LUNG CANCER AND CHRONIC BRONCHITIS IN WALES

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The mortality experience in both males and females from a variety of diseases differs between Wales and her larger neighbour England. Two such diseases are carcinoma of the lung and chronic bronchitis. The Registrar General (1965) gives standardized mortality ratios for lung cancer and bronchitis in the two standard regions of Wales: Wales I which comprises the industrial south of the Principality and Wales II which comprises the remainder (Table I). The mortality from lung cancer is lower than would be expected in both regions and for both sexes, while that for bronchitis is high in males in the industrial areas of Wales I while it is low in the more rural Wales II. The maps of Howe (1963) similarly show a low death rate from lung cancer in Wales as a whole and a rather higher than normal death rate from bronchitis.

TABLE I
STANDARDIZED MORTALITY RATIOS FOR LUNG CANCER
AND CHRONIC BRONCHITIS, WALES 1963
(FROM REGISTRAR GENERAL, 1965)

Disease	Sex	Standard Regions	
		Wales I	Wales II
Carcinoma of Lung	Male	85	70
	Female	62	52
Bronchitis	Male	120	72
	Female	102	63

Both lung cancer and bronchitis are conditions seen more often in urban than in rural areas (Stocks, 1947). For chronic bronchitis the mean annual death rate for the years 1958-1962 for men aged 45-64 years was 0.69 per thousand in rural areas; 1.13 per thousand in towns of 50,000 to 100,000 population; and 1.29 per thousand in towns of more than 100,000 population. In the case of lung cancer similar differences are apparent: the rates for men

of the same age group are 1.28 in rural areas, 1.83 in towns of 50,000 to 100,000, and 1.93 in the larger towns.

Different areas within the individual parts of England and Wales have differing proportions of town and country and for this reason a modified standardized mortality ratio has been calculated. In each area the population has been divided into those living in rural areas, those living in towns of less than 50,000 population, those living in towns with populations of 50,000 to 100,000, and those living in towns of more than 100,000 people (General Register Office, 1962). For each group the number of deaths expected was calculated on the basis of the age structure of the population, recorded in the 1961 census, and age-specific mortality rates were calculated for the years 1958-1962 for each of the four types of area from the data of the Registrar General (1960a, b, 1962, 1963, 1964).

By this method of calculation the effect of urban living can, to some extent be eliminated, and a better comparison can be made between the mortality experience of the Principality of Wales with that of the whole of the United Kingdom. In the 5-year period 1958-1962 inclusive, 4,551 men were certified as dying from lung cancer in Wales, whereas 4,732 deaths were expected: 7,009 men were certified as dying from chronic bronchitis, whereas only 5,332 deaths were expected. These two differences are statistically significant and show that there is indeed a deficiency of cases of lung cancer and an excess of cases of chronic bronchitis among the males of Wales. A possible explanation of these differences is that genetic factors are involved in the pathogenesis of these conditions and that the Welsh people, by virtue of their gene pool, are less susceptible to the one and more susceptible to the other. The present investigation tests this hypothesis.

MATERIAL AND METHODS

Previous investigations have shown that Wales is a heterogeneous community comprising the Welsh people, descended from the more ancient inhabitants of the region, and immigrants from the English side of the border who have come into the country during the population expansion of the last hundred or so years. The two populations are still, to some extent, separated, because of the adherence of the Welsh people to their culture, religious observances, and language.

The simplest indication of whether a man is Welsh or not is given by his language. If he speaks Welsh he is very likely to be Welsh as few immigrants to the country learn this difficult language. A broad index of the Welshness of the various parts of Wales is given by the proportion of individuals in the area who, at the Census of 1961, claimed to be Welsh speaking (General Register Office, 1962). Three well-defined parts of Wales may be identified by the proportion of the population who are Welsh speaking: in the counties of Anglesey, Caernarvon, Cardigan, Carmarthen, and Merioneth, more than 70 per cent. of the population are Welsh speaking; in the counties of Brecknock, Denbigh, Flint, Glamorgan, Montgomery, and Pembroke, and the county boroughs of Swansea and Merthyr Tydfil, between 15 and 45 per cent. of the population are Welsh speaking, and in the remainder of the Principality, the counties of Monmouth and Radnor, and the county boroughs of Cardiff and Newport, less than 10 per cent. of the population are Welsh speaking.

