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Volume 25

Wood, Leather and Some Associated Industries

Summary of Data Reported and Evaluation

Wood

The lumber and sawmill industries (including logging)
The furniture and cabinet-making industry
Carpentry and joinery
The pulp and paper industry

Leather

The leather tanning and processing industries
Boot and shoe manufacture and repair
The leather goods manufacturing industry (other than boot and shoe manufacture and tanning)

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THE LUMBER AND SAWMILL INDUSTRIES (INCLUDING LOGGING)

VOL.: 25 (1981) (p. 49)

5. Summary of Data Reported and Evaluation

5.1 Summary of data

Information on the occurrence of cancer in lumber and sawmill workers is limited, and there are no cohort or detailed case-control studies involving sizeable numbers of cases in these specific occupations. The available epidemiological data are primarily from surveys of statements of occupation on death certificates.

The possibility that an increased risk of nasal tumours may exist for lumber or sawmill workers was suggested by British occupational mortality statistics, and in two case-control series using death certificate data in the US. A study in Australia found a higher frequency of lumber and sawmill employees among patients with adenocarcinomas than among patients with other nasal cancers. Each of these studies was based on small numbers of cases (five or less) with lumber-sawmill jobs; in none were detailed occupational histories obtained and in none was employment classification verified, so that the possibility of employment in the furniture-making industry at some time could not be excluded.

Lung cancer mortality was found to be low among lumber and sawmill workers in statistics from the US and England & Wales. Similar results were found in a study of lumber and sawmill workers who were members of an American carpenters' union. A death certificate review showed a three-fold excess of lung cancer among lumber, sawmill and forestry employees in rural, but not urban, areas of coastal Georgia in the US. None of these surveys took smoking habits into consideration.

A nearly three-fold increased risk of Hodgkin's disease was found among lumber and sawmill workers in a case-control comparison of statements of occupation on death certificates from upstate New York. No overall increased risk of Hodgkin's disease among persons occupationally exposed to 'wood and trees' was reported in a case-control study in Israel; however, an increased risk for the mixed-cellularity type of Hodgkin's disease was reported for afforestation and lumber workers. Another review of death certificates for patients with Hodgkin's disease in the US showed a 40% excess risk for all woodworkers, including lumber-sawmill workers. A 20% elevated risk for all lymphoproliferative and haematopoietic cancers combined was reported for lumber and sawmill workers who were members of the US carpenters' union. The mortality statistics for Washington state do not show elevated mortality ratios for Hodgkin's disease among sawyers or among miscellaneous woodworkers (including sawmill workers). In none of the above studies were more than 15 cases of Hodgkin's disease found among persons with lumber-sawmill jobs.

A suggestion of an increase in incidence of stomach cancer arises from the general trend of elevated mortality ratios for sawyers, lumbermen, loggers and related woodworking trades in the state and national occupational mortality series. The increases were in the order of 10-50%.

Increased risks of about six-fold of both histiocytic lymphomas and soft-tissue sarcomas associated with exposures to chlorophenols have been reported in Sweden. Although data relating risks to occupation were unavailable, most use of chlorophenols is in the sawmill industry.

The confusion between the two occupational groups - lumber and sawmill workers - might be a reason for the discrepancies among the epidemiological findings for different cancers in different countries at different times.

Definition of the occupational groups in the future should take into account that lumber and sawmill occupations are quite different from the point of view of exposure to dust and to chemicals. The description of the industrial processes given in the text shows that some of the chemicals used are those for which there is sufficient evidence of carcinogenicity in humans and/or in experimental animals (see Appendix 4, in this volume). Some of these chemicals are no longer used; however, some are still in use.

