

Occupational cancer in Denmark

Cancer incidence in the 1970 census population

by

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PREFACE

The cancer incidence of the persons in the age range of 20—64 years at the time of the 1970 census has been followed for a ten-year period. The linked register from which these data were taken includes information on 115 000 cancer cases diagnosed among 2.8 million persons. The cancer incidence has been tabulated for 32 socioeconomic groups and 492 occupational groups, for all malignant neoplasms, and for 47 cancer sites.

In this report reference is made to appendices on the variables in the data set, economic status, occupational classification, industrial classification, socioeconomic classification, detailed groups defined by combination of occupational code and industrial code, and diagnostic groups and to a set of tables presenting the number of persons in the 1970 census by sex, five-year age group, and social group; cancer incidence for 1970—1980 by sex, site, and social group; observed versus expected numbers of cancer cases for detailed occupational groups; and detailed occupational groups at high risk of different types of cancer for the men and women separately. These appendices and tables are not included in this supplement of the *Scandinavian Journal of Work, Environment & Health* but are available on a computer diskette (in ASCII format) from the authors upon request.

We are indebted to Mr E Kanstrup, Mr K Søndergaard, Mr B Hansen, and Mr N Christensen for their assistance with the data processing, to Dr H Vang Jørgensen for his translation of the classifications, and to Ms L Buddig for her editing of the tables. The data processing took place in Danmarks Statistik, and the study was financially supported by the Danish Cancer Society.

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SURVEILLANCE SYSTEMS FOR OCCUPATIONAL CANCER

The potential for using death certificate data for the surveillance of occupational hazards was envisioned more than 100 years ago when the first occupational mortality statistics were published for England & Wales (1). In the decennial supplements, mortality rates for occupational groups have been calculated from the number of deaths, obtained from death certificates, and the size of the population, obtained from census data (2). The study approach used in the decennial supplement has only been followed to a limited extent in other countries. Three additional types of surveillance systems have, however, been developed during the last 10 years. First, studies have been published on the basis of linkage of individual records from censuses, death certificates, and cancer registries in the Nordic countries (3–19) and in England & Wales (20, 21) and Canada (22). Second, proportional analyses have been made of death certificates and cancer registrations coded with occupational information from states within the United States (23–30) and from New Zealand (31, 32). Third, large-scale case-referent studies based on interviews with cancer patients have been undertaken in the United States (33, 34) and in Canada (35). Examples of these surveillance systems are listed in table 1.

Limitations and potentials of surveillance systems

The classic occupational carcinogens were identified mainly by alert clinicians, and the decennial supplements never became a source for the generation of clues on carcinogens.

The inconsistencies that may exist between death certificates and census tabulations limited the emphasis that could be given to unexpected observations, and, as long as the decennial supplement was the only surveillance system, the possibility of an observed excess risk being generated purely by chance could not be ruled out before data were available from in-depth studies. It is interesting that an excess risk of oral and pharyngeal cancer among textile workers, one of the few leads followed-up (36), was observed in tabulations based on proportional analysis (37). A subsequent case-referent study did not in general confirm this observation (38). Finally, the decennial supplements showed a steep social gradient in overall mortality, and this social gradient directed action more towards general social policy than towards the identification of specific carcinogens.

Occupational carcinogens identified from clinical observations are mainly those causing rare types of

tumors (eg, mesothelioma, nasal cancer, liver angiosarcoma). Clusters of these diseases have occurred in communities where the specific occupational risk factors are common. Surveillance systems on occupational mortality and morbidity, on the other hand, also provide the potential for identifying moderately elevated risks of more frequent types of tumors among occupational groups spread throughout the country. The generation of clues from surveillance systems has been called “automatized case reports” (39). The numerator-denominator problem is overcome in data files based on individual record linkage, and the availability of several independent surveillance systems makes it possible, through the comparison of results from different data sets, to rule out excess risks generated by chance.

Data from surveillance systems have been used in recent years to delineate the cancer pattern of several occupational groups. Examples from the Nordic countries are cancer incidence among farmers (40), cancer incidence among workers in the electronics industry (41), cancer incidence among persons with sedentary work (42), and the occupational distribution of biliary tract cancer in Sweden (43). The registers have been used, for example, for identifying cancers of affluence in Finland (44) and for describing cancer among waiters in Norway (6) and among chimney sweeps in Denmark (45). Studies across the Nordic countries have been made on lung cancer in occupational groups with potential exposure to silica dust (46) and on bladder cancer among hairdressers (47).

