

INTERPRETATION

The described method of screening for occupational cancer risks has, however, several inherent limitations. First, the inhomogeneous industrial categories result in an unknown degree of attenuation of risk, ie, confer a dilution effect. The 2.8 million items of information on former employments held by the cancer patients under study, extracted from the files of the Pension Fund, concerned only a few variables. (This occurrence reflects the general property of administrative registries that the data content gives a poorer characterization of an individual than does the variety of information often obtained in ad-hoc epidemiologic studies.) The results from this study on mesothelioma demonstrate the extent of such risk attenuation. Increased risks of mesothelioma have been described in most industries in which asbestos is used or handled (56), and relative risks above 10 or even 100 have been reported among heavily exposed workers (141, 176). In the present study a relative risk of approximately 4 was seen among employees in the shipbuilding industry. Even if shipyard workers are not among the most heavily exposed, it is likely that some attenuation of the risk estimate, say, from a relative risk of 10 to one of 4, has taken place. This occurrence is probably due to the fact that only a proportion of the employees in the shipbuilding industry are exposed to asbestos, and clerks were included in the study. In a report from the United States (US) it was estimated that only about 60 % of all shipyard workers are exposed to asbestos (100). In general any unbiased misclassification present in the analysis will tend to bias the relative risk estimate towards 1.0 (19, 23, 188).

Second, deviations in cancer risk may be due to a combination of social and economic factors prevailing among employees in a given industry rather than to factors operating within the work environment. Such confounding by social and economic factors can be minimized with the use of a stratified analysis in which the position of the individuals is used as an indicator of social class, similar to the social-class adjustment carried out for occupational mortality in England and Wales (55). This type of analysis has not yet been conducted. Instead, it may be informative to compare cancer risks in subgroups of industries that belong to the same main industry, eg, to compare the estimated bladder cancer risk among employees in pharmacies and paint shops (SPIR = 243) with the risk among employees in other retail trades (SPIR = 101).

The most serious confounder is undoubtedly tobacco smoking, which is a well-known risk factor for various cancers, in particular lung cancer. Lung cancer is also associated with a number of occupational ex-

posures. No information on smoking habits was available in the present study. In an earlier Danish study, however, the fraction of smokers among male employees aged 30–59 years ranged from 60 to 80 %, being lowest among employees in agriculture and highest among employees in other services, including restaurants and hotels (150). When the type and quantity of tobacco smoked by the interviewees is accounted for, the range of smoking frequencies is estimated to lead to relative risks of lung cancer ranging from 0.87 to 1.12 (67). This approach indicates that SPIR values for lung cancer above 120 or below 80 cannot be attributed to smoking alone, and there is no reason to assume that smoking will confound the results for other cancers beyond the limits for lung cancer.

Third, information on job histories in this linkage study dates back only to 1964. It is not unreasonable to assume that skilled workers tend to stay in their trades and that unskilled workers seek employment in related industries, but migration between jobs would tend to dilute any influence of a given job exposure on cancer risk.

Finally, the insoluble problem of mass significance appears in any large-scale linkage study. In the present study, slightly over 8 000 associations were tested, which could give rise to some 400 significant results by chance alone. External sources of information can assist in the interpretation of the results. Outstanding risk estimates in the present study must be compared with corresponding risk estimates derived from similar studies performed in other countries or geographic areas. More activity in this area is much needed, as suggested previously (91).

These difficulties in inferring the carcinogenicity of job-related exposures are common to such occupational studies of a general nature as described in this report. On one hand, the associations may be spurious, due to confounding and problems of multiple comparisons; on the other dilution of carcinogenic exposures by use of broad occupational groups may result in the overlooking of true relationships. The last problem may be the most serious. A relative risk that is not significantly different from unity should therefore not be interpreted as indicating an absence of risk. Conversely, confounding is unlikely to explain major deviations in risk, and any relative risk above 1.5 that seems biologically plausible should be pursued in additional investigations.

Table 4 gives the numbers of cancer cases in each of the diagnostic groups included in the analysis. Mesotheliomas were considered as a group by themselves, and acute leukemias were singled out from the total

Table 4. Numbers of cancer cases (1970–1979) according to the diagnostic categories used for the analysis.

Cancer site	Total number of cases	Number of cases with SPF records ^a	
		Men	Women
Buccal cavity and pharynx	3 296	1 721	391
Esophagus	1 420	622	124
Stomach	8 561	2 795	860
Intestinal tract	20 035	6 782	3 701
Liver	1 377	587	209
Biliary tract	1 830	422	367
Pancreas	5 006	1 905	854
Nasal cavities and sinuses	300	161	50
Larynx	1 632	1 071	141
Lung and trachea	21 039	12 166	2 210
Mesothelioma	426	230	76
Breast	18 403	105	9 450
Uterine cervix	6 689	—	4 372
Other female genital organs	10 443	—	4 977
Testis	1 785	1 624	—
Other male genital organs	7 044	4 365	—
Kidney	3 563	1 430	614
Renal pelvis and ureter	1 030	472	176
Bladder	8 719	4 859	850
Melanoma	3 222	1 076	1 220
Other skin	14 591	5 980	2 818
Non-Hodgkin's lymphoma	2 735	1 085	518
Hodgkin's disease	1 207	610	316
Acute leukemia	1 402	534	327
Other leukemias	2 265	927	334
Other malignancies	10 836	4 591	2 735
All sites	158 856	56 120	37 690

^a SPF = Supplementary Pension Fund.

group of leukemias. Due to the difficulties in differentiating clinically between truly benign and invasive tumors of the urinary bladder, these tumors have been grouped together under the term bladder cancer. Finally, tumors of the renal pelvis and ureter were analyzed separately from tumors of the renal parenchyma.

The tumor groups were generally between 1 000 and 20 000 cases, only cancers of the intestinal tract and

the lung occurring in greater numbers. Table 4 also presents the proportions of cases recovered in the files of the Supplementary Pension Fund. In general, more males than females were recovered, owing to the preponderance of men active in the labor market. For the evaluation of industrial cancer risks, case series determined within defined subgroups of employees were compared with the standard case series, which is the site-specific distribution of cancer cases among all employees given in table 4.

