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Occupation and risk of cancer in Denmark. An analysis of 93,810 cancer cases, 1970-1979.

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31 cases and 19.8 expected. For none of the other major subgroups was there a significant deviation of the relative risk from unity.

Figure 19.3 shows the uniform risk pattern observed for the women employed in trade, restaurants and hotels; and the same was seen (figure 19.4) for the women in community, social and personal services. None of the relative risks of these groups significantly exceeded unity. The risk of cancer of genital organs other the cervix uteri was slightly increased among the women in health services (SPIR 116, 95 % CI 98—138).

Comments

Cancers of the genital organs among women have been associated with reproductive and other life-style factors, which are likely to be determined by socioeconomic factors rather than by occupation per se. Seen in this light, the differences in relative risks for cervical cancer between occupational groups are in line with current knowledge of its etiology. The influence of screening for precancerous lesions must also be taken into account when results concerning cancer of the cervix uteri are interpreted.

The increased risk of cervical cancer among the women in manufacturing is thus likely to be a reflection of the large proportion of blue-collar workers in this group. Previous studies from Denmark have shown that cervical cancer risk increases as socioeconomic status decreases (4, 35). In addition, women in low socioeconomic groups are also least likely to participate in population-based screening programs (personal communication from E Lynge, Danish Cancer Registry), and they are probably also the least likely to have had a vaginal cervical smear taken by their general practitioner. The Danish textile industry is located mainly in Jutland (72 % of all textile workers and only 44 % of all industrial workers), an area where screening was introduced later than in the Copenhagen area. In addition, 25 % of all employees in the textile industry live in Ringkøbing County (compared to 6 % of all industrial employees), which had no population-based screening program in the 1970s (116).

The influence of socioeconomic factors on risk is further corroborated by the finding of increased SPIR values among personnel in restaurants and hotels, and by the large differences in relative risk between women in sanitary services (high) and other groups in community services (low), particularly for women in health services, with an SPIR value of 63. Most of these women may be assumed to be nurses, who may be at low risk both because a large proportion of them are unmarried and sexually inactive and because women in the health services are particularly health conscious and use the screening services.

Women at low risk of cervical cancer may be at increased risk of cancer of the endometrium and ovaries if they remain nulliparous. It is therefore of interest to note the increased risk for cancer of other genital organs among women in health services.

The significantly increased risk among the women in nonmetallic mineral production may warrant further investigation, in view of the suggested associations between talc and asbestos and ovarian cancer.

Male genital organs

Malignancies affecting the genital organs of men are divided into cancers of the testis and other cancers of the genital organs, among which cancer of the prostate predominates.

Testis

The testicular cancer (ICD-7 178) incidence in Denmark is among the highest in the world (199), accounting for 1.9 % of all cancers among men in the country (48), with an age-standardized incidence rate of 8.2/100 000 person-years (world standard). Today, the incidence is approximately 270 % of that at the inception of the Danish Cancer Registry in 1942 (145). Men living in urban areas show a slightly higher risk than those living in the rural areas of Denmark. Most outstandingly, however, testicular cancer is a malignancy of young adults, with peak incidence in the late 20s; 50 % of these tumors appear before the age of 35 years (145).

Many studies have revealed a positive association between testicular cancer and socioeconomic status, the highest social classes having the highest risks. White-collar occupational groups have been found to have more testicular cancer than blue-collar groups; however, specific occupations have not yet been identified (172). An increased risk of testicular cancer has been reported among men who notified farming as their present occupation on their medical record (132). This finding could not be confirmed in two subsequent case-referent studies in Denmark (93) and the United States (24).

Findings. A total of 1 785 men with cancer of the testis were included in the study, of which the majority — 1 624 — had been members of the Supplementary Pension Fund (table 4).

Figure 21.1 shows that the risk of testicular cancer was close to expectancy in most of the main branches of industry. Except for a nonsignificant excess of 61 cases observed in agriculture compared to 56.9 expected, slightly increased risks of testicular cancer were detected among white-collar occupational groups, indicating the influence of socioeconomic status on the risk of having this malignancy.

Figure 20.2 shows the risks of testicular cancer among employees in selected subgroups of manufacturing. No major departure from unity appeared, and,

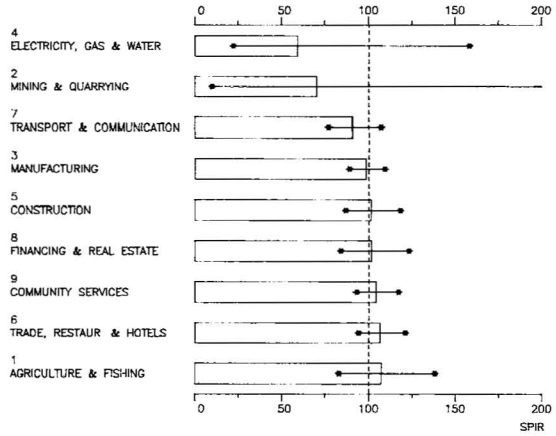

Figure 20.1. Risk of testicular cancer.

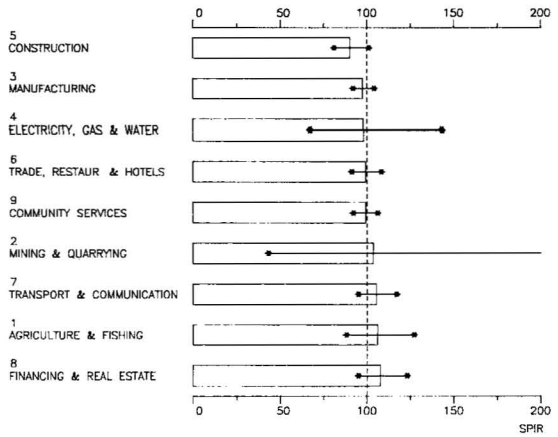

Figure 21.1. Risk of cancer of the prostate.

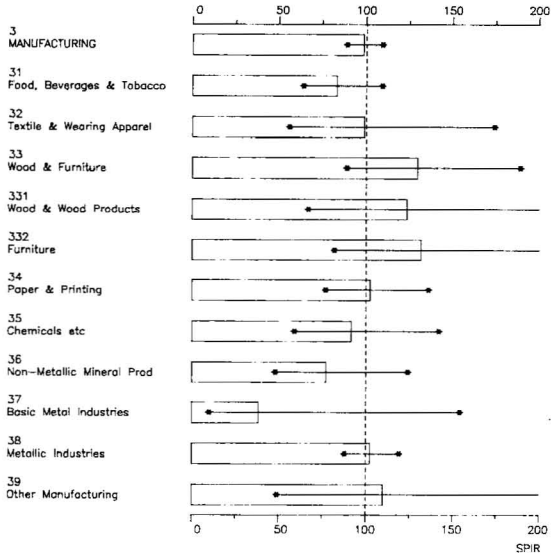

Figure 20.2. Risk of testicular cancer.

