

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 judicial 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

in one report industrial exposure to polychlorinated biphenyls was associated with the disease (13).

Findings. A total of 3 222 persons with cutaneous malignant melanoma were of an age at diagnosis that was compatible with membership in the Supplementary Pension Fund. Of this group of cancer patients, 2 296 (1 076 men and 1 220 women) were listed in the files of the Pension Fund with one or more employments in the labor market (table 4).

Figure 25.1 gives the risk estimates for melanoma among men in the nine main branches of industry. Except for community, social and personal services (SPIR 145), in which 276 cases of melanoma were observed compared to 190.0 expected (95 % CI 129–164), deficits of cases were detected in all the main branches. The risk was lowest in agriculture, forestry and fishing (SPIR 72), followed by financing, insurance and real

estate (SPIR 84), and transport, storage and communication (SPIR 87). The deficit was less prominent, although marginally significant, in manufacturing (SPIR 89, 95 % CI 78–101) and close to unity in construction (SPIR 98).

Among the women (figure 25.2), a significant deficit of cutaneous melanoma was observed in manufacturing (SPIR 83), with 172 cases observed and 206.8 expected (95 % CI 72–97). Nonsignificant deficits were found in the main branches of transport, storage and communication (SPIR 82) and trade, restaurants and hotels (SPIR 89). As for the men, a significant excess of melanomas was detected among the women in community, social and personal services (SPIR 113), with 513 observed cases compared to 452.3 expected (95 % CI 104–124). In contrast to the results for men, a nonsignificant excess risk was seen in the main branch of agriculture, forestry and fishing (SPIR 105), and a risk equal to unity was found in financing, insurance and real estate (SPIR 99).

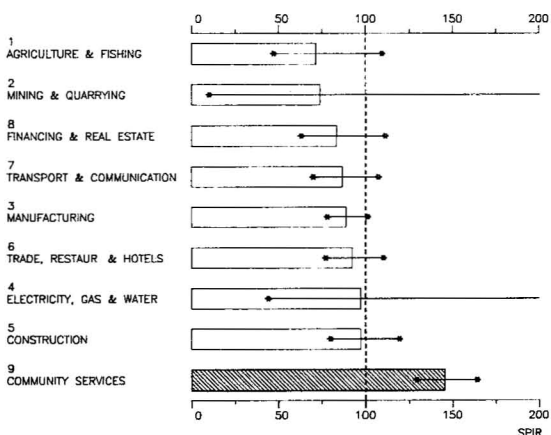


Figure 25.1. Risk of malignant melanoma among the men.

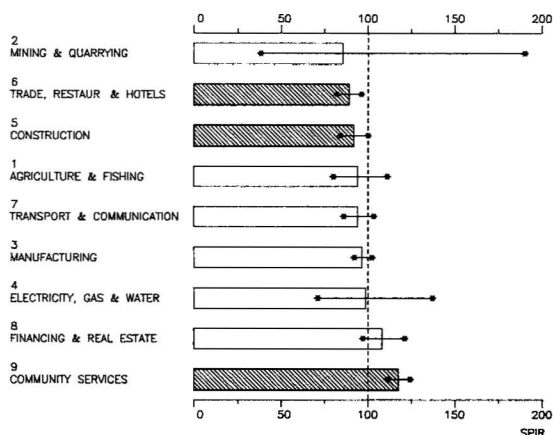


Figure 26.1. Risk of skin tumors other than melanoma among the men.

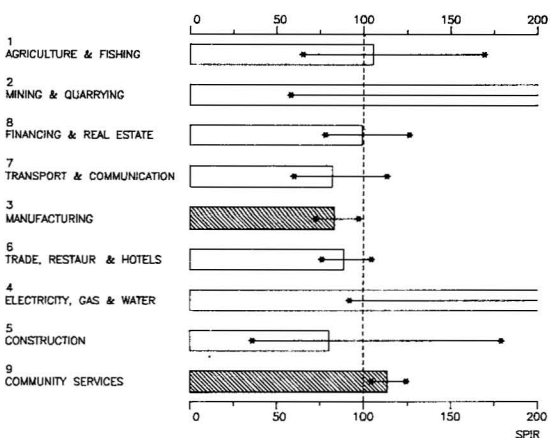


Figure 25.2. Risk of malignant melanoma among the women.