The validity of observations from surveillance systems may, however, still be questioned, as data on specific exposures are not available, data on confounding factors are not available, the occupational information in the source material may be inaccurate, the occupation may be known only at one point in time, and the system may suffer from various methodological weaknesses depending on the source material. The large quantity of data in the surveillance systems are, however, useful libraries for controlling for suspected associations and for searching for previously unknown associations. Studies of butchers and electrical workers may illustrate the potential of surveillance systems for the generation and initial follow-up of clues to occupational cancer.

Butchers

An excess risk of lung cancer among butchers was found in Denmark (48), England & Wales, and Sweden (49). Butchers also had an excess risk from lung can-

cer in England & Wales in earlier years (50). Supportive evidence came from surveys in Hamburg (51) and Baltimore (52), but not from the proportional mortality data from Washington State (53) or from the case-referent study made by the Roswell Park Memorial Institute (54). Updated data from Denmark and Sweden confirmed previous observations. The excess risk in Sweden was only partly explained by an above-average tobacco consumption among butchers (55), and the excess risk in Denmark was concentrated among butchers employed in this job for many years (56).

Three in-depth studies of lung cancer among butchers have been published later. A cohort study of members of the Baltimore's Meatcutter Union (57–59) showed an excess risk of lung cancer among white women working in meat-packing plants, grocery

stores/supermarkets, and chicken slaughtering plants. Fumes emitted during the wrapping of meat was hypothesized as a possible explanation (57).

Combustion products from meat smoking was hypothesized as a possible explanation for the excess risk of lung cancer among butchers in Sweden. Most workers in the meat industry had, however, performed several types of work, and a nested case-referent study in the cohort did not show smokehouse operation to be associated with an excess risk of lung cancer (60).

A cohort of workers from two bacon factories and a chain of slaughtering houses and meat distribution centers in England showed a standardized mortality ratio (SMR) for lung cancer of 133 for all workers and 184 for the subgroup of workers who worked with warm meat. Infection by an oncogenic virus was hypothesized as a possible explanation (61).

Table 1. Selected systems for the surveillance of occupational cancer.

Country	Study	Period	Method ^a	Cancer cases/deaths	Reference
United Kingdom	Decennial supplement for England and Wales	1979–1980 & 1982–1983	UDC	148 000	Office of Population Censuses and Surveys (2)
New Zealand	Cancer mortality in New Zealand	1974–1978	UDC	5 000	Pearce & Howard (31)
United States	Washington State	1950–1979	DP	455 000 ^b	Milham (24)
United States	Rhode Island	1973–1978	DP	51 000 ^b	Kelley & Gute (25)
United States	State of California	1959–1961	DP	199 000	Petersen & Milham (26)
United States	Massachusetts	1971–1973	DP	17 000	Dubrow & Wegman (27)
United States	Los Angeles County Cancer Surveillance Program	1972–1974	CP	60 000	Mack (30)
New Zealand	New Zealand Cancer Registry	1979–1983	CP	2 700 ^c	Pearce et al (32)
Denmark	Pension scheme data for cancer patients	1970–1979	LCP	94 000	Olsen & Jensen (16)
United States	Roswell Park Memorial Institute	1956–1965	ICC	14 000	Decoufle & Stanislawczyk (33)
United States	Third National Cancer Survey	1969–1971	ICC	7 500	Williams et al (34)
Canada	Case-referent study in Montreal	1979–1985	ICC	4 600	Siemiatycki et al (35)
Norway	Occupational mortality	1970–1980	LDC	27 000	Borgan & Kristofersen (5)
Sweden	Occupational mortality	1961–1970	LDC	120 000	Statistiska Centralbyrån (7)
Finland	Occupational mortality	1971–1980	LDC	20 000	Marin (11)
Denmark	Occupational mortality	1970–1980	LDC	60 000	Andersen (15)
Canada	Ten percent sample of labor force	1965–1973	LDC	4 200	Howe & Lindsay (22)
United Kingdom	Longitudinal mortality study	1971–1975	LDC	5 000 ^b	Fox & Goldblatt (20)
Norway	Cancer incidence by occupation	1961–1984	LCC	163 000	Andersen et al (6)
Sweden	Cancer environment register	1961–1979	LCC	605 000	Cancer-Miljöregistret-Nämnden (9)
Finland	Cancer incidence by occupation	1971–1980	LCC	39 000	Pukkala (13)
Denmark	Occupational cancer study	1970–1980	LCC	115 000	Lynge & Thygesen (17)
United Kingdom	Longitudinal cancer study	1971–1975	LCC	8 000	Leon (21)
Denmark	Occupational hospital discharge	1981–1984	LHC	2 106 000 ^d	Tüchsen & Bach (18)