5.2 Evaluation

The epidemiological data are not sufficient to make a definite assessment of the carcinogenic risks of employment in the lumber and sawmill industries. Some studies suggest that the incidences of nasal cancers and Hodgkin's disease may be increased. It is not known whether some nasal cancer patients described as working in lumber and sawmill industries may have worked in furniture manufacturing. The hypothesized link to Hodgkin's disease is not adequately supported. Soft-tissue sarcomas and histiocytic lymphomas have been reported following exposures to chlorophenols; although the risk to sawmill and lumber workers was not quantified directly, the use pattern of chlorophenols suggests that sawmill workers in this study were at increased risk for both of these malignancies. Stomach cancer is slightly elevated among these occupational groups in six mortality series; however, this might be related to nonoccupational factors.

Subsequent evaluation: [Suppl. 7 \(1987\)](#)

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THE FURNITURE AND CABINET-MAKING INDUSTRY

VOL.: 25 (1981) (p. 99)

5. Summary of Data Reported and Evaluation

5.1 Summary of data

A number of studies are available on the relationship between nasal cancer, in particular nasal adenocarcinoma, and occupational exposure in the furniture and cabinet-making industry. An initial clinical report, pointing out the high frequency of furniture workers among nasal adenocarcinoma cases from High Wycombe (near Oxford), in England, has been followed by three epidemiological studies from the same country. In the first, an approximately twenty-fold increase in the incidence of nasal cancer has been observed in the southern part of the Oxford Hospital region, with three-quarters of the cases being represented by adenocarcinomas. In the second study, based on complete ascertainment of all cases of nasal cancer that occurred in a defined area around Oxford during a decade, a ten-fold excess risk of nasal cancer was observed for furniture workers, with 90% of the cases being adenocarcinomas (against about 10% among other occupations). The third study comprises all cases of nasal cancer registered in the whole of England and Wales (excluding the Oxford region) during a defined period, and shows an increased incidence of nasal adenocarcinoma (relative risk, about 100) among furniture workers. A smaller but still significant increase in relative risk was also found for nasal cancers other than adenocarcinomas.

Studies in other countries also show excesses of nasal cancers in furniture workers.

Less information is available with respect to other cancer risks. A death certificate survey in England and Wales showed a 30% increased incidence of lung cancer among cabinet-makers; this survey showed a decrease of a similar size for patternmakers. A SMR of 84 was seen in US mortality statistics for furniture-fixture occupations. A case-control study (involving interviews with next-of-kin of dead people) from Sweden reported a six-fold increased risk of lung cancer for furniture makers (based on four cases with the relevant exposure). The same study found a small, non-significantly increased risk for gastrointestinal cancers.

Of three studies (two from the US, one from England), which have examined the association between Hodgkin's disease and occupation in the furniture industry, none has shown an association.

There is evidence of a link between the occurrence of nasal cancers in furniture workers and the introduction of mechanized operations that produce high levels of wood dust. The English epidemiological study strongly suggests a linkage of these cancers with exposure to hardwood dusts. Nevertheless, case reports from France also relate to exposures that began in the 1950s when softwoods and exotic hardwoods came into use. One report suggests a linkage with exposure to plywood dust for some cases.

The description of the industrial process indicates the use of chemicals for which there is evidence of carcinogenicity in humans and/or experimental animals (see Appendix 4, in this volume). Some of these chemicals are no longer used, but others still are.

5.2 Evaluation

There is *sufficient evidence* that nasal adenocarcinomas have been caused by employment in the furniture-making industry. The excess risk occurs mainly among those exposed to wood dust. Although adenocarcinomas predominate, an increased risk of other nasal cancers among furniture workers is also suggested. One study showed an increased relative risk for lung cancer (based on four cases from one factory); however, mortality statistics have in general shown no increase in lung cancer. No evaluation of the risk of lung cancer is possible.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: [Suppl. 7 \(1987\)](#)

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CARPENTRY AND JOINERY

VOL.: 25 (1981) (p. 139)

5. Summary of Data Reported and Evaluation

5.1 Summary of data

An increased proportion of carpenters and joiners among nasal adenocarcinoma patients is reported from a case-control study from the UK comparing nasal adenocarcinoma with other types of nasal cancers and from two studies, one from Australia and one from Sweden, comparing series of cases of nasal adenocarcinoma with cases of other nasal cancers. In a cohort mortality study from Denmark, an increased risk for nasal cancer (any type) is reported for carpenters and cabinet-makers taken together; three of the four observed deaths occurred in workers in the latter category. No carpenter was recorded in a large Danish clinical series of patients with nasal adenocarcinomas. No cases of nasal cancer were observed among carpenters in an incidence study in the UK, which revealed a substantial number of nasal adenocarcinomas in furniture workers. No excess risk of nasal cancer (all types) for carpenters could be shown in two case-control studies, one from Canada and one from Finland.