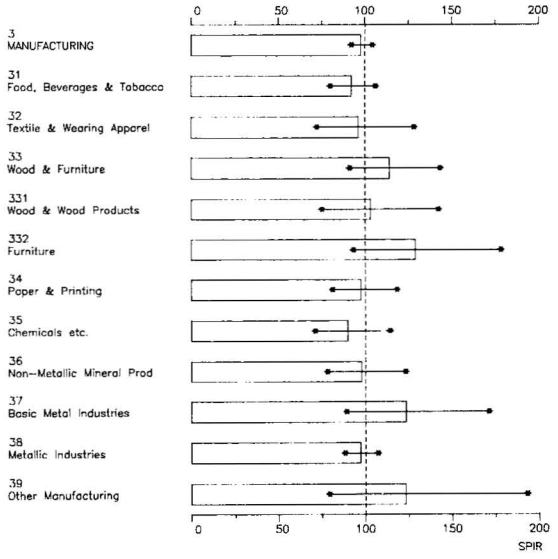

Figure 21.2. Risk of cancer of the prostate.

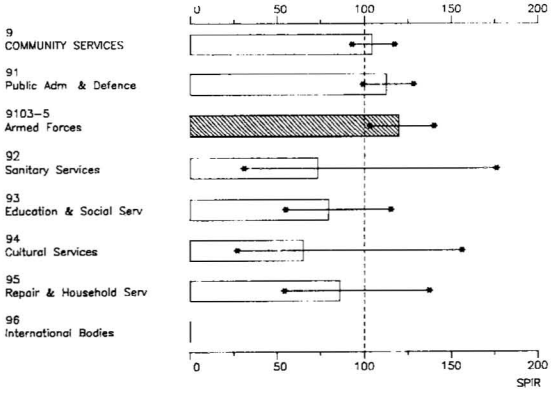

Figure 20.3. Risk of testicular cancer.

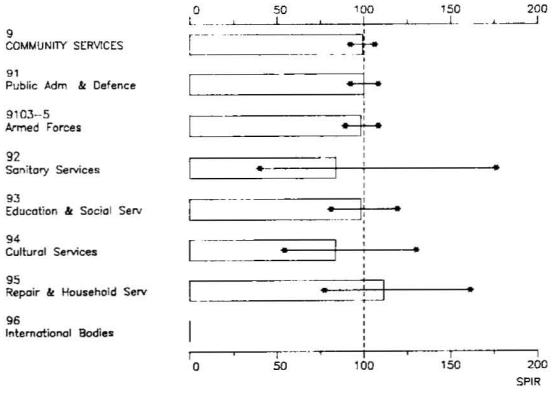

Figure 21.3. Risk of cancer of the prostate.

in fact, most of the risk estimates corresponded closely to the overall SPIR value of 98 for this branch. A slightly elevated, nonsignificant risk was seen, however, in the manufacture of wood and wood products, including furniture (SPIR 130).

The moderate excess risk for the men in community, social and personal services (figure 20.3) was due primarily to a 20 % excess risk among men employed in local administration, with 160 testicular cancers observed and 133.6 expected (95 % CI 103—140).

Other male genital organs

Cancer of the prostate constitutes the great majority (97 %) of the malignancies in the group "other male genital organs" (ICD-7 177, 179). The remainder are cancers of the seminal vesicle, epididymis, spermatic cord, penis, and scrotum.

Cancer of the prostate accounts for 10.7 % of all cancer cases among men in Denmark (48), and it is exceeded in frequency only by cancers of the lung and skin. The age-standardized incidence rate is 28.0/100 000 men (world standard). Today, the incidence is more than 2.5 times the incidence observed in the 1940s (158).

Prostatic cancer is mainly a malignancy of old age, and latent carcinomas at this site are seen relatively commonly at autopsy. When a cancer of the prostate is not clinically apparent by the time of death, it may be overlooked and missed in tumor registration. Large differences in incidence are observed worldwide, the highest rates being found in northwestern Europe and in North America and the lowest rates being recorded in Japan (199). Within the borders of Denmark, geographic variations in incidence are modest. Men living in urban areas have a slightly higher risk of prostatic cancer than men in rural areas (47).

Studies on migrating populations indicate that environmental factors are of importance. However, the causes of prostatic cancer are still unknown (61). A few occupational exposures, primarily to cadmium, have been linked to an elevated risk of prostatic cancer (81).

Findings. In total, 7 044 cancers of the male genital organs other than the testis were included in the study, but only 4 365 of the men concerned appeared in the files of the Supplementary Pension Fund (table 4).

Little variation in risk was seen among the male employees with prostatic cancer, as compared with the male employees with most other cancers. Figure 21.1 gives the risk of this malignancy in the nine main branches of industry, for which no major deviation from unity was observed, nor was a socioeconomic gradient detectable.

Figure 21.2 shows the risks in selected subgroups in manufacturing. Although nonsignificant, slightly elevated risks were observed for the employees in the manufacture of wood and wood products, including furniture (SPIR 114), and for those in the basic metal industries (SPIR 124).

Employees in subgroups of community, social and personal services (figure 21) exhibited risks of prostatic cancer that were close to the expected numbers.

Comments

Cancers of the genital organs account for almost 13 % of all malignancies among men in Denmark. The present analysis confirms the impression that factors other than occupation are the major determinants of these tumors. For testicular cancer, a slight socioeconomic gradient was revealed, with a preponderance of white-collar occupational groups (figures 20.1 and 20.3). No similar gradient was detectable for prostatic cancer. It has not been possible in this study to evaluate the role of cadmium exposure in the risk of prostatic cancer.

Urinary tract

This section concerns the most common malignancies of the renal parenchyma, renal-cell carcinoma or hypernephroma, and of the bladder. In most publications, cancers of the renal pelvis and ureter are grouped with cancer of the kidney for the presentation of incidence statistics. However, cancers of the renal pelvis and ureter have more in common with cancer of the bladder in terms of histology and etiology. They have therefore been covered in a separate section.

Kidney

Cancer of the kidney (ICD-7 180, partly) accounts for 2.2 % of all cancer cases in Denmark (unpublished data from the Danish Cancer Registry). The age-standardized incidence rates are 7.0/100 000 for men and 5.2/100 000 for women (world standard), with a male : female sex ratio of 1.3:1 (unpublished data from the Danish Cancer Registry). The age-standardized rate of kidney cancer among men and women in Copenhagen is twice that in rural areas of Denmark (47).

Not much is known about the etiology of kidney cancer. Worldwide, incidence rates tend to be high in northern Europe and North America (199). Cigarette smoking is the only risk factor that can be considered moderately well established (51, 67, 95, 200). Exposure to cadmium has been associated with an increased risk of genitourinary cancers, but limitations and inconsistencies in the epidemiologic studies led an IARC working group evaluating the carcinogenic risk of chemicals to humans to conclude that it was still far from clear which were the target organs for the putative carcinogenic action of cadmium in humans (86). Lead acetate, lead subacetate, and lead phosphate produce renal tumors in rats, and lead subacetate does so also in mice, after oral or parenteral administra-

tion (86). Finally, there have been reports of elevated renal cancer rates for coke oven workers (161) and for insulation workers (178). Asbestos use was implicated as a possible renal carcinogen in the latter study.