The site-specific cancer risks have been estimated for male employees in 119 different industrial branches and for women in 49 industrial branches. All of these risks are presented in the appendix of this paper. For each cell in the appendix table, specified by sex, cancer site and industrial branch, the observed number of cancer cases is given, followed by the relative risk for that cancer as estimated by the SPIR; the 95 % confidence interval of the SPIR value is also given. Thus, by reading the table horizontally, one can extract the cancer profile of a given industry. By reading the table vertically, one can find the site-specific cancer risk in the Danish industrial scene.

Each of the diagnostic groups listed in table 4 has been considered in detail in the following pages. Industrial subgroups of particular interest have been selected, and the relative risk of cancer (SPIR) among employees in that group is presented graphically and commented upon. Each graph is composed as follows: one horizontal bar per industrial branch, indicating the SPIR value among employees in that branch; the expected cancer risk in that branch, derived from the site-specific distribution of cancer cases among all employees in the country, indicated by a dotted line and corresponding to a SPIR value of 100; the 95 % confidence interval, shown by the stars at the end of the bar; and the significant deviation of the SPIR value from expectancy, as indicated by hatching of the bar.

RESULTS AND COMMENTS

Buccal cavity and pharynx

Malignancies of the buccal cavity and pharynx (ICD-7 140–148) include cancers of the lip, tongue, salivary glands, mouth, and pharynx. They account for 2.0 % of all cancer cases in Denmark (48). The age-standardized incidence rates are 9.3/100 000 for men and 3.0/100 000 for women (world standard) with a male:female sex ratio of 3:1.

Although it is a common malignancy in many parts of the world, especially in southeast Asia, cancer of the buccal cavity is a rare disease in northern Europe (121). In Denmark, cancer of the lip accounts for one-third of all cancers of the buccal cavity and pharynx,

and it occurs three times more often among the men in rural areas than among the men in Copenhagen and its suburbs (47). This geographic gradient does not occur for women. Cancers of the mouth, tongue, salivary glands, and pharynx show the reverse pattern, with highest risks in the Copenhagen area and the lowest risks in rural areas (47).

The excesses of lip cancer that have been observed among outdoor workers, including sailors and farmers, have been ascribed to exposure to sunlight and smoking. However, work exposures of outdoor workers have also been considered (110, 113). Metal, textile, and steel workers and plumbers (130, 136, 159, 204) have excess risks of oral cancer, and other reports have

suggested an increased risk among persons exposed to asbestos and polyvinyl chloride (29, 178). Some occupational studies indicate that persons engaged in occupations such as bartending and waiting on tables have the highest risks of oral and esophageal cancers (59, 139). In general, unskilled workers have a higher risk than professionals.

Findings. In total, 3 296 cases of cancer of the buccal cavity or pharynx were included in the study, of which 2 112 (1 721 in men and 391 in women) were covered by the Supplementary Pension Fund (table 4).

Figure 5.1 shows the risks of cancers of the buccal cavity and pharynx among the men in the nine main branches of industry. A significant deficit of cases appeared in the branch of community, social and personal services, with 270 cases observed compared to 303.0 expected (SPIR 89, 95 % CI 79—100), and in manufacturing, with 398 cases observed and 440.2 expected (SPIR 90, 95 % CI 82—100). The risks were

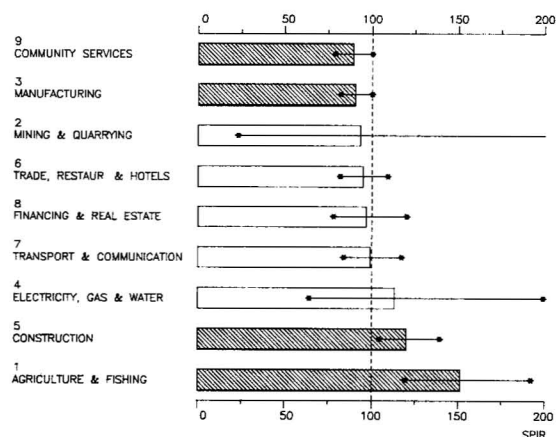


Figure 5.1. Risk of cancers of the buccal cavity and pharynx among the men.

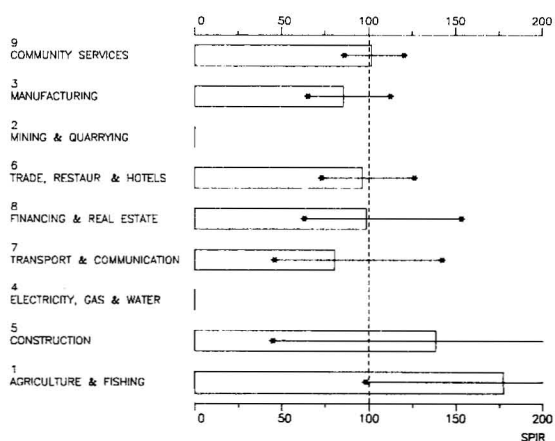


Figure 5.2. Risk of cancers of the buccal cavity and pharynx among the women.

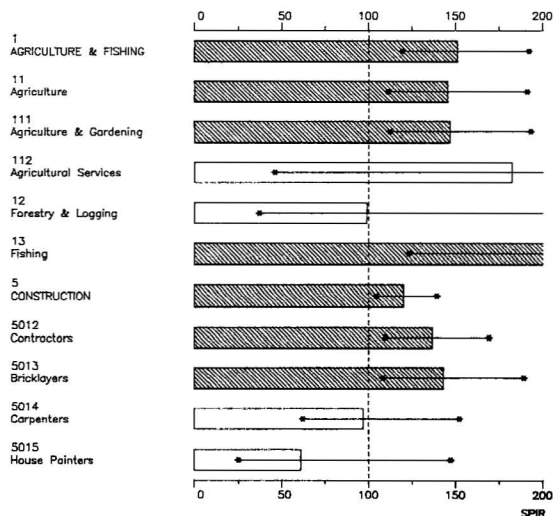


Figure 5.3. Risk of cancers of the buccal cavity and pharynx among the men.

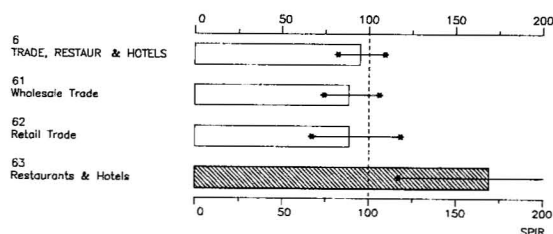


Figure 5.4. Risk of cancers of the buccal cavity and pharynx among the women.

