational exposure is difficult to establish. In the glass, ceramics and tile industry, several types of known and possible carcinogens may be present, these include arsenic, copper, nickel, manganese, and chromium (91). Stone cutters and carvers will often be exposed to silica dust, a proposed lung carcinogen. Very little is known about the risk factors

for breast cancer among men, and it is hard to imagine mechanisms through which the low risk of cancers of the breast and testis could be related with occupational exposures. However, nasal cancer has often been related to occupational exposures, but in the present group a specific carcinogen remains unidentified.

Packers, loaders and warehouse workers: occupational group 42

Workers in group 42 perform freight handling tasks, such as loading and unloading ship, aircraft and train cargoes and other freight, wrapping objects, packing liquids, materials and objects in containers, affixing labels on containers, rigging cables, wires and ropes for lifting, hauling and other purposes, and operating specialized vehi-

Table 74. Glass, ceramic and tile workers and others, women (N=28 033) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.5]	0	3	155	1	165	4	249	8	173	75—340
141	Tongue	[0.7]	0	2	95	[0.8]	0	6	275	8	138	60—272
143—144	Mouth	1	70	3	138	3	230	4	115	11	131	66—235
145—148	Pharynx	1	75	2	74	3	303	5	143	11	129	64—230
150	Esophagus	2	119	10	132	1	71	4	103	17	117	68—187
151	Stomach	6	72	50	119	19	128	37	122	112	117	97—141
153	Colon	29	104	43	112	26	75	77	94	175	96	83—111
154	Rectum	17	115	30	116	16	92	39	89	102	100	83—122
155.0	Liver	5	193	9	126	1	59	10	108	25	121	78—179
155.1	Gall bladder	1	23	11	80	2	76	15	88	29	77	52—110
157	Pancreas	8	83	22	88	10	96	41	125	81	104	83—129
160	Nose	2	341	1	71	[0.7]	0	8	558	11	267	133—477
161	Larynx	3	167	1	70	[0.5]	0	2	102	6	105	38—228
162	Lung	40	125	39	128	29	160	55	115	163	127	109—148
162.2	Pleura	1	150	2	164	2	830	2	235	7	235	95—485
170	Breast	90	80	186	86	97	100	336	99	709	93	86—100
171	Cervix uteri	46	133	32	146	26	112	54	119	158	126	108—147
172	Corpus uteri	30	108	45	83	26	105	82	98	183	96	83—111
175	Ovary	35	132	51	122	27	103	78	92	191	107	92—123
180.0	Kidney	7	95	14	67	4	52	32	110	57	88	66—114
181	Bladder	11	116	10	95	14	154	33	126	68	123	96—156
190	Melanoma	4	30	12	62	20	119	29	80	65	76	59—97
191	Other skin ^b	41	101	8	63	6	83	20	106	75	94	74—118
193	Brain	9	69	30	97	9	79	46	107	94	96	77—117
194	Thyroid	3	130	16	98	6	98	16	98	41	100	72—136
197	Connective tissue	1	84	4	82	1	59	6	78	12	77	40—135
201	Hodgkin's disease	2	121	7	184	2	152	4	87	15	132	74—218
200, 202	Non-Hodgkin's lymphoma	7	105	12	84	5	53	27	98	51	88	65—115
203	Multiple myeloma	3	93	12	115	4	74	19	134	38	114	81—157
204.3	Acute leukemia	3	84	7	96	8	274	10	101	28	118	79—171
204.0—2,4	Other leukemia	4	114	10	112	3	101	7	64	24	91	58—135
199	Unknown	5	173	13	89	17	135	35	103	70	109	85—138
140—204	All sites ^c	376	98	707	98	396	106	1220	103	2699	101	97—105

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

cles to lift, move, dump and stack materials in warehouses.

Results

For men, the SIR values for most alcohol-associated cancers, as well as for lung cancer, showed significant elevation (table 75). For the women, the risks of cancer of the tongue, lung, and cervix uteri were elevated for all 4 countries (table 76).

Comments

Among the men excess risks of cancers associated with alcohol or tobacco were observed: upper aerogastric tract, liver, lung, and pancreas. The consistent excess of tongue cancer among both genders, and in all countries, raises the question of whether some special exposure in packing work, such as the licking stamps and labels, may play a role.

Engine and motor operator workers: occupational group 43

Included in group 43 are stationary engine operators, crane and hoist operators, earth-moving and related operators, truck drivers, and motor-vehicle operators.

Results

For the men, excess risks of pleural and lip cancer were observed, while the SIR values for cancer of the breast, the testis, and the oral cavity were low (table 77). Among the women the risk of breast cancer was lower than expected, and the risk of cancers of the cervix and the lung were higher (table 78).

Comments

The elevated risk of pleural cancer can be considered an indication of asbestos exposure, most importantly from brake linings. A low risk of breast cancer and an

Table 75. Packers, loaders and warehouse workers, men (N=113 143) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	29	122	42	102	62	138	65	102	198	114	99–131
141	Tongue	7	146	10	122	30	190	29	123	76	145	114–181
143–144	Mouth	14	140	10	126	28	127	33	91	85	112	89–138
145–148	Pharynx	23	181	15	101	40	151	66	130	144	138	117–162
150	Esophagus	32	146	29	107	69	161	109	144	239	143	126–162
151	Stomach	90	109	203	111	282	112	375	113	950	112	105–119
153	Colon	118	96	90	99	316	109	459	104	983	104	98–110
154	Rectum	104	102	95	114	237	117	345	109	781	111	103–119
155.0	Liver	21	103	48	152	25	93	122	130	216	125	109–143
155.1	Gall bladder	14	109	17	99	19	113	44	123	94	114	92–139
157	Pancreas	59	99	114	136	152	118	255	111	580	115	106–125
160	Nose	5	96	8	129	9	83	17	117	39	106	76–145
161	Larynx	43	123	60	134	77	152	79	100	259	123	109–139
162	Lung	448	112	736	119	701	136	924	129	2809	125	120–130
162.2	Pleura	9	106	7	87	8	55	20	93	44	84	61–113
170	Breast	1	35	7	308	2	43	7	69	17	85	49–136
177	Prostate	152	94	258	104	603	93	1360	101	2373	99	95–103
178	Testis	16	88	14	146	25	93	25	94	80	98	78–122
180.0	Kidney	41	90	77	96	107	94	222	94	447	94	85–103
181	Bladder	160	102	102	91	311	112	465	101	1038	103	97–110
190	Melanoma	24	78	54	103	102	88	144	85	324	88	79–98
191	Other skin ^b	206	93	52	115	81	75	197	90	536	91	83–99
193	Brain	52	110	72	114	80	87	164	88	368	95	85–105
194	Thyroid	2	41	15	112	18	95	31	94	66	94	73–120
197	Connective tissue	4	71	15	105	15	91	46	105	80	100	79–124
201	Hodgkin's disease	12	127	15	93	15	82	40	105	82	100	80–124
200, 202	Non-Hodgkin's lymphoma	29	81	48	108	103	107	188	98	368	100	90–110
203	Multiple myeloma	19	96	34	118	66	104	95	95	214	101	88–115
204.3	Acute leukemia	14	83	13	65	44	138	73	118	144	110	94–130
204.0–2,4	Other leukemia	32	107	34	95	36	83	117	110	219	102	89–116
199	Unknown	11	84	47	122	169	127	174	99	401	111	101–123
140–204	All sites ^c	1602	104	2346	112	3832	111	6526	107	14306	108	107–110

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 76.** Packers, loaders and warehouse workers, women (N=42 229) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.1]	0	4	116	4	244	5	183	13	163	87–280
141	Tongue	1	511	4	107	3	142	9	246	17	175	102–280
143–144	Mouth	[0.4]	0	5	130	9	264	3	51	17	125	73–201
145–148	Pharynx	1	267	2	41	1	40	4	68	8	59	25–116
150	Esophagus	1	201	20	150	6	156	7	105	34	140	97–195
151	Stomach	3	124	87	117	52	127	47	91	189	111	97–129
153	Colon	8	97	75	110	102	109	144	103	329	107	96–119
154	Rectum	8	183	52	113	52	112	74	100	186	109	94–126
155.0	Liver	[0.8]	0	7	55	3	66	15	95	25	74	48–109
155.1	Gall bladder	[1.3]	0	24	99	10	137	33	113	67	108	84–137
157	Pancreas	3	105	33	75	33	115	49	87	118	89	75–107
160	Nose	2	1187	2	80	6	329	1	41	11	159	79–284
161	Larynx	[0.5]	0	2	77	3	209	4	123	9	116	53–220
162	Lung	9	97	85	155	83	177	124	154	301	157	140–176
162.2	Pleura	2	1031	4	184	[0.6]	0	2	139	8	180	78–355
170	Breast	30	97	387	100	220	91	540	97	1177	97	91–102
171	Cervix uteri	10	109	57	145	62	113	85	115	214	121	106–138
172	Corpus uteri	6	74	90	91	78	125	136	97	310	100	90–112
175	Ovary	9	120	92	122	70	107	149	106	320	111	99–123

(continued)

Table 76. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	3	139	39	105	21	102	51	103	114	104	87—125
181	Bladder	3	107	24	129	23	93	47	105	97	107	86—130
190	Melanoma	4	116	22	64	34	87	55	93	115	85	71—102
191	Other skin ^b	9	78	26	117	15	76	35	109	85	99	79—123
193	Brain	3	84	50	90	25	89	79	111	157	99	85—116
194	Thyroid	[0.6]	0	30	104	11	76	31	117	72	102	80—129
197	Connective tissue	[0.3]	0	7	80	1	23	15	117	23	88	56—132
201	Hodgkin's disease	[0.4]	0	6	90	1	31	16	211	23	129	82—193
200, 202	Non-Hodgkin's lymphoma	1	53	25	98	27	109	59	127	112	114	94—137
203	Multiple myeloma	[1.0]	0	23	123	12	81	32	131	67	114	88—144
204.3	Acute leukemia	1	100	26	200	11	146	13	79	51	134	100—176
204.0—2,4	Other leukemia	[1.0]	0	21	132	7	86	23	124	51	117	87—154
199	Unknown	[0.9]	0	21	82	41	119	58	100	120	101	84—120
140—204	All sites ^c	110	102	1362	105	1038	108	2072	104	4582	105	102—108

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 77. Engine and motor operator workers, men (N=114 891) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	32	152	44	99	27	109	63	145	166	124	107—144
141	Tongue	4	86	8	80	6	61	12	66	30	70	47—100
143—144	Mouth	2	22	7	73	9	66	23	83	41	68	49—93
145—148	Pharynx	14	116	15	88	12	73	34	87	75	89	70—112
150	Esophagus	12	64	27	95	31	132	53	105	123	101	85—121
151	Stomach	76	112	204	106	150	115	233	108	663	109	101—118
153	Colon	97	95	104	104	159	100	271	90	631	95	88—103
154	Rectum	90	106	87	99	92	83	215	100	484	97	89—106
155.0	Liver	10	59	30	92	10	71	54	87	104	83	68—101
155.1	Gall bladder	16	154	13	72	8	92	18	76	55	90	68—117
157	Pancreas	41	83	90	100	79	116	155	100	365	101	91—112
160	Nose	2	43	9	126	5	79	9	82	25	86	56—127
161	Larynx	38	123	55	113	26	88	71	123	190	114	99—131
162	Lung	343	104	688	108	369	129	553	112	1953	112	107—117
162.2	Pleura	9	122	15	157	14	167	24	148	62	149	114—191
170	Breast	1	41	2	79	1	36	3	41	7	46	19—95
177	Prostate	132	107	249	107	327	108	786	97	1494	102	96—107
178	Testis	15	59	7	51	23	90	20	57	65	65	50—83
180.0	Kidney	35	88	114	122	67	102	187	107	403	108	98—119
181	Bladder	128	98	122	104	174	117	313	99	737	103	96—111
190	Melanoma	27	83	68	100	76	89	147	95	318	93	84—104
191	Other skin ^b	195	100	49	105	52	93	141	100	437	100	91—109
193	Brain	49	106	74	92	65	105	142	90	330	95	85—106
194	Thyroid	7	149	15	89	14	113	27	97	63	102	79—131
197	Connective tissue	5	92	19	109	9	89	30	86	63	93	71—119
201	Hodgkin's disease	13	126	25	121	10	79	29	86	77	100	79—124
200, 202	Non-Hodgkin's lymphoma	27	83	50	95	56	95	146	100	279	96	85—108
203	Multiple myeloma	15	91	29	92	35	103	77	111	156	103	88—121
204.3	Acute leukemia	12	79	21	90	24	131	42	89	99	95	78—116
204.0—2,4	Other leukemia	24	95	38	97	26	112	75	100	163	101	86—117
199	Unknown	8	72	35	86	78	112	133	107	254	103	91—117
140—204	All sites ^c	1310	100	2337	104	2042	108	4232	100	9921	102	100—104

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 78. Engine and motor operator workers, women (N=3851) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip		1	212	[0.0]	0	[0.1]	0	1	1614	898	
141	Tongue	[0.0]	0	[0.5]	0	[0.0]	0	[0.2]	0	[0.8]	0	0–489
143–144	Mouth	[0.0]	0	[0.5]	0	[0.0]	0	[0.3]	0	[0.9]	0	0–416
145–148	Pharynx	[0.0]	0	5	729	[0.0]	0	[0.3]	0	5	476	154–1110
150	Esophagus	[0.0]	0	3	166	[0.0]	0	2	724	5	235	76–549
151	Stomach	[0.1]	0	8	77	[0.3]	0	4	171	12	92	48–161
153	Colon	[0.2]	0	6	63	3	438	2	31	11	65	33–117
154	Rectum	1	988	6	93	1	295	[3.6]	0	8	76	33–150
155.0	Liver	[0.0]	0	3	172	[0.0]	0	2	284	5	200	65–467
155.1	Gall bladder	[0.0]	0	1	30	[0.1]	0	[1.3]	0	1	21	1–119
157	Pancreas	[0.1]	0	7	115	[0.2]	0	5	205	12	137	71–239
160	Nose			[0.4]	0	[0.0]	0	1	806	1	200	5–1117
161	Larynx	[0.0]	0	1	270	[0.0]	0	[0.2]	0	1	168	4–935
162	Lung	1	362	24	308	2	521	12	272	39	303	216–415
162.2	Pleura	[0.0]	0	[0.3]	0			[0.1]	0	[0.4]	0	0–945
170	Breast	2	147	41	73	[2.2]	0	21	59	64	67	52–86
171	Cervix uteri	1	209	11	195	1	174	10	190	23	192	122–288
172	Corpus uteri	[0.2]	0	16	112	[0.5]	0	2	25	18	78	46–123
175	Ovary	2	776	15	138	1	170	8	93	26	128	84–188
180.0	Kidney	[0.1]	0	5	94	[0.2]	0	3	122	8	100	43–197
181	Bladder	[0.1]	0	4	154	1	567	1	49	6	123	45–268
190	Melanoma	[0.2]	0	3	60	[0.4]	0	2	46	5	50	16–117
191	Other skin ^b	[0.4]	0	2	66	[0.1]	0	[1.4]	0	2	40	5–145
193	Brain	[0.2]	0	9	112	1	389	6	135	16	124	71–201
194	Thyroid	[0.0]	0	5	119	[0.2]	0	1	54	6	96	35–209
197	Connective tissue	[0.0]	0	2	160	[0.0]	0	[0.8]	0	2	97	12–351
201	Hodgkin's disease	[0.0]	0	3	315	1	3098	[0.5]	0	4	270	73–690
200, 202	Non-Hodgkin's lymphoma	[0.1]	0	2	55	[0.2]	0	3	121	5	79	26–184
203	Multiple myeloma	[0.0]	0	3	115	[0.1]	0	2	188	5	132	43–307
204.3	Acute leukemia	[0.0]	0	3	163	[0.1]	0	1	106	4	139	38–355
204.0–2.4	Other leukemia	[0.0]	0	2	90	[0.1]	0	[0.9]	0	2	62	8–225
199	Unknown	1	5001	9	252	[0.3]	0	2	72	12	182	94–317
140–204	All sites ^c	8	208	205	111	11	135	98	86	322	104	93–116

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

elevated risk of cervical cancer are often found in groups of women who tend to have their first child at a young age and also have many children. The pattern of a high relative risk of cancers of the cervix and lung among women in typical "male" occupations was found also for this group; there were however few women in the group, especially in Denmark and Norway. There is no easy explanation for the lowered risk of breast cancer and testicular cancer among the men (almost identical to that found in occupational category 41).

Public safety and protection workers: occupational group 44

Workers in group 44 protect people and property against hazards and enforce law and order. Fire fighters, policemen and detectives, customs officers, guards, and watchmen are included.

Results

For the men, an excess number of cases of cancer of the colon, rectum, skin, and thyroid was observed (table 79). The risks of lung and lip cancer among the men were significantly low. For the women, a borderline significant elevation of lung cancer risk was observed and breast cancer was elevated in all 4 countries (table 80). For both genders, an increase in bladder cancer was found for all 4 countries, and for the men an elevated risk of kidney cancer was also observed.

Comments

This is a heterogeneous group, in which, especially, fire fighters should be expected to have occupational exposures with possible relation to cancer; benzene, asbestos, polycyclic aromatic hydrocarbons, formaldehyde, and diesel exhaust are all relevant exposures in this group. Elevated risks of cancer of the colon or rectum and of renal and bladder cancer have previously been found among both fire fighters and policemen, but no

Table 79. Public safety and protection workers, men (N=67 106) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	11	59	17	59	12	71	18	73	58	65	50–84
141	Tongue	2	47	6	104	4	68	11	105	23	87	55–131
143–144	Mouth	9	107	8	143	7	83	13	82	37	97	68–133
145–148	Pharynx	6	55	6	58	12	120	16	72	40	75	53–102
150	Esophagus	7	41	13	68	17	105	28	97	65	80	62–102
151	Stomach	62	102	128	101	104	113	126	103	420	104	95–115
153	Colon	111	119	63	99	134	123	202	118	510	117	107–127
154	Rectum	87	111	76	130	81	107	139	113	383	114	103–126
155.0	Liver	23	143	25	112	9	91	43	123	100	120	99–146
155.1	Gall bladder	11	116	13	109	5	82	19	141	48	117	86–155
157	Pancreas	42	92	65	110	45	94	110	124	262	109	96–123
160	Nose	2	47	2	46	6	147	5	79	15	79	44–130
161	Larynx	30	106	28	89	25	129	38	114	121	107	90–128
162	Lung	303	98	354	81	200	102	240	85	1097	90	85–95
162.2	Pleura	6	88	2	35	3	55	12	130	23	85	54–127
170	Breast	1	45	2	128	4	221	8	192	15	153	86–253
177	Prostate	127	111	220	126	257	109	494	107	1098	112	105–118
178	Testis	23	104	6	91	11	109	23	116	63	107	83–137
180.0	Kidney	46	127	63	111	58	135	108	108	275	117	104–131
181	Bladder	161	133	85	108	113	109	189	104	548	113	104–123
190	Melanoma	63	219	38	104	65	146	109	123	275	139	123–156
191	Other skin ^b	235	131	37	117	36	91	96	120	404	122	111–135
193	Brain	36	86	52	119	34	96	91	100	213	101	88–115
194	Thyroid	5	115	13	138	6	84	26	164	50	136	101–180
197	Connective tissue	2	41	8	81	6	97	22	110	38	93	66–128
201	Hodgkin's disease	18	194	13	117	7	104	19	100	57	123	93–160
200, 202	Non-Hodgkin's lymphoma	28	94	34	109	50	137	80	95	192	106	92–122
203	Multiple myeloma	10	65	24	118	23	98	54	136	111	112	93–135
204.3	Acute leukemia	15	110	15	108	11	94	32	120	73	111	87–139
204.0–2.4	Other leukemia	21	91	32	128	22	138	45	106	120	113	94–135
199	Unknown	15	148	22	81	47	96	83	117	167	106	91–124
140–204	All sites ^c	1302	108	1467	100	1413	110	2598	107	6780	106	104–109

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

specific relationship between exposure and cancer risk has been established (92, 93).

Cooks and stewards: occupational group 45

Workers in group 45 prepare and cook in hotels, restaurants and other public eating places, aboard ships and airplanes, and on trains.

Results

In the present group, cancers of all sites combined occurred more frequently than expected for the men (table 81). All alcohol-associated cancers showed a highly elevated SIR, while no such elevations were found for the women (table 82). Lung cancer risk was increased for both genders. For the men elevations were also observed for cancers of the breast, pancreas, and bladder. Cancers of the cervix and ovary occurred more frequently than

expected. The SIR for cancer of unknown sites was significantly elevated for the men and decreased for the women.