Findings. A total of 3 563 persons with cancer of the kidney was included in the study, of which 2 044 (1 430 men and 614 women) had been members of the Supplementary Pension Fund (table 4).

Figure 22.1 shows that the risk of cancer of the kidney in men was below expectancy within the main branches of mining and quarrying (SPIR 56), electricity, gas and water supply (SPIR 58), agriculture, forestry and fishing (SPIR 61), manufacturing (SPIR 90), and transport, storage and communication (SPIR 91). A significant deficit was observed in agriculture, forestry and fishing, with only 22 cases of kidney cancer observed compared to 36.0 expected (95 % CI 40—93). Elevated risks were detected within the branches of financing, insurance and real estate (SPIR 103), construction (SPIR 107), community, social and personal services (SPIR 112), and trade, restaurants and hotels (SPIR 113). The excesses in community services, with 280 observed kidney cancers and 249.8 expected (95 % CI 100—126), and in trade, restaurants and hotels, with 190 observed cancers and 168.3 expected (95 % CI 98—130), were marginally significant.

The equivalent analysis of the risk of kidney cancer among the women in the nine main branches of industry are shown in figure 22.2. Owing to the small number of cases, the confidence intervals are fairly wide, except for the branches of manufacturing (SPIR 91), community, social and personal services (SPIR 104), and trade, restaurants and hotels (SPIR 102). In these branches, the risk estimates deviated from those expected in the same directions as for the men, although to a less degree (figures 22.1 and 22.2).

Figures 22.3 and 22.4 show the risk estimates for male employees in selected subgroups within the main branch of manufacturing. An overall reduced risk for cancer of the kidney was recognized, mainly in the paper and printing industries (SPIR 70) and in the manufacture of food, beverages and tobacco (SPIR 81), although the risk in tobacco manufacture was close to unity. A 19 % excess risk was observed in the manufacture of textiles and wearing apparel. However, the confidence interval was wide. None of the results of these subgroups of manufacturing reached significance.

No significant result was seen for women, either, among the subgroups of employees in manufacturing (figure 22.5). As was determined for the men, a reduced risk was observed for the women in the paper and printing industries (SPIR 55), but the risks were very close to unity in the manufacture of food and related products (SPIR 105), including tobacco manufacturing (SPIR 98).

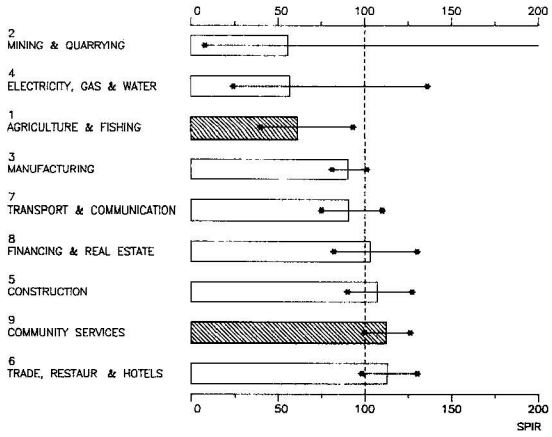

Figure 22.1. Risk of cancer of the kidney among the men.

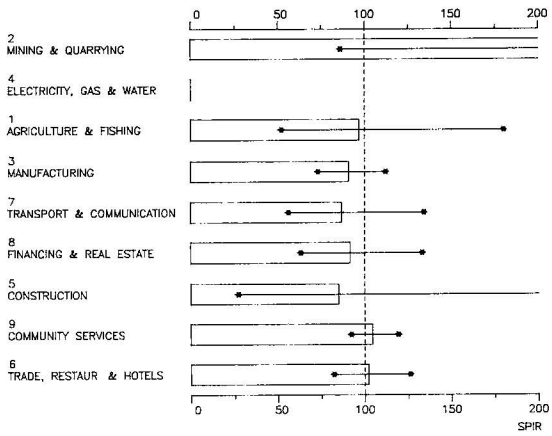

Figure 22.2. Risk of cancer of the kidney among the women.

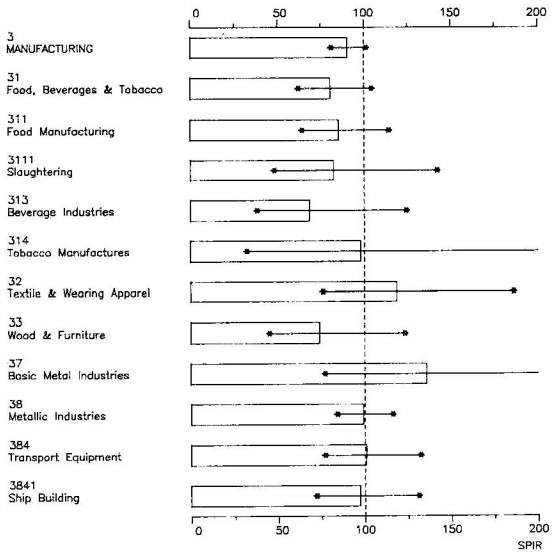

Figure 22.3. Risk of cancer of the kidney among the men.

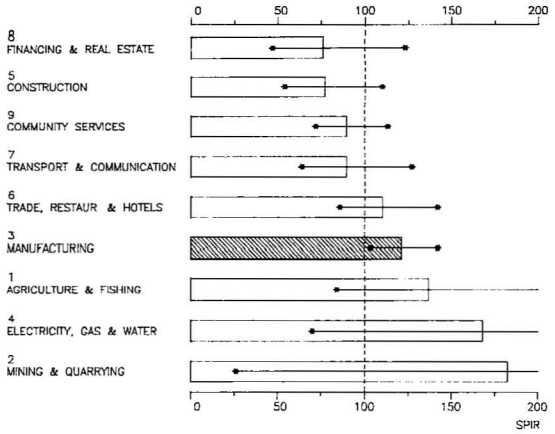

Figure 23.1. Risk of cancers of the renal pelvis and ureter among the men.

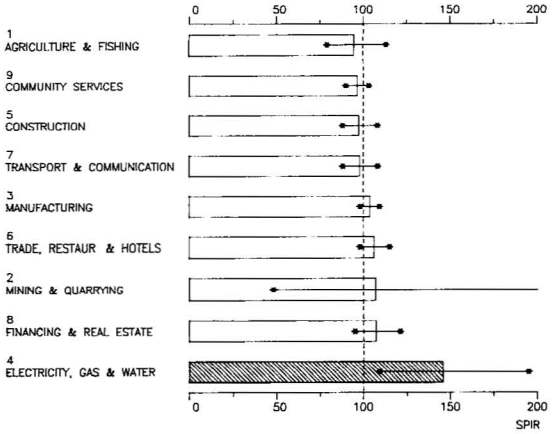

Figure 24.1. Risk of bladder cancer among the men.