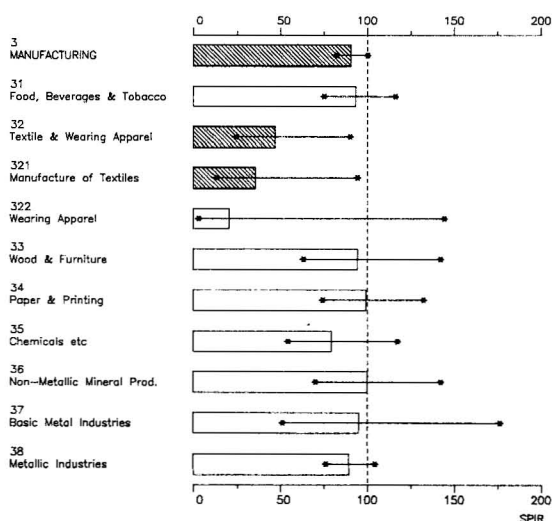


Figure 5.5. Risk of cancers of the buccal cavity and pharynx among the men.

close to unity in the main branches of trade, restaurants and hotels (SPIR 95), financing, insurance and real estate (SPIR 97), and transport, storage and communication (SPIR 99). Excesses were seen in the branches of electricity, gas and water (SPIR 113), construction (SPIR 120, 95 % CI 104–139), and agriculture, forestry and fishing (SPIR 151, with 68 cases observed and 45.0 expected, 95 % CI 119–192).

Also among the women (figure 5.2) risks of cancer of the buccal cavity or pharynx were above expectancy, although not statistically significantly so, in the main branches of construction (SPIR 139) and agriculture, forestry and fishing (SPIR 177), and a deficit of cases was observed in manufacturing (SPIR 86). In community services, a risk close to unity was observed among the women, in contrast to the decreased risk among the men in this same type of work.

The significantly excess risk of cancers of the buccal cavity or pharynx among male employees in the main branch of agriculture, forestry and fishing was due to excesses in the subgroups of agriculture (SPIR 146), with 52 cases detected compared to 35.7 expected (95 % CI 111–192), and of fishing (SPIR 217), with 12 cases observed and 5.5 expected (95 % CI 123–382) (figure 5.3). Figure 5.3 also shows that the elevated risk for construction workers was due to risks significantly above expectancy among employees of contractors (SPIR 137), with 83 cases of cancer of the buccal cavity or pharynx observed compared to 60.8 cases expected (95 % CI 110–169), and among bricklayers (SPIR 143), with 50 cases observed and 35.0 expected (95 % CI 108–189).

Even though the risk of cancer of the buccal cavity or pharynx among men was slightly below average in trade, restaurant and hotel work (figure 5.4), a significantly elevated risk was detected in the subgroup of employees in restaurants and hotels (SPIR 169), with 28 cases observed and 16.6 expected (95 % CI 117–245).

Striking deficits of cases were observed for the men in most subgroups of manufacturing (figure 5.5), being the most evident in the manufacture of textiles and wearing apparel (SPIR 47), with 9 cases observed compared to 19.3 expected (95 % CI 24–90). No similar clear-cut deficit was observed for the female employees in the textile industries (not shown).

Comments

In this linkage study, excess risks of cancer of the buccal cavity or pharynx were observed among persons in typical outdoor jobs, including men and women in farming and gardening and in fishing, and male employees of contractors and bricklayers (figure 5.3). This finding is certainly due to an excess number of cases of lip cancer, which may be caused, at least in part, by excessive exposure to sunlight (110, 113).

Excess numbers of cancer of the tongue, mouth or pharynx may explain the above-average risk found for

male employees in restaurants and hotels (figure 5.4). Unusually heavy smoking habits (150) and excessive alcohol consumption at many workplaces in this branch are the most probable reasons for the observation (204), although it is notable that a similar excess risk was not detected among the employees in the beverage industries. (See the appendix.)

In contrast to earlier findings (136), significant deficits of cases were detected among the men in the subgroups of the textile industry (figure 5.5). The reasons for this observation are unclear. However, similar observations were made for cancers of the larynx and lung (see figures 13.3 and 14.3 under “Respiratory System”) among the male employees in these occupations. Remarkably, the risks of malignant melanoma and other skin cancers (see figures 25.7 and 26.7 under “Skin”) were greater than expected among the workers in the textile industries. This finding may indicate that the deficit of cancers of the buccal cavity and pharynx is due to the occurrence of cancers at sites other than the lips.

Digestive organs

Esophagus

Although cancer of the esophagus (ICD-7 150) is a common malignancy in many parts of the world (199), it accounts for only 0.7 % of all cancer cases in Denmark (48). The age-standardized incidence rates are 2.8 per 100 000 for men and 1.1 per 100 000 for women (world standard) with a male:female sex ratio of 2.5:1. Since 1943, a 50 % decrease has been observed in the incidence of esophageal cancer in Denmark (47, 158).

Poor diet and low socioeconomic status seem to be features of the high-risk profile in many areas of the world (49). In western Europe and North America, the great majority of cases has been attributed to alcohol and tobacco consumption (49, 187). Other reports have suggested an increased risk among persons exposed to ionizing radiation and asbestos (15, 177). However, the overall contribution of occupational exposures to the incidence of esophageal cancer is judged to be modest.

Findings. A total of 1 420 cases of esophageal cancer was included in the study, of which data on 746 (622 in men and 124 in women) were available in the Supplementary Pension Fund (table 4).

The risks of cancer of the esophagus among the men in the main branches of industry are given in figure 6.1. Deficits were observed in agriculture and fishing (SPIR 70), in financing, insurance and real estate (SPIR 72), and in community, social and personal services (SPIR 76), the last-mentioned being significant, with 83 cases observed compared to 109.2 expected (95 % CI 61–94). Excesses were observed among the men in trade, restaurants and hotels (SPIR 119), trans-

port, storage and communication (SPIR 111), and manufacturing (SPIR 104). None of the excesses was however significantly above expectancy.

Among the women (figure 6.2) community, social and personal services (SPIR 100), manufacturing (SPIR 92), and trade, restaurants and hotels (SPIR 121) were the only branches in which there were enough cases for a reasonable risk estimation. No significant deviation from expectancy was found.