^a UDC = unlinked death certificate and census data (mortality rates), DP = death certificate data (proportionate mortality analysis), CP = cancer registry data (proportionate incidence analysis or case-referent analysis), LCP = linked cancer registry and pension scheme data (proportional incidence analysis), ICC = interview data (case-referent analysis), LDC = linked death certificate and census data (mortality rates), LCC = linked cancer registry and census data (incidence rates).

^b All deaths.

^c Only leukemia and controls.

^d All hospital discharges.

Electrical workers

Workers exposed to electrical and magnetic fields were noticed to have an excess risk of acute leukemia in Washington State during the period 1950–1979 (62). Supportive evidence came from the Cancer Surveillance Program in Los Angeles County (63), and the risk estimates were higher for acute myeloid leukemia. Mortality data from England & Wales for 1970–1972 showed no excess of acute myeloid leukemia for all electrical occupations, but high risks were observed for several subgroups. A case-referent study based on death certificates from 1973 allowed use of a more appropriate occupational classification and showed an overall relative risk (RR) of 2.3 (64). Data from the South Thames Cancer Register showed a proportionate ratio of 117 for all leukemia in 10 electrical occupations (65). An excess risk of leukemia, and in particular of acute myeloid leukemia, was found among amateur radio operators in Washington State and California (66, 67). Data from the New Zealand Cancer Register showed an odds ratio (OR) of 1.6 for leukemia among electrical workers (68, 69). The leukemia mortality was not elevated among electrical occupations in Wisconsin, and only slightly so for acute leukemia (70). There was no excess risk of leukemia among telephone operators (71), electrical engineers (72), and power linesmen and station operators (73) in Sweden, but an excess risk was found for electrical workers in a case-referent study on acute myeloid leukemia in Sweden (74). An analysis of death certificates in 16 states in the United States showed an odds ratio of 0.9 for all leukemia among electrical workers, and the same for acute myeloid leukemia. An excess risk was found in some occupational subgroups (75). An excess risk of leukemia has been found among long-time underground coal miners (76), welders (77), and naval shipyard electricians and welders (78) in the United States.

The combined data on leukemia in electrical occupations point to a weak association between electrical work and all leukemia (RR 1.18) and to a somewhat stronger association between electrical work and acute myeloid leukemia (RR 1.46) (79). In-depth studies on leukemia among electrical workers are in progress in several countries (80).

Danish surveillance systems

The existence of personal identification numbers in the Nordic countries facilitates individual record linkage on a national scale, and it is possible to construct cross-linked data files on occupational mortality and morbidity. Four nationwide surveillance systems on occupational cancer have been set up in Denmark. First, the cohort of persons aged 20–64 years at the time of the 1970 census has been followed for deaths and emigrations for a ten-year period, and the cancer mortality has been tabulated by occupation and industry (14, 15). Second, cancer patients notified in 1970–1979 have been searched for in the computerized files of the public supplementary pension fund for information on previous employer, and the linked data have been analyzed by industry on a proportional basis (16). Third, the cohort of persons aged 20–64 years at the time of the 1970 census has been followed also for cancer cases for a 10-year period, and the cancer incidence has been tabulated by occupation and industry (17). Fourth, the cohort of persons aged 15–64 years on 1 January 1981 and economically active in 1980 has been followed for hospital discharges in a four-year period, and discharge rates will be tabulated by occupational groups (18).

The cohort study on the cancer incidence of the 1970 census population is presented in this supplement.