A small elevation of relative risk for lung cancer among carpenters and joiners has been reported in one analysis of death certificates in the US, and in each of the three decennial analyses of occupational mortality reports in England and Wales. Two of these surveys also indicated an increased mortality for bladder cancer among carpenters and joiners. Four case-control studies (three from the US, one from Israel) on Hodgkin's disease show an increased risk for carpenters, limited in one study to one subcategory of the cases. An elevated risk is also reported in one analysis of occupational mortality from the US, but not in a similar study from England and Wales.

An increased risk for stomach cancer was observed in a Washington State occupational mortality analysis, but not in the data from England and Wales.

The term 'carpenter' is applied to completely different kinds of jobs in different countries: carpenters can be employed in occupations such as building, shipbuilding, metal factories and mining. Therefore, the exposure of this group of workers to chemicals and other materials varies widely and comprises a wide range of substances, for some of which there is evidence of carcinogenicity in humans and/or experimental animals (see Appendix 4, in this volume).

5.2 Evaluation

The epidemiological data are not sufficient to make a definitive assessment of the carcinogenic risks of employment as a carpenter or joiner. A number of studies, however, raise the possibility of an increased risk of Hodgkin's disease. There is conflicting evidence about an association between nasal adenocarcinoma and work as a carpenter. The highest level of relative risk reported is much lower than that for cabinet-makers and other woodworkers in the furniture industry, and much of the evidence is anecdotal; the possibility that the reported cases of nasal cancer had worked in these industries could not be ruled out. The evidence suggesting increased risks of lung, bladder and stomach cancer comes from large population-based occupational mortality statistical studies and is inadequate to allow an evaluation of risks for these tumours.

Subsequent evaluation: [Suppl. 7 \(1987\)](#)

THE PULP AND PAPER INDUSTRY

VOL.: 25 (1981) (p. 157)

5. Summary of Data Reported and Evaluation

5.1 Summary of data

Information on the cancer experience of paper and pulp mill workers is limited. Most of the studies that assess risk are based on reviews of death certificate information on occupation; few studies had occupational histories or information on potentially influential variables such as cigarette smoking, and none followed the cancer mortality or morbidity of a large cohort of workers.

A case-control study in New York state of death certificates of Hodgkin's disease showed a four-fold excess of this cancer associated with employment in the paper industry. A similar study in Washington state subsequently showed a two-fold increase of Hodgkin's disease, as well as smaller, but significant increases for other lymphomas, but not for leukaemia. Elevated lymphoma risks were also reported for both operatives and labourers in the paper and allied products industry in a large multi-tumour-site case-control study in New York state.

Lung cancer mortality rates among males were elevated in eastern, but not western, US counties with paper or pulp mills. Death certificate surveys of occupation likewise show inconsistent results, with significant increases among paper workers in three studies: one in the south-east US where an excess was seen in rural, but not urban areas, although workers were employed in industries in both areas; the second in a cross-sectional study where occupational data were missing for one-third of the cases; and the third in which a small increase was seen in a national survey of deaths by occupation throughout the US. Increases were not seen in two other studies, nor in a detailed interview survey in which occupational histories and information on cigarette smoking were obtained.

A large, multi-tumour-site case-control study in New York state reported a four-fold excess of laryngeal cancer linked to five or more years' employment in the paper industry; and a 50% elevated ratio for this cancer was observed among paper workers in the Washington state mortality statistics. Both studies involved small numbers of cases among paper workers: five and six, respectively. A four-fold excess of oral and pharyngeal cancer was also seen in the New York study; and in US counties with paper or pulp manufacturing industries there tended to be slightly elevated rates of oral and pharyngeal cancer mortality among males.