Figure 6.3 gives the analysis of risks for the men in manufacturing in more detail. Most subgroups of employees showed a risk below expectancy, with the marked exception of male employees in the beverage industries (18 cases observed and 7.0 expected, SPIR 257, 95 % CI 162–408). No case was observed in tobacco manufacturing (1.4 cases expected). (See the appendix.)

Among the women (figure 6.4), no case of esophageal cancer was found in the beverage industries (0.7 cases expected) or in tobacco manufacturing (0.6 cases expected). (See the appendix.) An excess number of observed cases, although small, was, however, seen for the women in the manufacture of furniture and fixtures; this excess was not found among the male employees in this industrial branch.

Figure 6.5 shows the risks of esophageal cancer among the women in selected subgroups of the main branch of trade, restaurants and hotels. The nonsignificant excess risk observed in this branch was due to significant excesses in the retail trade of clothing and leather goods, with 4 cases observed and 1.4 expected (SPIR 285, 95 % CI 107–758), and in the restaurant and hotel trade, with 8 cases observed and 2.9 expected (SPIR 273, 96 % CI 137–546). An excess risk was also seen for the men in the restaurant and hotel trade (SPIR 152), although it was nonsignificant. (See the appendix.)

Stomach

Today, cancer of the stomach (ICD-7 151) accounts for 4.3 % of all cancer cases in Denmark (48). The age-standardized incidence rates are 14.9/100 000 for men and 6.9/100 000 for women (world standard), with a male:female sex ratio of 2.2:1 (48). Even though the national incidence of gastric cancer has dropped by approximately 70 % since the start of the Danish Cancer Registry in 1942, this malignancy is still among the ten most common in Denmark for both sexes.

Despite the remarkably negative time trend observed and the uneven sex ratio, almost no geographic variation in incidence is detectable within the borders of Denmark (47).

No definite industrial exposure has yet been associated causally with gastric cancer. As for esophageal cancer, low socioeconomic status seems to be a common characteristic of patients with gastric cancer, albeit a nonspecific one (65, 73, 186). Cigarette smok-

ing (67) and alcohol intake (65, 206) have been linked to excess risk, but in the absence of dose-response relationships causality cannot be established. Exposure to high doses of radiation (atomic bomb survivors) appears to increase the risk of gastric cancer (137), but relatively few persons are today exposed to such high levels. The role of diet in the induction of gastric cancer is still equivocal, although certain studies suggest that a high intake of certain components of food may be of importance (143).

Findings. The stomach was the site of malignancy for 8 561 out of the 153 427 cancer patients included in the study. In total, data on 3 655 of the cases (2 795 in men and 860 in women) were available in the Supplementary Pension Fund (table 4).

Figure 7.1 shows the risk of gastric cancer among the men employed in the nine main branches of industry. As for esophageal cancer, the risk of gastric cancer was below expectancy among the men in financing, insurance and real estate (SPIR 82), with 110 cases observed and 134.6 expected (95 % CI 68–99), and among those in community, social and personal services (SPIR 96), but it was close to unity for the men in manufacturing (SPIR 102) and in transport, storage and communication (SPIR 98). In contrast to the results for esophageal cancer, a decreased risk of gastric cancer was detected among the male employees in trade, restaurants and hotels (SPIR 87), with 281 cases observed and 322.0 expected (95 % CI 78–98). Increased risks were found among the male employees in the supply of electricity, gas and water (SPIR 160), with 28 cases observed compared to 17.5 expected (95 % CI 110–232), among those in agriculture, forestry and fishing (SPIR 131) with 92 cases observed and 70.2 expected (95 % CI 107–161), and among construction workers (SPIR 109).

The risk pattern for gastric cancer among women (figure 7.2) seems to be fairly close to that among men. Decreased risks were observed in financing, insurance and real estate (SPIR 79) and in trade, restaurants and hotels (SPIR 95). Significantly increased risks were detected in electricity, gas and water supply (SPIR 487), with 3 cases observed and 0.6 expected (95 % CI 157–1 354), and in manufacturing (SPIR 121), with 156 cases observed compared to 129.2 expected (95 % CI 103–141).

A decreased risk of gastric cancer was detected among men in the beverage industries (SPIR 56), with 17 observed cases and 30.4 expected (95 % CI 35–90) (figure 7.3), and in paper manufacturing, printing and publishing (SPIR 76, 55 observed cases, 95 % CI 58–98). Otherwise, the slight overall excess risk of gastric cancer detected in the main branch of manufacturing was due mainly to excesses in oil and fat manufacturing (SPIR 171, 21 observed cases, 95 % CI 112–263), the manufacture of wood and wood products other than furniture (SPIR 182, 41 observed cases,

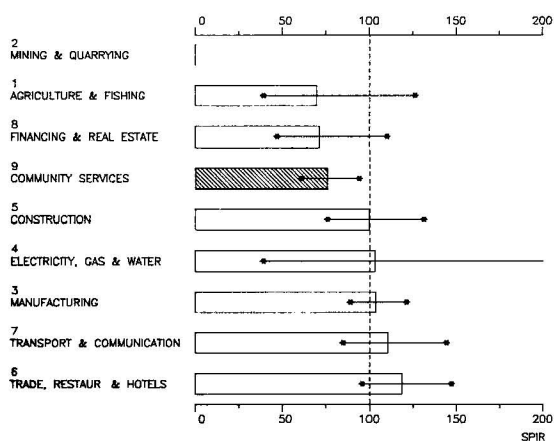


Figure 6.1. Risk of esophageal cancer among the men.

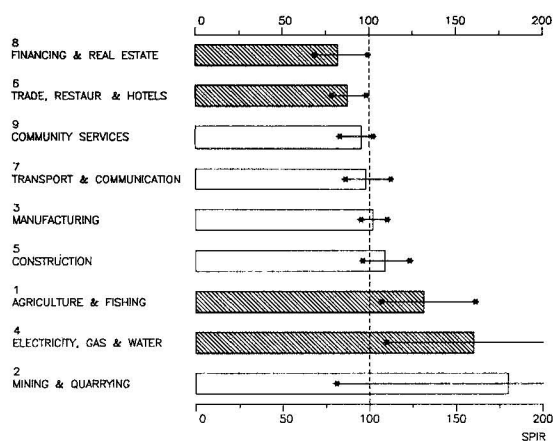


Figure 7.1. Risk of gastric cancer among the men.