Another useful index of Welshness is the surname. The surnames of Wales are few in number and are almost all patronymics, in contrast to the surnames of England which are largely territorial, occupational, or descriptive. Differences in the A B O and Rhesus blood group distributions and in the frequencies of gastric cancer and of benign prostatic hyperplasia in the Welsh and non-Welsh components of the population of the Swansea area of South Wales have been shown by a study of the surnames

of series of individuals (Ashley, 1966; Ashley and Davies, 1966a, b). This method was applied to the study of lung cancer and chronic bronchitis. The list of surnames regarded as Welsh comprises a series of 96 names, which between them identify up to 80 per cent. of the population of some of the Welsh speaking parts of Wales (Ashley and Davies, 1966a).

The observed deaths from lung cancer and from chronic bronchitis for the three areas of Wales—high Welsh speaking, moderate Welsh speaking, and low Welsh speaking—were extracted from the Registrar General's "Statistical Review" and compared with the expected numbers if the death rates for the rural and the various types of urban areas for England and Wales as a whole had applied (Table II). There is a significant deficiency of deaths from lung cancer in the intermediate Welsh speaking area but not in the areas where Welsh speaking is of very high or very low prevalence. There is a significant excess of deaths from bronchitis in all three areas, but no gradient conforming to the frequency of Welsh speaking is seen.

Two series were available for the study of Welsh names in lung cancer: 1,150 hospital cases and 730 death certificates. The 1,150 hospital cases were treated at Morriston Hospital. Of these, 630 had names included in our list of Welsh names, the expected number of Welsh names being 612. This was determined by sorting the cases according to their place of residence and calculating the number expected to have Welsh names by reference to an analysis of a 2 per cent. sample of the names on the electoral registers of the different areas. The second group consisted of copies of 730 death certificates of men whose residence was in the counties of Carmarthen, Glamorgan, and Monmouth and the four included county boroughs, and who had died of lung cancer during 1963; of these men 285 had Welsh names. Reference to the control data indicated that 301 Welsh names would have been expected.

TABLE II

DEATHS FROM LUNG CANCER AND BRONCHITIS IN MALES, WALES 1958—1962

Proportion Welsh Speaking	Carcinoma of Lung			Bronchitis		
	Observed	Expected	O/E × 100	Observed	Expected	O/E × 100
High	720	723	99·6	891	794	112
Moderate	2,510	2,656	94·5	4,122	3,008	134
Low	1,321	1,353	97·6	1,996	1,530	130
Total	4,551	4,732	96	7,009	5,332	132

A similar collection of 1,102 death certificates of men dying of chronic bronchitis from industrial South Wales showed that 499 had Welsh names. Reference again to the control data showed that 470 would have been expected. These differences are not statistically significant.

DISCUSSION

There appears to be an excess of cases of, and deaths from, bronchitis in the Principality of Wales, but no correlation can be established between the frequency of this condition and the degree of Welsh speaking in the community. Nor is there any association with Welshness as expressed by the possession of a Welsh name. These findings invalidate the hypothesis that the Welsh people have a genetic predisposition to this disease but rather suggest that the causative factors and the potential preventive measure are to be sought in the atmospheric environment of Wales and, in particular, the environmental conditions at work.

In the case of lung cancer there is a deficiency of cases and of deaths among males in the Principality, but again no association with Welshness expressed as Welsh speaking or as Welsh surnames. This finding also points to environmental factors being of importance in determining the attack rate of this disease rather than genetic factors. The deficiency of lung cancer and excess of chronic bronchitis form a pattern which is unusual. In England and Wales, as a whole, the death rates for lung cancer and for chronic bronchitis are dependent on the urban-rural distribution of the population. (Stocks, 1947). Both are commonest in the conurbations and least frequent in rural areas. Wales, however, when due allowance is made for the distribution of the population between town and country, shows a relative excess of the one and a deficiency of the other. There are three possible explanations of this difference. Firstly, there may be environmental factors in Wales which are pathogenic to the lungs in that they cause bronchitis but which are non-carcinogenic. Secondly, there may be a low level of ascertainment of lung cancer in Wales so that the reported death rate is too low. Thirdly, there may be circumstances connected with the type of chronic lung infection encountered in Wales which are antagonistic to oncogenesis in the lung.