Comments

In this group alcohol and tobacco are important work-related exposures, particularly for those working on ships. This finding is reflected in the elevated risk for cancer of the mouth, pharynx, esophagus and larynx among the men, and by the elevated risks of cancer of the liver and lung for both genders. The male-female differences in this group may be partly attributed to the fact that men and women work in different types of workplaces, for instance, airline stewardesses from Finland are included in this category. In addition, there were few female cooks in Denmark in 1970 (appendix 2). It has been questioned whether exposure to volatile carcinogens in frying fumes may increase the risk of lung cancer, but epidemiologic studies of cooks do not seem to support this possibility (94, 95).

Table 80. Public safety and protection workers, women (N=2637) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.0]	0	[0.1]	0	[0.2]	0	[0.2]	0	[0.5]	0	0–738
141	Tongue	[0.0]	0	[0.1]	0	[0.2]	0	[0.3]	0	[0.6]	0	0–598
143–144	Mouth	[0.1]	0	[0.1]	0	[0.3]	0	1	246	1	106	3–593
145–148	Pharynx	[0.1]	0	[0.2]	0	[0.2]	0	[0.4]	0	[0.9]	0	0–432
150	Esophagus	[0.1]	0	[0.5]	0	[0.4]	0	[0.4]	0	[1.4]	0	0–263
151	Stomach	2	500	5	200	5	116	1	29	13	122	65–208
153	Colon	[1.4]	0	2	88	11	116	5	53	18	80	47–126
154	Rectum	1	143	1	66	7	149	1	20	10	83	40–153
155.0	Liver	[0.1]	0	[0.4]	0	1	216	1	95	2	97	12–350
155.1	Gall bladder	[0.2]	0	1	119	1	130	4	207	6	159	58–347
157	Pancreas	[0.5]	0	1	65	2	66	4	107	7	80	32–164
160	Nose	[0.0]	0	[0.1]	0	[0.2]	0	2	1186	2	440	53–1591
161	Larynx	[0.1]	0	[0.1]	0	[0.1]	0	2	855	2	387	47–1399
162	Lung	1	82	4	228	7	158	9	158	21	160	99–245
162.2	Pleura	[0.0]	0	[0.1]	0	[0.1]	0	[0.1]	0	[0.3]	0	0–1425
170	Breast	5	136	15	143	28	124	49	119	97	124	101–151
171	Cervix uteri	[1.0]	0	[1.2]	0	5	105	9	157	14	110	60–185
172	Corpus uteri	2	184	3	104	7	123	9	91	21	107	67–164
175	Ovary	[1.0]	0	3	139	7	116	10	98	20	103	63–159
180.0	Kidney	[0.3]	0	4	346	2	99	1	30	7	102	41–209
181	Bladder	1	228	1	158	4	158	7	234	13	197	105–337
190	Melanoma	[0.4]	0	1	108	4	118	6	129	11	118	59–211
191	Other skin ^b	4	245	1	125	[2.1]	0	1	46	6	90	33–196
193	Brain	[0.4]	0	3	199	3	118	7	134	13	134	71–228
194	Thyroid	[0.1]	0	[0.8]	0	[1.3]	0	2	98	2	48	6–172
197	Connective tissue	[0.0]	0	[0.3]	0	[0.4]	0	1	108	1	61	2–341
201	Hodgkin's disease	[0.1]	0	1	532	1	325	[0.6]	0	2	179	22–648
200, 202	Non-Hodgkin's lymphoma	[0.3]	0	[0.8]	0	2	82	6	184	8	118	51–233
203	Multiple myeloma	[0.2]	0	[0.6]	0	1	64	3	185	4	101	27–258
204.3	Acute leukemia	[0.2]	0	2	506	1	133	[1.2]	0	3	121	25–353
204.0–2,4	Other leukemia	[0.2]	0	[0.5]	0	1	118	2	158	3	107	22–313
199	Unknown	[0.1]	0	1	115	1	28	3	76	5	58	19–136
140–204	All sites ^c	13	90	48	124	102	110	153	108	316	110	98–123

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 81. Cooks and stewards, men (N=12 684) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[1.8]	0	[1.2]	0	4	72	3	73	7	55	22–114
141	Tongue	1	242	[0.3]	0	3	133	5	289	9	192	88–365
143–144	Mouth	4	507	[0.3]	0	8	259	7	268	19	282	170–440
145–148	Pharynx	3	282	1	218	10	273	7	189	21	236	146–361
150	Esophagus	5	326	2	263	10	194	13	270	30	244	165–349
151	Stomach	7	125	3	58	39	135	15	73	64	106	82–136
153	Colon	13	156	3	112	37	105	26	92	79	106	84–132
154	Rectum	6	87	5	213	20	82	29	143	60	111	85–143
155.0	Liver	1	72	1	114	7	225	20	345	29	260	174–373
155.1	Gall bladder	1	118	[0.5]	0	[1.9]	0	2	90	3	55	11–159
157	Pancreas	4	99	4	167	26	174	18	123	52	144	108–189
160	Nose	1	247	[0.2]	0	1	71	2	191	4	131	36–335
161	Larynx	7	275	3	229	16	246	9	162	35	220	153–306
162	Lung	39	148	12	70	92	148	76	161	219	143	126–164
162.2	Pleura	1	160	1	389	2	107	1	67	5	118	38–275
170	Breast	2	963	[0.1]	0	2	315	1	144	5	312	101–727
177	Prostate	16	170	8	129	70	108	86	114	180	115	100–134
178	Testis	2	57	[0.4]	0	6	82	4	131	12	84	44–147

(continued)

Table 81. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	5	150	3	121	13	89	20	120	41	110	79—150
181	Bladder	15	141	1	32	38	116	46	154	100	131	107—159
190	Melanoma	3	90	2	106	17	79	21	147	43	105	76—142
191	Other skin ^b	19	115	[1.3]	0	6	49	11	84	36	83	58—115
193	Brain	1	23	2	89	11	74	21	142	35	96	67—134
194	Thyroid	[0.5]	0	1	215	4	131	3	116	8	122	53—240
197	Connective tissue	[0.5]	0	[0.5]	0	[2.4]	0	3	92	3	45	9—131
201	Hodgkin's disease	2	170	1	167	2	62	3	98	8	99	43—195
200, 202	Non-Hodgkin's lymphoma	6	200	1	70	9	66	16	117	32	100	69—142
203	Multiple myeloma	[1.4]	0	2	239	5	67	3	46	10	62	30—113
204.3	Acute leukemia	2	145	1	156	3	70	5	115	11	103	51—185
204.0—2,4	Other leukemia	[2.2]	0	1	96	2	38	7	100	10	65	31—119
199	Unknown	1	110	2	181	21	137	18	154	42	144	104—195
140—204	All sites ^c	152	138	61	101	489	116	531	133	1233	124	117—131

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 82. Cooks and stewards, women (N=43 199) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.0]	0	6	153	1	51	2	51	9	91	42—174
141	Tongue	[0.0]	0	3	73	2	83	5	99	10	86	41—159
143—144	Mouth	[0.0]	0	5	118	5	125	8	101	18	111	66—176
145—148	Pharynx	[0.0]	0	7	132	8	292	3	39	18	115	68—181
150	Esophagus	[0.0]	0	11	70	5	107	12	123	28	93	62—134
151	Stomach	[0.1]	0	92	111	42	83	78	103	212	101	89—116
153	Colon	[0.3]	0	72	96	115	103	183	93	370	96	87—106
154	Rectum	[0.2]	0	55	109	55	100	103	100	213	102	89—117
155.0	Liver	[0.0]	0	11	77	9	165	28	123	48	113	83—150
155.1	Gall bladder	[0.1]	0	15	55	15	166	48	112	78	98	78—123
157	Pancreas	[0.1]	0	48	96	35	98	96	117	179	107	92—123
160	Nose	[0.0]	0	4	150	3	139	3	89	10	122	59—224
161	Larynx	[0.0]	0	2	73	5	311	1	25	8	96	41—189
162	Lung	[0.4]	0	69	117	59	116	124	118	252	117	103—132
162.2	Pleura	[0.0]	0	3	129	1	140	3	151	7	139	56—287
170	Breast	3	234	378	100	256	98	700	101	1337	100	95—106
171	Cervix uteri	1	251	48	117	67	123	99	112	215	116	102—133
172	Corpus uteri	2	628	106	106	61	93	161	94	330	98	88—109
175	Ovary	[0.3]	0	88	116	80	114	201	115	369	115	104—127
180.0	Kidney	[0.1]	0	40	101	26	110	68	101	134	103	87—121
181	Bladder	[0.1]	0	27	130	37	124	71	111	135	118	100—139
190	Melanoma	[0.2]	0	35	103	33	85	63	91	131	92	78—109
191	Other skin ^b	[0.5]	0	27	104	22	90	40	84	89	90	73—111
193	Brain	[0.2]	0	56	102	30	102	88	99	174	101	87—117
194	Thyroid	[0.0]	0	34	120	14	93	29	90	77	102	80—127
197	Connective tissue	[0.0]	0	11	122	5	106	11	66	27	88	58—129
201	Hodgkin's disease	[0.0]	0	8	116	5	140	11	111	24	117	75—175
200, 202	Non-Hodgkin's lymphoma	[0.1]	0	22	82	29	102	65	103	116	98	81—117
203	Multiple myeloma	[0.0]	0	24	116	19	103	41	116	84	113	90—139
204.3	Acute leukemia	[0.0]	0	13	95	8	91	22	100	43	96	70—130
204.0—2,4	Other leukemia	[0.0]	0	21	121	8	79	31	119	60	112	85—144
199	Unknown	[0.0]	0	15	52	34	80	76	93	125	82	69—97
140—204	All sites ^c	6	134	1373	102	1104	103	2637	102	5120	102	99—105

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Home helpers: occupational group 46

Home helpers clean rooms, wash dishes, do laundry and ironing, and perform additional domestic duties in private homes. They may also prepare food and serve meals. Due to the small numbers, the men have been included in occupational group 53.

Results

An elevated risk of cancer of the lip was observed in all 4 countries (table 83), and a low SIR was observed for liver cancer. Breast cancer appeared somewhat less than expected, and cervical cancer was somewhat more frequent.

Comments

Elevated risks of cervical cancer and lowered risks of breast cancer are commonly found in groups of women who have relatively few years of education and have

more children at an earlier age than the average of women. High risks of lip cancer and low risks of liver cancer are typical for women in agriculture (96), and these risks reflect the fact that many home helpers perhaps come from farming.

Waiters: occupational group 47

Group 47 includes waiters, bartenders, and related workers. Workers in this group serve food and beverages in dining and drinking places, clubs, institutions and canteens, on board ships, and on trains.

Results

A highly elevated risk of cancer for all sites was observed for the men (table 84). For all the alcohol-associated can-

Table 83. Home helpers, women (N=120 372) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	8	266	6	151	3	119	16	135	33	155	106—217
141	Tongue	3	70	9	223	6	192	12	76	30	110	75—158
143—144	Mouth	8	87	4	94	5	97	21	86	38	88	62—121
145—148	Pharynx	12	150	6	116	3	84	17	70	38	93	66—127
150	Esophagus	11	98	15	92	7	118	16	56	49	79	58—104
151	Stomach	59	108	78	94	50	78	231	103	418	98	89—108
153	Colon	177	95	58	77	153	107	599	101	987	99	93—105
154	Rectum	94	96	49	98	71	101	309	99	523	98	90—107
155.0	Liver	11	65	18	125	3	43	50	74	82	77	61—96
155.1	Gall bladder	23	78	13	47	5	44	144	114	185	95	82—109
157	Pancreas	59	90	50	99	46	102	238	98	393	97	88—107
160	Nose	4	109	5	192	[2.8]	0	9	87	18	93	55—147
161	Larynx	11	101	3	115	1	48	12	93	27	95	62—138
162	Lung	205	102	50	87	57	85	282	85	594	91	84—98
162.2	Pleura	7	162	2	88	1	109	3	49	13	96	51—164
170	Breast	554	85	374	107	330	96	2064	91	3322	92	89—95
171	Cervix uteri	220	117	45	114	90	122	309	103	664	110	102—119
172	Corpus uteri	176	100	95	102	97	111	536	97	904	99	93—106
175	Ovary	181	112	88	124	106	114	575	102	950	107	100—114
180.0	Kidney	47	98	26	69	23	75	204	99	300	93	83—104
181	Bladder	60	95	20	97	37	98	179	94	296	95	84—106
190	Melanoma	71	101	36	114	47	89	222	93	376	96	86—106
191	Other skin ^b	242	96	27	101	31	100	122	87	422	94	85—103
193	Brain	81	108	52	102	43	110	249	86	425	94	85—103
194	Thyroid	12	90	17	65	23	115	105	97	157	93	80—109
197	Connective tissue	7	102	6	69	6	97	52	97	71	94	74—119
201	Hodgkin's disease	13	149	7	106	4	86	30	94	54	104	78—135
200, 202	Non-Hodgkin's lymphoma	42	101	21	81	46	125	195	100	304	101	91—113
203	Multiple myeloma	15	68	17	83	20	86	99	95	151	89	76—104
204.3	Acute leukemia	23	106	10	76	13	115	69	99	115	99	83—119
204.0—2,4	Other leukemia	22	95	13	76	20	158	83	105	138	105	89—124
199	Unknown	18	92	26	90	58	107	226	92	328	94	84—105
140—204	All sites ^c	2261	97	1249	97	1416	101	7798	95	12724	96	95—98

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

cers and many of the smoking-related cancers significant elevated risks were observed for the men in all 4 countries. For the women, cancers of the mouth, larynx, lung, cervix uteri, and bladder were in excess, while the risk of cancers of the corpus uteri and skin was low (table 85).

Comments

A strong relationship between cancers of the upper aerogastric tract and exposure to alcohol or tobacco is well established. Among waiters, these exposures can be considered work-related (97). The lung cancer risk, strongly associated with tobacco smoking, and the risk of bladder cancer and pancreatic cancer, with weaker associations with tobacco, are also indications of work-related exposure. In the Nordic countries, with a low prevalence of hepatitis B infection and aflatoxin exposure, the main cause also for liver cancer is considered to be alcohol abuse.

Building caretakers and cleaners: occupational group 48

Workers in group 48 take care of apartment houses, office buildings and other buildings and maintain them in an orderly and clean condition. The tasks can include operating furnaces or boilers to provide heat and hot water for tenants.

Results

The cancers of the lung and larynx were elevated for the men and women (tables 86 and 87). Among the men, an elevated risk of breast cancer was observed in all 4 countries. For the women the risks of breast cancer and endometrial cancer were similarly decreased, and cervical cancer was elevated in all 4 countries. Reduced risks of malignant melanoma and nonmelanoma skin cancer were also found for women in all 4 countries.

Table 84. Waiters, men (N=8974) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[4.3]	0	[1.2]	0	4	167	1	55	5	51	17–120
141	Tongue	5	541	2	743	5	537	9	1112	21	716	443–1094
143–144	Mouth	15	824	[0.3]	0	5	392	5	412	25	547	354–808
145–148	Pharynx	20	840	1	214	11	723	8	463	40	656	469–894
150	Esophagus	24	639	4	492	11	490	6	285	45	505	368–675
151	Stomach	17	122	3	54	12	94	10	113	42	102	74–138
153	Colon	24	117	4	143	24	157	17	137	69	135	105–171
154	Rectum	28	163	[2.5]	0	12	113	9	101	49	125	92–165
155.0	Liver	21	612	4	426	5	364	11	441	41	498	357–676
155.1	Gall bladder	5	234	1	196	3	351	[1.0]	0	9	201	92–382
157	Pancreas	17	169	3	119	9	137	11	171	40	156	112–213
160	Nose	2	214	1	519	[0.6]	0	1	208	4	181	49–464
161	Larynx	36	582	2	147	5	181	4	158	47	366	269–487
162	Lung	135	202	17	93	45	166	49	235	246	185	163–210
162.2	Pleura	1	67	[0.3]	0	[0.8]	0	2	292	3	93	19–272
170	Breast	[0.5]	0	[0.1]	0	1	376	[0.3]	0	1	87	2–484
177	Prostate	33	133	15	215	37	123	38	122	123	132	111–158
178	Testis	7	130	[0.4]	0	3	115	3	178	13	129	69–221
180.0	Kidney	13	162	3	120	11	177	6	79	33	135	93–190
181	Bladder	46	174	4	120	16	111	26	196	92	160	129–197
190	Melanoma	5	77	[1.9]	0	9	109	9	128	23	97	62–146
191	Other skin ^b	30	77	[1.3]	0	6	111	5	90	41	80	58–109
193	Brain	10	107	4	181	5	84	9	126	28	113	75–164
194	Thyroid	1	103	[0.5]	0	1	82	1	81	3	77	16–225
197	Connective tissue	2	179	[0.5]	0	[1.0]	0	1	66	3	73	15–213
201	Hodgkin's disease	1	46	[0.6]	0	3	238	[1.5]	0	4	72	20–185
200, 202	Non-Hodgkin's lymphoma	2	30	1	68	3	53	7	111	13	65	35–111
203	Multiple myeloma	4	119	1	115	3	92	1	34	9	87	40–164
204.3	Acute leukemia	2	65	1	151	3	167	1	50	7	93	37–191
204.0–2.4	Other leukemia	5	97	2	182	3	132	5	160	15	129	72–212
199	Unknown	3	137	2	169	7	103	10	192	22	143	90–217
140–204	All sites ^c	481	181	76	119	264	145	271	153	1092	159	149–168

^a International Classification of Diseases (7th revision). Sweden.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 85. Waiters, women (N=57 817) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	2	352	1	37	5	228	3	68	11	111	56–199
141	Tongue	1	125	5	156	1	34	11	190	18	142	84–224
143–144	Mouth	8	472	7	219	8	172	13	140	36	191	134–265
145–148	Pharynx	6	388	5	122	3	87	4	44	18	99	59–156
150	Esophagus	5	247	9	86	12	233	7	64	33	116	80–163
151	Stomach	14	140	59	96	70	127	87	104	230	109	96–124
153	Colon	36	107	69	123	134	106	222	99	461	105	96–115
154	Rectum	22	123	44	116	58	92	134	113	258	109	96–123
155.0	Liver	5	160	11	108	5	81	25	98	46	102	75–136
155.1	Gall bladder	4	76	14	73	11	113	38	80	67	82	63–104
157	Pancreas	18	154	42	119	41	106	102	111	203	114	100–131
160	Nose	1	143	1	47	3	120	3	78	8	87	38–172
161	Larynx	10	476	3	137	2	105	12	243	27	243	160–353
162	Lung	98	260	101	222	109	173	167	133	475	175	160–191
162.2	Pleura	[0.8]	0	3	161	[0.9]	0	3	131	6	103	38–224
170	Breast	129	100	338	96	355	106	770	91	1592	96	91–101
171	Cervix uteri	78	199	65	190	167	213	131	120	441	169	154–185
172	Corpus uteri	25	75	84	101	79	94	167	78	355	86	77–95
175	Ovary	44	141	63	96	100	111	211	98	418	104	95–115
180.0	Kidney	10	113	31	99	23	83	75	96	139	95	81–112
181	Bladder	23	202	27	181	47	142	103	142	200	152	132–174
190	Melanoma	7	47	28	87	37	65	72	83	144	76	64–89
191	Other skin ^b	36	76	13	73	20	74	43	81	112	77	64–93
193	Brain	9	60	52	102	49	125	123	114	233	109	96–124
194	Thyroid	1	37	22	80	18	85	37	94	78	86	68–107
197	Connective tissue	1	73	6	77	7	117	23	116	37	106	75–146
201	Hodgkin's disease	1	53	5	79	4	86	15	130	25	102	66–151
200, 202	Non-Hodgkin's lymphoma	12	153	18	82	29	85	69	94	128	93	78–111
203	Multiple myeloma	4	101	14	92	24	120	40	101	82	104	83–129
204.3	Acute leukemia	2	48	12	106	7	67	24	93	45	87	63–116
204.0–2,4	Other leukemia	3	71	14	106	13	118	28	94	58	100	76–129
199	Unknown	7	202	22	106	48	103	72	77	149	91	77–107
140–204	All sites ^c	586	131	1214	108	1504	114	3026	98	6330	106	103–109

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 86.** Building caretakers and cleaners, men (N=58 245) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	19	82	19	71	21	121	37	103	96	93	75–114
141	Tongue	5	106	4	82	5	87	13	101	27	96	63–139
143–144	Mouth	13	133	6	125	7	86	20	101	46	108	79–144
145–148	Pharynx	15	121	9	98	11	113	27	97	62	105	80–135
150	Esophagus	25	118	13	73	12	72	54	125	104	105	87–128
151	Stomach	88	112	128	108	122	123	192	101	530	109	100–119
153	Colon	117	99	65	113	115	102	255	101	552	102	94–111
154	Rectum	116	119	58	107	102	131	165	92	441	108	98–118
155.0	Liver	14	71	22	106	10	95	45	83	91	87	70–106
155.1	Gall bladder	14	114	7	63	4	61	20	97	45	89	65–119
157	Pancreas	64	111	58	107	59	117	134	103	315	108	96–120
160	Nose	7	139	2	52	6	147	9	113	24	115	74–171
161	Larynx	45	132	34	118	21	109	54	122	154	122	104–143
162	Lung	509	132	404	99	253	127	463	114	1629	117	111–123
162.2	Pleura	8	98	6	124	9	165	15	127	38	126	89–172
170	Breast	6	218	2	142	5	284	9	157	22	189	119–286
177	Prostate	155	102	185	108	263	100	806	102	1409	103	97–108
178	Testis	22	123	5	114	6	86	11	103	44	110	80–148

(continued)

Table 86. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	40	91	52	104	45	105	120	91	257	96	85—108
181	Bladder	157	104	94	128	127	117	274	106	652	110	102—119
190	Melanoma	24	80	34	117	33	86	79	90	170	92	79—107
191	Other skin ^b	216	102	21	71	38	90	108	86	383	93	84—103
193	Brain	53	115	30	85	39	121	104	106	226	107	94—122
194	Thyroid	4	84	9	119	10	151	9	52	32	88	60—125
197	Connective tissue	9	164	13	157	10	167	24	102	56	129	98—168
201	Hodgkin's disease	12	130	10	116	4	65	25	128	51	117	87—154
200, 202	Non-Hodgkin's lymphoma	44	128	21	78	40	113	93	88	198	98	85—113
203	Multiple myeloma	24	126	15	81	28	113	53	93	120	101	84—121
204.3	Acute leukemia	20	123	12	101	10	84	34	100	76	103	81—129
204.0—2,4	Other leukemia	30	104	22	97	21	124	58	97	131	102	86—121
199	Unknown	16	127	21	84	43	83	87	88	167	89	76—103
140—204	All sites ^c	1677	114	1395	103	1476	111	3505	102	8053	106	104—108

^a International Classification of Diseases (7th revision).
^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.