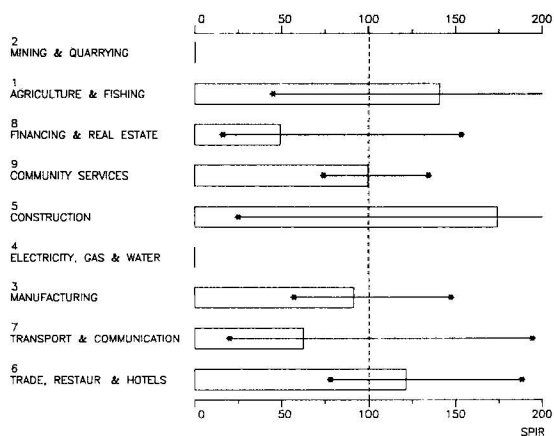


Figure 6.2. Risk of esophageal cancer among the women.

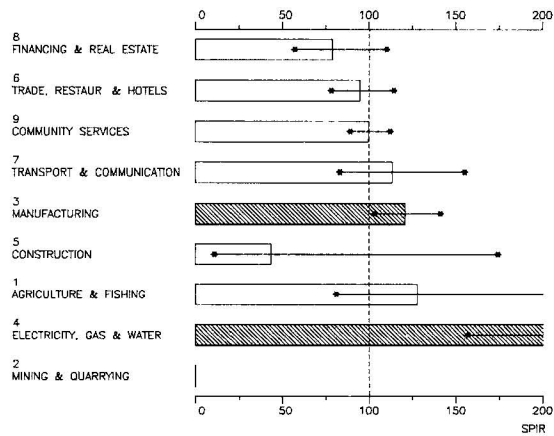


Figure 7.2. Risk of gastric cancer among the women.

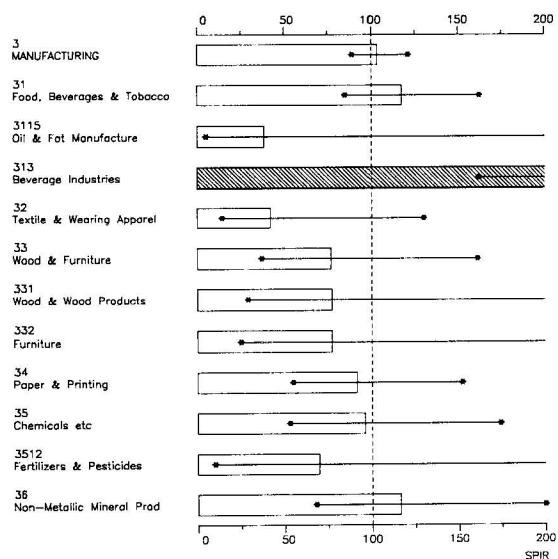


Figure 6.3. Risk of esophageal cancer among the men.

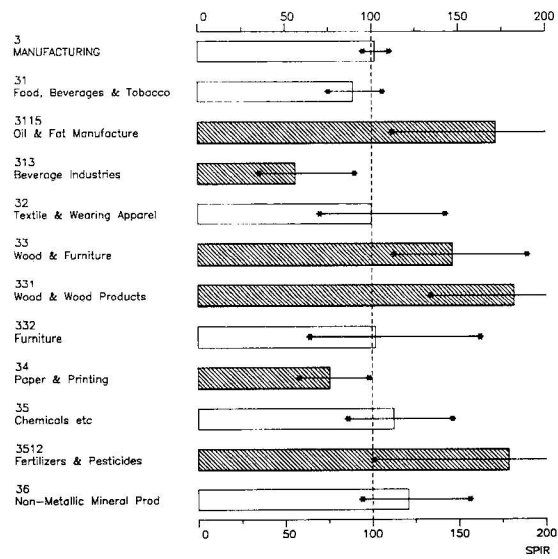


Figure 7.3. Risk of gastric cancer among the men.

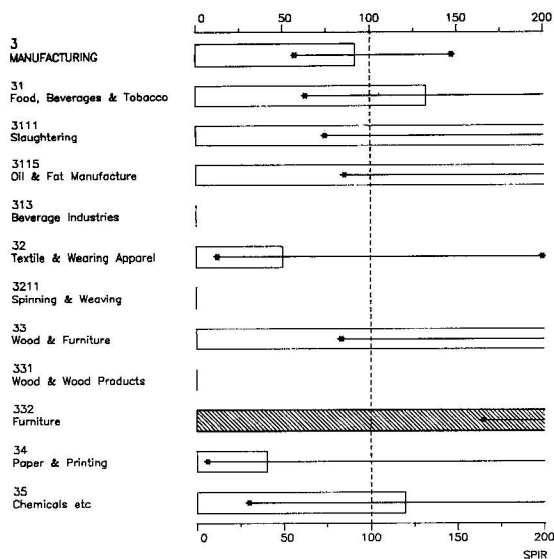


Figure 6.4. Risk of esophageal cancer among the women.

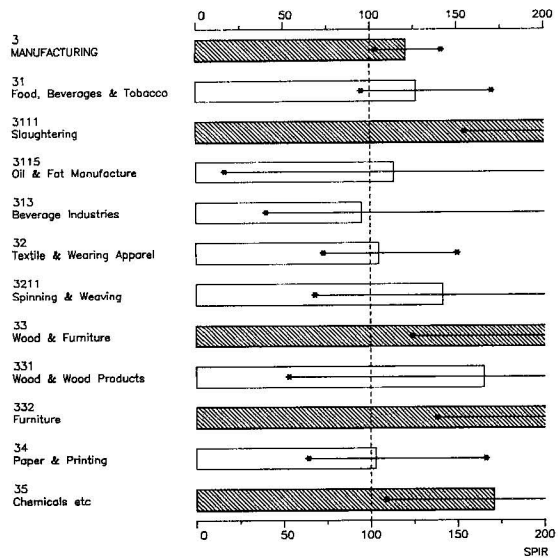


Figure 7.4. Risk of gastric cancer among the women.

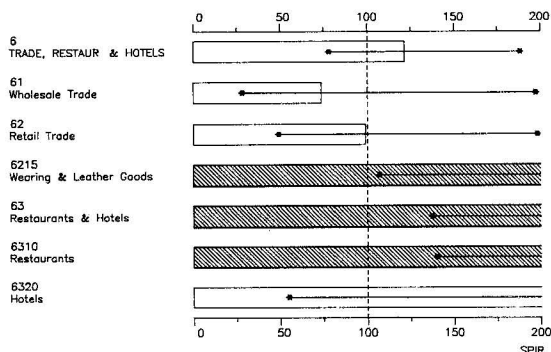


Figure 6.5. Risk of esophageal cancer among the women.