The description of the industrial processes shows that some of the chemicals used are those for which there is evidence of carcinogenicity in humans and/or experimental animals (see Appendix 4, in this volume). Although some of these chemicals are no longer used, others are still in use. The introduction of chlorination for treatment of effluents from pulping processes may cause transformation of molecular species to form carcinogenic and/or mutagenic chemicals.

5.2 Evaluation

The epidemiological data are not sufficient to make a definitive assessment of the carcinogenic risk of employment in the paper or pulp mill industries. Several studies suggest that an increased risk of lymphoproliferative neoplasms, particularly Hodgkin's disease and perhaps leukaemia, may be linked to employment in the paper and pulp industries.

Excesses of oral and pharyngeal and of laryngeal cancers were reported in two studies designed to generate hypotheses, and have not been evaluated in independent studies. There appears to be no moderate or large overall increased risk of lung cancer among paper workers. The excess risk of lung cancer observed in some subgroups of workers in two of the studies cannot be evaluated.

Subsequent evaluation: [Suppl. 7 \(1987\)](#)

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THE LEATHER TANNING AND PROCESSING INDUSTRIES

VOL.: 25 (1981) (p. 199)

5. Summary of Data Reported and Evaluation

5.1 Summary of data

There is only one case report of an adenocarcinoma of the nasal cavity occurring in a tanner. In a study in England and Wales covering the period 1961-1966, no leather tanners or processors were found among patients with adenocarcinomas or other types of nasal cancers. (See monograph on boot and shoe manufacture & repair.)

No data specifically related to laryngeal cancer in leather tanners and processors were available. In a large, multi-tumour-site case-control survey in New York state, the relative risk for developing laryngeal cancer associated with employment for more than five years in the leather industry was 5.5 (based on 6 cases).

SMRs for lung cancer in male tanners, leather dressers and curriers estimated from mortality statistics in England and Wales during the period 1921-1938 were in the order of 150. No excess was found in the study in England and Wales in 1961. SMRs for 'leather workers' in England and Wales in 1971 and for 'leather operatives' in the US were not significantly different from 100. However, in a cross-sectional study in Los Angeles in 1972-1973, the risk ratio for men engaged in 'leather-manufacturing and sales' was 1.72 ($p < 0.05$).

The SMR for bladder cancer in male tanners, leather dressers and curriers estimated from mortality statistics in England and Wales in the 1920s was 170. More recent reports listing SMRs for comparable occupational groups were not available to the Working Group.

An association between work in the leather trades and bladder cancer is suggested by three of four case-control studies. The one study among these that subclassified leather occupations shows that eight patients were engaged in 'preliminary' processes and tanning within the leather industry (relative risk, 1.5; not statistically significant).

No studies specifically related to lymphoma in leather tanners or processors were available. The SMR for 'leather workers' in England and Wales in 1971 was 184 for non-Hodgkin's lymphomas and 77 for Hodgkin's disease. In a large, multi-tumour-site case-control study in New York state, the relative risk for all lymphomas among 'leather workers' was 3.4 in men (based on 7 cases, $p < 0.05$) and 2.6 in women (based on 8 cases, $p < 0.05$).

In a large, multi-tumour-site case-control study in New York state, the relative risk for cancer of the oral cavity and pharynx among male 'leather workers' was 3.2 ($p < 0.01$, based on 18 cases). A correlation study in the US showed mortality rates for oral and pharyngeal cancer to be slightly elevated in counties with leather manufacturing industries.

Vital statistics from England and Wales and from the US suggest that death rates from renal cancer among 'leather workers' and 'employees in the leather industry' are about 1.6-2.3 times greater than those in the general population.

The SMR for cancer of the stomach in tanners in England and Wales in 1961 was 135 ($p < 0.05$). No data on comparable occupational groups in England and Wales at other periods or in other countries were available to the Working Group.