Table 87. Building caretakers and cleaners, women (N=249 115) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	10	110	19	123	4	42	10	74	43	91	66—122
141	Tongue	14	109	13	83	12	99	22	123	61	104	80—134
143—144	Mouth	30	108	17	104	24	122	26	93	97	106	86—129
145—148	Pharynx	26	110	28	138	14	98	29	106	97	113	92—138
150	Esophagus	40	118	71	114	32	144	36	109	179	118	102—137
151	Stomach	177	105	345	107	279	118	302	117	1103	112	106—119
153	Colon	517	91	241	83	530	98	657	97	1945	94	90—98
154	Rectum	273	91	215	110	272	102	362	101	1122	100	94—106
155.0	Liver	64	123	63	114	22	84	94	121	243	115	101—130
155.1	Gall bladder	96	105	120	112	38	90	168	115	422	109	99—120
157	Pancreas	220	109	238	121	197	118	302	109	957	113	106—121
160	Nose	7	63	15	146	16	153	14	119	52	119	89—156
161	Larynx	47	146	10	96	11	136	21	143	89	136	109—167
162	Lung	740	124	287	126	323	122	430	115	1780	121	116—127
162.2	Pleura	15	114	9	102	6	170	13	189	43	133	96—179
170	Breast	1655	86	1143	82	1175	86	2258	88	6231	86	84—88
171	Cervix uteri	740	133	227	146	455	150	478	143	1900	141	135—147
172	Corpus uteri	474	90	296	77	307	88	560	89	1637	87	82—91
175	Ovary	450	93	277	97	360	97	683	107	1770	99	95—104
180.0	Kidney	134	92	140	92	130	111	248	105	652	100	93—108
181	Bladder	210	110	84	103	138	97	208	95	640	101	93—109
190	Melanoma	178	86	122	99	151	70	194	73	645	80	74—86
191	Other skin ^b	625	83	79	78	77	67	144	89	925	82	77—87
193	Brain	209	94	200	99	148	94	300	92	857	95	88—101
194	Thyroid	31	77	118	116	80	100	126	104	355	103	93—115
197	Connective tissue	19	92	31	92	23	95	65	108	138	99	84—118
201	Hodgkin's disease	34	130	22	89	19	105	24	67	99	94	77—115
200, 202	Non-Hodgkin's lymphoma	131	104	95	93	129	92	198	89	553	94	86—102
203	Multiple myeloma	76	113	92	114	87	100	116	97	371	105	95—116
204.3	Acute leukemia	71	108	52	101	59	136	81	103	263	110	97—124
204.0—2,4	Other leukemia	76	107	61	91	44	93	109	121	290	105	94—118
199	Unknown	68	114	93	83	200	100	292	104	653	100	93—108
140—204	All sites ^c	6884	99	4926	97	5461	100	9252	99	26523	99	98—100

^a International Classification of Diseases (7th revision).
^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.

Comments

The nonsignificant elevations of pleural mesothelioma risk can be related to occupational exposure to asbestos. The cancer pattern probably indicates higher alcohol and tobacco consumption among the women in this group than among the general population. A reduced risk of breast cancer and cancer of the corpus uteri and an increased risk of cancer of the cervix are often found in groups with a relatively low education, and they relate to a fertility pattern of a young age at first birth and many births. Little is known about breast cancer among men, and the increased risk in this group is hard to explain.

Chimney sweeps: occupational group 49

Chimney sweeps remove soot from flues, chimneys, and connecting pipes and may also clean furnaces and boil-

ers. Due to the small numbers, women have been included in occupational group 53.

Results

Despite the rarity of this occupation, significantly elevated SIR values were obtained for cancers of the bladder, stomach, and lung and the overall types of cancer (table 88).

Comments

The primary exposure of chimney sweeps is to soot, which is a complex mixture produced by the combustion of coal, coke, oil, or wood. Chimney soot is rich in poly-aromatic hydrocarbons, a group of compounds with a well-documented carcinogenic effect (98). Chimney sweeps may also be exposed to potentially carcinogenic metals, including arsenic, chromium, cadmium, and nickel, and to combustion gases such as sulfur dioxide and carbon monoxide, asbestos from pipe and furnace insulation, and organic solvents used as degreasing agents

Table 88. Chimney sweeps, men (N=3612) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	181	3	148	2	182	1	81	7	142	57–293
141	Tongue	[0.1]	0	[0.4]	0	1	251	[0.5]	0	1	69	2–383
143–144	Mouth	1	415	[0.4]	0	[0.6]	0	3	370	4	201	55–514
145–148	Pharynx	1	312	[0.7]	0	1	149	[1.1]	0	2	70	8–253
150	Esophagus	[0.5]	0	2	153	2	190	3	211	7	164	66–338
151	Stomach	4	232	12	136	10	167	7	115	33	146	101–205
153	Colon	6	235	4	92	8	114	11	129	29	129	86–185
154	Rectum	3	142	3	75	3	61	5	82	14	81	45–137
155.0	Liver	1	234	2	130	2	312	4	231	9	208	95–394
155.1	Gall bladder	[0.3]	0	[0.8]	0	[0.4]	0	[0.7]	0	[2.2]	0	0–171
157	Pancreas	[1.2]	0	6	147	3	96	2	46	11	86	43–154
160	Nose	[0.1]	0	[0.3]	0	[0.3]	0	[0.3]	0	[1.0]	0	0–365
161	Larynx	2	251	2	90	1	78	2	119	7	117	47–241
162	Lung	17	206	35	115	14	109	18	128	84	128	102–158
162.2	Pleura	1	533	[0.4]	0	[0.4]	0	2	426	3	215	44–627
170	Breast	[0.1]	0	[0.1]	0	[0.1]	0	[0.2]	0	[0.5]	0	0–735
177	Prostate	6	206	11	93	15	100	28	127	60	116	88–149
178	Testis	1	131	[0.4]	0	1	165	3	258	5	171	56–400
180.0	Kidney	[1.0]	0	4	102	2	71	4	79	10	78	37–143
181	Bladder	7	214	6	110	7	104	16	178	36	147	103–204
190	Melanoma	[0.9]	0	2	84	2	70	6	128	10	92	44–170
191	Other skin ^b	4	81	2	93	3	118	3	76	12	88	46–154
193	Brain	1	81	3	103	5	219	5	105	14	125	68–210
194	Thyroid	[0.1]	0	1	163	[0.5]	0	1	120	2	99	12–357
197	Connective tissue	[0.2]	0	2	307	[0.4]	0	[1.0]	0	2	90	11–325
201	Hodgkin's disease	[0.3]	0	1	142	[0.4]	0	1	97	2	81	10–294
200, 202	Non-Hodgkin's lymphoma	[0.9]	0	3	143	1	42	4	94	8	83	36–165
203	Multiple myeloma	2	480	[1.4]	0	1	65	3	152	6	113	41–246
204.3	Acute leukemia	[0.4]	0	1	109	1	132	1	73	3	87	18–254
204.0–2,4	Other leukemia	1	156	2	116	1	97	2	94	6	109	40–236
199	Unknown	[0.3]	0	1	54	1	32	6	169	8	90	39–178
140–204	All sites ^c	54	162	106	104	86	103	148	122	394	116	105–128

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

(99). It seems probable that at least part of the excess risk of lung and bladder cancer is caused by occupational exposure, whereas the causal relationship for stomach cancer is less apparent.

Hairdressers: occupational group 50

Group 50 includes hairdressers, barbers, beauticians, and others. Workers holding these occupations typically shampoo, cut, and style hair and apply hair colorants, waving and straightening preparations and conditioners, or they give various beauty treatments to customers, apply make-up to actors and other performers, and make wigs.

Results

Among the men, excess risks of cancers of the bladder, lung, and skin were observed, while the SIR for lip can-

cer was low in all 4 countries (table 89). Among the women, an increased risk was observed for cancers of the pharynx, lung, cervix, and ovary (table 90).

Comments

Hairdressers may be exposed to a variety of chemical agents, some of which are known as proved, probable or possible human carcinogens (100). Among the cancer sites consistently found to have elevated risks were lung and bladder cancers among male hairdressers. Similar results have been published previously (42). Few actual measurements of exposures of professional hairdressers are available. In Finland it has been estimated that only about one-third of hairdressers currently use protective gloves (101). An increased risk of lung cancer among hairdressers has been found in several studies, in accordance with the higher prevalence of smokers reported for this group. The excess bladder cancer risk among male hairdressers is probably not attributable to smoking alone (100).

Table 89. Hairdressers, men (N=10 298) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	16	[0.4]	0	1	41	3	53	5	34	11–78
141	Tongue	2	150	[0.1]	0	1	115	3	141	6	136	50–296
143–144	Mouth	1	37	[0.1]	0	2	167	3	92	6	83	30–180
145–148	Pharynx	1	29	[0.2]	0	3	207	9	197	13	135	72–230
150	Esophagus	3	51	1	322	3	130	6	89	13	85	45–146
151	Stomach	18	83	3	145	11	80	28	96	60	90	69–116
153	Colon	39	119	1	100	12	77	43	110	95	107	87–131
154	Rectum	31	113	[0.9]	0	14	129	34	121	79	117	93–146
155.0	Liver	6	108	1	276	3	207	11	133	21	134	83–205
155.1	Gall bladder	7	203	[0.2]	0	2	219	5	158	14	181	99–304
157	Pancreas	10	62	5	543	7	100	22	108	44	99	72–133
160	Nose	[1.4]	0	[0.1]	0	[0.6]	0	[1.3]	0	[3.4]	0	0–109
161	Larynx	10	105	1	215	5	183	9	126	25	126	82–186
162	Lung	127	118	4	58	35	127	83	130	249	121	107–137
162.2	Pleura	1	43	[0.1]	0	[0.8]	0	[1.9]	0	1	20	0–109
170	Breast	1	127	[0.0]	0	1	401	2	223	4	204	56–523
177	Prostate	44	103	5	156	30	86	126	107	205	103	90–119
178	Testis	6	107	[0.1]	0	1	66	5	208	12	124	64–217
180.0	Kidney	18	147	1	124	10	162	20	94	49	121	89–160
181	Bladder	67	158	3	235	27	180	50	122	147	147	125–173
190	Melanoma	9	104	1	203	5	78	24	154	39	126	89–172
191	Other skin ^b	70	116	[0.5]	0	6	104	29	150	105	122	101–148
193	Brain	17	129	[0.6]	0	1	20	14	83	32	90	61–127
194	Thyroid	3	216	[0.1]	0	3	291	5	169	11	199	100–357
197	Connective tissue	1	64	[0.2]	0	[0.9]	0	7	178	8	122	53–241
201	Hodgkin's disease	5	185	[0.2]	0	[1.0]	0	2	59	7	97	39–199
200, 202	Non-Hodgkin's lymphoma	11	113	[0.5]	0	7	134	15	87	33	101	69–142
203	Multiple myeloma	5	93	1	322	[3.4]	0	12	134	18	100	59–158
204.3	Acute leukemia	4	88	[0.2]	0	2	115	5	90	11	91	46–163
204.0–2,4	Other leukemia	9	112	1	254	4	169	11	117	25	123	80–182
199	Unknown	2	57	[0.4]	0	7	97	14	89	23	86	54–129
140–204	All sites ^c	459	111	29	124	205	110	609	112	1302	112	106–118

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Table 90. Hairdressers, women (N=26 545) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	[0.6]	0	1	87	[0.5]	0	1	85	2	59	7–214
141	Tongue	[0.7]	0	1	75	[0.7]	0	2	122	3	68	14–200
143–144	Mouth	[1.6]	0	1	74	1	95	3	123	5	78	25–183
145–148	Pharynx	3	209	2	115	2	261	7	274	14	216	118–362
150	Esophagus	1	55	3	65	1	89	3	117	8	79	34–156
151	Stomach	9	95	26	99	5	42	20	94	60	87	66–112
153	Colon	36	115	32	133	31	112	59	104	158	113	97–132
154	Rectum	13	80	15	94	16	116	31	102	75	98	77–123
155.0	Liver	[2.9]	0	5	114	[1.4]	0	3	47	8	53	23–105
155.1	Gall bladder	5	105	8	97	4	191	11	95	28	105	70–151
157	Pancreas	10	94	17	112	9	108	22	99	58	103	78–133
160	Nose	1	151	2	225	[0.6]	0	2	191	5	158	51–369
161	Larynx	[1.9]	0	3	343	3	696	1	71	7	153	62–316
162	Lung	33	100	28	150	16	113	45	133	122	122	102–146
162.2	Pleura	[0.8]	0	[0.8]	0	[0.2]	0	[0.6]	0	[2.4]	0	0–156
170	Breast	131	101	147	103	79	100	286	110	643	105	97–113
171	Cervix uteri	45	108	18	126	18	92	59	148	140	121	103–143
172	Corpus uteri	42	152	41	124	19	100	53	94	155	114	97–133
175	Ovary	38	133	43	162	19	91	64	102	164	118	101–138
180.0	Kidney	11	139	11	86	3	49	27	134	52	111	83–145
181	Bladder	12	118	7	111	6	83	12	67	37	89	63–123
190	Melanoma	15	88	12	89	12	83	29	90	68	88	68–112
191	Other skin ^b	48	102	8	102	7	118	12	90	75	101	80–127
193	Brain	17	110	25	119	6	64	38	113	86	108	87–134
194	Thyroid	3	100	15	128	4	74	4	29	26	76	50–112
197	Connective tissue	[1.4]	0	4	123	[1.4]	0	11	181	15	123	69–204
201	Hodgkin's disease	3	128	3	108	[1.2]	0	3	75	9	88	40–166
200, 202	Non-Hodgkin's lymphoma	15	192	9	97	8	103	16	78	48	106	78–141
203	Multiple myeloma	3	85	6	94	5	116	5	52	19	80	48–125
204.3	Acute leukemia	5	116	3	63	[2.4]	0	10	131	18	94	56–148
204.0–2,4	Other leukemia	1	24	6	107	3	126	8	103	18	91	54–143
199	Unknown	5	151	11	123	10	98	16	68	42	91	66–123
140–204	All sites ^c	452	105	520	112	287	94	919	104	2178	105	100–109

^a International Classification of Diseases (7th revision). ^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden. ^c Excludes nonmelanoma skin cancer.

Launderers and dry cleaners: occupational group 51

Group 51 consists of persons who launder, dry-clean and press clothing, textile fabrics, and similar products.

Results

Lung cancer risk was elevated among both the men and the women (tables 91 and 92). Among the women an elevated risk of Hodgkin's lymphoma was observed. In all 4 countries, women had a low risk of breast cancer and cancer of the corpus uteri, but the observed number of cervical cancers was higher than expected.

Comments

Launderers handle soap and other chemical cleaning agents, while persons engaged in dry-cleaning have used different types of solvents, mainly tetrachloroethylene, supplemented with trichloroethylene and fluorocarbons

11 and 113 (102). Different tasks according to gender may explain why men and women in certain occupations have different cancer risks, but it is not possible from the present study to determine whether the elevated risk of Hodgkin's lymphoma among the women is related to occupational exposures or not. The pattern of gynecological cancer and breast cancer among the women is probably related to fertility factors, indicating a higher number of children and a relatively low age at first birth.

Military personnel: occupational group 52

Group 52 consists of professional military personnel who lead, plan, organize, and execute military work. Due to the small numbers, women have been included in occupational group 53.

Table 91. Launderers and dry cleaners, men (N=5619) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	33	1	167	1	73	2	60	5	60	19—140
141	Tongue	[0.6]	0	[0.1]	0	[0.5]	0	1	77	1	40	1—222
143—144	Mouth	1	77	1	889	1	152	3	150	6	148	54—322
145—148	Pharynx	[1.6]	0	[0.2]	0	1	125	3	107	4	73	20—187
150	Esophagus	5	179	1	249	[1.3]	0	1	25	7	82	33—170
151	Stomach	12	116	1	38	14	184	20	117	47	125	92—166
153	Colon	19	123	[1.3]	0	12	138	18	78	49	101	74—133
154	Rectum	16	124	1	82	3	49	13	78	33	89	61—125
155.0	Liver	3	116	2	428	1	124	5	103	11	126	63—225
155.1	Gall bladder	1	62	[0.3]	0	2	397	1	53	4	94	26—242
157	Pancreas	13	172	3	244	8	204	11	91	35	141	98—196
160	Nose	1	151	[0.1]	0	[0.3]	0	[0.8]	0	1	53	1—296
161	Larynx	3	66	1	153	1	65	9	207	14	126	69—212
162	Lung	61	120	5	55	27	172	48	125	141	124	105—146
162.2	Pleura	[1.1]	0	[0.1]	0	[0.4]	0	1	87	1	36	1—200
170	Breast	[0.4]	0	[0.0]	0	[0.1]	0	[0.5]	0	[1.1]	0	0—341
177	Prostate	24	121	3	80	25	129	66	97	118	106	89—127
178	Testis	1	46	[0.1]	0	[0.7]	0	[1.5]	0	1	22	1—123
180.0	Kidney	7	121	2	171	3	87	12	93	24	103	66—153
181	Bladder	12	60	3	182	11	131	36	147	62	114	87—146
190	Melanoma	2	51	1	133	3	89	11	114	17	96	56—153
191	Other skin ^b	29	104	2	302	3	94	9	80	43	100	72—135
193	Brain	8	132	[0.9]	0	2	73	12	115	22	109	68—165
194	Thyroid	2	323	[0.2]	0	[0.6]	0	2	110	4	126	34—323
197	Connective tissue	1	140	[0.2]	0	[0.5]	0	1	42	2	53	6—190
201	Hodgkin's disease	[1.2]	0	[0.2]	0	[0.5]	0	[2.0]	0	[4.0]	0	0—93
200, 202	Non-Hodgkin's lymphoma	6	133	[0.6]	0	6	210	15	143	27	146	96—213
203	Multiple myeloma	7	288	[0.4]	0	2	105	5	94	14	138	75—231
204.3	Acute leukemia	2	94	[0.3]	0	1	106	3	91	6	90	33—196
204.0—2,4	Other leukemia	3	80	[0.5]	0	1	76	2	36	6	54	20—117
199	Unknown	1	61	1	178	5	125	12	128	19	122	73—190
140—204	All sites ^c	211	109	26	85	131	127	333	103	701	108	100—116

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Results

The risk of lung, lip, nose, and pharynx cancer was lower than expected (table 93). The risk of colon cancer and kidney cancer was similarly elevated in all 4 countries. The excess of prostate cancer was found mainly in Denmark and Finland, and the risk of skin cancer was higher in all countries except Finland.