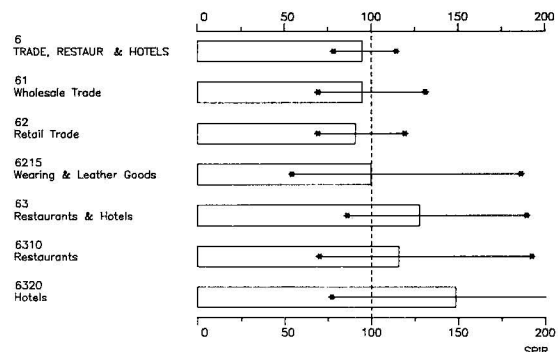


Figure 7.5. Risk of gastric cancer among the women.

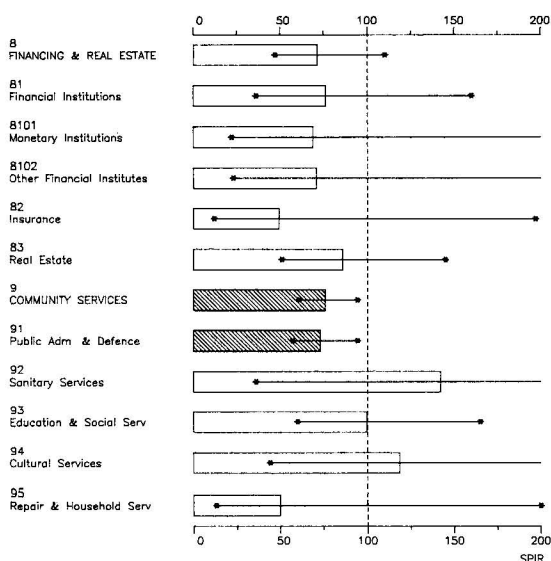


Figure 6.6. Risk of esophageal cancer among the men.

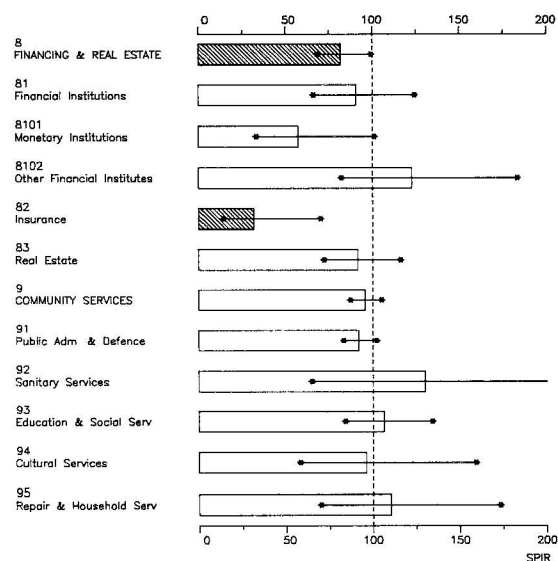


Figure 7.6. Risk of gastric cancer among the men.

95 % CI 134—247), and the manufacture of fertilizers and pesticides (SPIR 179, 12 observed cases, 95 % CI 101—314).

Among the women in manufacturing (figure 7.4) increased risks were found in most subgroups of employees. In slaughtering, which includes the preparing and preserving of meat, 13 cases of gastric cancer were detected compared to 4.9 expected (SPIR 265, 95 % CI 154—456). Significant excesses were also observed in the manufacture of wooden furniture (SPIR 307), with 6 observed cases and 2.0 expected, but the excess risk of gastric cancer observed in the manufacture of wood and wood products other than furniture (SPIR 165) was not significant. Finally, a significantly elevated risk was detected among the women in the manufacture of chemicals (SPIR 171), with 19 observed cases and 11.1 expected.

Figure 7.5 gives the risk of gastric cancer among the women employed in trade, restaurants and hotels, where slight, nonsignificant excesses were observed.

Finally, figure 7.6 shows the risk estimates for selected subgroups of male employees in financing, insurance and real estate and in community, social and personal services. Most subgroups demonstrated risks below expectancy, the most pronounced being for the men employed in the insurance business (SPIR 32), with only 6 observed cases and 19.0 expected (95 % CI 14—70).

Intestinal tract

The group of malignancies of the intestinal tract (ICD-7 152, 153, 154) includes cancer of the small intestine (duodenum, jejunum and ileum), cancer of the colon, and cancer of the rectum, excluding the anus. In Denmark, cancer of the colon accounts for 61 % of all intestinal cancers, and cancer of the rectum for 37 %, leaving only some 2 % of the cases localized in the small intestine (48). The incidence of intestinal cancer is 37/100 000 men and 31/100 000 women (world standard), which is equivalent to 13.2 % of all cancer cases in the country. The male:female sex ratios are 1:1 for colon cancer, 1.6:1 for rectal cancer, and around 1.3:1 for cancer of the small intestine (48). As in many other industrialized countries, a slight urban-rural gradient is seen in Denmark, the incidence in Copenhagen being 30 % higher than that of rural areas (47). Since the start of the Danish Cancer Registry in 1942, a 40—45 % increase in age-standardized incidence has been observed for colon cancer, and a 20 % decrease for cancer of the rectum (158).

Socioeconomic differences have also been observed for colorectal cancer. The social class gradient is however the reverse of that for esophageal and stomach cancer in that a higher colon cancer incidence has been shown for higher social classes (64, 208). Although there is no firm evidence, diet is assumed to play the most important role in the induction of colorectal cancer (92). A high consumption of meat and a low consumption of cereals is the norm in industrialized coun-

tries, where cancer of the large intestine is common (8). Other environmental factors, including occupational exposures, also seem to play a role, either alone or in combination with dietary practice. The industries in the United States and the United Kingdom in which death rates from colorectal cancer are elevated employ mainly white-collar workers. Mortality is excessive in those occupations involving metal work, yarn or textiles, and leather goods (173). An increased risk of colorectal cancer has been seen among asbestos workers (179), and epidemiologic studies of wood-shop workers in the United States have also suggested an excess risk in this trade.