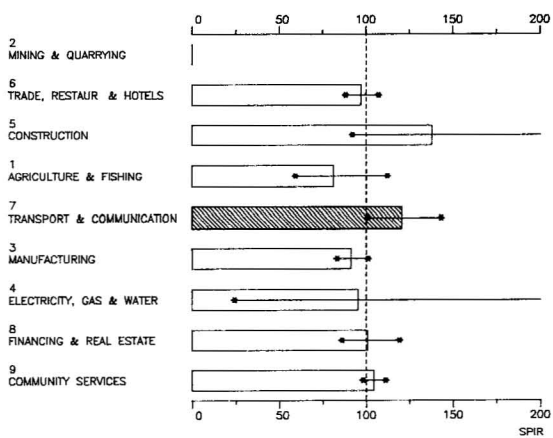


Figure 26.2. Risk of skin tumors other than melanoma among the women.

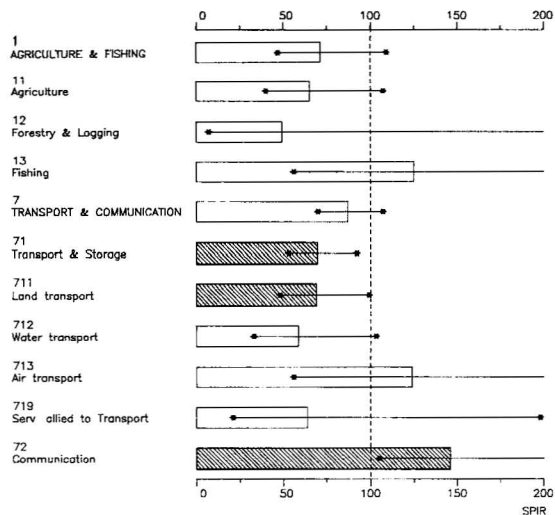


Figure 25.3. Risk of malignant melanoma among the men.

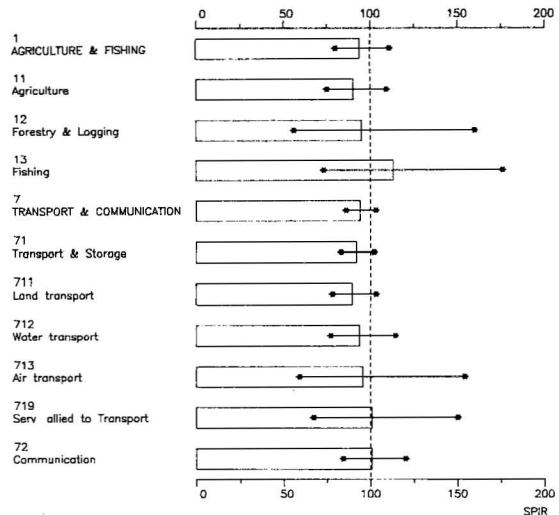


Figure 26.3. Risk of skin tumors other than melanoma among the men.

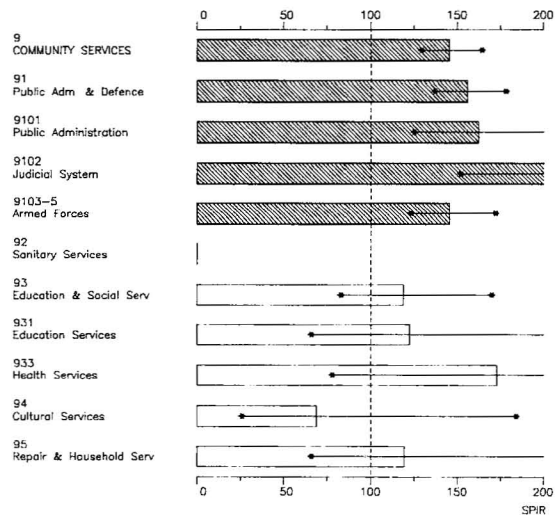


Figure 25.4. Risk of malignant melanoma among the men.

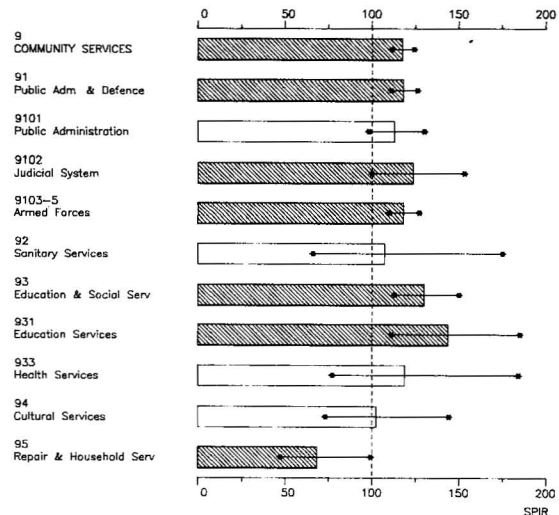


Figure 26.4. Risk of skin tumors other than melanoma among the men.