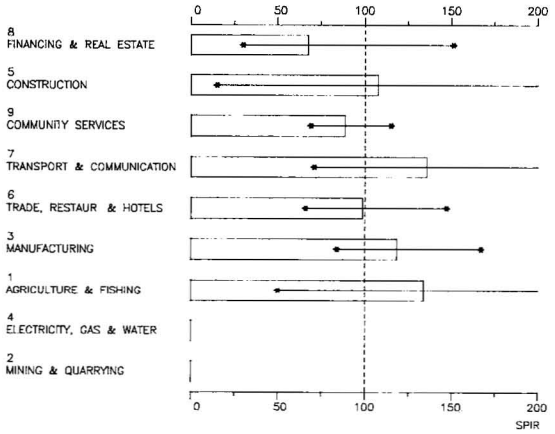

Figure 23.2. Risk of cancers of the renal pelvis and ureter among the women.

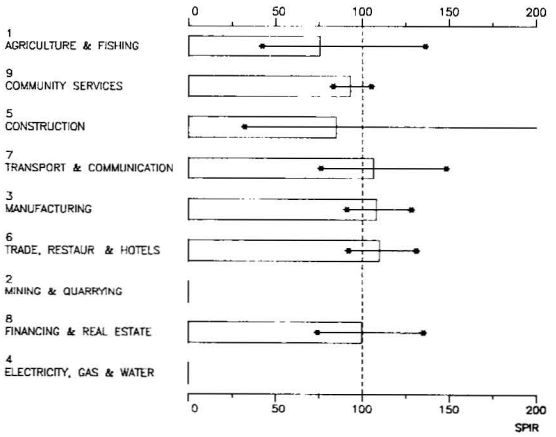

Figure 24.2. Risk of bladder cancer among the women.

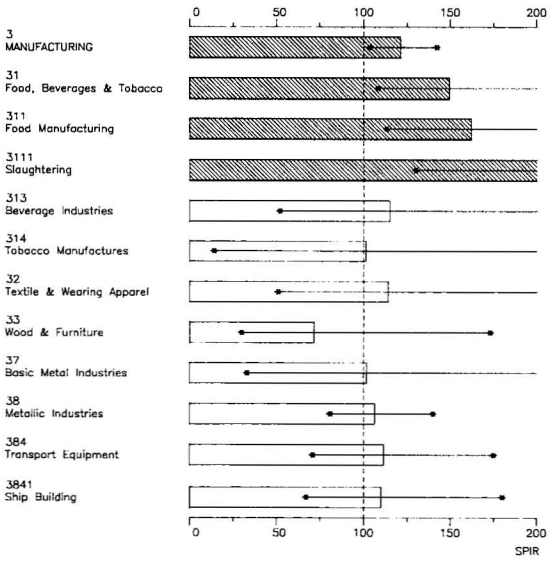

Figure 23.3. Risk of cancers of the renal pelvis and ureter among the men.

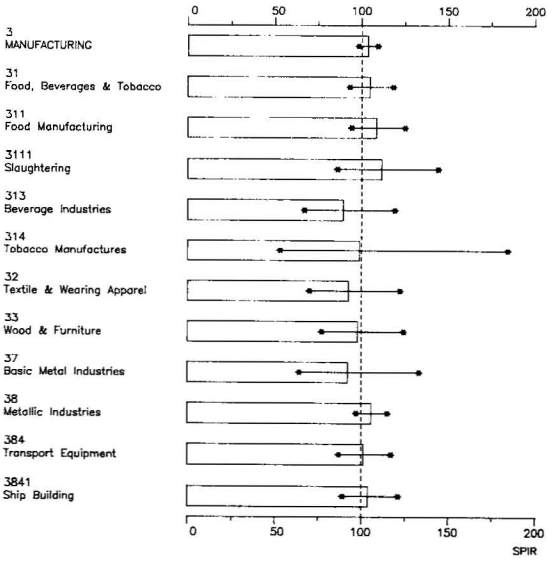

Figure 24.3. Risk of bladder cancer among the men.

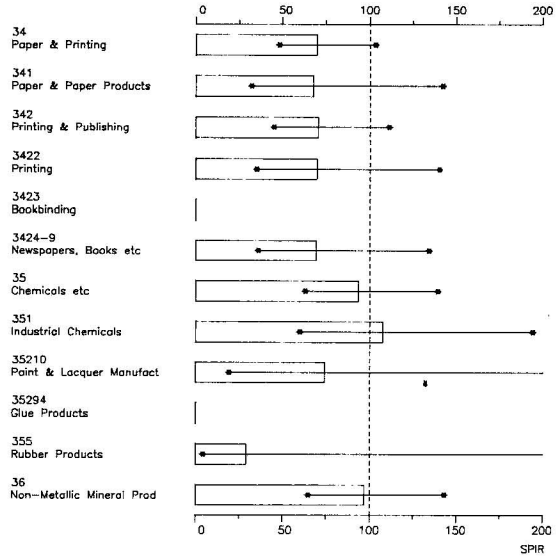

Figure 22.4. Risk of cancer of the kidney among the men.

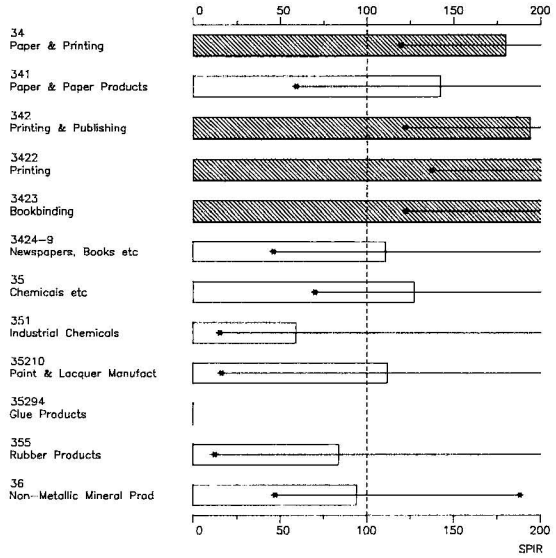

Figure 23.4. Risk of cancers of the renal pelvis and ureter among the men.

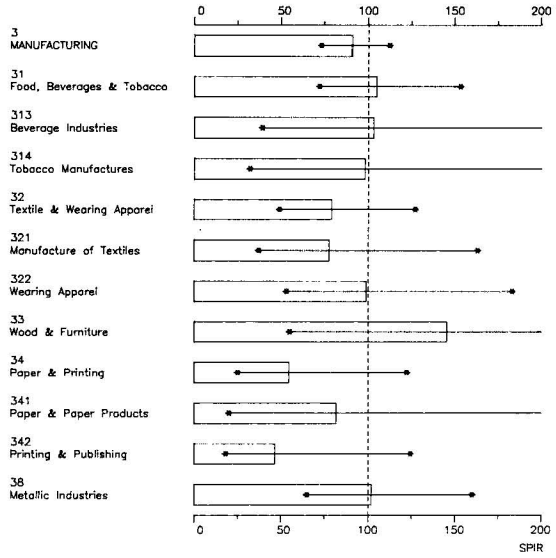

Figure 22.5. Risk of cancer of the kidney among the women.

