Cancer mortality among leather tanners

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ABSTRACT Workers were studied at a tannery that operated from 1873 to 1960, once one of the biggest in Scandinavia. The results show a slight numerical increase of deaths from cancer of the stomach and a significant, threefold excess mortality from cancer of the pancreas. Even in view of critical questions about validity it seems likely that this excess might be related to exposure to chemicals in tannery work.

Work in tanneries may entail exposure to several chemicals for which there is evidence of carcinogenicity in people or laboratory animals or both.¹ Some surveys have suggested an association between working in leather industries and cancer of the lung, larynx, buccal cavity, pharynx, bladder, and lymphomas¹ and cancer of the kidney.^{1,2} A study dealing specifically with leather tanners and bladder cancer, however, showed no significantly increased risk of this disorder.³ Recently Pippard *et al* reported a study of the mortality of tanners in which no significant excess mortality was found for any of the common sites of cancer (stomach, large intestine, rectum, lung, prostate and bladder).⁴ In the light of the inconsistency between the various studies further information seems to be needed, and the present study was carried out on workers at a tannery in the south east of Sweden. The company had been in operation from 1873 to 1960, and in the 1940s it was one of the biggest in Scandinavia, with more than 600 people employed, producing mainly leather for shoe uppers. No other sizable industry operated in the area, most people being farmers or forestry workers or employed in associated services.

The tanning operations were primarily carried out manually, but became more and more mechanised. The main method was chrome tanning, which was introduced at the beginning of the century but vegetable tanning also took place. Chrome tanning entailed exposure to trivalent and hexavalent chromium compounds and vegetable tanning to European chestnut, oak, and red quebracho. Some exposure to fungicides, especially chlorophenols, is also likely to have occurred as well, but the extent of the exposure is not known exactly. Nor are there any quantitative data available from hygienic measurements.

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Accepted 4 November 1985

Materials and methods

The local register of deaths and burials, covering all people in the parish where the tannery was located, was used as the source of subjects for this study focusing on cancer deaths. Since cancer is rare in the younger age groups, the study was restricted to include only men aged 45 or more. This also allowed for a latent period thus increasing the likelihood of demonstrating a possible effect from long term occupational exposure.

The study period was 1951-79 and the estimated background population for the parish was based on the average of the censuses from 1960, 1965, 1970, and 1975. Causes of death were classified in accordance with the 8th revision of the International Classification of Disease (ICD 1965). According to the principles for classification, only the underlying cause of death was considered for each individual.

A first need was an age stratified evaluation of the mortality in the parish, comparing the mortality pattern for different cancer sites in the parish with that of the national figures of mortality as based on the official statistics of Sweden. To evaluate a possible relation between tanning and certain cancers, a set of case-referent comparisons were also undertaken. Cases were those who had died from cancers of the buccal cavity and pharynx (ICD 140-149), stomach (ICD 151), pancreas (ICD 157), respiratory system (ICD 160-163), kidney and bladder (ICD 188-189), and lymphomas (ICD 200-202) during the study period. Referents were taken as all people who had died from causes other than cancer during the same period.

The occupational title, as given in the register of deaths and burials, was used as an exposure criterion. Thus people with a title of "tanner" or "tannery worker" were classified as exposed and all others were considered as unexposed.

Various rate ratios, confidence intervals, and p val-

Table 1 Case-referent analysis of deaths from cancer of the stomach (ICD 151). Referents are people who died from causes other than cancer. Exposure is taken as the occupational title of "tanner" and "tannery worker"

Age (years)	Cases-referents	Non-exposed	Exposed
45-64	C	2	1
	R	85	9
65-74	C	8	2
	R	101	20
≥75		9	3
		202	47
Total	C	19	6
	R	388	76
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CRR (Crude rate ratio)		1	1.6
SMR (Standard mortality rate)		1	1.5
Mantel-Haenszel χ^2		0.9	
Mantel-Haenszel rate ratio			1.6
point estimate			
95% Confidence interval			(0.6-4.0)

ues were calculated according to the methods described by Miettinen⁵⁻⁷ and Mantel and Haenszel.⁸

Results

The register of deaths and burials showed that 597 men aged 45 or more had died in the parish during the study period 1951-79 compared with an expected number of 587. There was no significant difference between the observed and expected number of deaths for all cancers (ICD 140-209) in the parish, but there appeared a slight numerical excess of deaths due to cancer of the stomach and a significantly raised mortality from cancer of the pancreas with 14 cases against 5.6 expected, a risk ratio of 2.5 ($p < 0.005$).

