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Cancer incidence in the rubber industry in Norway

by Tor Norseth, MD, PhD,¹ Aage Andersen,² Jens Giltvedt, MD

NORSETH T, ANDERSEN A, GILTVEDT J. Cancer incidence in the rubber industry in Norway. *Scand j work environ health* 9 (1983): suppl 2, 69-71. Cancer incidence was studied among 2,448 male rubber workers employed for 18 months or more with at least eight years of observation time. A suggested increased risk of bladder cancer, lymphoma, and leukemia was found in the footwear department; the number of observed to expected cases was 4/2.81, 5/2.26, and 4/1.76, respectively. An unexpected increased risk of pancreatic cancer was found for the maintenance-workshop department, the observed to expected numbers being 6/0.90.

Key terms: bladder cases, leukemia, pancreatic cancer.

From data of the Norwegian Cancer Registry, the incidence of cancer has been studied in a Norwegian rubber footwear and tire plant. The Cancer Registry has information on all new cases of cancer in Norway since 1953. All cases are reported to the Registry from hospitals and pathological laboratories in all areas of the country. The Central Bureau of Statistics provides information about the cause of death of all deceased persons in the country.

Subjects and methods

The footwear and tire plant in question is located in a rural district in Norway and was established in 1923. It has both male and female workers. For the analysis, the plant supplied lists of presumably all workers who were employed in the plant in 1940 or had started work after this time. Records were not available for workers which left the plant before

1940. This lack of information may lead to an underestimation of the cancer risk of employees who started work prior to 1940. All employees still alive at the beginning of 1953 have been under observation from then on. They have been followed until death or, if still alive, until the end of 1978. It is difficult to follow female cohorts in Norway because females generally change their surname at marriage. This study is therefore based on a cohort of 2,448 men with at least 18 months of employment as shown in table 1. As seen from the table, only three workers were lost to the follow-up.

Results

Table 2 shows the observed and expected number of cases for selected cancer

Table 1. The total cohort and the number of employees (males) in the cohort divisions used in the study.

Cohort division	Number
Total employed in 1940 or later	3,179
Employed after 1970	398
Employed < 18 months	317
Dead before 1953	13
Unknown	3
Included in the cohort	2,448

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Table 2. Selected cancer forms in the rubber industry for the period 1953–1979.

Cancer form	Observed	Expected
Stomach	12	19.24
Large intestine	12	10.25
Rectum	9	6.66
Pancreas	7	5.85
Lungs	15	18.03
Prostate	23	20.87
Bladder	7	7.74
Nervous system	5	4.23
Lymphoma	8	5.64
Leukemia	9	4.70
All others	30	42.32
Total	137	145.53

Table 3. Lung cancer in different departments of the footwear and tire plant.

Department	Number of workers	Observed	Expected
Footwear	1,017	4	6.70
Tire	443	3	3.01
Workshop	272	1	2.35
Rubber treatment	233	2	2.83
Other	483	5	3.14
Total	2,448	15	18.03

Table 4. Bladder cancer in different departments of the footwear and tire plant.

Department	Number of workers	Observed	Expected
Footwear	1,017	4	2.81
Tire	443	2	1.26
Workshop	272	—	1.09
Rubber treatment	233	1	1.23
Other	483	—	1.35
Total	2,488	7	7.74

Table 5. Pancreatic cancer in different departments of the footwear and tire plant.

Department	Number of workers	Observed	Expected
Footwear	1,017	1	2.08
Tire	443	—	0.94
Workshop	272	6	0.90
Rubber treatment	233	—	0.98
Other	483	—	0.95
Total	2,448	7	5.85

forms in the cohort. The expected number of cancers was obtained by calculation of the risk of getting cancer for each worker separately for each calendar year

of the observation period. This procedure was carried out with the use of the age-specific incidence rates of cancer. The total number of cancers in the group was 137 with an expected number of 145.53. A possible increased risk was noted only for leukemia, there being nine observed cases against the 4.70 cases expected.

The relative cancer risk was also analyzed by department. Each worker was allocated to the department where he had been working for the longest period. Table 3 shows no increased risk for lung cancer in the footwear, tire, workshop, maintenance, rubber treatment, or "other" departments. Four of the total seven cases of bladder cancer were observed in the footwear department against 2.81 cases expected (table 4).

Surprisingly the number of pancreatic cancers in the workshop/maintenance department was significantly higher than the expected number, 6 observed against 0.90 expected (table 5). Maintenance workers may often have high exposures to a variety of substances. A detailed examination of the work history of our cases did not indicate any common or predominant exposure pattern however. All workers with pancreatic cancer had started work in the plant before 1955, but no dose-response was found between the date of appointment or the exposure time and risk of cancer.

A closer look at the suggested increased risk of leukemia revealed that cases were found in almost all departments (table 6). There was a predominance of acute leukemia; of the total cases, four were classified as polynuclear, three as lymphocytic, one as monocytic, and two were without cell type classification. All workers with leukemia started to work prior to 1955, and the latency period from the start of employment until the diagnosis of cancer varied from 2 to 43 years (mean 26 years). No dose-response relationship was found between the date of employment or exposure time and the risk of cancer.

A suggested risk of lymphoma was found in the footwear department (table 6). There were three cases of Hodgkin's disease, one reticulosarcoma, one giant follicular cell lymphoma, one case of mucosis fungoides, and two unclassified cases.

Table 6. Lymphoma and leukemia in different departments of the footwear and tire paint.

Department	Number of workers	Lymphoma		Leukemia	
		Observed	Expected	Observed	Expected
Footwear	1,017	5	2.26	4	1.76
Tire	443	1	0.93	—	0.75
Workshop	272	—	0.70	2	0.69
Rubber treatment	233	—	0.73	2	0.71
Other	483	2	1.02	1	0.79
Total	2,448	8	5.64	9	4.70

Discussion

A benzene-based glue was used in the footwear department up to 1940 and possibly in small amounts a few years thereafter. During the period 1940 to 1975 a glue based on benzene with up to 4 % aromatics, probably predominantly benzene, was used. Six of the nine workers with leukemia have a documented glue exposure, as have six of the eight workers with lymphoma and the one worker with pancreatic cancer which was not classified to the workshop/maintenance department. Only three of the workers with lymphoma or leukemia had, however, worked in the plant prior to 1940. The

frequency of glue exposure within the noncases is not known.

The present results support previous reports of an increased cancer risk in the rubber footwear and tire industry. The increased risk is probably related to the use of glue in the rubber footwear department. Benzene has been widely used in this glue, but most of our cancer cases started to work in the plant after such glue had been removed. We think, however, that also glue based on benzene with small amounts of benzene (up to 4 %) may constitute an increased risk. Further studies are necessary to evaluate the significance of the demonstrated increased risk of pancreatic cancer.