Comments

This group consists of both people doing office work and persons doing mainly outdoor work. Specific occupational exposures are not readily identified. Colon cancer and prostate cancer have both been associated with sedentary work (78). The pattern of an increased risk of malignant melanoma and low risk of lip cancer is typical for indoor occupations (103). The low lung cancer risk, mainly found in Finland, probably reflects a lower smoking prevalence among military personnel than in the general population, whereas no obvious explanations can be given

for the low SIR values of nasal and pharyngeal cancer.

Other economically active persons: occupational group 53

Group 53 is highly heterogeneous and consists of all occupational titles not included in previous occupational groups (01—52), for example, precision mechanic workers, athletes and sportsmen, photographers, bath attendants, and several subgroups of service workers. Included were also workers excluded from previous occupational groups (01—52) because of their small numbers.

Results

Cancer of the lung, nose, and all alcohol-associated cancers were significantly elevated for the men in this group

Table 92. Launderers and dry cleaners, women (N=23 714) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	99	[1.3]	0	1	131	5	342	7	154	62–317
141	Tongue	1	70	[1.4]	0	[1.0]	0	[1.9]	0	1	18	0–99
143–144	Mouth	3	97	1	71	[1.6]	0	7	232	11	121	60–216
145–148	Pharynx	1	38	[1.8]	0	1	89	2	68	4	47	13–122
150	Esophagus	5	132	6	114	2	109	1	28	14	97	53–162
151	Stomach	16	86	26	95	16	82	31	111	89	95	76–117
153	Colon	61	96	19	76	27	62	71	96	178	86	75–100
154	Rectum	28	84	13	77	22	101	43	111	106	96	79–116
155.0	Liver	14	242	6	127	3	140	5	59	28	132	88–191
155.1	Gall bladder	7	69	9	98	4	114	16	101	36	93	65–129
157	Pancreas	26	115	13	78	16	116	30	98	85	102	81–126
160	Nose	2	161	1	114	2	237	1	79	6	142	52–309
161	Larynx	5	138	1	108	[0.6]	0	[1.6]	0	6	89	33–194
162	Lung	83	124	29	146	15	72	45	111	172	116	100–135
162.2	Pleura	1	68	1	130	[0.3]	0	1	133	3	92	19–268
170	Breast	186	88	101	82	101	95	246	92	634	89	83–97
171	Cervix uteri	65	107	18	133	27	119	45	131	155	118	101–138
172	Corpus uteri	50	84	33	97	20	73	57	84	160	85	73–99
175	Ovary	75	140	28	111	29	101	70	103	202	115	100–132
180.0	Kidney	10	62	6	45	5	53	36	141	57	88	67–115
181	Bladder	17	80	2	29	19	163	19	79	57	89	68–116
190	Melanoma	17	75	15	139	20	125	19	70	71	93	73–117
191	Other skin ^b	66	79	4	47	9	95	24	136	103	86	71–105
193	Brain	27	110	19	107	15	124	34	100	95	107	87–131
194	Thyroid	3	68	9	101	5	83	8	64	25	79	51–116
197	Connective tissue	1	44	2	68	4	211	9	141	16	119	68–193
201	Hodgkin's disease	7	247	1	47	2	142	9	241	19	188	113–293
200, 202	Non-Hodgkin's lymphoma	10	72	15	170	10	89	20	84	55	95	71–123
203	Multiple myeloma	5	66	8	115	10	140	8	61	31	89	60–126
204.3	Acute leukemia	6	83	2	45	4	116	11	132	23	98	62–147
204.0–2,4	Other leukemia	5	64	2	35	5	128	11	112	23	84	53–127
199	Unknown	3	45	9	94	19	115	28	91	59	93	71–120
140–204	All sites ^c	753	98	403	91	414	96	983	99	2553	97	93–101

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

(table 94). For the women, cancers of the larynx, pharynx, lung, and cervix uteri were in excess (table 95).

Comments

Due to the variety of occupations included in this group, specific exposures are hard to relate to the cancer experience, and a social-class perspective seems more appropriate. It seems likely that most of the workers in this category represent low-education occupations mixed together with some smaller categories with healthy life habits. In this group the men and women had very similar cancer profiles. Cancer of the upper aerogastric tract, lung, and liver can, to a large extent, usually be attributed to tobacco or alcohol or their combination. Gastrointestinal cancers have often been related to dietary factors, although recent findings also indicate that sedentary life-style is a factor in the genesis of colon cancer. A high risk of cervical cancer has often been found in groups which also have high lung cancer risk, although

the association between smoking and cervical cancer is controversial and probably not a direct one.

Economically inactive persons: occupational group 54

Group 54 includes housewives, early pensioners, students, and persons receiving social support, and it was defined somewhat differently in the respective countries. In Norway, persons with less than 100 hours of work in a year were defined as inactive, whereas, in Finland, the limit is set at 1000 hours of work in a year. In Sweden and Denmark, only those without any paid work on the census date were included as economically inactive persons.

Results

For the men, an elevated risk of cancer combined was observed, while, for the women, no increase was found

Table 93. Military personnel, men (N=41 437) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	1	12	3	51	9	80	10	93	23	63	40—95
141	Tongue	1	45	3	175	3	59	6	120	13	93	49—159
143—144	Mouth	3	76	3	191	7	102	8	106	21	105	65—161
145—148	Pharynx	5	92	[2.6]	0	7	86	3	28	15	56	31—92
150	Esophagus	6	88	2	55	12	115	4	31	24	71	46—106
151	Stomach	16	72	22	88	56	101	40	78	134	87	73—103
153	Colon	40	118	18	127	85	119	87	116	230	118	104—135
154	Rectum	35	124	12	105	38	76	58	107	143	99	84—117
155.0	Liver	7	121	2	50	6	98	16	108	31	101	69—143
155.1	Gall bladder	3	93	2	84	4	108	5	87	14	93	51—156
157	Pancreas	15	92	13	109	29	99	37	95	94	98	79—119
160	Nose	1	54	[1.1]	0	1	33	1	33	3	33	7—97
161	Larynx	10	82	4	60	13	93	18	114	45	92	67—124
162	Lung	88	81	40	52	130	99	113	88	371	83	75—92
162.2	Pleura	2	71	[1.6]	0	4	101	6	142	12	95	49—167
170	Breast	[0.9]	0	[0.4]	0	3	233	4	212	7	157	63—323
177	Prostate	46	157	32	148	124	110	184	100	386	111	100—123
178	Testis	20	110	5	156	16	102	11	103	52	109	81—143
180.0	Kidney	17	111	26	178	41	130	57	120	141	130	110—153
181	Bladder	54	122	7	47	81	124	80	98	222	108	94—123
190	Melanoma	22	125	13	99	51	107	67	149	153	124	106—145
191	Other skin ^b	91	121	4	69	35	147	52	157	182	132	114—152
193	Brain	28	125	18	118	33	101	46	102	125	108	91—129
194	Thyroid	2	92	4	129	7	108	5	65	18	93	55—147
197	Connective tissue	2	78	1	33	7	140	9	95	19	95	57—148
201	Hodgkin's disease	3	51	5	120	9	131	11	120	28	107	71—155
200, 202	Non-Hodgkin's lymphoma	11	80	10	116	28	96	41	104	90	99	79—121
203	Multiple myeloma	5	90	5	115	12	81	22	124	44	104	75—139
204.3	Acute leukemia	6	96	8	209	4	46	12	98	30	97	65—138
204.0—2,4	Other leukemia	7	79	7	129	10	99	15	79	39	90	64—123
199	Unknown	2	50	6	112	27	90	31	96	66	92	71—117
140—204	All sites ^c	449	95	281	93	883	104	1077	100	2690	99	96—103

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

(tables 96 and 97). For the men, all alcohol-associated cancers showed an excess risk. Significantly increased risks were also found for cancer of the lung, lip, stomach, gallbladder, pancreas, breast, and testis, and for cancer with unknown origin. A lowered risk for malignant melanoma was only found for the men. For the women, only small deviations from the expected values were observed.

Comments

Definite exposures are difficult to describe in this heterogeneous group. For the men, the results are best inter-

pretable in light of the socioeconomic status of the group. Moreover, a proportion of the persons may have left the labor force due to diseases they developed before the cancer disease. A high risk of cancer of the upper aerogastrointestinal tract, liver, and lung have often been associated with low socioeconomic status, mainly through drinking and smoking habits. The economically inactive women, on the other hand, had a cancer experience very similar to the general female populations of the Nordic countries, probably due to the fact that the largest portion of economically inactive women are represented by housewives.

Table 94. Other economically active persons, men (N=133 047) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	71	97	35	93	10	76	70	124	186	103	89—119
141	Tongue	27	173	12	169	8	164	19	88	66	134	103—170
143—144	Mouth	48	153	14	204	13	193	39	118	114	146	122—176
145—148	Pharynx	62	153	18	137	14	173	61	131	155	143	122—168
150	Esophagus	109	167	35	140	17	136	109	163	270	159	141—180
151	Stomach	285	118	167	100	70	96	347	119	869	113	105—120
153	Colon	350	97	70	86	107	126	369	94	896	98	92—104
154	Rectum	288	96	87	115	56	95	279	99	710	99	92—107
155.0	Liver	104	173	43	149	13	168	107	130	267	149	132—168
155.1	Gall bladder	39	105	13	84	5	104	23	73	80	90	71—112
157	Pancreas	188	107	72	95	32	86	202	100	494	101	92—110
160	Nose	26	162	3	55	4	124	21	158	54	142	107—185
161	Larynx	158	148	55	136	25	166	69	96	307	131	117—147
162	Lung	1457	125	733	129	200	133	720	113	3110	123	119—128
162.2	Pleura	30	117	5	72	4	93	19	97	58	103	78—133
170	Breast	12	140	2	99	4	285	2	22	20	94	58—146
177	Prostate	457	103	224	95	169	95	1139	99	1989	99	95—103
178	Testis	65	81	6	80	17	165	34	114	122	96	80—114
180.0	Kidney	133	96	67	95	30	89	207	96	437	96	87—105
181	Bladder	518	112	95	93	82	102	350	86	1045	99	93—105
190	Melanoma	79	74	35	80	45	117	132	80	291	82	73—92
191	Other skin ^b	602	90	38	92	30	98	157	82	827	89	83—95
193	Brain	142	91	34	64	39	133	151	85	366	88	80—98
194	Thyroid	13	81	7	62	7	117	24	77	51	79	59—104
197	Connective tissue	19	103	10	81	5	98	44	108	78	102	81—127
201	Hodgkin's disease	44	129	17	126	3	51	39	107	103	114	94—139
200, 202	Non-Hodgkin's lymphoma	129	115	34	87	31	106	161	92	355	100	90—111
203	Multiple myeloma	55	94	21	81	15	82	86	96	177	92	80—107
204.3	Acute leukemia	68	130	20	115	9	94	54	95	151	111	95—130
204.0—2,4	Other leukemia	105	118	41	127	14	111	90	95	250	109	96—124
199	Unknown	42	109	42	119	42	110	165	105	291	108	96—121
140—204	All sites ^c	5167	113	2059	108	1120	111	5509	101	13855	107	105—109

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 95.** Other economically active persons, women (N=96 440) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	3	112	3	61	2	88	10	147	18	108	64—171
141	Tongue	3	80	3	58	4	136	12	133	22	105	66—160
143—144	Mouth	11	136	4	75	7	147	16	112	38	117	83—161
145—148	Pharynx	13	186	10	149	6	176	16	113	45	144	105—192
150	Esophagus	8	82	18	92	5	93	15	90	46	90	66—120
151	Stomach	46	95	111	106	56	97	138	107	351	103	93—115
153	Colon	174	106	100	106	142	109	347	101	763	104	97—112
154	Rectum	112	130	69	108	73	113	183	100	437	110	100—121
155.0	Liver	9	60	25	140	8	126	43	109	85	108	86—134
155.1	Gall bladder	31	120	41	120	11	108	66	90	149	104	88—122
157	Pancreas	65	113	64	102	45	111	155	110	329	109	98—122
160	Nose	2	61	1	29	4	157	2	33	9	59	27—112
161	Larynx	19	200	5	142	4	206	13	170	41	181	130—246
162	Lung	262	151	91	121	78	124	217	111	648	128	118—138
162.2	Pleura	7	184	5	168	[0.9]	0	3	85	15	134	75—221
170	Breast	579	99	485	98	335	101	1191	90	2590	95	91—98
171	Cervix uteri	227	131	65	123	93	124	219	126	604	127	117—137
172	Corpus uteri	133	87	124	96	86	103	321	97	664	95	88—103
175	Ovary	153	108	97	99	79	89	333	100	662	100	92—108

(continued)

Table 95. Continued

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
180.0	Kidney	42	100	54	107	29	103	111	92	236	98	86—111
181	Bladder	63	115	21	80	49	143	105	94	238	105	93—119
190	Melanoma	60	91	43	97	48	89	119	86	270	89	79—101
191	Other skin ^b	198	89	31	97	30	107	74	91	333	91	82—102
193	Brain	59	87	62	87	34	88	163	96	318	92	82—102
194	Thyroid	16	128	33	89	20	98	69	110	138	104	88—123
197	Connective tissue	7	111	11	94	8	135	28	91	54	98	74—129
201	Hodgkin's disease	8	94	7	79	6	130	23	126	44	109	79—146
200, 202	Non-Hodgkin's lymphoma	34	91	29	84	37	107	110	97	210	95	83—109
203	Multiple myeloma	21	109	31	119	18	86	60	99	130	102	86—121
204.3	Acute leukemia	24	122	20	114	13	123	48	119	105	119	99—144
204.0—2,4	Other leukemia	21	102	21	96	11	96	42	92	95	95	77—116
199	Unknown	13	76	34	94	44	91	148	103	239	97	86—111
140—204	All sites ^c	2246	109	1747	101	1409	106	4735	99	10137	102	100—104

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.**Table 96.** Economically inactive persons, men (N=422 337) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971—1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	130	123	344	122	111	111	251	114	836	118	110—126
141	Tongue	33	192	59	138	92	274	171	219	355	207	186—230
143—144	Mouth	55	138	61	155	78	174	258	219	452	187	170—205
145—148	Pharynx	75	153	144	165	126	233	353	216	698	197	183—212
150	Esophagus	125	127	324	162	170	181	464	179	1083	166	157—176
151	Stomach	526	127	1495	111	707	118	1436	120	4164	117	114—121
153	Colon	625	106	634	108	646	101	1648	109	3553	107	103—110
154	Rectum	513	106	606	103	430	98	1116	104	2665	103	99—107
155.0	Liver	163	173	338	149	119	189	603	185	1223	172	163—182
155.1	Gall bladder	88	135	145	123	46	116	177	144	456	132	120—144
157	Pancreas	332	115	647	114	344	117	1005	129	2328	121	116—126
160	Nose	17	76	35	104	35	152	51	109	138	110	93—130
161	Larynx	169	116	392	138	153	147	420	162	1134	143	135—151
162	Lung	2365	126	6351	142	1549	141	3433	143	13698	139	137—141
162.2	Pleura	39	104	48	114	24	79	69	97	180	99	86—115
170	Breast	9	68	16	106	13	137	57	160	95	130	105—158
177	Prostate	865	100	2002	92	1486	96	4618	98	8971	97	95—99
178	Testis	71	99	39	112	69	132	157	137	336	123	110—137
180.0	Kidney	225	111	434	98	254	105	931	119	1844	110	105—115
181	Bladder	773	105	919	116	611	99	1627	106	3930	107	104—110
190	Melanoma	108	95	198	90	185	83	454	81	945	85	79—90
191	Other skin ^b	928	97	358	107	258	106	820	109	2364	103	99—107
193	Brain	196	105	280	100	191	104	710	114	1377	108	103—114
194	Thyroid	23	105	58	91	54	133	137	120	272	113	101—128
197	Connective tissue	27	106	78	101	35	95	156	106	296	103	92—116
201	Hodgkin's disease	30	76	82	106	36	89	195	135	343	114	102—126
200, 202	Non-Hodgkin's lymphoma	190	119	277	110	196	98	713	112	1376	110	104—116
203	Multiple myeloma	100	105	198	107	139	96	313	93	750	98	92—106
204.3	Acute leukemia	71	92	108	91	68	94	236	110	483	100	92—110
204.0—2,4	Other leukemia	180	124	250	103	106	104	433	118	969	113	106—121
199	Unknown	83	145	374	133	499	162	790	133	1746	141	134—147
140—204	All sites ^c	8299	116	17355	119	8749	114	24712	119	59115	118	117—119

^a International Classification of Diseases (7th revision).^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.^c Excludes nonmelanoma skin cancer.

Table 97. Economically inactive persons, women (N=2 424 702) — observed number (O) of cancers and standardized incidence ratio (SIR), 1971–1991, by country and cancer site. (95% CI = 95% confidence interval)

ICD-7 ^a	Site	Denmark		Finland		Norway		Sweden		Total		
		O	SIR	O	SIR	O	SIR	O	SIR	O	SIR	95% CI
140	Lip	79	97	150	102	102	105	154	102	485	102	93–111
141	Tongue	112	106	142	102	117	95	193	95	564	99	91–107
143–144	Mouth	241	99	148	100	196	99	320	105	905	101	95–108
145–148	Pharynx	159	88	178	99	154	111	327	113	818	104	97–111
150	Esophagus	306	103	665	107	215	99	399	110	1585	106	101–111
151	Stomach	1617	104	3174	103	2426	102	3033	102	10250	103	101–105
153	Colon	5169	101	2762	101	5259	99	7698	103	20888	101	100–103
154	Rectum	2653	101	1796	99	2541	97	3847	100	10837	99	97–101
155.0	Liver	483	106	554	105	271	106	914	105	2222	105	101–110
155.1	Gall bladder	898	106	1153	111	431	103	1774	108	4256	108	105–111
157	Pancreas	1860	100	1900	101	1670	101	3017	98	8447	100	98–102
160	Nose	103	107	103	109	109	104	135	104	450	106	97–116
161	Larynx	237	97	91	111	83	106	153	103	564	102	94–111
162	Lung	4543	96	1887	97	2557	100	3751	97	12738	97	95–99
162.2	Pleura	107	95	68	89	26	74	67	90	268	90	80–101
170	Breast	14816	98	10982	96	13593	97	27127	100	66518	98	97–99
171	Cervix uteri	4240	100	1327	98	3226	100	3609	99	12402	99	98–101
172	Corpus uteri	4039	99	3090	100	3376	100	6258	101	16763	100	99–102
175	Ovary	3632	95	2219	94	3505	94	6447	97	15803	96	94–97
180.0	Kidney	1325	107	1359	105	1158	101	2659	106	6501	105	102–107
181	Bladder	1656	99	727	96	1361	98	2322	97	6066	97	95–100
190	Melanoma	1559	97	972	95	2284	97	2875	99	7690	97	95–100
191	Other skin ^b	6232	98	1077	105	1185	103	1859	102	10353	100	98–102
193	Brain	1804	102	1670	103	1606	100	3445	100	8525	101	99–103
194	Thyroid	385	109	874	103	905	102	1394	104	3558	104	101–107
197	Connective tissue	191	114	294	101	271	109	714	107	1470	107	102–113
201	Hodgkin's disease	203	90	227	102	193	96	430	103	1053	99	93–105
200, 202	Non-Hodgkin's lymphoma	1086	99	932	103	1436	102	2518	104	5972	103	100–105
203	Multiple myeloma	625	104	722	100	829	97	1338	101	3514	100	97–104
204.3	Acute leukemia	587	104	452	98	439	98	891	102	2369	101	97–105
204.0–2,4	Other leukemia	651	101	636	101	474	102	1012	101	2773	101	98–105
199	Unknown	563	102	1167	108	2108	105	3305	108	7143	107	104–109
140–204	All sites ^c	56701	99	44103	100	54381	99	100605	101	255790	100	100–100

^a International Classification of Diseases (7th revision).
^c Excludes nonmelanoma skin cancer.

^b Basal cell carcinomas have been included for Denmark and excluded for Finland, Norway, and Sweden.

Discussion

General comments

Our study covers about 20 years of cancer incidence for the population born between 1906 and 1945 and living in the 4 Nordic countries (Denmark, Finland, Norway, and Sweden) in 1970. Ten million persons were included in the study. The economically active persons were classified into 53 occupational groups, and the economically inactive persons formed a separate group. During the 20 years of follow-up, 180 million person-years were accumulated. One million incident cancer cases occurred during the follow-up period. The cancer cases were classified into 35 diagnostic groups. The present study is thus one of the largest studies ever reported on work-related cancer.

Validity of census data

For the 1970 census, it was compulsory for all heads of households to fill out self-administered questionnaires. The questionnaire data were centrally coded in the national statistical offices. A control survey was undertaken in Norway to check the quality of the 1970-census data. It was based on personal interviews with a random sample of the census population. In comparison with the data from the census, overall 2.1% more men and 13.8% more women reported having more than 500 hours of income-producing work. The main deficits in the census data came from agriculture and public and private services. However, the distributions by main occupational groups (the 2 first digits of the code) for those recorded as economically active were fairly similar (104).