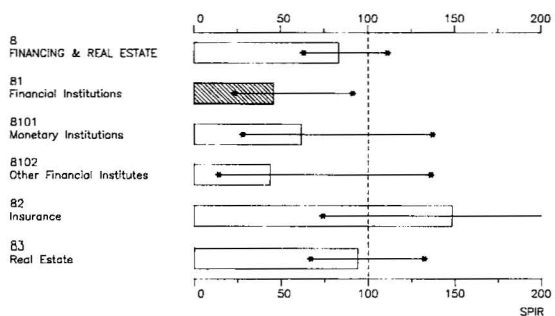


Figure 25.5. Risk of malignant melanoma among the men.

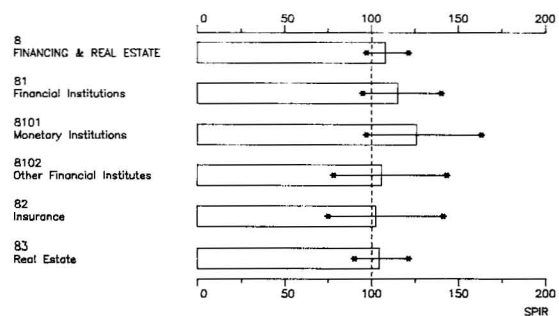


Figure 26.5. Risk of skin tumors other than melanoma among the men.

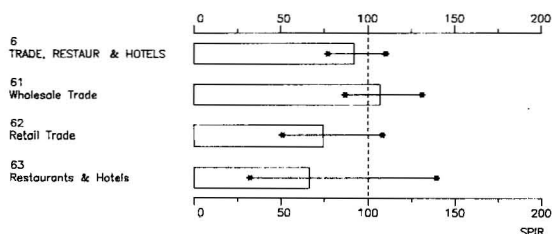


Figure 25.6. Risk of malignant melanoma among the men.

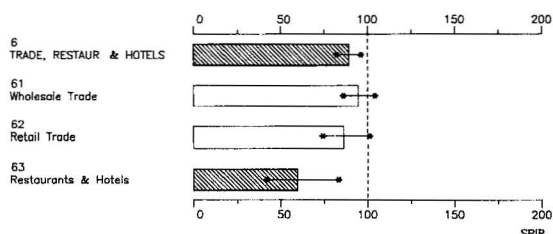


Figure 26.6. Risk of skin tumors other than melanoma among the men.

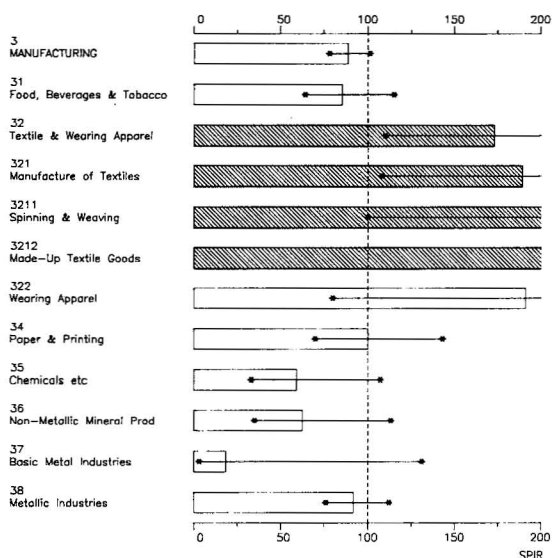


Figure 25.7. Risk of malignant melanoma among the men.

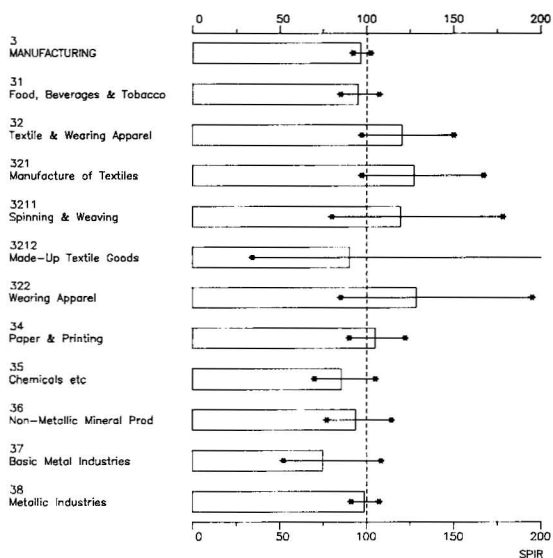


Figure 26.7. Risk of skin tumors other than melanoma among the men.