Inhalation of both chemical vapours and dust (including leather and hide dust) and dermal contact with these agents could occur simultaneously. For most workers, the degree and types of exposure depend upon their

specific occupation and work area within the tannery. For example, the unloading of a hide-processing drum may result in simultaneous contact with the chemical substances within the drum, by inhalation and dermal contact, and with the chemical dusts generated while recharging the drums. In the case of a tannery which incorporates all the processes of leather production, beamhouse workers may also be exposed to the organic vapours generated in the finishing department; however, their exposure to these agents may be lower than that of those employed within the finishing area. Workers in the buffing area are exposed to leather dust and to its burden of tanning chemicals, while those working in the hide receiving and sorting area are exposed to hide dust. Buffing area workers may also be exposed to solvent vapours from the finishing area; due to the proximity of the hide-sorting area to the beamhouse, hide sorters may also be exposed to beamhouse contaminants. The chemical complexity of the tanning process and the wide variety of finishing agents used will almost certainly result in worker exposure *via* inhalation and dermal contact to multiple and changing chemical pollutants.

The industry is moving towards greater automation and mechanization. However, in many plants wet hides are still handled manually throughout the manufacturing process. Some workers may subject their hands and arms to tanning chemicals both by handling wet hides and by direct exposure to the chemicals.

It must be emphasized that often more than one of the operations are carried out in the same work room, and this results in cross pollution. Furthermore, in some operations, the work load and elevated temperature and relative humidity may change the environmental exposure. These features of the industry make evaluation of individual exposures difficult.

Employment in tanneries may entail exposure to a number of chemicals for which there is evidence of carcinogenicity in humans and/or laboratory animals (see Appendix 5, in this volume).

5.2 Evaluation

Very few epidemiological studies or case reports deal specifically with workers engaged in leather tanning and processing. There is no evidence to suggest an association between leather tanning and nasal cancer. The suggested associations between employment in the leather industry (not further specified) and cancer of the lung, larynx, buccal cavity, pharynx, and kidney and lymphomas come from hypothesis-generating surveys. They do not refer specifically to workers in tanneries. A positive association between employment in the leather industry (not further specified) and bladder cancer is supported by a number of studies. The only study that dealt specifically with leather tanners, however, revealed a relative risk of 1.5, which is not statistically significant.

Subsequent evaluation: [Suppl. 7 \(1987\)](#)

BOOT AND SHOE MANUFACTURE AND REPAIR

VOL.: 25 (1981) (p. 249)

5. Summary of Data Reported and Evaluation

5.1 Summary of data

The incidence rates of nasal cancers in workers engaged in boot and shoe manufacture in Northamptonshire, UK, in the 1960s were more than ten times greater than those of the general population. The relative risks were in the order of 35-fold for adenocarcinomas and 4 for squamous-cell carcinomas. A study in Florence has confirmed the association between shoemaking and nasal adenocarcinoma. This is also supported by a number of case reports from other countries.

A UK case-control study (in which the occupational histories of patients with nasal adenocarcinomas were compared with those of patients with other nasal cancers) indicated a relative risk of about 8 associated with work in the leather industry. A substantial proportion of the cases had been engaged in shoe production or repair. In the Northamptonshire study, the elevated risk was confined almost entirely to workers in the preparation and finishing departments: work in these areas entailed cutting, trimming and sanding, which were the dustiest operations.

A substantial proportion of the nasal cancer patients described in the study in Florence were engaged in trimming.

No observations on laryngeal cancer specifically related to boot and shoe manufacturers were available. In a large, multi-tumour-site case-control survey in New York State, the relative risk for development of laryngeal cancer associated with employment for more than five years in the 'leather industry' was 5.5 (based on six cases).

