A Preliminary Analysis to Study Time Trends in the Incidence of Cancer of the Larynx

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ABSTRACT

In this paper, a graphical analysis of the data on the incidences and mid year population in Scotland for 1960-1989 is done to study the temporal variation. The incidence rates along with the 95% confidence limits for the mean incidences are calculated. The main conclusion is that while the incidence rates are higher in older people the increase over time is mainly a result of cohort effects.

1. INTRODUCTION

The incidence rate of a disease is the number of cases occurring per unit of time per person (Lancaster, 1974). Usually the incidence rate is calculated per thousand per annum or per hundred thousand per annum. Incidence rates can be used to study temporal variations occurring in any event, over a considerable continuum of time. By the study of incidence rates we would come to know whether these are increasing or decreasing. This could effect the health planning. For example, if the rates are increasing some planning could be made to increase the number of beds in the hospital.

Epidemiology deals with the patterns of disease occurrence in human populations, and with the identification of the factors that influence these patterns (Lilienfeld and Lilienfeld, 1980). Epidemiologists are particularly concerned with the presentation and interpretation of temporal variations in cancer rates.

The data on incidences of cancer of the larynx are used to study the temporal variation of incidence of cancer of the larynx by analyzing the set of rates arranged in two-way tables of age at incidence by time and periods of incidence. Birth cohort is another factor, which can play an important role in producing influencing the trends of in cancer of the larynx. Age, period and cohort models are the usual approach for estimating temporal variation.

Information on all cases of cancer of the larynx for Scotland for the period 1960-1989 is available in the office of the Registrar General for Scotland (1992).

For each person with cancer of the larynx the sex, age in years, year of registration and year of birth are held as individual records i.e. there is one record for each case giving details of age at incidence, date of incidence and date of birth. Data on mid period populations for 5-year age groups are also available. These data on the individual records are collapsed to form 3 way tables of age group by time period by birth cohort and 2 way tables of age group by time period for males and females separately. These data in the form of these tables can be used to study the trend in cancer of the larynx. The 2 way tables represent 10 year overlapping cohorts and the 3 way tables represent 5-year non-overlapping cohorts.

These data can be used to study the trends for the incidence of cancer of the larynx by analyzing the set of rates arranged in two-way tables of Age at incidence by time period of incidence. A number of different methods are available to estimate the separate effects of age, period and cohort. Some require the use of a three-way table while others require a two-way table.

After the age of thirty, the capacity of the human body to resist a disease may deteriorate as the age increases. Age is considered a vital factor in studying the rate of increase of a particular disease. Due to ever going developments in the universe many factors influence the human body negatively. All these factors can be safely summed up into one factor called the time period. Time period may be called responsible for temporal variation in the spread and extent of a disease. Another factor, which is apparently hidden in age and time period, may also be responsible for the temporal variation in some particular disease. This factor is the birth cohort. An attempt can be made to find out if age, period or cohort can explain temporal variation, if any, in the incidence data mentioned earlier.

2 MATERIALS AND METHODS

The two-way tables by age group and calendar period are available for males and females separately. The rows correspond to the age groups and the columns to periods of time. The data are classified into 11 age groups of 5 years length and 6 time periods of 5 years each.

respectively. 95% confidence intervals for the incidence rates are represented in the Table A and Table B.

Figure 1 shows that the incidence rates for males in the first age group — 35-39 fluctuate greatly over the time period span. The incidence rates rise from period 1960-1964 to period 1965-1969. There is more a fall than rise from period 1965-1969 to period 1970-1974. The incidence rate remains stable until period 1975-1979 where it again experiences a rise and fall for the next periods i.e. 1980-1984 and 1985-1989. This rise and fall is a usual characteristic of small samples in which the random variations produce such effects and the 95% confidence intervals all overlap. The fluctuation in the curves for other nine age groups decrease gradually and a rise in incidence rates over the period span is observed. The increase in the incidence rates for higher age groups is quite evident from the Figure 1 and the Table A. The increase in incidence rate for age groups 70-74, 75-80 and 80-84 is nominal. Consider, for example, age groups 3 to 6 i.e. 45-49 to 60-64, where there is a clear separation of the confidence intervals in the first period compared to the last. There is more overlap in the oldest 3 age groups.

Figure 2 shows that females experience less cancer in the larynx than males in Scotland over the time period span. The minimum rate is about 0.12 (per 100,000) for age group 35-39 while for the same age group of males has a rate of about 0.55 (per 100,000). Also incidence rate have fallen regularly from year 1960 to 1984 for the first three Age Groups 35-39, 40-44, and 45-49 of females. From age group 50-54 onward there is an increase in the incidence rates both for males and females over the time span. There is a great deal of overlap in the 95% confidence intervals and only at 60-74 is there a clear separation from the first to last periods. For these higher age groups the parallelism is quite evident.