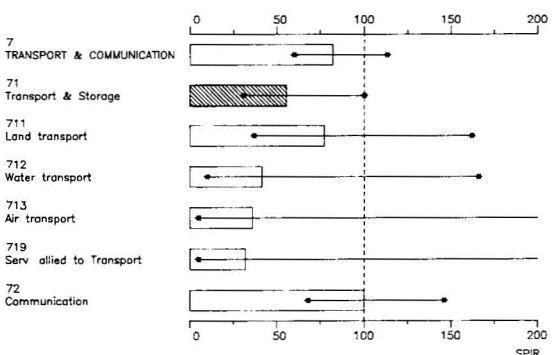


Figure 25.8. Risk of malignant melanoma among the women.

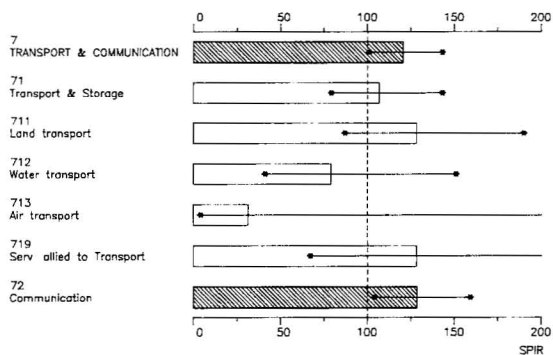


Figure 26.8. Risk of skin tumors other than melanoma among the women.

A substantial proportion of employees in agriculture, forestry and fishing and in transport, storage and communication work out of doors. The risks of developing malignant melanoma for the men in selected subgroups in these two branches of industry are shown in figure 25.3. In all but a few subgroups, the risk estimates were well below expectancy, eg, in the branch of transport and storage (SPIR 70, 95 % CI 53–92). The most marked deviation from the pattern of low

risks was the increased risk in the branch of communication (SPIR 146), with 36 observed cases of melanoma and 24.7 expected (95 % CI 105–202). This branch involves communication to the public by mail, wire and radio, except for broadcasting studios and stations, and thus employs a significant number of indoor workers.

The risk of malignant melanoma among male employees in community, social and personal services (fig-

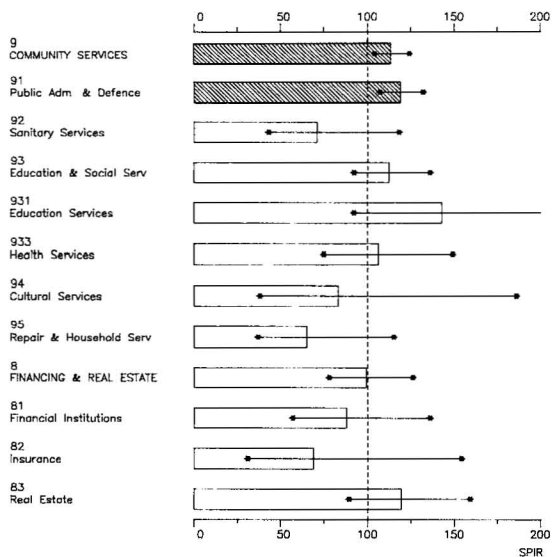


Figure 25.9. Risk of malignant melanoma among the women.

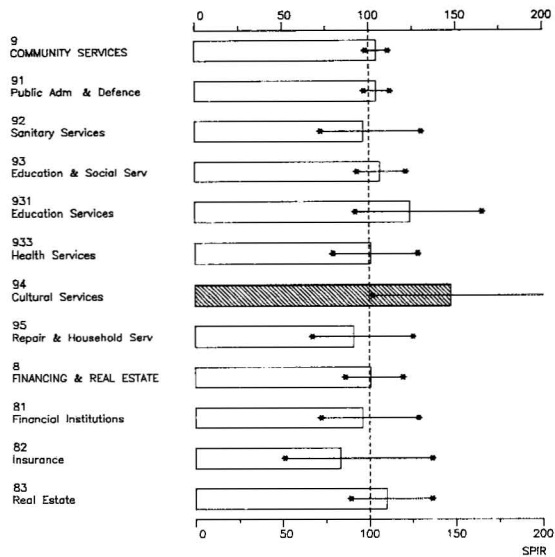


Figure 26.9. Risk of skin tumors other than melanoma among the women.