A control study of the 1970-census data was undertaken in Sweden by linkage with interview data from sample surveys of the labor force. The study showed an underreporting of economic activity in the census data for persons with 20 or less hours of work per week, coming especially from women in agriculture. The distributions by the main occupational groups for those recorded to be economically active were, as in Norway, fairly similar (105). The accuracy of the occupational codes used in Finland has also been evaluated, and it proved to be high (104). No control survey was undertaken for the 1970 census in Denmark, but when a sample of original census questionnaires was retrieved for a nested case-referent study, no coding errors were detected (33). It seems reasonable to conclude that there may be a certain amount of underreporting of economic activity among women working part-time in agriculture and service work, but the quality of the data for persons reported as economically active seems to be high.

Validity of cancer incidence data

In Denmark, the cancer registration was voluntary with a small fee paid for each notification until the reporting became compulsory for all physicians in 1987. Several independent studies indicate a good coverage of the cancer registration from the very beginning in 1943. A comparison between the cancer register data and the hospital files for all cervical cancer patients treated in selected hospitals during the period 1943–1966 thus showed that less than 1% of the treated patients were missing in the cancer register data (106). A thorough review of hospital records for twins born in 1881–1920 and comparison with the cancer register data showed that 97% of the registered cancer cases were confirmed either with histology or surgery (107). Comparison between 1977 data from the then newly established hospital discharge register and the cancer register showed that 95% of the cancer cases in the hospital discharge register were known also in the cancer register, with the deficits found for cancers of the digestive organs, breast, female genital organs, and lymphatic and blood producing tissue (108).

Cancer registration in Norway has been compulsory from 1953 on, and it was, from the beginning, based on a combination of reporting from clinical and pathology departments (109). A comparative study was undertaken for 2 counties in 1976 between the cancer register data and data retrieved from the Economic and Medical Information System. The study showed an overall completeness of the cancer register of 98%, with the deficit coming from, in particular, leukemia and multiple myeloma (110).

As in Norway, cancer registration in Finland is based on a combination of reporting from clinical and pathological departments, and the registration has been compulsory since 1961. A linkage was made between the data from the cancer register and from the national hospital discharge register for 1985–1988. The agreement was good (about 99%) for most diagnostic groups, but it showed about a 10% underreporting in the cancer register for benign neoplasms of the central nervous system (mainly among elderly people), chronic lymphatic leukemia, and multiple myeloma (111).

There are some minor differences in the registration procedure in Sweden, as death certificates have not been used as a data source. Validation studies have been made by linking the cause of death register with the cancer register (112). The studies showed a dropout in completeness of a maximum of 4.5%, with the deficits found for leukemia, cancers of the prostate and stomach, and myeloma.

Linkage

The linkage between the census data, the mortality and emigration data, and the cancer incidence data was based on the unique personal identification numbers used in all 4 countries. Apart from errors in the identification numbers, which are extremely rare, the method thus by definition ensured a complete ascertainment of relevant events. Emigrations were not taken into account in the follow-up in Sweden, but, as the emigrations were few during the study period, the influence will have been negligible in the risk estimates from Sweden.

Occupational mobility

This study of cancer incidence through a 20-year follow-up period is based on the occupation recorded in the census in 1970. This study design would be unproblematic in an archaic society where a person continued in the same trade throughout his or her lifetime. But major changes took place in the labor market structure in the Nordic countries from 1920 to 1990, as described in the section on the occupational history of the study population.

The extent to which the 1970 occupation reflects lifetime experience probably varies considerably across occupational groups. The census data from 1975, 1980, and 1985 were linked in Finland for a study of occupational mobility. When analyzed by main occupational groups, the study showed that 85% of the men worked in the same occupation in 1975 and 1980. The percentage varied from 91% in transport to 82% in administration and manufacture. The overall percentage for women was 85%, varying from 89% in communication to 77% in administration. The comparison between 1980 and 1985 also indicated a very stable labor market in Finland at that time (113).

Between the censuses of 1960 and 1970 in Sweden 45.5% of the men and 24.8% of the women were recorded with the same type of job in both censuses. The low percentage for women could be explained by their entrance into the labor market during the 1960s (114).

The Norwegian census data from 1960 and 1970 have been linked and used in a study of occupational mortality (20). However, these data are presented in a way in which it is not possible directly to calculate percentages for occupational mobility from 1960 to 1970. In Finland occupation-specific standardized mortality ratios were calculated in 2 ways: first based on a single census and then restricted to persons who had stayed in the same occupation in subsequent censuses. The estimates for standardized mortality ratios were practically identical in both analyses (115).

No linkage of census data has been made in Denmark. By comparison of birth cohorts from one census to the next, it is clear, however, that at least one-fourth of the men working in manufacture, construction, and transport

in 1970 had a background in agriculture (13). A background in agriculture is expected to affect the cancer pattern of such occupational groups, as the cancer risk of farmers is in general low and as farmers normally have a lower tobacco consumption than other occupational groups.

Labor market changes are expected to affect the occupational groups differently. A skilled or self-employed worker in 1970 would normally have served an apprenticeship in the trade at an early age and would have worked in the trade ever since. An unskilled worker in manufacture would more likely have a background in other occupations. Among slaughterhouse workers in Denmark in 1982, as an example, only 1.5% of the skilled butchers, but 40% of the unskilled slaughterhouse workers, had worked previously in agriculture for at least 5 years (116).

Classification of occupation

We have grouped the economically active population into 53 occupational groups in order to get stable numbers and to account for the different coding systems in the 4 countries. However, Denmark has used "pension fund" data as the basis for its coding, while the other countries have used the NYK code. From the point of view of workplace exposures, some of the occupational codes used in the original census data are already heterogeneous. In a study like this, we would therefore not be able to identify all possible occupational risks. Nickel smelting workers, known to have about a 30-fold excess risk of nasal cancer (117), have, in our study, been grouped together with other occupations in occupational group 27 (smelters and metal foundry workers), and the SIR for nasal cancer in this broad group was only 1.44. Despite these limitations, a major part of the known associations between occupations and specific cancer diseases was found also in the present study, as illustrated by the examples that follow.

The load of physically demanding work used to be highest for men in mining, forestry, fishing, agriculture, and construction. Women working in health care and cleaning also have physically demanding jobs. With the automatization of industrial processes, the physical work load in many jobs diminishes, and physical activity during leisure time then has to be considered in addition to physical activity at work when it comes to interpreting occupational differences in, for example, the incidence of breast and colon cancers.

Not all associations found in our study between occupations and specific cancer diseases reflect risks caused by exposures at the workplace. Besides workplace exposures, the occupational groups vary also in their exposures to other risk factors. Such major risk factors are tobacco smoking, alcohol consumption, dietary habits, and reproductive pattern.

Occupation and tobacco smoking

By 1990, a major social class difference had developed with 58% of male unskilled workers smoking cigarettes compared with only 29% of male salaried employees with a higher education (51).

In Finland in 1968, 46% of men working in agriculture smoked compared with 61% of men working in manufacture (54). These percentages had decreased to 34% and 49%, respectively, in 1978 (118), and to 33% and 44% in 1990 (118). Approximately 56% of Swedish men smoked in 1968, and this percentage had decreased to 51% in 1974 and 41% in 1981. Nineteen percent of male farmers were daily smokers in 1982–1983 compared with 40% of male industrial workers (53). On the average 54% of Norwegian men smoked in 1975. This percentage varied from 43% in agriculture and fishing to 60% in manufacture and 68% in mining and quarries (119).

Although the available data have been collected in different ways and cover different periods, they consistently point to a decrease in tobacco smoking among Nordic men during the study period 1970 to 1990, and they consistently point to a lower proportion of smokers among farmers than among workers in manufacture. Tobacco workers (occupational group 40) have had easy access to cigarettes, and therefore they smoke more than the general population. Furthermore, by 1990, the smoking level was low among academics.

Occupation and alcohol consumption

Alcohol consumption is, as tobacco smoking, unevenly distributed across the occupational groups. Alcohol consumption was, throughout the study, period lower in Finland, Norway, and Sweden than in Denmark. In Denmark, in 1976, an average of 23% of men reported consumption of at least 11 alcoholic drinks per week. The proportion was 30% for those who had a university degree and for office workers, but only 7% for farmers. Five percent of women reported consumption of at least 11 alcoholic drinks per week. Consumption of wine increased after Denmark joined the European Union in 1972, and wine consumption in 1985 showed a marked social class gradient from 41% for persons with a university degree to 4% for blue-collar workers. Beer consumption showed the opposite trend with 38% for academic occupations and 75% for blue-collar workers (120).

Beverage manufacture workers (89) and male waiters and cooks have shown a higher consumption of alcoholic beverages than the general population (95). Finnish men aged 30–49 years in 1978–1990 showed that 42% of higher white-collar workers consumed at least 8 alcoholic drinks per week compared with 33% of workers with light or moderately physically demanding jobs (121). The highest indices for alcohol-related utilization

of health care resources in the early 1970s were, in Finland, obtained for laborers, painters, seamen, construction workers, forestry workers, artists, and journalists (119).

The sparse data also indicate that the higher social classes and some categories within the lowest social classes had the highest average alcohol consumption and that farmers had a very low consumption.

Occupation and dietary habits

Data on dietary habits in the economically active population are sparse. However, surveys were carried out among samples of Finns aged 25–64 years in 1982 and 1992. The mean daily consumption of cheese, vegetables, and alcohol rose in all the educational groups, whereas rye, potatoes, butter, coffee, and sugar consumption fell. There were only minor differences between changes in food consumption across the educational groups (122). In 1992, the intake of milk and butter was significantly higher among men with a lower level of education, whereas the intake of vitamin C and carotenoids was significantly lower (123).

The intake of potatoes was higher among the men in the lowest social class in Denmark in 1985 than in the highest social class, but the intake of vegetables and fruit varied in the opposite direction. Consumption of milk and milk products among men was higher in the highest social class (122). The food consumption among women varied less by social class than among men, but it showed the same tendencies.

The food consumption by educational groups among Swedish men in 1989 resembled that reported for Danish men. There was a higher consumption of potatoes among the men with a lower education, and this consumption was compensated by a higher intake of other vegetables and fruit among men with a higher education (124). The same pattern was observed among Norwegian men in 1986–1988 (125).

The data from the late 1980s thus all seem to indicate that men with a higher education consume more vegetables and fruit than men with a lower education. Among the women, the differences in dietary habits were fewer, but in the same directions as those for the men.

Occupation and reproductive pattern

The fertility pattern by educational group is known for women born in Norway in 1935. These data are highly relevant for our study population, as women born in 1935 passed from 34 to 54 years of age during our study period. Twenty-three percent of the women with 7–9 years of school attendance had a child before reaching 21 years of age, whereas this was the case for only 1% of the women with 15 or more years of school attendance. The percentages for first child before the age of 26 years were 72% and 23%, respectively. The average number of chil-

dren at the age of 39 years was 2.6 for the low schooling group and 2.0 for the high schooling group. In the 1945 cohort, age at first birth had decreased, as 32% of the women with a lower education and 3% of those with a higher education had a child before 21 years of age. The average number of children at age 39 years had, however, decreased somewhat with 2.4 for the women with a lower education and 1.8 for those with a higher education (126).

In Finland in 1970, married women above 34 years of age with preprimary and a lower level of basic education had an average of 2.7 children, whereas women with a university education had an average of 1.5 children (127). In a sample of married women aged 15–49 years and interviewed in Denmark in 1970, 23% of the women with 7–9 years of education reported birth of the first child before reaching 20 years of age, whereas this was the case for only 2% of the women with 12 or more years of education (128). The fertility differences were relatively small among Swedish women born in 1940–1949, with women with only a basic education having an average of 2.1 children and women with a university education having an average of 1.9 children (129).

The reproductive pattern of the women contributing

the major part of the cancer cases in the present study has thus varied considerably by educational level, although these differences seem to have diminished for the later cohorts of women.

Mass significance

In this study, we present SIR values for men and women, 4 countries, 54 occupational groups, and 35 cancer sites, which in theory gives 15 120 possible SIR values. Although some of these possible combinations do not occur in reality, we nevertheless present data for a very large number of combinations. Inevitably, many of these combinations will, by chance, emerge with significantly high or low SIR values. In the interpretation of the findings, it is therefore important to pay attention not only to the size of the SIR values or the confidence intervals, but also to the consistency across countries and to the biological plausibility.

Comments on selected cancer sites

The most important sites involved in work-related cancer are cancers of the lung, nose, bladder, and pleura.

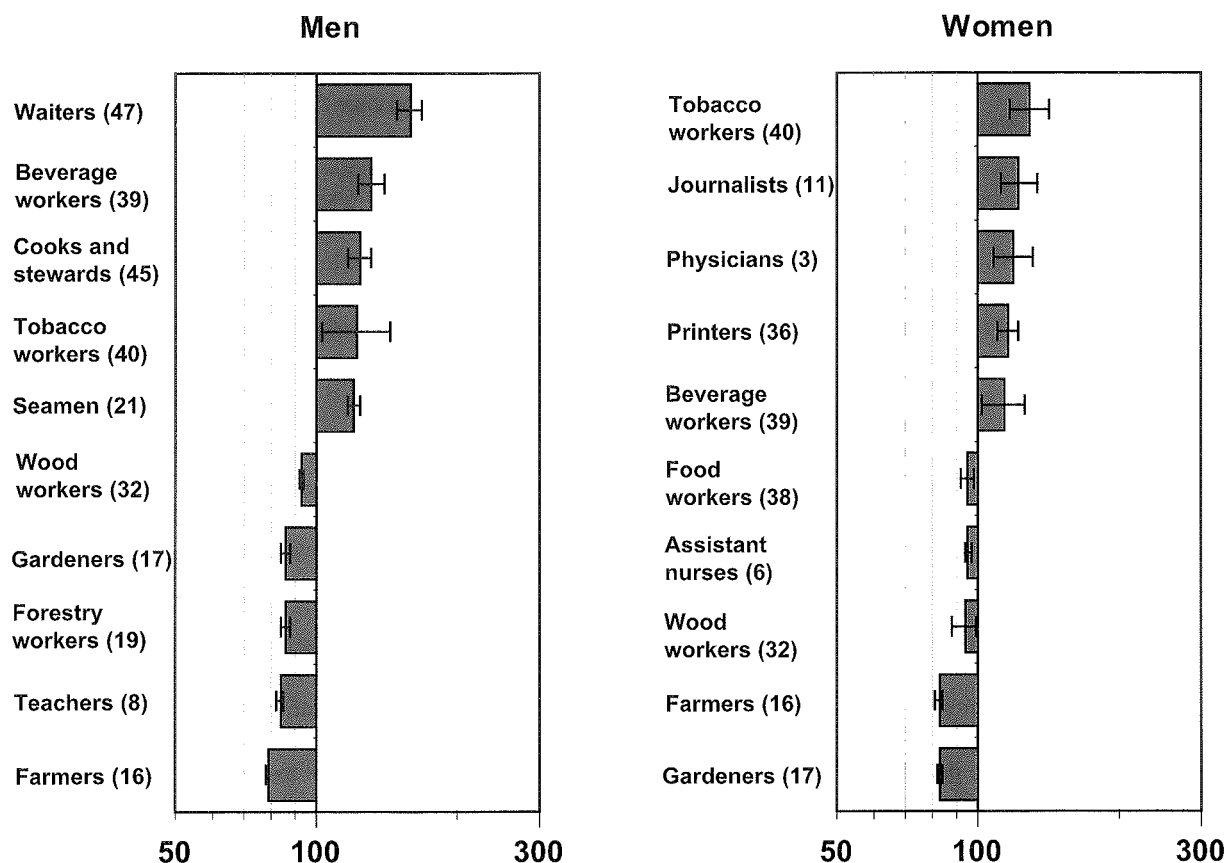


Figure 4. Risk of all cancer sites combined in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men and women, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included.

These sites also form the most important potential for cancer prevention (130). In some of the occupations with the highest SIR, social factors are probably more important determinants of some cancer risks than workplace exposures, for instance, for female journalists.

In the following discussion we present the data for selected cancer sites for the 5 occupational groups with the highest and the lowest SIR values. Only occupations with ≥ 5 as expected numbers are included in this section.

All cancer sites combined

The group "all cancers combined" includes numerous cancer diseases with different etiologies. Increased SIR values of total cancer in many occupations indicate that high risks of certain cancers are not always compensated by low risk of other types of cancer.

The study shows more than a 2-fold difference in the SIR values for men, from 79 for farmers to 159 for waiters, and for the women the SIR values varied from 83 for gardeners to 129 for tobacco workers (figure 4). The occupations with the highest SIR values for the men also include beverage workers, tobacco workers and seamen, all persons with easy access to tobacco and alcoholic beverages at work. At the bottom of the scale are farmers and teachers. In Finland, Norway, and Sweden farmers have a low prevalence of smokers (131). At the top of the list for women are tobacco and beverage workers and journalists, and at the bottom of the scale are gardeners and farmers.

Lip cancer

The incidence of lip cancer in the Nordic countries is 5 to 10 times higher for men than for women, and, since few lip cancers among women were included in the occupational groups, it is not discussed further. Men living in rural areas and, in particular, those employed in outdoor occupations, such as fishermen and farmers, have earlier been found to have the highest risk of this disease (132, 133). By far the majority of lip cancers occurs on the lower lip, and the risk has been ascribed to exposure to sunlight and smoking (134).

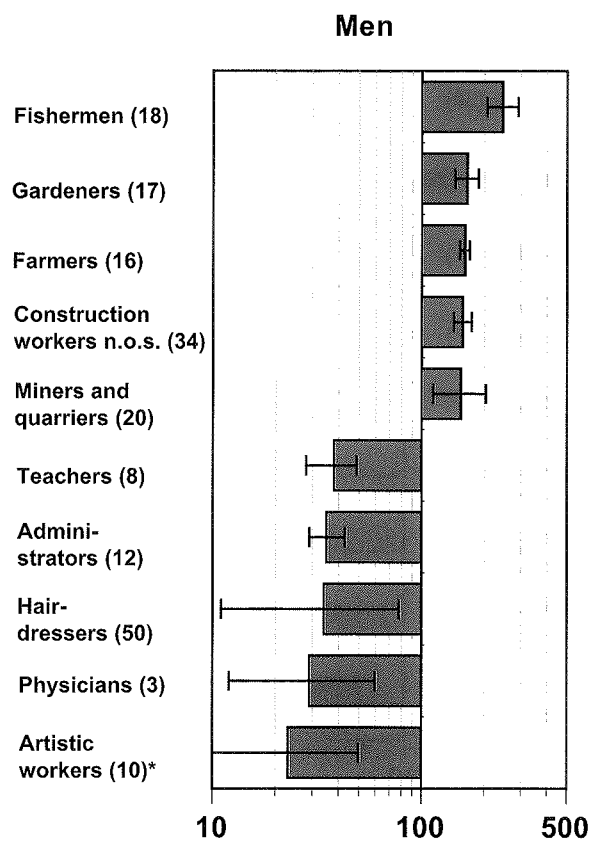
Case-referent studies using outdoor work as a proxy measure for exposure to ultraviolet radiation have all shown a consistent excess risk of lip cancer for outdoor workers (135). In our study outdoor workers also ranked with the highest SIR values (figure 5). The lowest ranked occupations were all indoor occupations.

Cancer of the pleura

Pleural cancer is a rare disease. In the Nordic countries in 1981—1985 the incidence for men was 8—10 cases per million, and for women it was 1—2 per million person-years. The incidence increased for the men from 5—7 per million person-years in 1970—1974 to 15—20 per million person-years in 1985—1989. More than 95% of pleural cancers are histologically verified or diagnosed by X-ray examinations and classified as mesothelioma.

Almost all pleural cancers are associated with asbestos exposure and are known to be the result of occupational activity or environmental exposure (77, 136). Generally speaking, those working producing asbestos products have been heavily exposed to asbestos, and, among the users, maintenance workers, construction workers, welders, and mechanics can also be expected to be exposed to asbestos.

Cancer of the pleura shows the greatest interval of variation in SIR values by the occupations included in our study, in which plumbers, welders, and mechanics



* CI-boundary is outside chart range

Figure 5. Risk of lip cancer in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included. (n.o.s. = not otherwise specified)

top the list of high risk (figure 6). These workers have all been exposed to asbestos, the mild-steel welders especially if they worked at shipyards (73), and insulators have been heavily exposed. The excess risk of pleural cancer among seamen is probably not only due to those working in machine rooms, since also deck personnel seem also to have a high risk of mesothelioma (137).

