Short Communication

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Non-Hodgkin’s lymphomas and occupation in Sweden

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Abstract Objectives: To investigate whether there is a risk excess of non-Hodgkin’s lymphoma among Swedish workers associated with particular occupations. Methods: The base population was made up of Swedish men (1,779,646) and women (1,101,669) who were gainfully employed at the time of the 1970 census, had also been present in the 1960 census and were still alive and older than 24 years as of 1 January, 1971. They were followed up for 19 years until the end of 1989. Age-period standardised incidence ratios were computed in a dataset linking cancer diagnoses from the Swedish national cancer register to occupational and demographic data obtained in the census of 1970. Log-linear Poisson models were fitted, allowing for geographical area. Risk estimators per occupation were also computed for workers reporting the same occupation in 1960 and 1970, a more specifically exposed group. Results: There were 7,610 non-Hodgkin’s lymphomas reported in the study cohort, 5,391 cases in men and 2,219 in women. A relative risk of over 1.20 and statistically significant was observed in men among accountants and auditors, secretaries and typists, auctionists, non-specified rail and road transport workers, telecommunications traffic officers, telegraph and radio operators, photographic-laboratory workers and other production and related work. The risk excess was confirmed in men with the same occupation in both censuses. In women, only three occupations achieved statistical significance: metal platers and coaters, truck and conveyor operators and store and warehouse workers. Conclusions: The risk excess observed in telecommunication and transport workers could be explained by electromagnetic radiation exposure. We did not find a risk excess in agricultural occupations, that has been largely documented by other study groups.

Key words Non-Hodgkin’s lymphoma · Occupation

Introduction

Non-Hodgkin’s lymphomas (NHL) are a heterogeneous collection of lympho-proliferative malignancies with different behaviours and responses to treatment.

There is no consensus about the causes of the dramatic rise in the incidence rates during the past years. Improvements in diagnostic techniques, changes in disease classification and the upsurge of AIDS-related lymphomas account for only a small percentage of the increase (Palackdharry 1994).

In general, rates for NHL are positively related to socio-economic level and are more frequent among occupations held by people in high social classes (Pearce and Bethwaite 1992; Pollán and Gustavsson 1999).

NHL have also been associated with exposure to phenoxy herbicides (Hardell and Eriksson 1999), chlorinated phenols (Rothman et al. 1997), and dioxins during the manufacturing process or after accidental exposure. A high risk has been found in farmers and other agricultural workers, although other potential risk factors, such as other agricultural chemicals, zoonotic viruses, and solvents, may be involved. (Kojevina et al. 1995).

The principal aim of this paper was to investigate whether there is a risk excess of non-Hodgkin lymphoma among Swedish workers associated with particular occupations, in order to suggest occupational factors that could contribute to the growing trend in the incidence of these tumours, which still remains unexplained (Linet et al. 1993; Devesa and Fears 1992).

Material and methods

The base population for this historical cohort study was made up of Swedish men and women who were gainfully employed at the time of the 1970 census, had also been present in the 1960 census and were still alive and older than 24 years as of 1 January, 1971.
The cohort included 1,779,646 men and 1,101,669 women who were aged 25 to 64 years at the beginning of the study and who were subsequently followed up for 19 years until the end of 1989.

Information was drawn from two linked data sets: (1) the Swedish cancer environment register, providing information on incident cancer cases, including a number of demographic variables from the 1960 and 1970 censuses. This register was used to compute specific rate numerators; and (2) a background population register comprising all individuals in the 1970 census, with information on occupation and residence in 1970, occupation in 1960, and, if applicable, date of death. This register was used to calculate specific rate denominators. The record linkage between these two registers has been described in detail elsewhere (Wiklund and Eklund 1986).

Person-years in each of 278 occupations in men and 263 in women were accumulated from 1971 until the date of death or up to 1989. After incident non-Hodgkin's lymphoma, persons were considered to be still at risk of a new episode of this kind of tumour, so they were counted as person-years for the denominators. This would imply a very slight overestimation of denominators. The overall person-time that each person contributed to the study was allocated to the corresponding cells of the variables of stratification. These variables were occupation, county of residence in 1970, age group and calendar time period. The variables of occupation and county, drawn from the 1970 census, were regarded as fixed, while age and period were time dependent. Clayton's algorithm was used in calculating the exact number of person-years. Occupation was classified according to the Nordic Classification of Occupations (Cancer-Miljöregistret 1994).