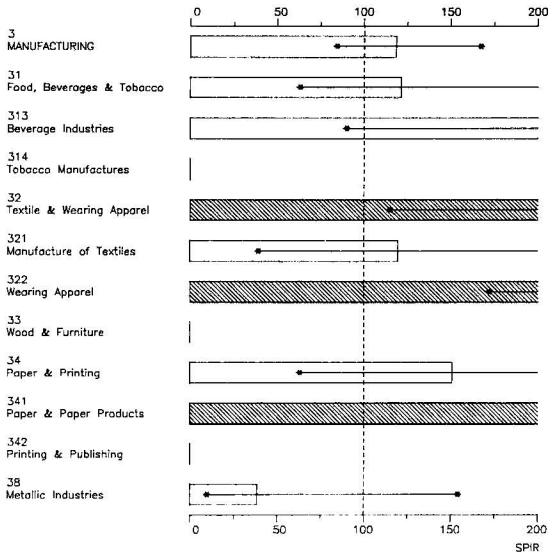

Figure 23.5. Risk of cancers of the renal pelvis and ureter among the women.

The decreased risk seen among the men in the main branch of agriculture, forestry and fishing (figure 22.6) was due entirely to a significant deficit of 18 observed kidney cancers compared to 28.9 expected in the subgroup of farming (SPIR 62, 95 % CI 39—99). Although the risk of kidney cancer in the main branch of construction remained close to the average, the subgroup of carpenters was at a 48 % increased risk (95 % CI 98—223). (See the appendix.)

Finally, figures 22.7 and 22.8 show that the nonsignificant excesses of kidney cancer among the men in subgroups of community, social and personal services and in trade, restaurants and hotels were distributed rather uniformly in the various subgroups, the only exception being employees in sanitary services (SPIR 59).

Renal pelvis and ureter

Cancers of the renal pelvis and ureter (ICD-7 180 partly) represent approximately 0.6 % of all cancers occurring in Denmark, with a male : female sex ratio of 1.5:1, which corresponds more closely to the sex ratio for kidney cancer than to that for bladder cancer (unpublished data from the Danish Cancer Registry).

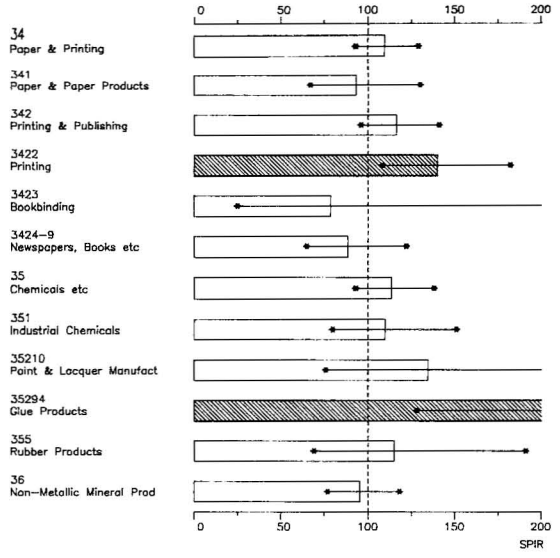

Figure 24.4. Risk of bladder cancer among the men.

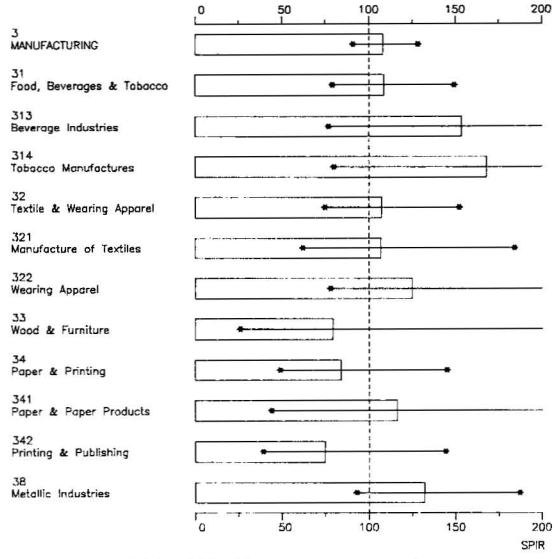

Figure 24.5. Risk of bladder cancer among the women.

Tumors at these sites are commonly thought to share epidemiologic characteristics with bladder cancer (9, 170); for a discussion of the risk factors for cancers of the renal pelvis and ureter, the reader is referred to the section on bladder cancer.

Findings. In total, 1 030 cases of cancer of the renal pelvis and ureter were included in the study, of which 648 (in 472 men and in 176 women) were included in the Supplementary Pension Fund (table 4).

Figure 23.1 shows the risks of cancer of the renal pelvis and ureter for the men employed in the nine main branches of industry. Low risks were seen for the men in financing, insurance and real estate (SPIR 76), construction (SPIR 78), community, social and personal services (SPIR 90), and transport, storage and communication (SPIR 90). However, none was significantly below expectancy. Excesses were detected for manufacturing (SPIR 121), agriculture, forestry and fishing (SPIR 137), electricity, gas and water supply (SPIR 168), and mining and quarrying (SPIR 182). The excess among the employees in manufacturing was significant, with 147 cancers of the renal pelvis and ureter and 121.4 expected (95 % CI 103—142).

For the women (figure 23.2), financing, insurance and real estate (SPIR 68), community, social and personal services (SPIR 89), trade, restaurants and hotels (SPIR 99), and manufacturing (SPIR 118) were the only branches of industry in which there were enough cases for a reasonable risk estimation.

The significant excess risk among the men in manufacturing (figures 23.3 and 23.4) was confined mainly to excesses in the food and related product industry (SPIR 150, 95 % CI 108—207) and in the paper and printing industry (SPIR 180, 95 % CI 119—271). Among the men in food manufacturing (SPIR 163), 29 cases of cancer of the renal pelvis and ureter were observed compared to 17.9 expected (95 % CI 113—233). This increase was due in particular to 12 cases in the branch of slaughtering as compared to 5.2 expected (SPIR 229, 95 % CI 130—403). No excess risk was observed for tobacco manufacturing, but the number of cases was small. Very high risks were detected in subgroups of the paper and printing industry. Among employees in printing, 10 cases were observed and 3.9 expected (SPIR 254, 95 % CI 137—473), and in bookbinding two cases were seen and 0.4 expected (SPIR 489, 95 % CI 122—1955).