For the incidences of cancer of the larynx among males the age curves for various age groups lie at a higher place than the age curve for their respective previous age group (if any). Hence age is an important factor for the increase of incidence of cancer in the larynx. This is more obvious in the younger ages where there is less overlap in the confidence intervals for different ages in the same period. The behaviour of the age curves is not different for the female data except for one age group. For the second age group i.e. 40-45 the incidence rate is lower for the time period 1960-1964 as compared to the first age group i.e. 35-40. This deviation is, however, due to the small sample effects and can be ignored. Age is, therefore, an important factor for incidences of cancer of the larynx among females also.

For the incidence rate data on males and females the curves for the age group 45-49 years and higher age groups can be seen to have an upward trend in contrast to younger ages. It looks as the age-period model could hardly explain the data well for incidences of cancer in the larynx in males and females in Scotland over the period 1960-1989.

Figure 3 and Figure 4 show the plotting of cohorts against the mid point of age groups. The points pertaining to the same cohort are joined. The curves for males show a clear trend in the incidences along the age groups. The distance among the curves for the cohorts show that cohort seems to have a significant effect on the incidence of cancer in the larynx in males. There seems to exist clear parallelism between the curves for various cohorts. The curves for females are not so regular as for males. The differences between the curves, however, identify that the cohort does seem to affect the incidence of cancer in the larynx in the females in Scotland.

4. CONCLUSION AND SUGGESTIONS

From this graphical analysis the age-cohort model seems to fit the data in a better way than the age-period model for incidence of cancer of the larynx of males and females of in Scotland. It is clear that the interpretation of the graphs is problematic in view of the low rates, particularly for females. Consequently various models should be fitted to analyze the changes in the rates taking sampling variability into account. To analyze statistically, various models can be fitted to the data.

New approaches to the analysis of temporal variation in disease incidence lead to the generalization of indirect standardization to the estimation of parameters of the age-period-cohort model (Holford, 1983). The parameters of the age-period-cohort model can also be estimated through Poisson or logistic regression analysis.