There was also an excess risk of pleural cancer in the occupational group of technical, chemical, physical, and biological work (SIR 132 based on 170 cases). Some of the occupations included in this group were civil engineering and chemists potentially exposed to asbestos (23). A number of chemists worked in the paper pulp industry, an industry where asbestos has been widely used (138). Our findings are in line with the theory that even short-term exposure to asbestos could cause mesothelioma, in contrast to lung cancer risk, which shows a dose-response relation to asbestos exposure (139).

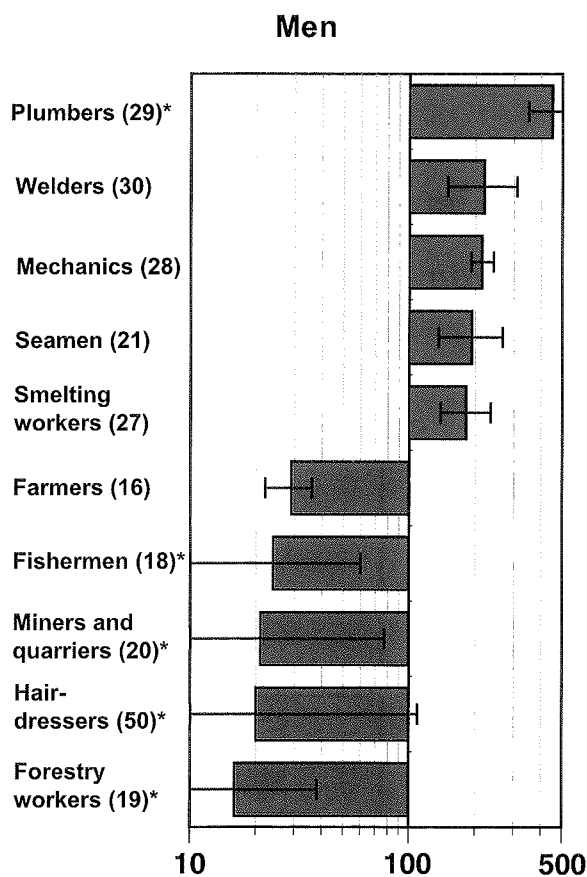
The very low SIR values observed in occupations

without or with little contact with asbestos, such as farmers, fishermen, and forestry workers, indicate low or no exposure to asbestos. For forestry workers the SIR was 16, based on 5 observed cases and 31 expected cases.

For the women all the SIR values were based on small numbers, and no significant differences were observed. The highest SIR was found for female textile workers, for whom 21 cases were observed (SIR 153).

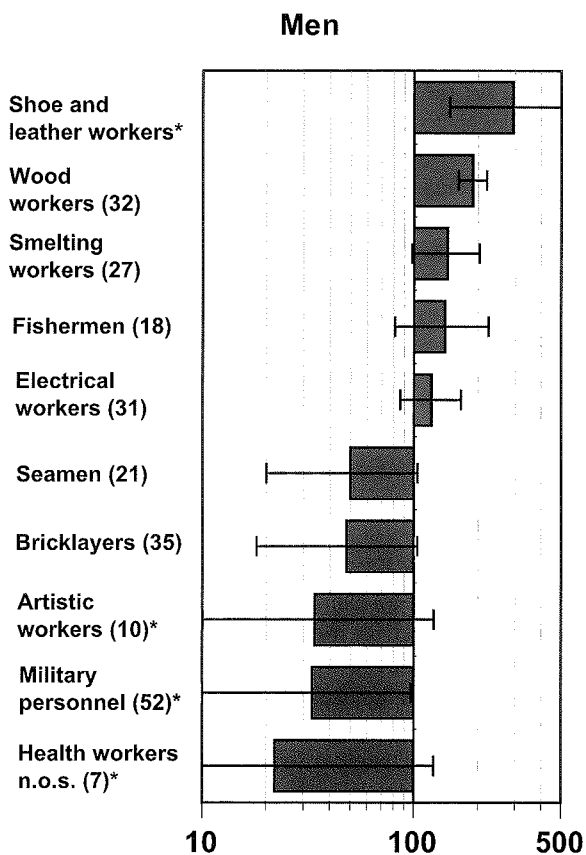
Cancer of the nose and nasal sinuses

Nasal cancer is a rare type of cancer. In 1981—1985, in the combined Nordic countries, the incidence was 6 and 3 per million person-years for men and women, respectively. Several occupations and industrial exposures have been associated with increased risks. However, due to the rarity of these tumors, the identification of high risk groups has frequently been based on few cases. There has



* CI-boundary is outside chart range

Figure 6. Risk of cancer of the pleura in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included.



* CI-boundary is outside chart range

Figure 7. Risk of cancer of the nose and the nasal sinuses in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men and women, with the 95% confidence intervals, logarithmic scale. All observations are based on ≥ 5 expected cases except for shoe and leather workers (observed number 11, expected number 3.7). (n.o.s. = not otherwise specified)

been little evidence of nonoccupational causes for this disease.

In the present study the shoe and leather workers experienced the highest risk of nasal cancer, with an SIR of 294 (figure 7). Relative risks well in excess of 5–10 in the boot and shoe manufacturing industries have been reported (140). Shoe and leather workers are exposed to dust from leather and to benzene from glue (141).

Wood workers had the second highest SIR; in the Nordic countries many wood workers are exposed to soft wood. Most of the available cohort and case-referent studies of nasal cancer have shown increased risks associated with exposure to wood dust (142). A firm association has been established between nasal cancer and employment in the furniture-producing industry (71). Studies of wood workers operating outside the furniture-producing industry have also shown excess risks, even when exposed exclusively to soft wood. An excess risk of nasal cancer in workers exposed to benzene in gasoline vapors has been reported (110).

An increased risk of nasal cancers has also been found to be associated with exposures to employment in the nickel process industry (143). In our study nickel process workers were included in the broad group of smelt-

ing workers, which showed an elevated SIR. Most of the observed cases came from Norway, where an important nickel refinery is located.

Lung cancer

Lung cancer was the most frequent cancer among the men in our study and number 5 among the women. Tobacco smoking is by far the most important cause of this disease, but occupational risk factors also seem to have an important role (34). During the 30-year period 1960–1990, in all the Nordic countries, except Finland, the incidence of lung cancer increased 2- to 3-fold for men and 4- to 5-fold for women (144).

Throughout our study period there was a social gradient in smoking behavior. Workers and salaried employees had the highest consumption in Denmark (51), and housewives and people working in agriculture had the lowest consumption in Norway (52), Sweden (53), and Finland (54).

In our study the groups with the highest risk of lung cancer among the men were waiters and tobacco work-

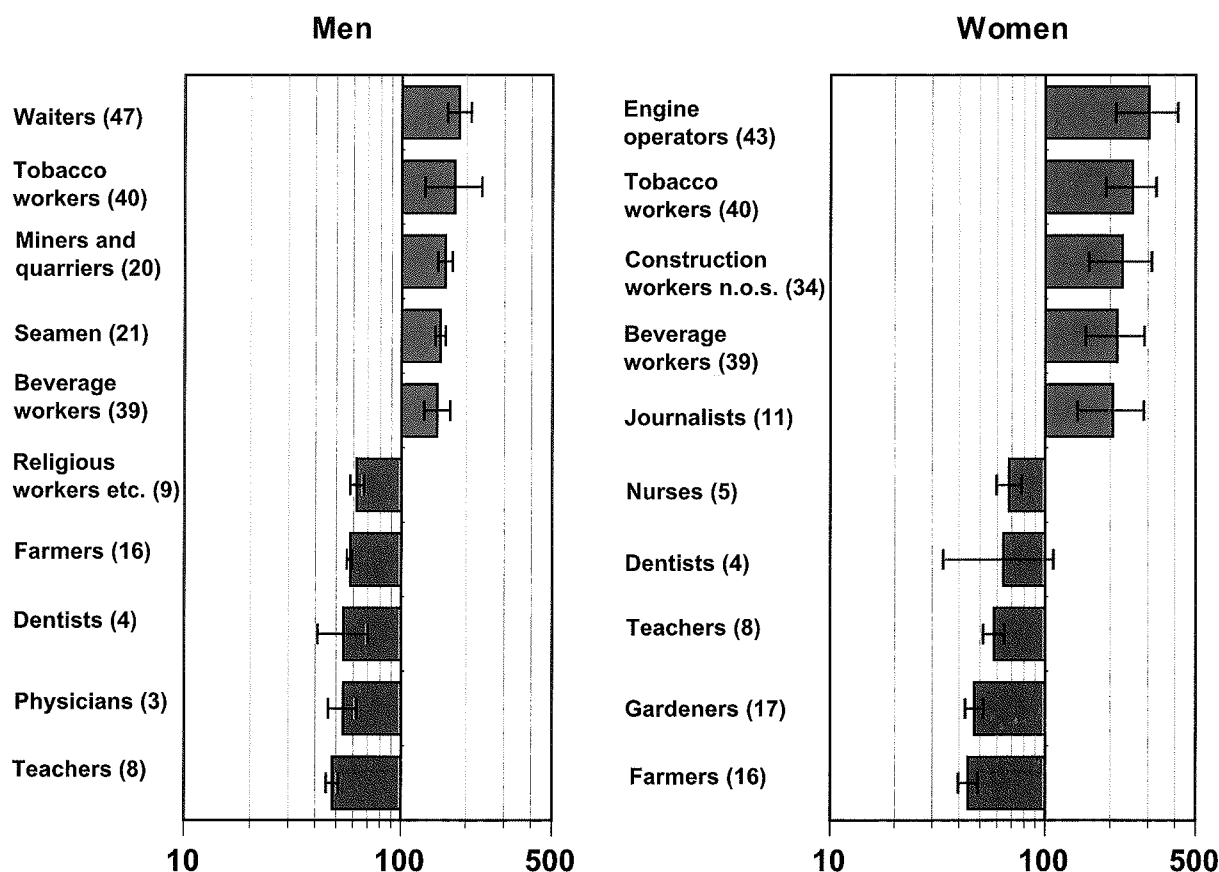


Figure 8. Risk of lung cancer in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men and women, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included. (n.o.s. = not otherwise specified)

ers (figure 8, see page 97). Female waiters also had an elevated risk (SIR 175), but they were not among those who ranked highest. Waiters had an additional risk from passive smoking at work. Tobacco workers, who had the second highest SIR for both genders, have had easy access to cigarettes and therefore possibly smoke more than the general population.

Miners and quarry workers have a high risk of lung cancer (SIR 158) but a low risk of many other smoking-related cancers. Their lung cancer risk may therefore be related to exposure to silica dust (145) and radon daughters (146). For Finnish miners, exposure to asbestos may also play a role. It was found that Finnish miners exposed to anthophyllite asbestos seemed to have a high risk of lung cancer, but a low risk of mesothelioma (147).

A very high prevalence of cigarette smoking and an excess risk of lung cancer has been demonstrated for seamen (69). Especially for seamen working in machine rooms exposure to asbestos, polycyclic aromatic hydrocarbons, and oil mist also contribute to the elevated lung cancer risk.

Somewhat in disagreement with the general socioeconomic gradient is the high risk among female journal-

ists; they have probably smoked more than other women of similar socioeconomic status. The excess risk for female engine and motor workers is also difficult to interpret.

In spite of smoking being the etiologically dominant factor, lung cancer is quantitatively the most important of the work-related cancers. A Nordic study based on data from the cancer registries estimated that 18% of all lung cancer among men and less than 1% among women are attributable to occupational exposures (130). Other studies have estimated the attributable risk to be 9% for men and 2% for women (145). Asbestos, arsenic, beryllium, cadmium, chromium, diesel exhaust, nickel, silica, soot, and radon daughters are all listed as lung carcinogens by the International Agency for Research on Cancer (77). Asbestos is the most important exposure in terms of the attributable number of lung cancers. Several of the occupational exposures increase the lung cancer risk additively or even multiplicatively when combined with tobacco smoking (148).

The present study shows the lowest SIR values for lung cancer among those working as farmers and gardeners and among those with the highest education and

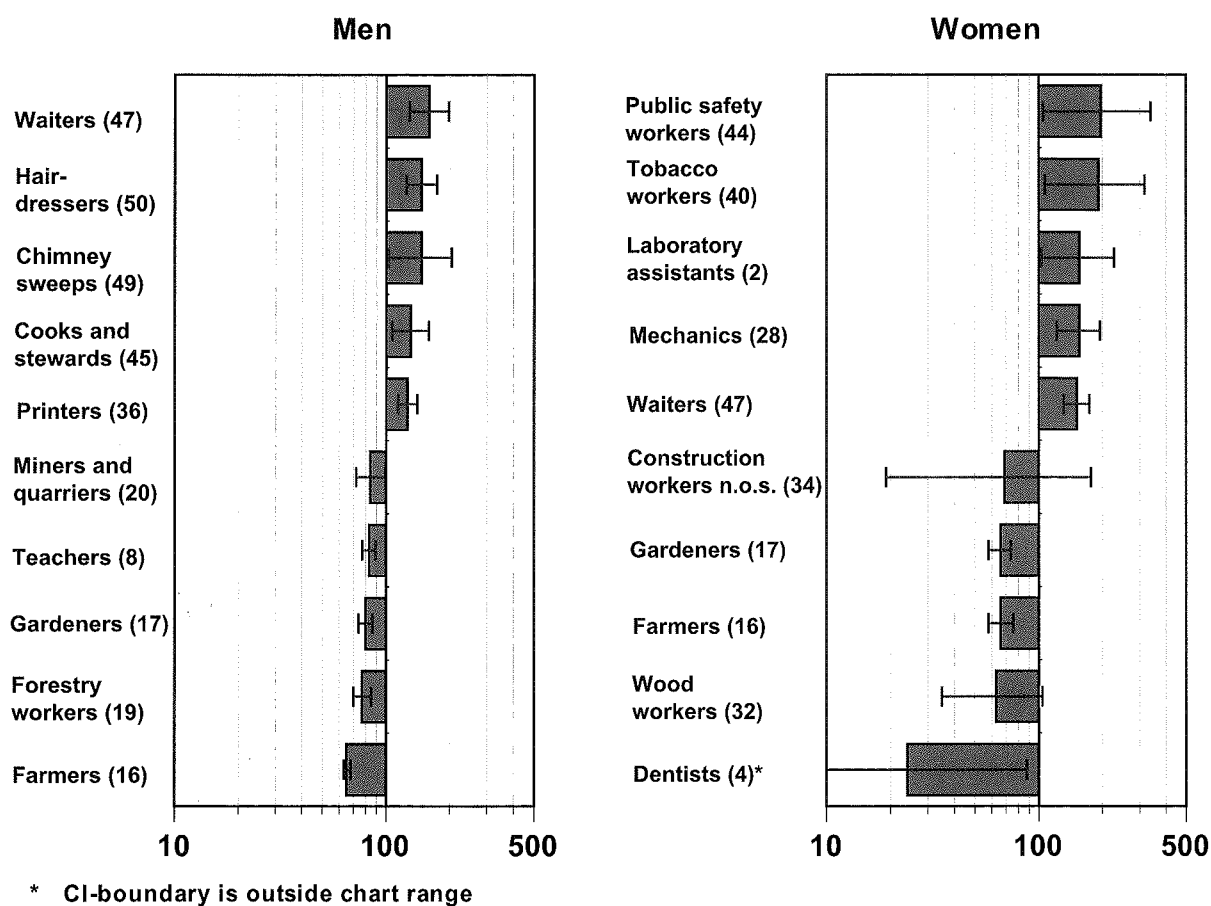


Figure 9. Risk of bladder cancer in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men and women, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included. (n.o.s. = not otherwise specified)

working with humanitarian, health and other social activities. The SIR values in these occupational groups are 3- to 4-fold lower for men when they are compared with the highest ranked occupational groups. In Denmark, similar differences were reduced to a 2-fold difference when controlled for tobacco smoking (34). A large part of this residential variation can be accounted for by work-related factors.

Bladder cancer

The most important known risk factor for bladder cancer is tobacco smoking, but several occupational exposures have also been associated with an elevated risk. Studies of bladder cancer among workers in the dyestuffs industry, and later among rubber workers, hold an important place in the history of work-related cancer (77).

In the present study it was not possible to separate the contributions from smoking and occupational exposures. It is however, possible to compare occupations with a high bladder cancer risk with those with a high

lung cancer risk. Waiters are ranked with the highest SIR for bladder cancer among men and among the highest SIR values for women (figure 9). Waiters and female tobacco workers were among those with the highest SIR for lung cancer, and their excess risk for bladder cancer is therefore probably due to smoking as the major risk factor.

Chimney sweeps and male hairdressers are among the occupations with the highest SIR values for bladder cancer, and they have elevated risks for lung cancer. Several studies have found an excess of bladder cancer among workers exposed to polycyclic aromatic hydrocarbons. Chimney sweeps are exposed to chimney soot, which is rich in these chemicals, a group of compounds well-documented as carcinogenic (77, 98).

Male hairdressers have been classified by the International Agency for Research on Cancer as an occupational group with probable carcinogenic exposures (100). Male hairdressers are known to be exposed to aromatic amines, used in brilliantine and hair dyes.

Almost all occupational groups with low SIR values for bladder cancer also have low SIR values for lung cancer.

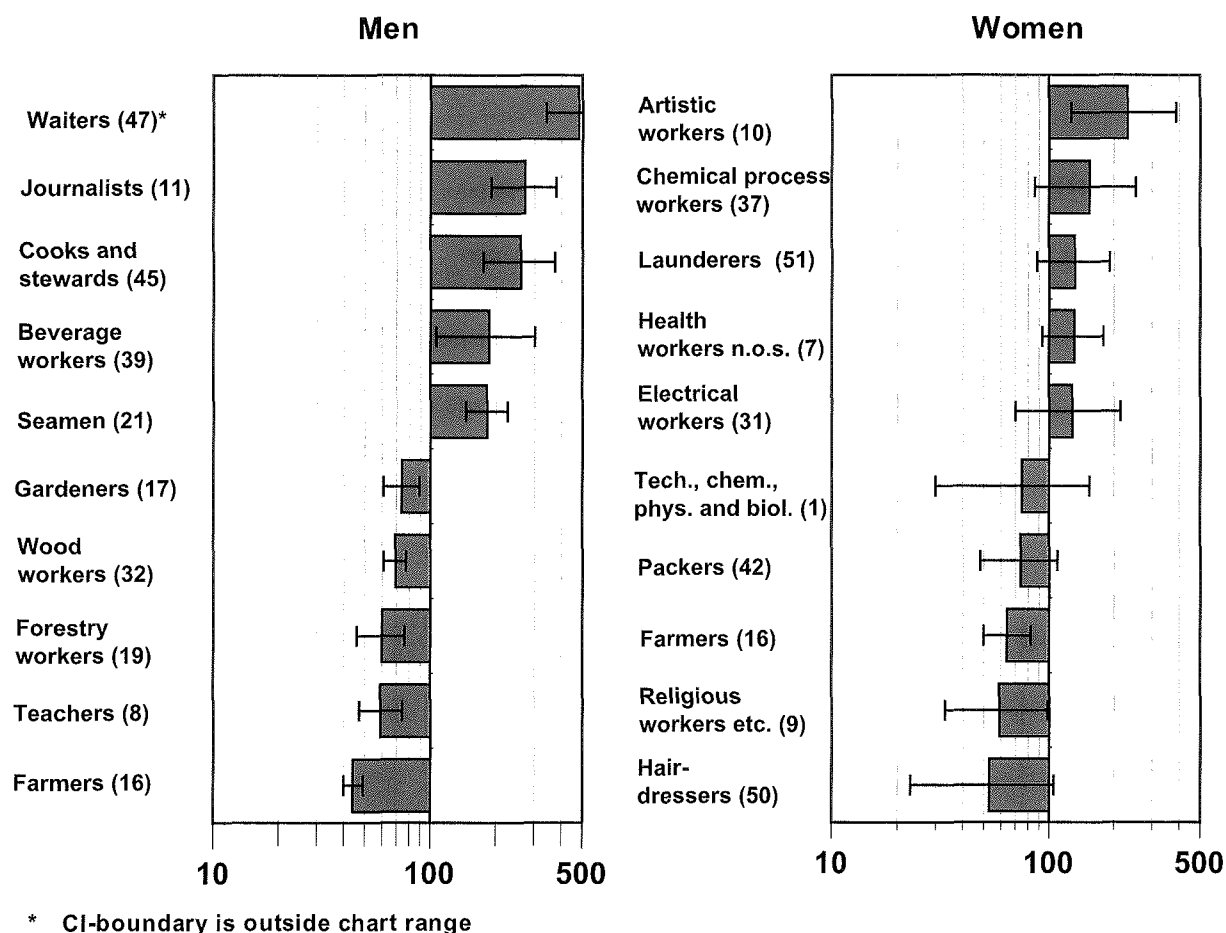


Figure 10. Risk of liver cancer in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men and women, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included. (n.o.s. = not otherwise specified, Tech., chem., phys., and biol. = technical, chemical, physical and biological workers)

cer, such as gardeners and those working in agriculture and pedagogical work.