The case-referent analyses, focusing specifically on the tannery workers, showed no excess risks for cancer in total or with regard to a number of cancer sites such as buccal cavity, pharynx, lung, kidney, bladder, or lymphomas. Cancer of the stomach was slightly increased, however, the Mantel-Haenszel point estimate amounting to 1.6 with a 95% confidence interval of 0.6-4.0 (table 1). For cancer of the pancreas the Mantel-Haenszel point estimate was 3.1 with a 95% confidence interval of 1.1-9.2 (table 2).

Discussion

The results of this study tend generally to confirm those of Pippard *et al*;⁴ the earlier association reported between employment in the leather industries and certain types of cancers was not found. The finding of a statistically significant increase of pancreatic cancer together with a tendency towards an

excess of stomach cancer, however, require some consideration with respect to its validity.

The acquisition of cases and referents from the parish register could be thought not to be entirely satisfactory due to the incompleteness of such registers. The register of deaths and burials in the parish, however, contained fairly complete information about the diagnoses as transferred from the death certificates; we have also found the quality of the local registers in many other similar studies satisfactory. The use of the occupational title as an exposure criterion might also be criticised for being too insensitive, but tanner and tannery worker are rather specific titles and would certainly indicate an involvement in the tanning process. Therefore, the risk of overestimating the number of exposed people is probably low, but indeed the problem might rather be of an underestimate to the numbers exposed. Since the study period was extended through 1979-19 years after the close down of the factory—some tanners might have obtained new jobs and, consequently, would have died with other occupational titles, thereby being classified as non-exposed instead of exposed. This would lead to conservative risk estimates, given an effect of exposure as noted in this study.

In recent years there has been a rapid increase in the incidence of pancreatic cancer in many countries but the specific aetiology remains obscure. Several environmental factors have been associated with pancreatic cancer including occupational carcinogens, dietary factors, and smoking. The tanners had been exposed to chromium, a recognised carcinogen,⁹ although such an exposure has not been specifically thought of as causing gastrointestinal cancers. Exposure to chlorophenols is likely to have occurred and chlorophenols might be associated with sarcoma of the stomach (Hardell, personal communication),

Table 2 Case-referent analysis of deaths from cancer of the pancreas (ICD 157). Referents are people who died from causes other than cancer. Exposure is taken as the occupational title of "tanner" and "tannery worker"

Age (years)	Cases-referents	Non-exposed	Exposed
45-64	C	3	1
	R	85	9
65-74	C	3	2
	R	101	20
≥75	C	3	2
	R	202	47
Total	C	9	5
	R	388	76
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CRR (Crude rate ratio)		1	2.8
SMR (Standardised mortality ratio)		1	3.1
Mantel-Haenszel χ^2		4.2	
Mantel-Haenszel rate ratio			3.1
point estimate			
95% Confidence interval			(1.1-9.2)

which would be classified as neoplasma ventriculi, ICD 151. Cancers of the stomach and pancreas have been associated with dietary factors^{10 11} and although there is no particular reason to believe that the standard of living and diet would have differed to any great extent between the tanners and other people in the parish, such a difference cannot be entirely ruled out. Tobacco smoking might also play a part in the production of pancreatic cancer,¹² but in the present study there was no excess risk for other smoking related cancers, especially lung cancer, which seems to imply that the smoking habits of the tannery workers were unexceptional and no explanation for the increased risk of pancreas cancer. A considerable difference in smoking habits between the exposed and unexposed is needed to result in an overmortality of about twice or more, even when the association is much stronger than for smoking and pancreatic cancer, for lung cancer, for example.¹³

When studying several cancer sites statistically, there is always the possibility of mass significance—that is, the increased risk of pancreatic cancer in the parish could be a chance finding. Only additional studies of similarly exposed populations will determine whether or not the association found is a true health hazard for tannery workers and others with similar exposures.

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