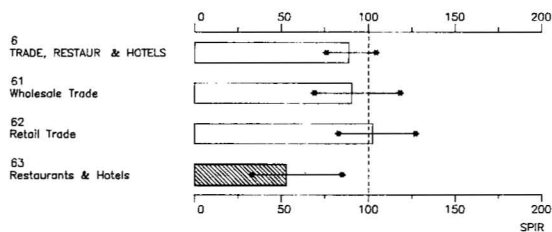


Figure 25.10. Risk of malignant melanoma among the women.

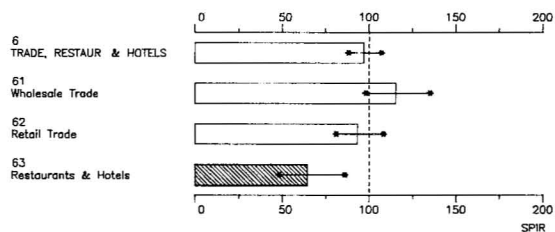


Figure 26.10. Risk of skin tumors other than melanoma among the women.

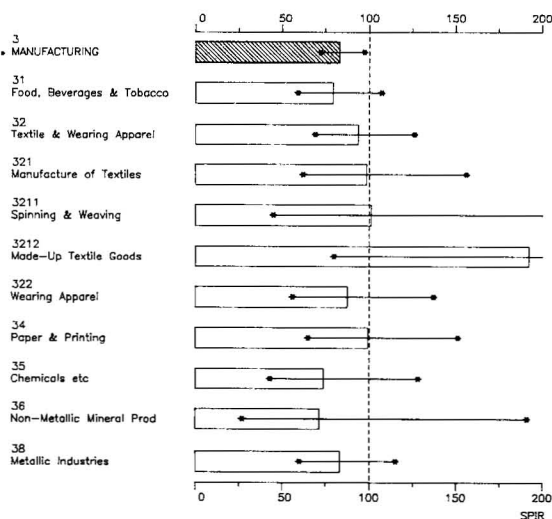


Figure 25.11. Risk of malignant melanoma among the women.

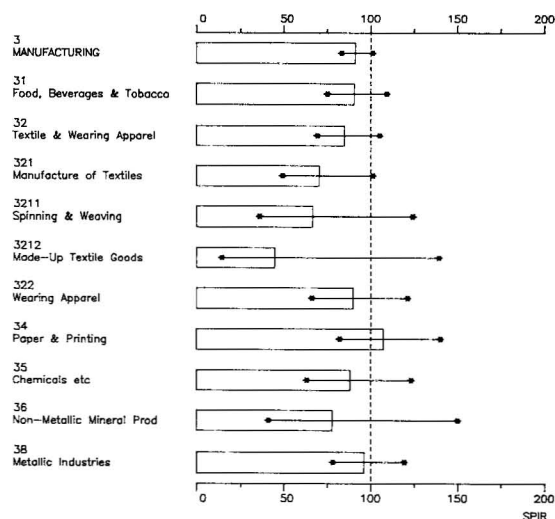


Figure 26.11. Risk of skin tumors other than melanoma among the women.

ure 25.4), who are mostly indoor workers, was significantly elevated, reflecting mainly the high risks of public administration and defense (SPIR 156), with 225 cases observed compared with 144.2 expected (95 % CI 137—178). Most pronounced were the excesses among employees in public administration associated with the government (SPIR 163, 95 % CI 125—211), in the judicial system, including the police (SPIR 223, 95 % CI 152—327), and among employees in the armed forces (SPIR 146, 95 % CI 123—172). Excesses in subgroups other than public administration and defense were more questionable, but the numbers of cases were small.

People employed in financing, insurance and real estate usually work indoors, and a striking deficit of melanomas was observed among employees in financial institutions in particular (SPIR 46), with only 8 cases observed and 17.5 expected (95 % CI 23—91) (figure 25.5).