Among the women (figure 23.5), nonsignificant excesses were observed in the food and related product industry (SPIR 121) and in the paper and printing industry (SPIR 151). The latter finding was accounted for by a significant excess of five cancers of the renal pelvis and ureter among the women in the manufacture of paper and paper products compared to 0.8 expected (SPIR 659, 95 % CI 274—1 583). In textiles and wearing apparel, 12 cases were observed among the women and 5.9 expected (SPIR 203, 95 % CI 115—358).

Nonsignificantly increased risks were observed in the main branch of agriculture, forestry and fishing among both the men and the women (figures 23.1 and 23.2). The increase for the men seemed to be due partly to a significant increase in the branch of forestry and logging (SPIR 344, 95 % CI 129—917) (figure 23.6), but the number of cases was small.

Finally, the risks are shown for the men employed in selected subgroups of community, social and personal services in figure 23.7 and in trade, restaurants and hotels in figure 23.8. The slight deficit of cancers of the renal pelvis and ureter seen in commu-

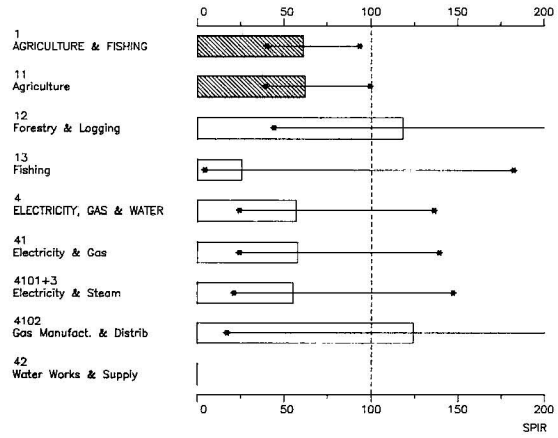

Figure 22.6. Risk of cancer of the kidney among the men.

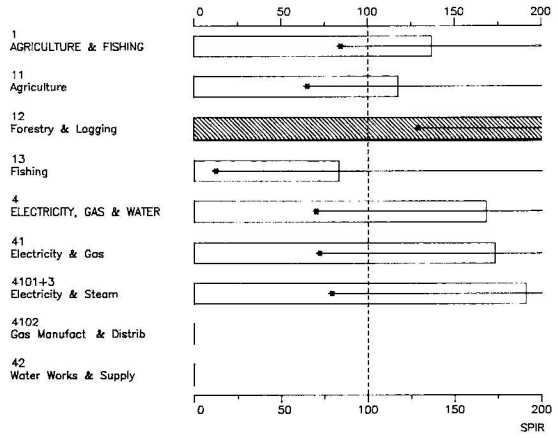

Figure 23.6. Risk of cancers of the renal pelvis and ureter among the men.

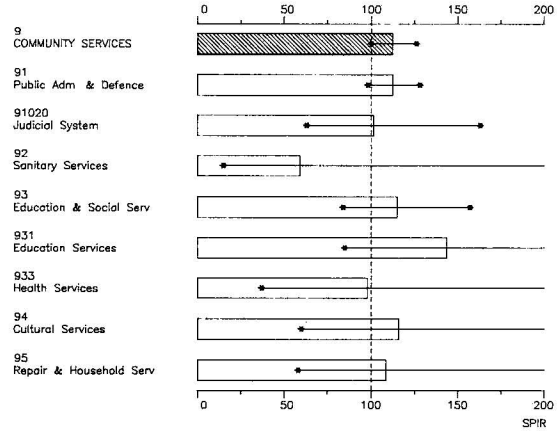

Figure 22.7. Risk of cancer of the kidney among the men.

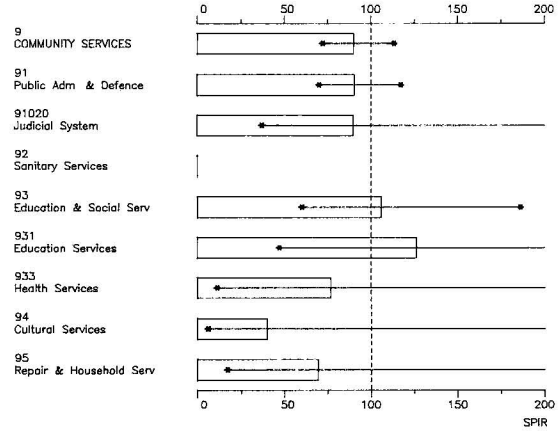

Figure 23.7. Risk of cancers of the renal pelvis and ureter among the men.

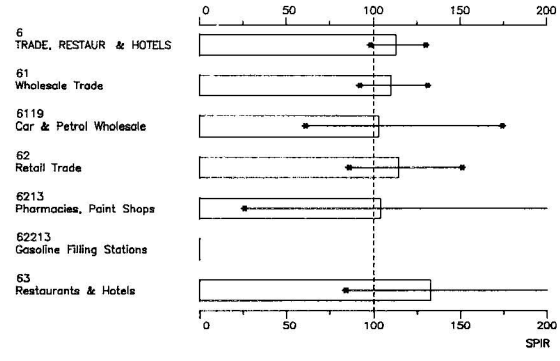

Figure 22.8. Risk of cancer of the kidney among the men.

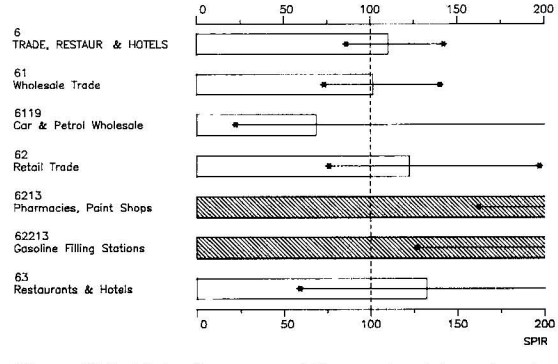

Figure 23.8. Risk of cancers of the renal pelvis and ureter among the men.

nity, social and personal services (SPIR 90) is reflected in most of the subgroups of this main branch. The non-significant excess of these tumors in the main branch of trade, restaurants and hotels (SPIR 110) reflects an excess of 3 cases among employees in pharmacies and paint shops, with 0.6 expected (SPIR 501, 95 % CI 162—1 554), 2 cases in gasoline service stations, with 0.4 expected (SPIR 509, 95 % CI 127—2 037), and a smaller excess among employees in restaurants and hotels (SPIR 132).

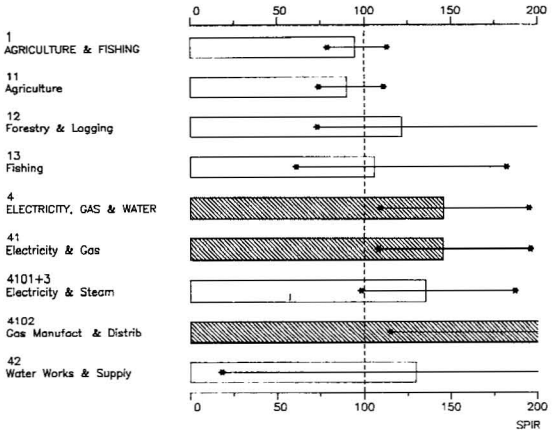

Figure 24.6. Risk of bladder cancer among the men.