Liver cancer

Exposure to the known hepatocarcinogens, hepatitis B virus and aflatoxins, is relatively low in the Nordic countries, and a large proportion of primary liver cancers can reasonably be attributed to extensive alcohol consumption (149, 150).

A working group of the International Agency for Research on Cancer concluded that the occurrence of liver cancer is causally related to the consumption of alcoholic beverages (151). Therefore, when primary liver cancer is classified by occupation, high risks can be expected in occupational groups which, on the basis of easy availability of alcohol or cultural traditions, have a high alcohol consumption (152). On the other hand, possible direct occupational factors may be hidden behind the strong effect of alcohol.

Among the men, waiters, journalists, cooks, beverage workers, and seamen ranked as the 5 groups with the

highest risk (figure 10, see page 99). At the other end of the scale were farmers, forestry workers, teachers, wood workers, and gardeners. The risk of primary liver cancer did not vary so much across the different occupations among the women. Artistic and literary workers were the only occupational group with a significantly elevated risk. The lowest risk was observed for farmers, those in religious, juridical and other humanistic work, and hairdressers. The risk pattern of men fits well with the image of the prevalence of alcohol abusers in various occupations, whereas for women the role of chemical factors seems quite potential.

Colon cancer

Diet is assumed to play the most important role in the risk of colon cancer. Several dietary factors, for example, a high consumption of animal fat and meat have been suggested to increase the risk of colon cancer, while other factors, for example, a high consumption of fiber, fruit, and vegetables, have been suggested to decrease the risk. A high consumption of fat and meat and a low consump-

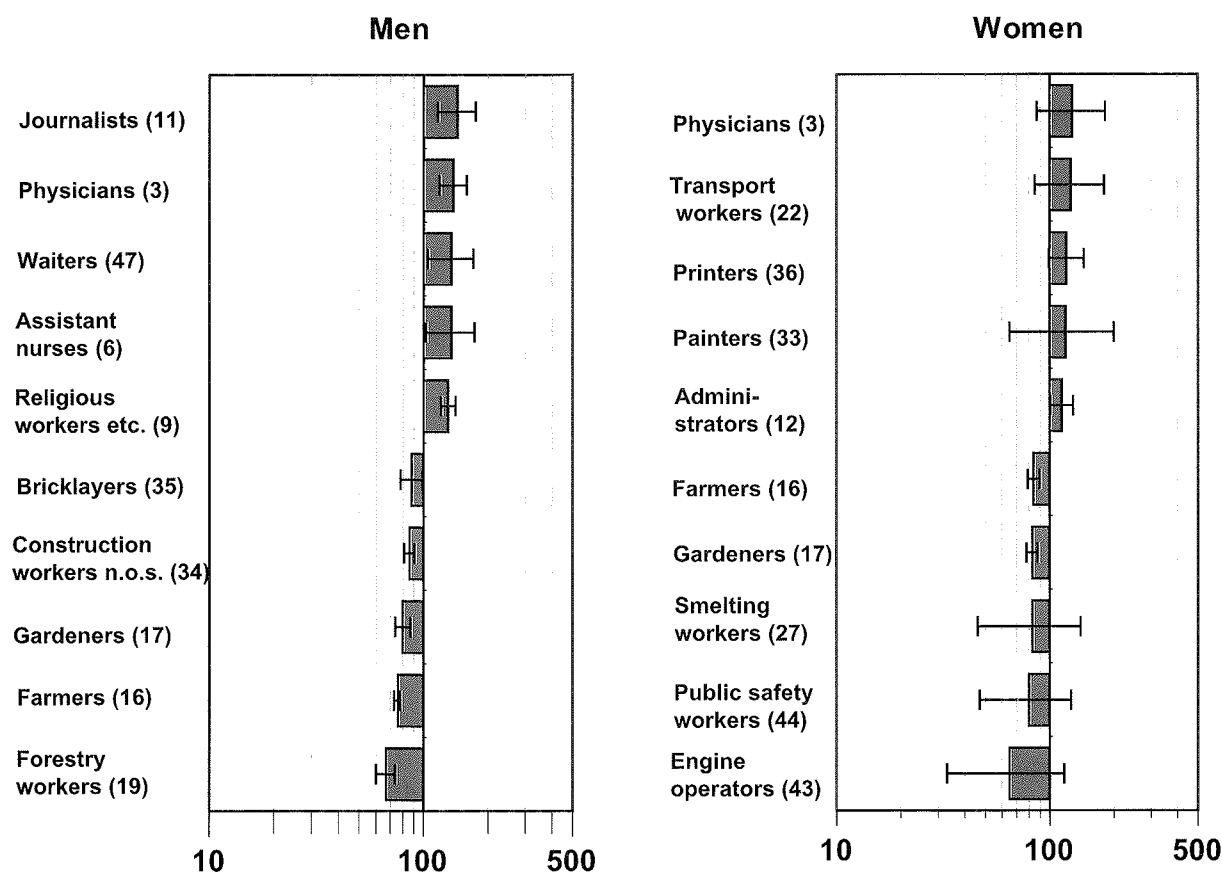


Figure 11. Risk of colon cancer in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men and women, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included. (n.o.s. = not otherwise specified)

tion of cereals and fruits has been the norm in the Nordic countries, and the incidence of colon cancer is also high (109, 130).

A reduced risk of colon cancer among those with a high level of physical activity has been reported (78). Occupations which require many years of education and imply mostly sedentary work have been reported to rank among those with the highest risk of colon cancer (153). Our results, especially among men, support this finding, as journalists and physicians ranked among those with the highest colon cancer risk and outdoor workers such as farmers and forestry workers had the lowest risk (figure 11).

It is surprising that male waiters are listed among high-risk groups since that occupation does not generally imply sedentary work, and colon cancer is not known to be related to smoking or drinking, which is apparently more common among waiters. This finding may be explained by dietary habits, but it may also be a chance finding due to the multiple comparisons.

Breast cancer

Breast cancer risk has a strong social gradient, associated first of all with reproductive pattern, but probably also with diet. The risk of breast cancer increased among women with a young age at first birth and who had few births. Groups with a higher education often have fewer children and at a later age than groups with a lower education. In accordance, most occupations with the highest breast cancer risk require long and higher education (figure 12).

Little is known about how occupational exposures may relate to breast cancer risk, although several substances have been suggested (154). Ionizing radiation is a breast carcinogen. Nurses (SIR 129) have a higher breast cancer risk than assistant nurses (SIR 94), a difference which could probably be explained by the differences in reproductive pattern could certainly explain some of the excess risk. Whether part of the excess risk could be attributable also to X-ray exposures could not be decided on the basis of occupational classification in the present study.

All the occupational groups with the highest rank, except probably journalists, may include persons exposed to one or more factors suggested to influence the risk, such as ionizing radiation, organic solvents, chemical mutagens, viruses, anesthetic gases, and antineoplastic and other pharmaceutical drugs (154). On the other hand, the list of low-risk occupations also includes many occupations with exposures to solvents and other hazardous agents. As several low-risk occupations require physical activity at work, such activity may be a protective factor for breast cancer.

Malignant melanoma of the skin

Malignant melanoma exhibits many of the same features and has the same strong social gradient as observed for cancers of the colon and breast.

The occupations with the highest SIR values for malignant melanoma, dentists, physicians and journalists, also showed a significantly high SIR for other skin cancer. Dentists ranked among those with the highest SIR for malignant melanoma for both genders, and they had the highest risk for other skin cancer among women. It cannot be excluded that dentists are exposed through their daily work to ultraviolet radiation from lamps.

Sunburn in susceptible people is accepted as the major cause malignant melanoma. In the present study fishermen and forestry workers ranked as the groups with the lowest risk of malignant melanoma among the men. This finding may well be explained by the fact that these groups have constant sun exposure and they do not burn in the sun, as opposed to leisure-time sun exposure, which is often followed by sunburn.

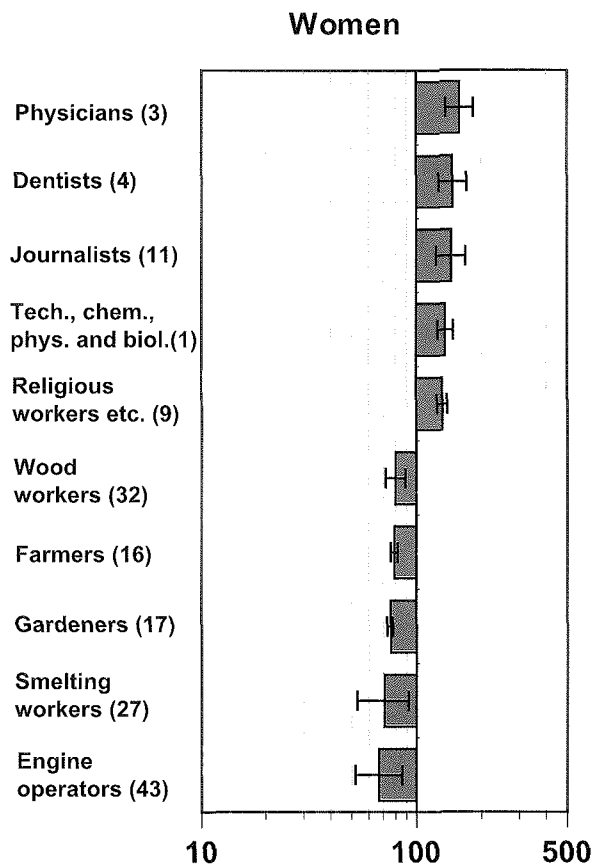


Figure 12. Risk of breast cancer in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the women, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included. (Tech., chem., phys. and biol. = technical, chemical, physical and biological workers)

There is little evidence in the scientific literature of a relation between occupational exposures and risk of ma-

lignant melanoma (155), and our study did not raise hints of such associations either (figure 13).

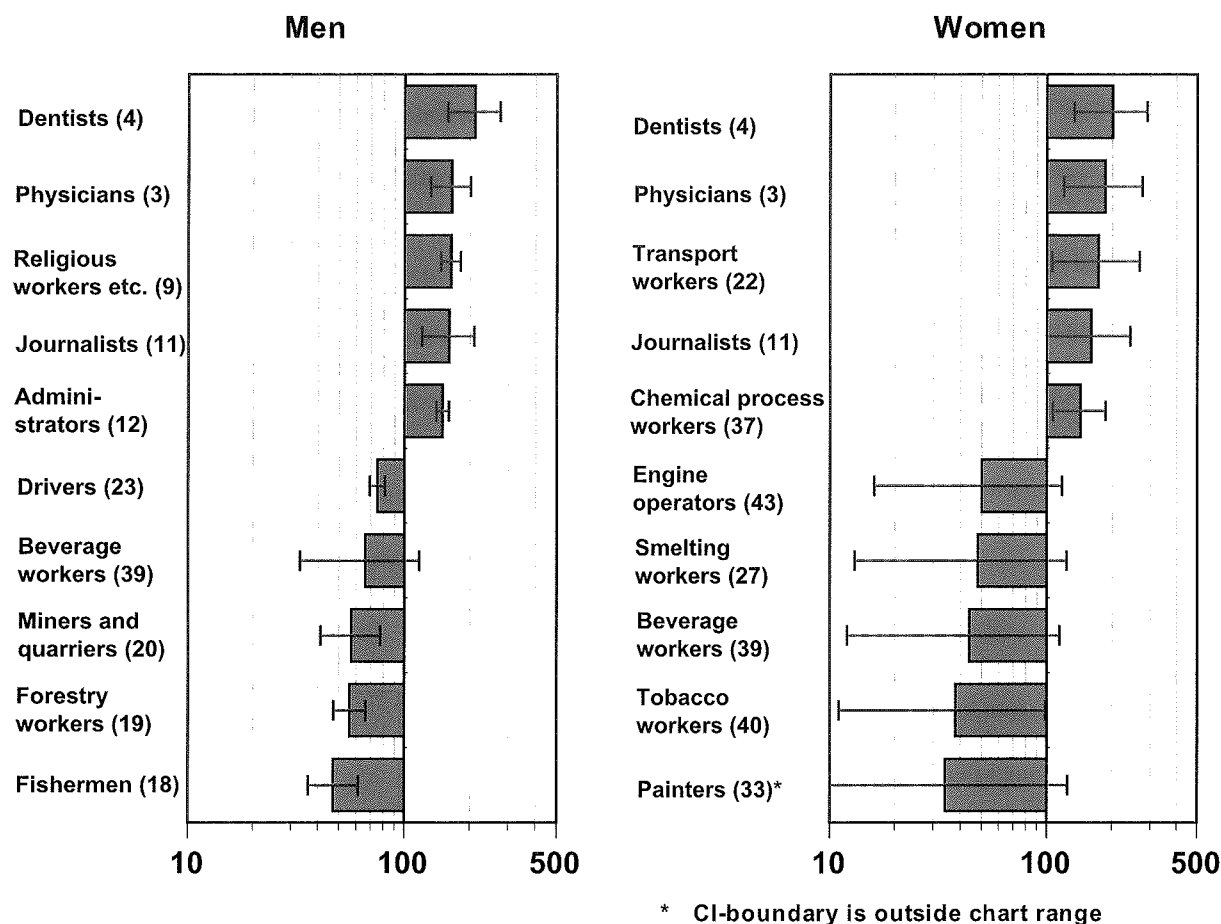


Figure 13. Risk of malignant melanoma in occupations (occupational group code in parentheses) with the 5 highest and 5 lowest standardized incidence ratios for the men and women, with the 95% confidence intervals, logarithmic scale. Only occupations with ≥ 5 expected cases have been included.

Acknowledgments

This study was financially supported by the Nordic Cancer Union and Europe Against Cancer Programme of the European Commission, DG V SOC 96 200742 05F02. Data for the study were prepared in collaboration with the national statistical offices: Danmarks Statistik, Denmark; Statistiska Centralbyrån, Sweden; Statistisk Sen-

tralbyrå, Norway; and Tilastokeskus, Finland. We are furthermore indebted to Tor Haldorsen, Jan Gunnarskog, Jan Ivar Martinsen and Torsten Skov for their assistance with the preparation of the data and their discussion of the methods.

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Appendices

Appendix 1

Occupational groups defined by NYK codes and ISCO 1958 codes

Group	Occupation	NYK codes	ISCO 1958
01	Technical, chemical, physical and biological workers	00, 01, 02 (except 013)	00, 01, 02, 0X1
02	Laboratory assistants	013	0X9
03	Physicians	030, 031	031
04	Dentists	032	032
05	Nurses	040, 041, 042	041, 042
06	Assistant nurses	045	04920
07	Other health and medical workers	043, 046, 047, 049, 05	04990, 05
08	Teachers	06	06
09	Religious, juridical and other social-science-related workers	07, 08, 0x	07, 08, 0Y
10	Artistic workers	09 (except 95)	091, 093
11	Journalists	095	092
12	Administrators and managers	10, 11	10, 11
13	Clerical workers	20, 21, 29	20, 21, 29
14	Sale and agents	30, 31, 32, 33 (except 332, 333)	30, 31, 32., 332, 339
15	Shop managers and assistants	332, 333	331
16	Farmers	401, 404, 411	40110—40166, 40190, 41110—41150, 41175—41190
17	Gardeners and related workers	40, 41, 42 (except 401, 404, 411)	40169—40184, 41155—41170, 42
18	Fishermen, whalers and sealers	43	43
19	Forestry workers	44	44
20	Miners and quarry workers	50, 51, 52, 59	50, 51, 52, 59
21	Seamen	60, 61	60, 61
22	Transport workers	62, 63, 65, 66, 69	62, 63, 65, 66, 69
23	Drivers	64	64
24	Postal and communication workers	67, 68	67, 68
25	Textile workers	70, 71	70, 71
26	Shoe and leather workers	72	72
27	Smelters and metal foundry workers	73	73
28	Mechanics, iron and metalware workers	75 (except 755, 756)	75010—75490, 75705—75990
29	Plumbers	755	755
30	Welders	756	756
31	Electrical workers	76	76
32	Wood workers	77	77
33	Painter and wall paperhangers	78	78
34	Other construction workers	79 (except 791)	79210—79990
35	Bricklayers	791	791
36	Printers and related workers	80	80
37	Chemical process workers	83	83
38	Food manufacture workers	82 (except 824)	82120—82390, 82510—82990
39	Beverage manufacture workers	824	824
40	Tobacco manufacture workers	84	84
41	Glass, ceramic and tile workers and others	81, 85	81, 85
42	Packers, loaders and warehouse workers	86, 88	86, 88
43	Engine and motor operator workers	87	87
44	Public safety and protection workers	90	90
45	Cooks and stewards	911, 912	911, 912
46	Home helpers	914, 915	91920, 91930, 91940
47	Waiters	92	92
48	Building caretakers and cleaners	93 (except 933)	93120, 93230, 93290
49	Chimney sweeps	933	93240
50	Hairdressers	941	94140, 94150, 941, 90
51	Launderers and dry cleaners	95	95
52	Military personnel	X1	Armed forces
53	Other economically active persons	74, 89, 96, 97, 99, 913, 916, 917, 919, 942, 98, X2	Remaining codes
54	Economically inactive persons		

Appendix 2

Number of persons^a in the 1970 census by gender, country and occupational group

Group	Occupation	Men					Women				
		Denmark	Finland	Norway	Sweden	Total	Denmark	Finland	Norway	Sweden	Total
01	Technical workers, etc	76 466	55 752	38 909	194 783	365 910	5 187	4 812	1 261	8 983	20 243
02	Laboratory assistants	1 541	1 510	2 119	3 571	8 741	4 524	3 625	1 570	3 867	13 586
03	Physicians	5 530	3 026	3 850	6 905	19 311	1 210	1 167	611	1 594	4 582
04	Dentists	1 911	635	1 917	3 810	8 273	1 137	1 559	549	1 502	4 747
05	Nurses	-	-	-	-	-	22 687	17 652	15 431	27 015	82 785
06	Assistant nurses	2 104	127	829	3 920	6 980	18 219	18 956	10 379	74 411	121 965
07	Other health workers	5 187	2 755	1 955	6 185	16 082	12 620	13 655	8 063	19 838	54 176
08	Teachers	34 401	22 386	27 375	50 911	135 073	34 017	29 478	23 225	65 400	152 120
09	Religious workers, etc	13 182	11 664	12 142	37 367	74 355	4 055	10 038	4 877	21 404	40 374
10	Artistic workers	4 558	4 679	3 425	10 500	23 162	1 979	2 334	1 623	4 456	10 392
11	Journalists	2 249	2 217	1 786	5 361	11 613	554	1 613	386	2 330	4 883
12	Administrators	73 826	28 942	43 073	61 755	207 596	10 224	3 524	3 662	11 059	28 469
13	Clerical workers	43 386	24 028	41 480	76 086	184 980	127 444	99 052	69 537	203 389	499 422
14	Sales agents	20 527	34 929	35 596	56 218	147 270	939	12 905	6 487	13 848	34 179
15	Shop workers	78 694	16 773	20 424	77 430	193 321	69 758	55 871	48 781	117 393	291 803
16	Farmers	117 583	147 977	74 237	96 590	436 387	43 113	28 312	37 105	3 705	112 235
17	Gardeners	18 602	27 135	8 881	41 532	96 150	5 677	95 281	24 946	46 543	172 447
18	Fishermen	8 604	1 840	20 133	4 249	34 826	-	-	-	-	-
19	Forestry workers	2 537	31 881	8 064	32 695	75 177	-	-	-	-	-
20	Miners & quarry workers	955	5 264	6 205	10 131	22 555	-	-	-	-	-
21	Seamen	11 331	6 914	28 554	8 781	55 580	-	-	-	-	-
22	Transport workers	15 758	16 614	14 799	31 513	78 684	81	2 688	335	1 110	4 214
23	Drivers	64 625	62 382	44 684	88 005	259 696	1 842	901	1 028	6 140	9 911
24	Postal workers	11 872	8 151	8 205	19 263	47 491	3 485	17 975	11 887	29 670	63 017
25	Textile workers	9 548	5 948	6 509	14 610	36 615	25 649	36 669	14 662	37 175	114 155
26	Shoe & leather workers	2 317	2 427	1 863	4 148	10 755	1 976	4 370	1 076	2 854	10 276
27	Smelting workers	28 827	8 979	12 613	26 869	77 288	488	990	123	1 273	2 874
28	Mechanics	71 726	58 184	62 905	160 942	353 757	5 032	4 126	1 442	13 502	24 102
29	Plumbers	7 009	10 242	7 826	18 454	43 531	-	-	-	-	-
30	Welders	0	10 233	11 645	22 856	44 734	-	-	-	-	-
31	Electrical workers	19 306	24 674	27 554	58 849	130 383	7 330	2 767	1 832	7 366	19 295
32	Wood workers	44 600	55 405	64 089	96 003	260 097	2 109	9 072	324	3 069	14 574
33	Painters	15 602	13 028	9 887	27 351	65 868	138	1 231	145	607	2 121
34	Other construction workers	50 252	41 764	25 521	53 462	170 999	62	3 752	36	60	3 910
35	Bricklayers	17 040	5 764	6 362	11 300	40 466	-	-	-	-	-
36	Printers	12 055	6 666	7 288	17 993	44 002	2 603	4 606	1 599	5 513	14 321
37	Chemical process workers	8 757	12 671	14 208	19 345	54 981	3 837	3 567	1 348	3 803	12 555
38	Food workers	31 242	7 666	15 273	21 388	75 569	17 707	12 711	7 523	10 279	48 220
39	Beverage workers	3 993	391	823	1 278	6 485	1 831	608	126	625	3 190
40	Tobacco workers	530	109	183	107	929	2 711	401	243	344	3 699
41	Glass makers, etc	16 934	10 422	12 339	27 455	67 150	4 945	8 802	3 405	10 881	28 033
42	Packers	14 845	23 229	26 763	48 306	113 143	1 249	15 597	7 956	17 427	42 229
43	Engine operators	16 460	31 155	19 830	47 446	114 891	82	2 303	86	1 380	3 851
44	Public safety workers	14 609	15 793	9 891	26 813	67 106	137	396	698	1 406	2 637
45	Cooks & stewards	2 027	937	5 310	4 410	12 684	64	15 001	8 062	20 072	43 199
46	Home helpers	-	-	-	-	-	25 039	13 827	10 815	70 691	120 372
47	Waiters	3 726	936	2 053	2 259	8 974	5 602	15 433	11 705	25 077	57 817
48	Building caretakers	14 520	11 737	8 596	23 392	58 245	74 120	53 130	43 857	78 008	249 115
49	Chimney sweeps	478	1 010	623	1 501	3 612	-	-	-	-	-
50	Hairdressers	4 274	216	1 490	4 318	10 298	6 749	6 574	3 001	10 221	26 545
51	Launderers	1 853	316	778	2 672	5 619	8 020	4 633	3 283	7 778	23 714
52	Military personnel	9 988	6 521	11 324	13 604	41 437	-	-	-	-	-
53	Other workers	56 404	19 350	9 240	48 053	133 047	24 702	19 944	11 198	40 596	96 440
54	Economically inactive	67 234	103 932	61 836	189 335	422 337	593 615	446 497	493 265	891 325	2 424 702
Total		1 161 585	1 007 286	893 264	1 922 080	4 984 215	1 184 549	1 108 405	899 553	1 924 989	5 117 496

^a Person-years in the period 1971—1975 divided by 5; due to small numbers, the persons in the groups marked by - were moved to occupational group 53.