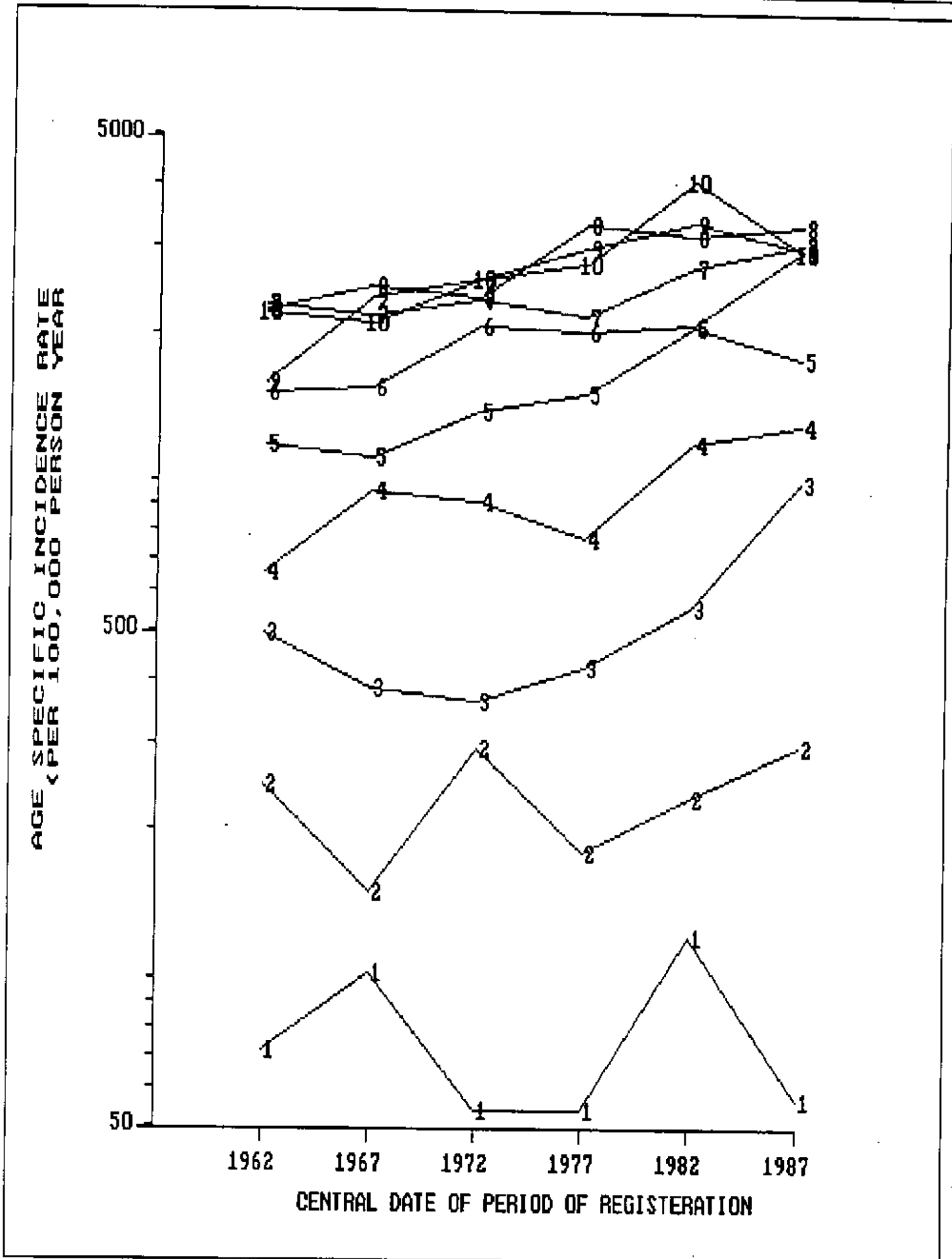

Figure 1: Incidence of cancer in males in Scotland against central date of each period. Rates are plotted using a logarithmic scale

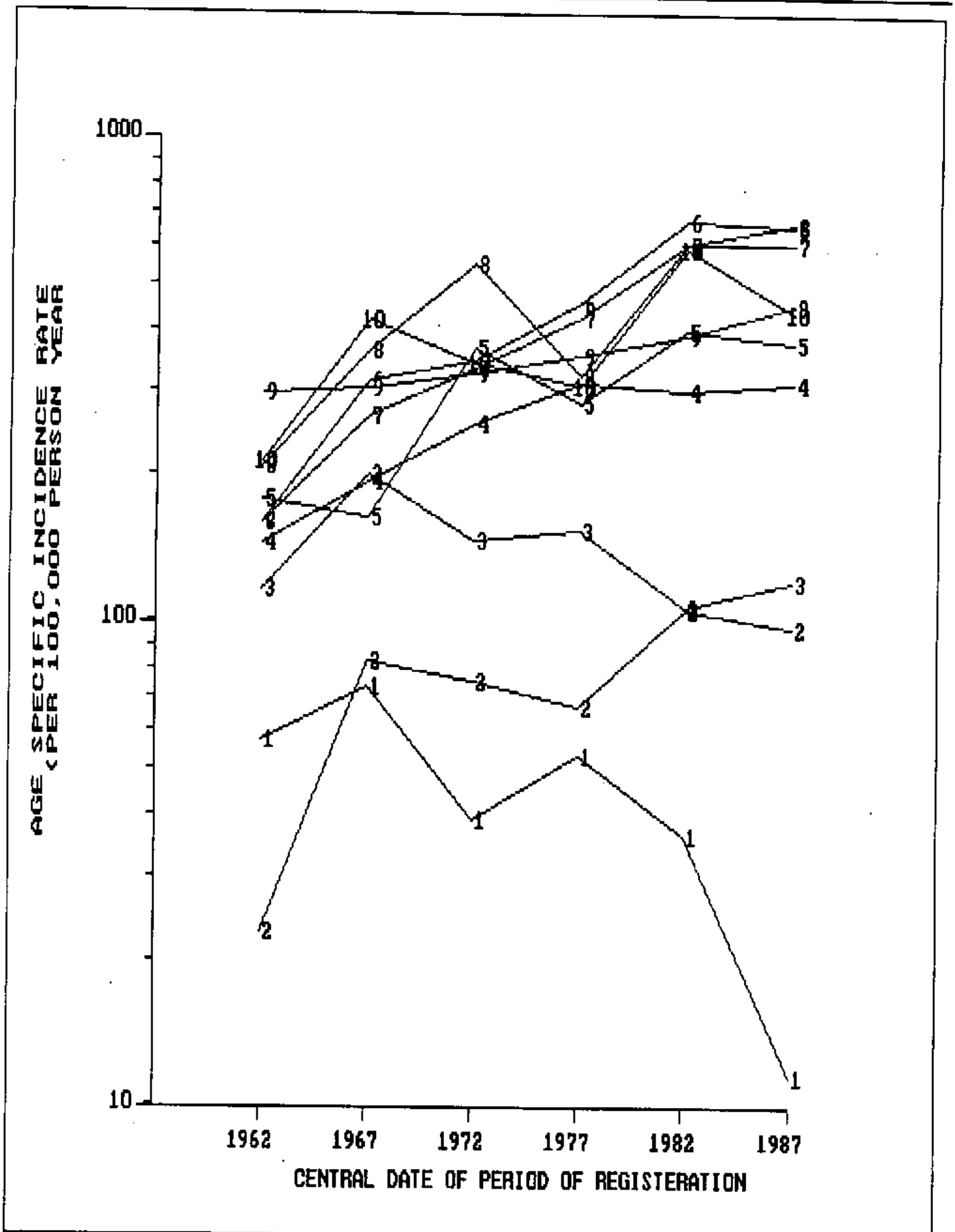

Figure 2: Incidence of cancer in females in Scotland against central date of each period. Rates are plotted using a logarithmic scale.

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