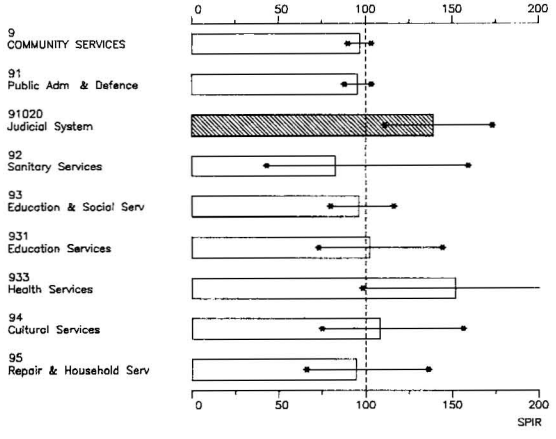

Figure 24.7. Risk of bladder cancer among the men.

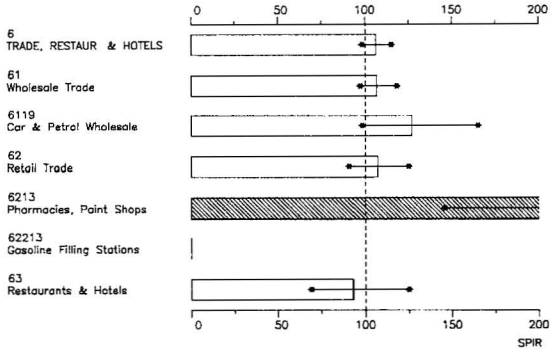

Figure 24.8. Risk of bladder cancer among the men.

Bladder

It is difficult to distinguish clinically between truly benign and invasive tumors of the urinary bladder (ICD-7 181). In the present investigation, therefore, all tumors of the urinary bladder were grouped under the term "bladder cancer," which thus includes both papillomas and frankly invasive cancers (48).

Tumors of the urinary bladder and urethra account for 5.4 % of all cancer cases in the country (48). The incidence of bladder cancer is unusually high in Denmark, with age-standardized incidence rates of 24.6/100 000 person-years for men and 6.1/100 000 for women (world standard) (48), the male : female sex ratio being 4.1:1. During the years 1943—1980, increases of 10 and 4—5 % per year were observed for men and women, respectively (146).

As for cancer of the kidney and renal pelvis, including ureter, a marked geographic variation in the incidence of cancer of the bladder is seen within the borders of Denmark, with a 90 % higher risk in the capital than in rural areas (47).

Several case-referent studies have been conducted to examine the importance of industrial exposures in the risk of bladder cancer. A firm association was found between employment in the dyestuffs industry in the United Kingdom, the United States, and Italy and the occurrence of bladder cancer (28, 167, 207). Benzidine and beta-naphthylamine were identified as especially potent bladder carcinogens (83). Excess risk has also been found within the rubber industry (14, 126, 135), due most probably to exposure to aromatic amines (87), in the leather, textile and printing industries (6, 37, 207), and possibly among printers (27), hairdressers and machinists (6), truck drivers (181), and several other groups of workers. Occupational exposures to coal soot, coal tar and pitch, coal tar fumes, and some impure mineral oils have appeared to cause cancer of the bladder (83), possibly due to the presence of polycyclic aromatic hydrocarbons. Finally, numerous case-referent studies on bladder cancer have shown a relative risk of around two among cigarette smokers compared to nonsmokers (27, 38, 78, 90, 112).

Findings. The bladder and urethra were the sites of cancer for 8 719 patients out of the 153 427 included in the study. Of these, 4 859 men and 850 women were covered by the Supplementary Pension Fund (table 4).

Figure 24.1 shows the risk of bladder cancer among the men in the nine main industrial groups. The risk pattern resembles that of cancer of the renal pelvis and ureter (figure 23.1). Deficits of cases appeared in the branches of agriculture, forestry and fishing (SPIR 95), community, social and personal services (SPIR 97), construction (SPIR 98), and transport, storage and communication (SPIR 98). Excesses were detected within the branches of manufacturing (SPIR 104), trade, restaurants and hotels (SPIR 106), mining and quarrying (SPIR 107), financing, insurance and real estate (SPIR 107), and supply of electricity, gas and water (SPIR 146). In the last category, there were 45 observed cases of bladder cancer compared with 30.9 expected (95 % CI 109—195).

Among the women (figure 24.2), the numbers of

cases were large enough to yield reasonable risk estimates only for the main branches of community, social and personal services (SPIR 93), manufacturing (SPIR 108), and trade, restaurants and hotels (SPIR 110), none of which was significantly different from 100.

Figures 24.3 and 24.4 give the risk estimates for the men in selected subgroups of the main branch of manufacturing. A nonsignificant excess of bladder cancer was noted in the manufacture of food and related products (SPIR 105), although not in the beverage industries (SPIR 89) or in tobacco manufacturing (SPIR 99). The increased risk detected in the paper and printing industry was due mainly to a significant excess of 55 cases of bladder cancer with 39.3 expected in the printing industries (SPIR 140, 95 % CI 108—182). An overall elevated risk was seen in selected subgroups of chemical producing industries (SPIR 114), which was especially marked in the manufacture of paints and lacquers (SPIR 135) and glue products (SPIR 511), with 2 observed cases and 0.4 expected in the latter (95 % CI 128—2 043).

The risk estimates among the female employees in the subgroups of manufacturing (figure 24.5) were quite unlike those for the male employees, partly because of the small number of cases among the women involved in the analysis (table 4). The risk of bladder cancer was slightly higher than expected among the women employed in the manufacture of food and related products (SPIR 109) and those in the textile industry (SPIR 107). Notably, no excess was seen in the paper and printing industry.

The significantly increased risk for the men in the main branch of electricity, gas and water (figure 24.6) was due to an excess of bladder cancer in the subgroup of electricity and gas manufacturing (SPIR 146) and, in particular, gas manufacturing and distribution (SPIR 242), with 7 observed cases and 2.9 expected (95 % CI 115—508).

Although a slightly lowered overall relative risk was detected among the male employees in community, social and personal services (figure 24.7), increased risks were noted among the employees in the health services (SPIR 152) and in the judicial system (SPIR 139), with 78 observed cases and 56.2 expected in the latter (95 % CI 111—173). Risks above expectancy among the male employees in the wholesale trade (SPIR 107) and the retail trade (SPIR 107) (figure 24.8) were due mainly to an excess of 56 observed bladder cancers with 44.2 expected in the car and gasoline wholesale trade (SPIR 127, 95 % CI 98—165) and to an excess of 15 observed cases with 6.2 expected in pharmacies and paint shops (SPIR 243, 95 % CI 146—403).