Findings. A total of 20 035 persons with cancers of the rectum, colon, and small intestine were included in the study, of which 10 483 (6 782 men and 3 701 women) had been members of the Supplementary Pension Fund during active employment on the labor market after April 1964 (table 4).

Slightly increased risks of colorectal cancer were detected among the men in the main branches of industry that employ mainly white-collar workers (figure 8.1). Thus slight excesses were observed in financing, insurance and real estate (SPIR 103), in trade, restaurants and hotels (SPIR 105), and in community, social and personal services (SPIR 106), the last-mentioned reaching significance with 1 262 cases of colorectal cancer observed and 1 189.2 expected (95 % CI 100—112). Slightly decreased risks of colorectal cancer were seen among the men in manufacturing (SPIR 98), transport, storage and communication (SPIR 95), construction (SPIR 92, 524 cases observed, 95 % CI 85—100), and electricity, gas and water supply (SPIR 83).

Among the women (figure 8.2) nonsignificant deficits were observed in construction (SPIR 88) and in trade, restaurant and hotel work (SPIR 96). Risks above expectancy were detected in transport, storage and communication (SPIR 114), agriculture, forestry and fishing (SPIR 115), and financing, insurance and real estate (SPIR 117), of which the last was significant, with 219 cases observed and 187.3 expected (95 % CI 102—133). The overall risk estimates in the two largest of the main branches — manufacturing and community services, comprising 554 and 1 324 cases in women, respectively — were close to unity.

Figure 8.3 gives the risk of colorectal cancer among men in selected subgroups of manufacturing. (See also figures 6.3 and 7.3.) No significant deviation from unity was observed, and only slight excesses were detected in the manufacture of textiles and wearing apparel (SPIR 102) and in the manufacture of wood and wood products (SPIR 106). No excess was found among employees in shipyards, where past exposures to asbestos were presumably high (SPIR 91). (See the appendix.)

Among the women employed in the textile industry, however, the risk of colorectal cancer was found

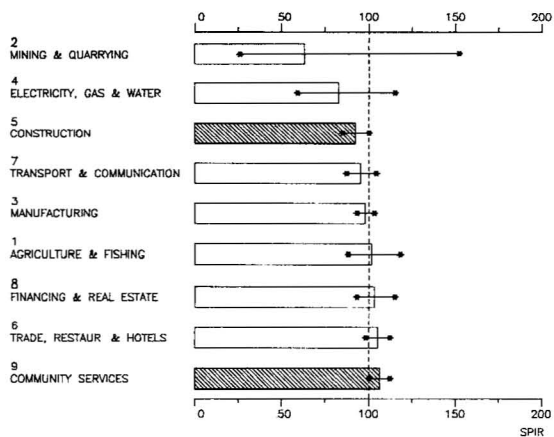


Figure 8.1. Risk of intestinal cancer among the men.

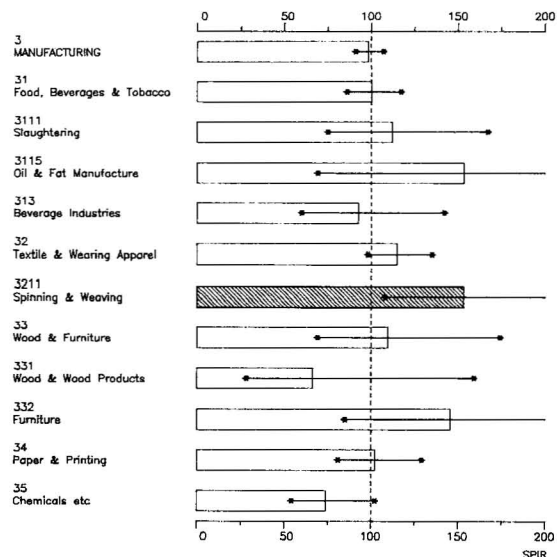


Figure 8.4. Risk of intestinal cancer among the women.

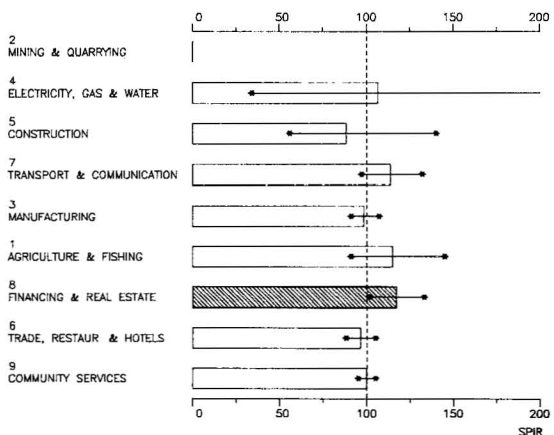


Figure 8.2. Risk of intestinal cancer among the women.

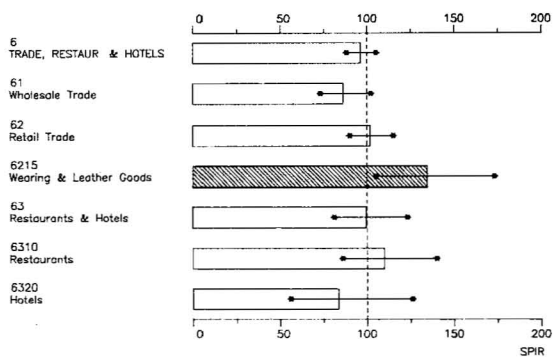


Figure 8.5. Risk of intestinal cancer among the women.

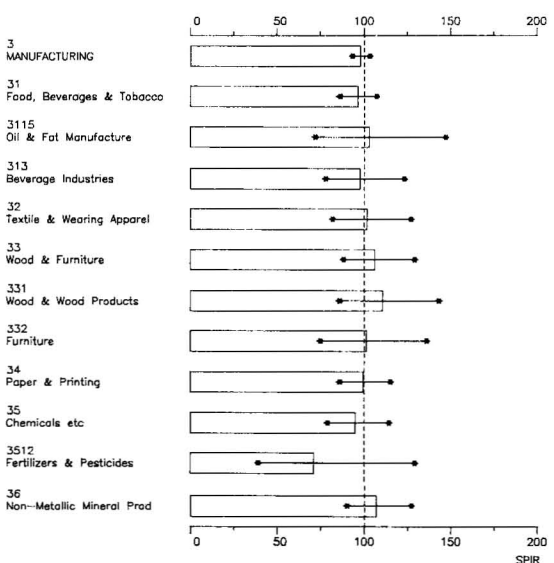


Figure 8.3. Risk of intestinal cancer among the men.