In England and Wales in 1951, SMRs for lung cancer in factory and non-factory employed boot and shoemakers were 73 and 158, respectively ($p < 0.05$ for both); in 1961, the SMR for all shoemakers was 154 ($p < 0.05$). SMRs for lung cancer in footwear workers in the US and for shoemakers or repairers and leather workers in Washington State were slightly but not significantly elevated. In a cross-sectional study in Los Angeles in 1972-1973, the risk ratio for shoe repairers was 2.33 ($p < 0.05$, based on 7 cases).

None of these studies took smoking habits into consideration.

Increased risks of bladder cancer were found in death certificate surveys in The Netherlands in the 1930s (PMR = 170 for shoemakers) and in the US in 1950 (SMR = 288, based on 9 cases, for shoemakers and repairers). No increases were seen in the UK or in Washington State more recently.

An association between work in the leather industry and bladder cancer is supported by three (all in the US) of four case-control studies, with relative risks in the order of 2-6. In two of the studies, no distinction was made between shoemakers and other leather workers. In one of these, 8 of 16 cases among leather workers had worked in the same shoe manufacturing company, which also included a leather tannery. In a third study, with equal numbers of cases and controls, there were seven shoe repairers and one shoemaker among the cases, and one shoe repairer and two shoemakers among the controls.

SMRs for leukaemia in England and Wales in 1951 and in 1961 and the PMR in Washington State ranged between 131 and 186, all based on 7 to 8 deaths.

Series of cases of benzene haemopathies¹ among shoemakers have been described in Italy and in Turkey. Erythroleukaemia was particularly frequent in these groups. Benzene was a constituent of the adhesives, and

benzene levels were measured in some of the shoe factories in which leukaemia patients had worked. A study in Sweden showed 21 observed cases of leukaemia *versus* 13.5 expected. The association with benzene is further supported by a report suggesting that the occurrence of leukaemia in shoemakers has decreased following the replacement of benzene with petrol.

The PMR for lymphomas among shoemakers and repairers in Washington State was 40 (based on 2 deaths). In a large multi-tumour-site case-control study in New York State, the relative risk for workers in the leather industry was 3.4 in men (based on 7 cases, $p < 0.05$) and 2.6 in women (based on 8 cases, $p < 0.05$).

The PMR for cancer of the oral cavity and pharynx among shoemakers/'shoehands' in The Netherlands in the 1930s was 260 (based on 5 deaths). In a large, multi-tumour-site case-control study in New York State, the relative risk for shoemakers/shoe repairers was 3.6 ($p < 0.05$, based on 8 cases).

In England and Wales in 1951, SMRs for stomach cancer in factory- and non-factory-employed boot and shoemakers were 122 and 120, respectively; in 1961, the SMR for shoemakers was 106 and that for cutters in the footwear industry 135.

Handling of leather in boot and shoe manufacture may entail exposure to some of the chemicals used in the tanning and finishing processes and to other chemicals for which there is evidence of carcinogenicity in humans and/or experimental animals (see Appendix 5, in this volume).

5.2 Evaluation

Employment in the boot and shoe industry is causally associated with the development of nasal adenocarcinomas; and relative risks well in excess of 10-fold have been reported in England and in Italy. It is most likely that exposure to leather dust plays a role in the association. There is also evidence that an increased risk may exist for other types of nasal cancers for employment in boot and shoe repairing shops.

There is evidence of an increased risk of bladder cancer associated with employment in the leather industry. Although boot and shoemakers were included in these studies, it is not possible to determine whether the risk relates to them in particular or to other occupational subgroups.

The occurrence of leukaemia and aplastic anaemia among shoemakers exposed to benzene is well documented (see also IARC, 1974).

Hypothesis-generating surveys have suggested associations between boot and shoe manufacture/repair and cancer of the lung, oral cavity and pharynx and stomach. The same surveys have suggested associations between work in the leather industry (occupation not further specified) and cancer of the larynx and lymphoma. Most of these associations were positive. In view of the design of the pertinent studies these findings cannot be evaluated.

¹Benzene-associated haemopathies include pancytopenia, erythroleukaemia and leukaemia.