Appendix 3

Number of person-years under follow-up by gender, country and occupational group^a

Group	Occupation	Men					Women				
		Denmark	Finland	Norway	Sweden	Total	Denmark	Finland	Norway	Sweden	Total
01	Technical workers, etc	1 221 380	1 054 480	764 857	3 530 037	6 570 754	84 733	93 414	24 924	167 719	370 790
02	Laboratory assistants	24 821	28 779	41 193	63 979	158 772	74 312	70 328	31 197	71 748	247 585
03	Physicians	87 174	56 480	73 245	124 968	341 867	19 377	22 499	11 955	29 667	83 498
04	Dentists	30 702	11 922	37 491	69 221	149 336	18 553	30 128	10 982	27 894	87 557
05	Nurses	-	-	-	-	-	370 452	344 596	309 741	503 118	1 527 907
06	Assistant nurses	34 015	2 462	15 755	68 979	121 211	299 292	370 698	208 139	1 376 430	2 254 559
07	Other health workers	82 296	50 758	37 267	110 485	280 806	206 511	265 559	162 632	368 962	1 003 664
08	Teachers	556 312	427 069	540 557	933 118	2 457 056	559 235	573 394	469 975	1 220 012	2 822 616
09	Religious workers, etc	209 033	217 858	231 599	675 416	1 333 906	66 212	194 117	96 601	396 420	753 350
10	Artistic workers	70 322	86 189	65 036	188 867	410 414	31 613	44 618	31 955	82 420	190 606
11	Journalists	35 112	40 950	34 158	95 175	205 395	8 954	30 850	7 493	43 113	90 410
12	Administrators	1 158 678	534 532	816 772	1 100 403	3 610 385	165 284	67 659	71 808	203 369	508 120
13	Clerical workers	690 391	441 953	799 579	1 346 725	3 278 648	2 091 498	1 919 602	1 399 180	3 768 544	9 178 824
14	Sales agents	325 815	641 938	676 403	992 074	2 636 230	15 183	244 699	127 007	251 928	638 817
15	Shop workers	1 234 753	315 757	397 220	1 392 934	3 340 664	1 140 462	1 083 753	976 710	2 160 310	5 361 235
16	Farmers	1 880 227	2 620 932	1 403 216	1 690 291	7 594 666	713 084	525 259	742 057	66 134	2 046 534
17	Gardeners	294 054	501 215	168 966	728 459	1 692 694	93 354	1 826 624	498 629	851 445	3 270 052
18	Fishermen	135 850	32 705	378 328	74 706	621 589	-	-	-	-	-
19	Forestry workers	40 037	575 979	152 928	574 502	1 343 446	-	-	-	-	-
20	Miners & quarry workers	14 730	94 250	116 866	176 863	402 709	-	-	-	-	-
21	Seamen	175 052	125 695	538 095	155 567	994 409	-	-	-	-	-
22	Transport workers	249 198	306 570	280 412	558 769	1 394 949	1 361	51 596	6 652	20 238	79 847
23	Drivers	1 023 657	1 158 468	857 433	1 572 048	4 611 606	30 166	17 079	20 007	112 818	180 070
24	Postal workers	193 046	149 617	156 479	336 158	835 300	56 726	345 227	239 958	548 300	1 190 211
25	Textile workers	148 679	107 845	121 876	252 982	631 382	419 724	704 156	292 482	677 128	2 093 490
26	Shoe & leather workers	35 194	43 354	34 170	70 466	183 184	32 321	83 976	21 604	52 178	190 079
27	Smelting workers	456 100	162 871	236 589	466 712	1 322 272	7 952	19 031	2 439	23 407	52 829
28	Mechanics	1 135 548	1 075 317	1 213 251	2 857 721	6 281 837	82 310	79 047	28 686	247 019	437 062
29	Plumbers	111 279	188 050	151 596	329 482	780 407	-	-	-	-	-
30	Welders	-	191 616	226 196	410 664	828 476	-	-	-	-	-
31	Electrical workers	308 415	461 165	537 727	1 061 664	2 368 971	119 592	53 613	36 555	135 585	345 345
32	Wood workers	708 070	996 394	1 223 585	1 684 411	4 612 460	34 559	174 432	6 510	56 284	271 785
33	Painters	247 076	234 365	185 143	479 556	1 146 140	2 288	23 770	2 903	11 083	40 044
34	Other construction workers	784 368	734 900	473 147	937 336	2 929 751	988	70 584	714	1 101	73 387
35	Bricklayers	269 633	102 649	119 551	198 340	690 173	-	-	-	-	-
36	Printers	192 142	124 988	140 522	319 462	777 114	42 496	88 135	31 649	100 461	262 741
37	Chemical process workers	136 315	233 848	262 833	333 522	966 518	62 206	68 140	26 713	69 264	226 323
38	Food workers	492 162	141 290	287 595	374 185	1 295 232	289 942	245 200	149 236	187 086	871 464
39	Beverage workers	60 723	7 161	15 417	21 632	104 933	29 267	11 703	2 484	11 207	54 661
40	Tobacco workers	7 941	1 917	3 222	1 847	14 927	43 978	7 579	4 669	6 381	62 607
41	Glass makers, etc	264 578	191 698	233 042	479 724	1 169 042	80 863	169 074	68 177	198 968	517 082
42	Packers	228 746	418 755	494 939	824 625	1 967 065	20 505	299 926	157 468	317 628	795 527
43	Engine operators	262 442	578 996	384 231	844 787	2 070 456	1 305	43 957	1 774	25 495	72 531
44	Public safety workers	233 475	289 490	186 953	480 431	1 190 349	2 239	7 471	13 771	25 990	49 471
45	Cooks and stewards	31 047	16 829	100 175	76 628	225 219	994	287 022	157 712	362 961	808 689
46	Home helpers	-	-	-	-	-	410 253	261 479	212 969	1 291 546	2 176 247
47	Waiters	54 786	16 587	38 154	39 443	148 970	90 155	296 854	232 068	457 320	1 076 397
48	Building caretakers	223 607	209 195	155 858	395 251	983 911	1 207 005	1 007 921	868 150	1 415 033	4 498 109
49	Chimney sweeps	7 528	18 022	11 830	26 568	63 948	-	-	-	-	-
50	Hairdressers	66 512	3 851	27 442	74 759	172 564	111 018	125 838	60 205	189 209	486 270
51	Laundresses & cleaners	28 452	5 819	14 162	46 615	95 048	130 704	88 483	64 644	140 965	424 796
52	Military personnel	159 823	125 379	220 865	247 931	753 998	-	-	-	-	-
53	Other workers	859 792	337 816	170 226	832 650	2 200 484	398 721	379 619	220 549	739 389	1 738 278
54	Economically inactive	916 360	1 524 573	996 995	3 014 234	6 452 162	9 490 029	8 185 589	9 677 108	15 967 206	43 319 932
Total		18 197 448	18 021 298	16 851 687	33 743 372	86 813 805	19 157 776	20 904 298	17 788 841	13 980 483	92 831 398

^a Due to small numbers, the person-years in the groups marked by - were moved to occupational group 53.

Appendix 4

Number of new cancer cases^a during the follow-up period by gender, country and occupational group^b

Group	Occupation	Men					Women				
		Denmark	Finland	Norway	Sweden	Total	Denmark	Finland	Norway	Sweden	Total
01	Technical workers, etc	5 132	3 634	3 111	16 851	28 728	343	386	122	656	1 507
02	Laboratory assistants	115	78	223	284	700	244	272	150	329	995
03	Physicians	388	202	448	636	1 674	116	97	60	160	433
04	Dentists	126	40	186	337	689	90	143	69	139	441
05	Nurses	-	-	-	-	-	1 763	1 290	1 580	2 272	6 905
06	Assistant nurses	125	5	97	432	659	1 278	1 223	1 108	6 833	10 442
07	Other health workers	386	216	200	576	1 378	1 049	1 012	740	1 681	4 482
08	Teachers	1 787	1 272	2 078	3 419	8 556	2 171	2 375	2 032	5 335	11 913
09	Religious workers, etc	1 011	848	1 409	3 167	6 435	298	786	608	2 108	3 800
10	Artistic workers	373	360	388	958	2 079	181	190	159	411	941
11	Journalists	156	166	184	569	1 075	39	146	53	228	466
12	Administrators	6 514	2 712	5 892	7 097	22 215	1 019	344	509	1 290	3 162
13	Clerical workers	3 049	2 196	4 415	8 203	17 863	9 688	7 719	7 487	19 142	44 036
14	Sales agents	1 606	2 819	4 499	6 067	14 991	80	1 221	879	1 560	3 740
15	Shop workers	7 413	934	2 080	6 939	17 366	6 338	4 117	5 716	12 259	28 430
16	Farmers	9 276	17 983	9 397	11 290	47 946	3 016	2 970	4 136	455	10 577
17	Gardeners	1 606	2 029	1 024	4 268	8 927	431	7 509	2 641	4 725	15 306
18	Fishermen	713	252	2 539	497	4 001	-	-	-	-	-
19	Forestry workers	218	2 734	905	3 033	6 890	-	-	-	-	-
20	Miners & quarry workers	90	599	806	1 042	2 537	-	-	-	-	-
21	Seamen	807	593	2 832	928	5 160	-	-	-	-	-
22	Transport workers	1 463	1 457	1 969	3 502	8 391	7	275	41	122	445
23	Drivers	5 456	4 720	4 824	7 682	22 682	131	81	124	581	917
24	Postal workers	743	699	905	2 340	4 687	333	1 557	1 271	2 954	6 115
25	Textile workers	961	578	871	1 874	4 284	2 299	3 223	1 873	4 517	11 912
26	Shoe & leather workers	255	273	299	609	1 436	155	380	125	354	1 014
27	Smelting workers	2 283	959	1 696	3 150	8 088	48	72	10	137	267
28	Mechanics	5 669	4 712	6 665	15 653	32 699	426	336	160	1 555	2 477
29	Plumbers	557	883	801	1 732	3 973	-	-	-	-	-
30	Welders	0	644	1 099	1 935	3 678	-	-	-	-	-
31	Electrical workers	1 293	1 703	2 602	4 683	10 281	605	170	205	747	1 727
32	Wood workers	3 579	6 400	8 230	10 487	28 696	193	682	40	317	1 232
33	Painters	1 343	1 280	1 358	3 089	7 070	6	86	25	68	185
34	Other construction workers	5 090	4 965	3 714	5 867	19 636	5	397	6	3	411
35	Bricklayers	1 446	700	879	1 282	4 307	-	-	-	-	-
36	Printers	929	428	780	1 746	3 883	247	437	223	621	1 528
37	Chemical process workers	945	1 070	2 031	2 423	6 469	356	289	168	447	1 260
38	Food workers	2 794	617	1 978	2 462	7 851	1 489	964	922	1 157	4 532
39	Beverage workers	503	36	143	187	869	201	52	18	76	347
40	Tobacco workers	79	16	28	12	135	302	37	46	30	415
41	Glass makers, etc	1 589	887	1 584	3 192	7 252	376	707	396	1 220	2 699
42	Packers	1 602	2 346	3 832	6 526	14 306	110	1 362	1 038	2 072	4 582
43	Engine operators	1 310	2 337	2 042	4 232	9 921	8	205	11	98	322
44	Public safety workers	1 302	1 467	1 413	2 598	6 780	13	48	102	153	316
45	Cooks and stewards	152	61	489	531	1 233	6	1 373	1 104	2 637	5 120
46	Home helpers	-	-	-	-	-	2 261	1 249	1 416	7 798	12 724
47	Waiters	481	76	264	271	1 092	586	1 214	1 504	3 026	6 330
48	Building caretakers	1 677	1 395	1 476	3 505	8 053	6 884	4 926	5 461	9 252	26 523
49	Chimney sweeps	54	106	86	148	394	-	-	-	-	-
50	Hairdressers	459	29	205	609	1 302	452	520	287	919	2 178
51	Launderers	211	26	131	333	701	753	403	414	983	2 553
52	Military personnel	449	281	883	1 077	2 690	-	-	-	-	-
53	Other workers	5 167	2 059	1 120	5 509	13 855	2 246	1 747	1 409	4 735	10 137
54	Economically inactive	8 299	17 355	8 749	24 712	59 115	56 701	44 103	54 381	100 605	255 790
Total		99 031	100 237	105 859	200 551	505 678	105 343	98 695	100 829	206 767	511 634

^a Excludes nonmelanoma skin cancer.^b - = not applicable.

Appendix 5

Diagnostic groups defined by ICD-7 codes

ICD-7	Cancer site	Text used in tables
140	Lip	Lip
141	Tongue	Tongue
143—144	Mouth	Mouth
145—148	Pharynx	Pharynx
150	Esophagus	Esophagus
151	Stomach	Stomach
153	Colon	Colon
154	Rectum	Rectum
155.0	Liver	Liver
155.1	Gallbladder	Gallbladder
157	Pancreas	Pancreas
160	Nose, nasal cavities	Nose
161	Larynx	Larynx
162.0—1,8	Lung	Lung
162.2	Pleura	Pleura
170	Breast	Breast
171	Cervix uteri	Cervix uteri
172	Corpus uteri	Corpus uteri
175	Ovary	Ovary
177	Prostate	Prostate
178	Testis	Testis
180.0	Kidney (excluding renal pelvis)	Kidney
181	Urinary bladder	Bladder
190	Malignant melanoma of the skin	Melanoma
191	Nonmelanoma skin cancer ^a	Other skin
193	Brain and central nervous system	Brain
194	Thyroid	Thyroid
197	Connective tissue	Connective tissue
201	Hodgkin's disease	Hodgkin's disease
200, 202	Non-Hodgkin's lymphoma	Non-Hodgkin's lymphoma
203	Multiple myeloma	Multiple myeloma
204.3	Acute leukemia	Acute leukemia
204.0—2,4	Other types of leukemia	Other leukemia
199	Unknown and unspecified sites	Unknown
140—204	All sites excluding nonmelanoma skin cancer	All sites

^a Basal-cell carcinomas have been included for Denmark and excluded for Finland, Norway and Sweden.

Appendix 6

Age-standardized cancer incidence rates in 1981—1985 by gender, country and diagnostic group^{a, b, c}

ICD-7	Site	Men				Women			
		Denmark	Finland	Norway	Sweden	Denmark	Finland	Norway	Sweden
40	Lip	3.3	4.6	2.8	2.3	0.4	0.5	0.4	0.4
141	Tongue	0.9	1.0	1.2	1.0	0.5	0.6	0.6	0.5
143—144	Mouth	1.9	0.9	1.8	1.6	1.1	0.6	0.7	0.6
145—148	Pharynx	2.5	1.3	1.9	2.0	0.8	0.4	0.5	0.7
150	Esophagus	3.4	3.4	2.7	3.1	1.2	2.3	0.7	0.8
151	Stomach	13.2	22.2	16.9	13.8	6.1	12.1	8.5	6.9
153	Colon	21.3	12.7	18.9	17.4	20.2	11.0	18.0	15.8
154	Rectum	15.9	10.8	15.7	11.7	9.6	6.7	10.2	8.3
155.0	Liver	3.4	4.1	2.0	4.0	1.9	2.1	1.1	2.2
155.1	Gallbladder	1.9	2.7	1.2	2.9	3.2	4.2	1.7	4.6
157	Pancreas	9.3	10.5	8.7	8.4	7.0	7.0	5.7	6.2
160	Nose	0.8	0.5	0.7	0.5	0.4	0.3	0.3	0.2
161	Larynx	5.4	4.6	3.5	2.8	1.1	0.3	0.3	0.3
162	Lung	59.6	70.3	33.6	27.0	20.7	7.9	8.8	9.0
162.2	Pleura ^d	..	0.8	1.0	..	0.1	0.2	..	..
170	Breast	0.6	0.3	0.4	0.4	66.2	51.2	53.3	61.2
171	Cervix uteri	-	-	-	-	17.0	4.9	14.0	9.5
172	Corpus uteri	-	-	-	-	15.0	11.6	12.1	12.8
175	Ovary	-	-	-	-	14.6	12.0	14.2	14.9
177	Prostate	28.5	36.9	43.5	47.7	-	-	-	-
178	Testis	8.0	1.7	6.6	3.7	-	-	-	-
180.0	Kidney	7.5	9.3	8.3	10.1	4.6	5.2	4.0	5.9
181	Bladder	24.2	14.3	18.9	16.9	6.3	2.8	5.0	4.7
190	Melanoma	6.6	6.1	9.8	8.8	9.2	6.0	12.4	8.8
191	Other skin	7.2	6.2	7.7	9.3	3.6	4.2	4.4	4.2
193	Brain	8.8	9.0	9.3	10.7	8.0	9.4	8.2	10.4
194	Thyroid	0.9	1.7	1.6	1.6	2.1	5.8	5.1	4.1
197	Connective tissue	3.1	2.1	1.5	2.1	2.9	1.6	1.3	1.8
201	Hodgkin's disease	2.6	2.6	2.3	2.2	1.5	1.7	1.4	1.5
200,202	Non-Hodgkin's lymphoma	7.7	8.0	7.6	8.7	5.6	5.8	5.5	5.5
203	Multiple myeloma	3.2	3.1	4.1	3.7	2.1	2.5	2.6	2.4
204.3	Acute leukemia	4.9	5.4	3.6	4.0	3.6	4.2	3.0	3.6
204.0—2,4	Other leukemia	4.8	3.1	3.4	4.4	2.5	1.5	1.9	2.2
199	Unknown	10.7	6.5	9.3	8.9	8.7	6.4	7.5	9.3
140—204	All sites ^e	271.6	265.6	248.4	240.1	251.4	193.9	215.1	221.9

^a All rates have been age-standardized according to the world standard population.

^b Reference: Tulinus H, Storm HH, Pukkala E, Andersen A, Ericsson J. Cancer in the Nordic countries, 1981—86: a joint publication of the five Nordic Cancer Registries. APMIS 1992;100 suppl 31: 1—194.

^c - = not applicable.

^d Obtained from the cancer registries.

^e Excludes nonmelanoma skin cancer.

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