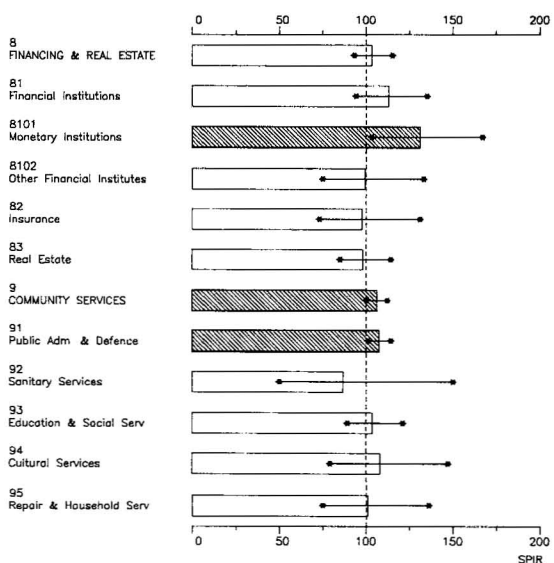


Figure 8.6. Risk of intestinal cancer among the men.

to be slightly above expectancy (SPIR 115) (figure 8.4), due mainly to a significant excess risk of 32 cases observed and 20.9 expected for the spinning, weaving and finishing of textiles (SPIR 153). Even though a deficit of cases was observed among the women in trade, restaurants and hotels (figure 8.5), an excess risk was detected in that part of retail trade manufacturing clothing and leather goods (SPIR 135), with 60 intestinal cancers observed and 44.6 expected (95 % CI 105—173).

Finally, figure 8.6 gives the risks among selected subgroups of male employees in financing, insurance and real estate and in community, social and personal services. Most of the employees in these areas of business experienced risks above or close to average expectancy.

Liver

Primary liver cancer (ICD-7 155.0) is a rare malignancy in Denmark (as in the rest of northern Europe, the United Kingdom and North America), accounting for approximately 1 % of all malignant tumors in the country (48). The age-standardized incidence rates are 3.4/100 000 men and 2.2/100 000 women (world standard), with a male:female sex ratio of 1.5:1. Although subject to incomplete tumor ascertainment, a substantial increase in the incidence of primary liver cancer has apparently taken place in Denmark since the start of the Cancer Registry in 1942 — among both men and women (158).

In many parts of the world, especially in Africa and Asia, primary liver cancer is the leading cause of death (111). Hepatitis B virus is thought to be the most important factor in the predominant type of liver cancer, hepatocellular carcinoma (53). Together with aflatoxins, which occur widely in the diet and environment of millions of people in the Third World, the hepatitis B virus may prove to be a factor that can be controlled. In the industrialized world, alcohol consumption is highly correlated with cirrhosis and with risk of liver-cell carcinoma (109, 124), and in a Danish study of brewery workers who were entitled to consume an allotment of beer every workday, both an excess risk of primary liver cancer and an increased risk of dying from liver cirrhosis were observed (88).

Hepatic angiosarcoma, which is a very rare type of primary liver tumor, has been causally associated with occupational exposure to the vinyl chloride monomer (16). This tumor is also caused by thorotrast, a radioactive diagnostic substance (77), and in one study it was associated with exposure to inorganic arsenical insecticides (165). Other reports have described an increased risk of primary liver cancer in association with oral contraceptive use (99) and with treatment with androgenic-anabolic steroids (153).

Findings. Of the patients included in the study, 1 377 had a primary cancer of the liver. For 796 of these (587

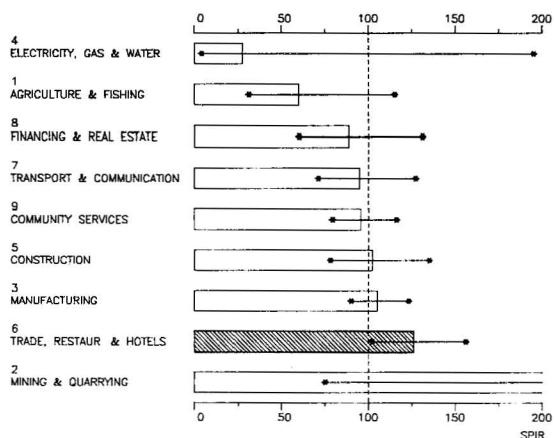


Figure 9.1. Risk of primary liver cancer among the men.

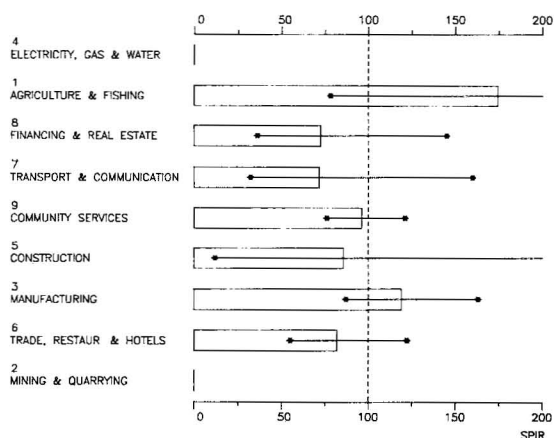


Figure 9.2. Risk of primary liver cancer among the women.

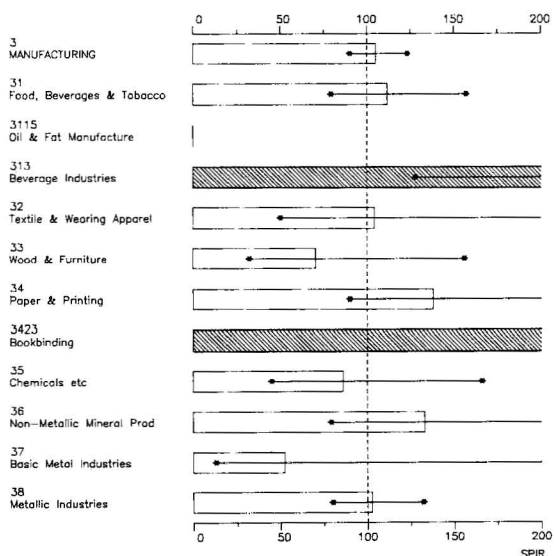


Figure 9.3. Risk of primary liver cancer among the men.