Subsequent evaluation: [Suppl. 7 \(1987\)](#)

The LEATHER GOODS MANUFACTURING INDUSTRY (OTHER THAN BOOT AND SHOE MANUFACTURE AND TANNING)

VOL.: 25 (1981) (p. 279)

5. Summary of Data Reported and Evaluation

5.1 Summary of data

There have been a few case reports of nasal carcinomas among leather-goods manufacturers other than boot and shoemakers.

No observations on laryngeal cancer specifically related to leather-goods manufacturers other than boot and shoe manufacturers and tanners were available. In a large, multi-tumour-site study in New York State, the relative risk for laryngeal cancer associated with employment for more than five years in the leather industry (not further specified) was 5.5 (based on 6 cases).

No observations on lung cancer specifically related to 'other' leather goods manufacturers were available. The SMR for leather workers in England and Wales in 1971 was 104; SMRs for 'operatives, leather' and for 'leather except footwear' in the US were 103 (based on 37 cases) and 140 (based on 28 cases), respectively. In a cross-sectional study in Los Angeles in 1972-1973, the risk ratio for men engaged in 'leather manufacturing and sales' was 1.72 ($p < 0.05$). No information on smoking habits was given in these studies.

No observations on bladder cancer specifically related to leather-goods manufacturers other than boot and shoe manufacturers and tanners were available. In England and Wales, SMRs for 'leather workers' in 1961 and for 'leather' in 1971 were 122 (based on 8 cases) and 151, respectively. An association between work in the leather trades and bladder cancer is suggested by three of four case-control studies. In the one study among these in which occupations were reported by cases and controls, one of the 12 cases (a pocket-book maker) and three controls had been engaged in the production of 'other' leather goods.

No observations on lymphoma specifically related to leather goods manufacturers other than boot and shoe manufactures and tanners were available. The SMR for 'leather workers' in England and Wales in 1971 was 184 for non-Hodgkin's lymphomas and 77 for Hodgkin's disease. In a large, multi-tumour-site case-control study in New York State, the relative risk for all lymphomas for 'leather workers' was 3.4 in men (based on 7 cases; $p < 0.05$) and 2.6 in women (based on 8 cases; $p < 0.05$).

A number of cases of pancytopenia, erythroleukaemia and leukaemia have been observed among workers exposed to benzene during the manufacture of leather goods other than shoes and boots in Turkey and Italy.

The SMR for leukaemia for 'leather workers' in England and Wales in 1971 was 119, and that for 'operatives, leather' in the US was 73 (based on 6 cases).

No studies of other cancers specifically related to 'other' leather goods manufacturers are available. In a large, multi-tumour-site case-control study in New York State the relative risk for cancer of the oral cavity and pharynx for male 'leather workers' was 3.2 (based on 18 cases; $p < 0.01$). A correlation study in the US reported that mortality rates for cancer of the oral cavity and pharynx were slightly elevated in counties with leather manufacturing industries.

Vital statistics in England and Wales and the US suggest that death rates from renal cancers among 'leather workers' and 'employees in the leather industry' are greater than in the general population.

In addition to benzene, employment in the production and handling of leather goods (other than boots and shoes and tanning) may entail exposure to a number of chemicals for which there is evidence of

carcinogenicity in humans and/or laboratory animals (see Appendix 5, in this volume).

5.2 Evaluation

There are a few reports of cases of leukaemia following exposure to benzene (a known human carcinogen, see IARC, 1974) in the manufacture of leather goods other than boots and shoes or in tanning. The few cases of nasal cancers reported are insufficient to make an association with employment in the manufacture of leather goods (other than boots and shoes or tanning).

A positive association between employment in the leather industry (not further specified) with bladder cancer is supported by a number of studies; but the specific role of the production of leather goods (other than boots and shoes or tanning) cannot be evaluated. The suggested associations between employment in the leather industry (not further specified) and cancer of the lung, larynx, oral cavity and pharynx, kidney and lymphomas come from hypothesis-generating surveys. They do not refer specifically to workers engaged in the production of leather goods (other than boots and shoes or tanning).

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