No significant deviation from unity was detected for the men in the subgroups of trade, restaurants and hotels (figure 25.6). However, the tendency seemed to be towards decreasing risks, from that of the subgroup in wholesale trade, with a risk close to expectancy (SPIR 107), to that for the retail trade (SPIR 74) to that for the subgroup of restaurant and hotel work (SPIR 66).

Figure 25.7 gives the risk estimates for melanomas among the male employees in selected manufacturing industries. Although the overall risk was found to be some 11 % below expectancy, a very interesting excess of malignant melanomas was found in textile manufacturing (SPIR 173), with 19 observed cases compared with 11.0 expected (95 % CI 110—272). This excess risk was detected in all the subgroups of textile manufacturing, including the manufacture of made-up textile goods (SPIR 590), with 4 cases of melanoma and 0.7 expected (95 % CI 221—1 572).

Figure 25.8 shows the risk for the women employed within the branch of transport, storage and communication. Risks of melanoma below unity were found in all the subgroups of this branch, similar to the findings for the men (figure 25.3), except for the subgroup of communication, for which the risk observed was exactly as expected on the basis of the average risk for melanomas among all female employees (SPIR 100).

The excess risk of malignant melanoma among women in the branch of community, social and personal services (figure 25.9) was due mainly to an excess of melanomas in the subgroup of public administration and defense (SPIR 119), with 367 cases observed and 308.8 expected (95 % CI 107—132). No clear-cut tendency could be detected in the risk deviations for the remaining subgroups. However, a non-significant excess was observed in educational services (SPIR 143). There was also no clear trend in the risks of melanoma among the women in the subgroups of financing, insurance and real estate (figure 25.9).

The deficit of melanomas among the women in the branch of trade, restaurants and hotels (figure 25.10) was due mainly to a significant deficit in the branch of restaurants and hotels (SPIR 53), with only 17 cases detected and 32.0 expected (95 % CI 33—85).

Figure 25.11 shows the risk of malignant melanoma for the women in selected manufacturing industries. Overall deficits of cases are seen in most subgroups of this main branch. The excesses observed among the men in textile industries (figure 25.7) were not found among the women, except for work in made-up textile goods (SPIR 191), with 5 cases observed and 2.6 expected (nonsignificant).

Nonmelanotic skin

After cancers of the lung in men and of the breast in women, nonmelanotic skin cancers (ICD-7 191) are the most frequently occurring cancers, accounting for 12.0 % of all malignancies in Denmark, when multiple tumors in the same individual are regarded as one case only. The standardized annual incidence rate is 39.4/100 000 person-years for men and 27.6/100 000 for women (world standard) (48), with a male:female sex ratio of 1.4:1. Owing to the benign behavior of this type of tumor, many nonmelanoma skin cancers are diagnosed and treated outside hospitals. Although systematic coverage of all practicing dermatologists in the country has been achieved, some underreporting may still persist, giving rise to underestimation of the true incidence of these tumors.

The prevailing risk factor for nonmelanoma skin cancers is chronic ultraviolet radiation (46). High rates are found among outdoor workers, with a tendency for skin cancers to arise on sun-exposed surfaces. Ultraviolet radiation in repeated doses induces skin cancer in experimental animals, and ionizing radiation causes skin cancer in humans and in laboratory animals (140). Excess risks have been observed among radiologists and uranium miners (125, 180).

Sir Percival Pott reported an excess of scrotal cancer among chimney sweeps exposed to soot over 200 years ago. Exposure to mineral oils has also been linked with skin and scrotal cancer, excess risks having been observed among shale-oil workers, jute processors, tool setters operating automatic lathes, and mule spinners (18). An increased occurrence of scrotal and skin cancer has also been detected among metal workers exposed to poorly refined cutting oils and among machine operators exposed to lubricating oils (98). Workers exposed to coal gas and tar experience excess risks of skin cancer (52). The carcinogenic effects of soots, tars, and oils are thought to be due to the presence of polycyclic aromatic hydrocarbons (86), and the findings in humans are consistent with the capacity of these compounds to induce skin cancers in laboratory animals (196).

Exposure to inorganic arsenical compounds in drugs, drinking water, and the occupational environ-

ment has been associated with the development of skin cancer in humans (84). Arsenical cancers are usually multiple, involve unexposed parts of the body and unusual locations, such as the palms of the hands, and are associated with hyperpigmentation and keratosis of the skin (175). Excesses of skin cancer have recently been described among pesticide applicators (198) and among chemical and printing workers (202); the agents responsible for these associations are not known.