The first of these explanations remains possible. In Table III the beds used per million of the male population for the treatment of chronic bronchitis and of lung cancer for the fifteen hospital regions of England and Wales are extracted from the "Report of the Hospital In-Patient Enquiry, 1961" (Ministry of Health and General Register Office, 1964), and the

ratios of the numbers of beds used for the two conditions have been calculated. Ratios very much higher than that for the country as a whole were shown for Newcastle, Leeds, Sheffield, Wales, Birmingham, and the North-East Metropolitan region. Much lower ratios were seen in the other three Metropolitan regions and in Oxford and Manchester. It is feasible that there are differences in the environment of these two sets of regions which may be of aetiological importance.

TABLE III
BED ALLOCATIONS FOR CHRONIC BRONCHITIS AND LUNG CANCER IN MEN IN FIFTEEN HOSPITAL REGIONS OF ENGLAND AND WALES

Hospital Region	Beds/million		
	Bronchitis	Lung Cancer	Br/L.C. $\times 100$
Newcastle	147.8	67.8	218
Leeds	213.2	81.9	260
Sheffield	129.2	60.5	214
East Anglia	105.3	67.8	155
N.W. Metropolitan	167.2	118.7	141
N.E. Metropolitan	216.1	98.8	219
S.E. Metropolitan	150.8	104.3	144
S.W. Metropolitan	149.1	114.9	130
Wessex	104.9	55.6	189
Oxford	121.8	99.2	123
South Western	93.9	58.6	160
Wales	224.9	101.9	211
Birmingham	129.4	57.3	226
Manchester	104.3	83.9	125
Liverpool	183.0	115.8	158
All Regions	154.2	87.7	176

The second explanation is considered unlikely because there is a great interest, both medical and lay, in respiratory disease in Wales, and the majority of men with respiratory complaints are, at least, referred for radiology. Additionally, a large number of autopsies are carried out in cases suffering from, or suspected of, pneumoconiosis and some instances of lung cancer are revealed and reported without previous clinical diagnosis.

The third alternative, that some protection to the lungs may be afforded by the type of lung disease common in Wales, must be considered. Pneumoconiosis is of frequent occurrence among the miners of South Wales. It is precipitated by the inhalation of dusts containing silica as well as carbon, and is often associated with respiratory tuberculosis. The basic histological lesion of fibrosis is almost always accompanied by chronic inflammatory changes. It is possible that the reactive fibrous tissue of the pneumoconiotic lung together with the presence within the lung substance of many immunologically competent inflammatory cells may create an environment in which enhanced immune mechanisms are at hand to destroy any cells which may undergo neoplastic change before overt neoplasia can be manifest. The reactivity of the lung in auto-immune

disease, clinically and radiologically apparent in rheumatoid pneumoconiosis (Caplan, 1953), may then be enhanced by the pre-existing pulmonary disease. The observation of Kennaway and Kennaway (1953) that lung cancer is less frequent in miners than in the general population also indicates a probable environmental protective factor.

Support is lent to this concept by the findings set out in Table III. The hospital regions in which the number of beds for the treatment of bronchitis is relatively larger than the number used for the treatment of lung cancer include the regions serving the coalfields of Britain, while mining is not an important industry in any of the areas with a low ratio of beds used for bronchitis and beds used for lung cancer. The numbers of cases included in the survey for the five regions with coalfields, Newcastle, Leeds, Sheffield, Birmingham, and Wales were 1,572 bronchitis and 885 lung cancer. In the five regions North-West, South-East, and South-West Metropolitan and in Oxford and Manchester, there were 1,553 discharges for bronchitis and 1,186 for lung cancer. These differences are real and suggest either that the environment of these areas, presumably of the coalfields, contains substances which tend to induce bronchitis rather than cancer or that the changes associated with the bronchitis seen in these areas are inimical to lung cancer development.

SUMMARY

Evidence is adduced to show a relative deficiency of lung cancer and a relative excess of bronchitis in Wales. The hypothesis that these are due to genetic differences in susceptibility to these diseases in the Welsh and non-Welsh people of Wales is disproved by the lack of any association with Welsh names or with Welsh speaking.

The ratio between the use of beds for lung cancer and for bronchitis in the various hospital regions of England and Wales is examined, and it is shown that there is a relative deficiency of lung cancer in

those areas in which the nation's coalfields are situated. It is suggested that there may be environmental factors which dispose specifically towards bronchitis or that the lung changes seen in the mining areas are inimical to the developing cancer cell and that potential cancers are destroyed before they have time to develop.

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