Age-standardised incidence rates per occupation for the whole period were computed using the standard European population as reference. Standardised incidence ratios (SIR) were calculated for men and women in each of all occupations, stratifying for 5-year age-classes and 5-year calendar-year periods, and using the cancer incidence among cohort member to calculate expected numbers of cases. SIR were also computed for the ten major occupational sectors.

On the assumption that the observed number of cases was distributed in each stratum as a Poisson variable, we fitted log-linear Poisson models, comparing occupations against others in the general cohort, adjusting for geographical risk area. Relative risks (RRs) were adjusted for geographical area categorised in five levels by grouping counties with similar SIR as follows: lower than 0.90, from 0.90–0.95, from 0.95–1.05, from 1.05–1.10 and greater than 1.10. In these models, the number of expected cases was introduced as an offset. Given that the expected number was computed on the basis of the age- and period-specific reference rates, the RR for each occupation was likewise age- and period-adjusted. Only those occupations with at least two observed cases were analysed.

To take into account the relationship between social class, lifestyle and occupation, we also computed RRs for other occupations of the same occupational sector (i.e., those with the same first digit) as reference. In addition, RRs per occupation were also calculated separately considering as exposed only those men who reported that occupation in 1970 and in 1960.

Results

During the follow-up, 7,610 non-Hodgkin's lymphomas were reported in the study cohort, 5,391 cases in men and 2,219 in women. The overall standardised rate was 17.95 cases per 100,000 person-years in men and 11.60 in women.

Table 1 presents, for men, the number of cases, the SIR and the RRs for the ten occupational sectors and the 53 occupations with at least two observed cases and a SIR equal to or greater than 120. In general, RRs from Poisson models taking geographical area into account were similar to the corresponding SIRs, and we were not able to demonstrate a positive confounding effect of this variable. The county with the lowest SIR was Jämtland (SIR = 0.79, 95% CI 0.62–0.99), and that with the highest one was Gotland (SIR = 1.29, 95% CI 0.94–1.72) (data available by the authors on request).

There were no substantial differences in risk across occupational sectors. For particular occupations, a relative risk over 1.30, statistically significant or nearly significant, was observed among physicians, teachers of music, art or crafts, ministers and priests, accountants and auditors, staff officers, bookkeepers, secretaries and typists, auctionists, non-specified rail and road transport workers, telecommunications traffic officers, telephone and radio operators, radio and television repairmen, photographic-laboratory workers, other production and related work, and launderers and dry-cleaners. On the right-hand side of Table 1, SIRs and RRs for the same occupations are presented, but taking into account only those workers reporting such occupations in both censuses (1960 and 1970). Risk estimators are higher than 1.40 for all the above-mentioned job codes, except in the case of telecommunications traffic officers and photographic-laboratory workers, that only included 12 and 53 workers in 1960 and 1970, respectively. In addition, a significant RR in this subgroup, based on more than five cases, was found for rolling-mill workers and prison and reformatory officials.

Table 2 depicts the same analysis for female workers. There was also a geographical variation in non-Hodgkin's lymphomas for women, with Jämtland again as the county with the lowest incidence (SIR = 0.69, 95% CI 0.43–1.04), and Kalmar with the highest one (SIR = 1.27, 95% CI 1.00–1.60) (data available on request).

Once more, occupational sectors did not show a different risk pattern, with the exception of sales work, which presented an almost significant 10% excess risk. Among the 29 occupations with a SIR greater than or equal to 120 and based on two or more cases, only three achieved statistical significance: metal platers and coaters, truck and conveyor operators, and store and warehouse workers, and only the risk for the last-mentioned was based on a substantial number of cases. None of these job codes showed a statistically significant increase of risk in the subcohort of women with the same occupation in the 1960 and 1970 censuses. In this subcohort, the occupation of catering supervisors depicted a significant high risk based on 14 cases.

Intra-sector analyses, taking as reference only workers in the same occupational sector were also conducted in both general cohort and subcohort with the same occupation in both censuses, but the results were very similar and are not presented here.

Discussion

After adjustment for age, period of diagnosis and geographical area, twelve occupations were identified with a statistically significant risk in men, either in the general