Findings. A total of 14 591 persons with nonmelanoma skin cancers was included in the study, of which 8 798 (5 980 men and 2 818 women) had been members of the Supplementary Pension Fund (table 4).

Figure 26.1 shows the risks of these skin tumors among the men in the nine main branches of industry. Excess risks were detected in financing, insurance and real estate (SPIR 108) and in community, social and personal services (SPIR 117), the increase in the latter being significant, with 1 245 observed skin cancer cases compared to 1 061.0 expected (95 % CI 111–124). Risks below expectancy were detected in the main branches of mining and quarrying (SPIR 86), trade, restaurants and hotels (SPIR 89), construction (SPIR 92), agriculture, forestry and fishing (SPIR 94), transport, storage and communication (SPIR 94), and manufacturing (SPIR 97). In the branch of trade, restaurants and hotels, the risk estimate was significantly below expectancy, with 632 observed cases and 709.4 expected (95 % CI 82–96).

A nonsignificantly excess risk of skin cancer was observed among the women (figure 26.2) in the main branch of community, social and personal services (SPIR 104). The risk among the women in financing, insurance and real estate was close to unity. In contrast to the deficit of cases among the men in transport, storage and communication, a significant excess was seen for the women (SPIR 129, 95 % CI 101–143), with 129 cases observed and 107.0 expected. Deficits were detected in the main branch of agriculture, forestry and fishing (SPIR 81) and in manufacturing (SPIR 91).

Figure 26.3 shows the risks of skin cancers among the men in selected subgroups of agriculture, forestry and fishing and of transport, storage and communication. In these occupational groups, with mainly outdoor exposures, the risks were generally below average, except for employees in services allied to transport and in communication, with risks close to unity, and for the employees in fishing, who experienced an excess risk (SPIR 113) which was not significant.

In contrast, risks of skin cancer other than melanoma among the men in the subgroups of community, social and personal services (mainly indoor workers) were in general higher than the average risk among all male employees included in the study (figure 26.4). Significant excesses were observed in public administration and defense (SPIR 118), with 973 cases observed

and 824.9 expected, and in educational, social and health services (SPIR 130), with 187 cases observed and 144.0 expected. The most marked excess risk (SPIR 144) within the branch of community, social and personal services was observed in educational services with 60 cases compared to 41.8 expected. The employees in repair and household services constituted a clear-cut exception from this overall pattern, with a significant deficit of cases (observed 22, expected 39.6, SPIR 68), including a deficit for the repair of motor vehicles and motorcycles (observed 8, expected 15.2, SPIR 53). (See the appendix.)

The male employees in all the subgroups of financing, insurance and real estate (mainly indoor workers) showed slight excess risks for skin cancers (figure 26.5).

Figure 26.6 gives the risk estimates for the men in the three main subgroups of trade, restaurants and hotels. The risk seemed to decrease from a nonsignificantly lowered risk estimate of 95 in wholesale trade to a nonsignificant estimate of 86 in retail trade to a significantly decreased risk estimate of 59 in restaurants and hotels, with 34 observed cases compared to 57.3 expected (95 % CI 42–83).

No clear-cut tendency was observed among the men in the main subgroups of manufacturing (figure 26.7), although a slight overall deficit of skin cancers was detected. It is noteworthy, however, that, in the manufacture of textiles, there was a nonsignificant excess risk of 120, with 82 observed skin cancer cases and 68.1 expected (95 % CI 97–150).

The excess risk of nonmelanoma skin cancers among the women in the branch of transport, storage and communication (figure 26.8) was due mainly to a significant excess in communication (SPIR 129), with 86 observed cases and 66.9 expected (95 % CI 104–159). No such excess was observed for the men (figure 26.3).

Figure 26.9 shows that the slight excess risk among the women in community, social and personal services occurred also in some subgroups of this branch. The risks of skin cancers in the subgroups of financing, insurance and real estate were close to unity.

The risks of nonmelanoma skin cancers among the female employees in the main branch of trade, restaurants and hotels are given in figure 26.10. The same risk gradient observed over the subgroups for the men was observed for the women, ie, a decreasing risk from wholesale trade (SPIR 115) to retail trade (SPIR 93) to restaurants and hotels (SPIR 64), with 45 cases observed and 69.9 expected in the last group (95 % CI 48–86).

Finally, figure 26.11 gives the risks of skin cancer for the women in selected subgroups of manufacturing. Although nonsignificant, the risks were strikingly below average in almost all the subgroups of the manufacture of textiles (SPIR 70), with 29 observed cases and 41.2 expected (95 % CI 49–101).