Comments

The incidence of cancers of the urinary tract is high in Denmark. The occurrence of cancers of the renal pelvis and ureter within the nine main branches of industry (figures 23.1 and 23.2) was in many respects similar to that of bladder cancer (figures 24.1 and 24.2), probably due in part to common occupational risk factors. Excesses of these tumors were noted among employees in manufacturing, in trade, restaurants, and hotels and in electricity, gas and water supply, the last only among the men. Deficits were seen in community, social and personal services, in construction, and in transport, storage and communication. Most strikingly, the occurrence of kidney cancer (figures 22.1 and 22.2) was quite unlike that of cancers of the renal pelvis, ureter and bladder, with lower risks than expected in manufacturing and in electricity, gas and water supply and higher risks in community, social and personal services and in construction. However, similar low risks for all cancers of the kidney and bladder were seen in agriculture and fishing, and a similar excess risk in trade, restaurants and hotels.

Manufacturing. Lowered risks of kidney cancer and elevated risks for cancers of the renal pelvis, ureter, and bladder were shown to be a general tendency in both the main branch and in the subgroups of employees in manufacturing.

The lowered overall risk of tumors of the kidney in the manufacture of food and related products among men (figure 22.3) and the increased risks of tumors of the renal pelvis, ureter, and bladder (figures 23.3 and 24.3) may be due to occupational risk factors specific for the renal pelvis and lower urinary tract. These unknown risk factors are apparently present in most food manufacturing industries (see the appendix) and seem in particular to be associated with slaughtering, which also includes the preparing and preserving of meat. Except for cancers of the renal pelvis, ureter and bladder in women (figures 23.3 and 24.3) no excess of cancers of the urinary tract was detected in the beverage industries, and this finding may indicate that the smoking habits in that group do not differ significantly from those in other industries.

The men employed in the printing industry were at significantly excess risk of developing cancers of the renal pelvis and lower urinary tract (figures 23.4 and 24.4), an association demonstrated in earlier studies (6, 27, 37, 207). The tumors of the renal pelvis and ureter seem to be a more general problem among subgroups of employees in paper manufacturing and printing, including bookbinding, than is bladder cancer (figures 23.4 and 24.4). Strikingly, no excess of kidney cancer was detected among the men in any of the paper and printing industries (figure 22.4); on the contrary, a marginally significant deficit was recognized, and this deficit may indicate that site-specific carcinogens are operating in these industries.

Among the women employed in paper and printing, quite another pattern of risk of urinary cancer emerged, based however on much fewer cases.

Increased risks of cancers of the renal pelvis, ureter, and bladder were seen in the manufacture of paper and paper products but not in the printing and publishing industries (figures 23.5 and 24.5). Decreased risks of kidney cancer were observed among the women (figure 22.5).

A deficit of kidney cancers was also detected for the women in the manufacture of textiles and wearing apparel, but this same group had an excess of tumors of the renal pelvis and lower urinary tract (figures 22.5, 23.5, and 24.5). The manufacture of wearing apparel, except footwear, involving the cutting and sewing of fabrics, leather, fur, and other materials, seems to be associated with the most prominent excess. Excess risks of urinary cancer among people who have been employed in the textile industry have also been reported in other studies (6, 37, 207).

Agriculture, forestry and fishing. Although the risk of cancers of the renal pelvis and ureter was slightly increased among the men in agriculture (figure 23.6), the risk for cancers at other sites in the urinary system (figures 22.6 and 24.6) were lower (significantly so for cancer of the kidney), perhaps suggesting below-average tobacco consumption (150) and the absence of known industrial bladder and kidney carcinogens.

Electricity, gas and water supply. The excesses of cancers of the renal pelvis, ureter, and bladder in the men in the branch of electricity and gas manufacturing and distribution (figures 23.6 and 24.6) may be due to exposures to oil soot and coal soot, the latter being considered to be a human bladder carcinogen (167). No similar excess risk was detected for the occurrence of kidney cancer (figure 22.6).

Wholesale and retail trade, restaurants and hotels. The results of the current analysis suggest that male employees in paint shops, pharmacies, drug stores, and perfumeries are at a significantly increased risk of developing tumors of the renal pelvis and lower urinary tract (figure 23.8 and 24.8). No such effect was seen for cancer of the kidney (figure 22.8), a finding which again indicates that site-specific carcinogens for the renal pelvis, ureter, and bladder — perhaps benzidine, beta-naphthylamine and carcinogenic dyestuffs — are at work in these occupations.

No other study has reported an association between employment in the car and gasoline wholesale trade and bladder cancer or between employment in gasoline service stations and tumors of the renal pelvis and ureter, as demonstrated in the present analysis (figures 24.8 and 23.8). These excesses may be due to exposure to gasoline fumes, although the numbers of cases were small and chance cannot be excluded as an explanation for these findings.

Social and related community services. In general, the risk of bladder cancer was found to be below expectancy in the branch of community, social and personal services. However, the employees in the judical system had a 39 % increased risk of developing a tumor at this site and those in the health services a 52 % increased risk (figure 24.7).

Skin

Melanoma

This section concerns malignant melanoma of the skin (anus included) (ICD-7 190). Malignant melanomas at other sites, such as melanomas of the eye and gastrointestinal tract, are grouped with the tumors of those organs. Although cutaneous melanoma remains a rare tumor, accounting for 2.1 % of all incident cancers in Denmark (48), much attention has been directed towards this malignancy owing to the dramatic rise in incidence observed over the last 40 years. In Denmark, the average annual increase was 9 % among the men and 12 % among the women during the period 1943—1980, with the most prominent increase after the mid-1960s. The age-standardized incidence rates of melanoma are now 6.0/100 000 person-years for men and 8.4 per 100 000 for women (world standard) with a male:female sex ratio of 0.7:1 (48, 144).

Malignant melanoma is considerably more frequent among whites than among more pigmented people (199). Worldwide, there is a marked latitude gradient for the occurrence of melanoma, white populations living near the equator having higher rates than those living near the poles, ultraviolet radiation therefore being incriminated as a risk factor for this malignancy (102, 174). The north-south gradient is not, however, consistently present in studies of European populations (44, 66) indicating that the hypothetical relationship between malignant melanoma and solar radiation is not straightforward and that other factors (eg, skin complexion) may play a role as well.

The anatomical site distribution of melanomas differs substantially between men and women. About 50 % of such cases among men are located on the neck and trunk, compared to 25 % among women, and some 20 and 40 % of the cases of melanoma are located on the lower limbs of men and women, respectively (144). This distribution seems to reflect clothing habits. A puzzling contradiction to this sex-dependent site distribution is the observation that outdoor work apparently does not impose an extra risk of developing melanoma (106); in fact, the risk of melanoma has been found to be higher among professional workers and clerks (74, 185) than among manual workers. Peak exposures to sunlight followed by burns may also be associated with increased melanoma risk.

Surveys of mortality rates in United States counties with petroleum and chemical industries have showed an increased rate of malignant melanoma (20, 76), and