Comments

The incidence of skin cancer is high in Denmark. The detection and registration of cases of malignant melanoma is considered to be complete, whereas skin cancers other than melanoma are undoubtedly subject to some underreporting. If such underreporting is related to type of occupation, it may give rise to bias in occupational risk assessments of nonmelanoma skin cancer.

At first impression, the risk estimates for malignant melanoma for employees in the main branches of industry (figures 25.1 and 25.2) and for skin cancers other than melanoma (figures 26.1 and 26.2) did not show any clear-cut similarities. However, a distinction between indoor and outdoor work and social class gradation can be made for this apparently complex pattern of risk estimates.

Indoor work. Excess risks of both kinds of skin cancer were observed in the branch of community, social and personal services among both the men (figures 25.4 and 26.4) and the women (figures 25.9 and 26.9), although the excess of malignant melanoma among the male employees was the most distinct. The excesses were due mainly to increased risks in the subgroups of public administration, the judicial system, and the armed forces, but also in the educational, social and health services, particularly for nonmelanoma skin cancers.

The risks of skin cancers for the workers in sanitary services, which include garbage and sewage disposal, house cleaning, and chimney, window and office cleaning, and for workers in repair and household services, which include the repair of motor vehicles and motorcycles, laundries, laundry and cleaning plants, domestic services, and barber shops, were found to be below average. This result may reflect the fact that some such employees are outdoor workers and are of a lower social class.

Surprisingly, the risks of malignant melanoma among the employees in financing, insurance and real estate (figures 25.5 and 25.9) were found to be close to unity (women) or below expectancy (men), even though most such employees are assumed to work indoors. The risks of nonmelanoma skin cancers in this branch (figures 26.5 and 26.9) were again close to unity (women) or slightly above expectancy (men). These findings may be due to lower social status.

Outdoor work. Except in the branch of fishing, deficits of cases of malignant melanoma and of skin cancers other than melanoma were found in the subgroups of agriculture, forestry and fishing (figures 25.3 and 26.3). In another branch in which work is partly outdoors — transport, storage and communication — the risks of malignant melanoma were below average for both the men (figure 25.3) and the women (figure 25.8), with the striking exception of a significantly excess risk among the male employees in communication.

A pattern similar to that of malignant melanoma was observed for skin cancers other than melanomas, although it was the female employees in communication who demonstrated a significantly elevated risk (figures 26.3 and 26.8). This excess among workers in communication may reflect the fact that they have more in common with employees in public administration than with those in the other subgroups within transport, storage and communication or that specific carcinogens operate in the branch of communication (13, 190).

Trade, restaurants and hotels. The main branch of trade, restaurants and hotels is made up of employees in wholesale trade, retail trade, and restaurants and hotels, all of whom are assumed to be indoor workers. For both malignant melanoma (figures 25.6 and 25.10) and nonmelanoma skin cancers (figures 26.6 and 26.10), a substantial variation in risk was observed between the subgroups, from an almost average risk among employees in wholesale trade to a nonsignificantly decreased risk in retail trade to a significantly decreased risk among the employees in restaurants and hotels. This finding may also reflect a social class gradient.

Manufacturing. Significant or marginally significant deficits of skin cancers were detected in manufacturing, reflecting low risks in most of the subgroups of this branch (figures 25.7, 26.7, 25.11, and 26.11). Among the men, however, markedly excess risks of melanoma were observed in all the subgroups of the textile and wearing apparel industries. Such an excess was also seen for skin cancers other than melanoma. No similar effect was observed among the women, a finding which may indicate that the carcinogen occurs only in the work processes performed mainly by men, although in common use in the textile industry.

The excess risk of melanoma in the chemical industry reported elsewhere (20, 76) was not seen in this study.

Lymphatic and hematopoietic tissues

Non-Hodgkin's lymphoma

The heterogeneous group of tumors non-Hodgkin's lymphoma (ICD-7 200, 202) accounts for 1.8 % of all malignancies in Denmark (48). The age-standardized rates are 6.4/100 000 men and 4.4/100 000 women (world standard), with a male:female sex ratio of 1.5:1 (48). The incidence has doubled 2.5 times since the inception of the Cancer Registry in 1942, among both men and women (158). No consistent urban-rural gradient has been observed (47).

Little is known of the etiology of non-Hodgkin's lymphoma, although a positive gradient with socioeconomic status may exist (163). Surveys of occupa-