Coronary Artery Disease in Wales*

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Recent investigations have shown that the population of the Principality of Wales is heterogeneous and is composed of two moieties, the indigenous Welsh and immigrants, mostly from the English side of the border. Genetic differences in the major blood group systems and cultural differences in the use of the Welsh language and the practice of religious observances have been found to be related to the possession of a Welsh surname (Ashley and Davies, 1966a). The surname in turn has been used as a marker to indicate the genetic nature of the higher mortality from gastric cancer in Wales and the higher morbidity from prostatic hyperplasia (Ashley and Davies, 1966b; Ashley, 1966).

The present investigation is directed to a study of coronary artery disease in Wales with reference to the possibility that genetic factors may be responsible for the difference in mortality from this cause in Wales as compared with England. The Registrar General (1965, 1966) reported Standardized Mortality Ratios (S.M.R.) for deaths classified as Arteriosclerotic Heart Disease, including Coronary Artery Disease, for the area of the Welsh Hospital Board, which is coterminous with the Principality. The S.M.Rs. were for males and females, respectively, 112 and 105 in 1963, and 112 and 112 in 1964; all four of these ratios are significantly different from 100. These high S.M.Rs. are particularly striking when it is remembered that coronary thrombosis tends to be an urban disease while Wales is a largely rural country.

Results

Mortality Rates from Coronary Artery Disease within Wales. Wales can be divided on the basis of the major local government areas into three parts in which the frequency of Welsh speaking is high (> 70%), medium (10–45%), and low (< 5%). These areas differ considerably in the proportions of the population who live in urban and

rural areas, and, as the age specific death rates for coronary artery disease differ in towns and in country (Table I), I have calculated a corrected mean Standardized Mortality Ratio for the years 1958–1962 for the three parts of Wales in which the several death rates for the different types of area have been applied (Table II). On the basis of this corrected S.M.R., deaths under the Registrar General's category B26 (Arteriosclerotic heart disease including coronary disease) are significantly more frequent in the high Welsh speaking area than in the low Welsh speaking area. The data from which the death rates were calculated were extracted from the Registrar General's Annual Reports for the years 1958 to 1962 (Registrar General, 1960, 1961, 1962a, 1963, 1964): the population was that of the census year 1961 (Registrar General, 1962b).

A Clinical Series. A series of 1436 instances of coronary artery disease in men in whom the diagnosis was substantiated by electrocardiography was made

TABLE I
AGE SPECIFIC MORTALITY RATES PER THOUSAND
FOR THE FIVE-YEAR PERIOD 1958–1962 FOR DEATHS
IN THE CATEGORY B 26; IN MEN

	Age (yr.)		
	25–	45–	65–
Towns > 100,000	1.46	19.7	87.1
Towns > 50,000	1.49	19.6	90.3
Towns < 50,000	1.33	17.9	78.5
Rural areas	1.01	15.5	71.9

TABLE II
CORRECTED STANDARDIZED MORTALITY RATIOS
FOR ARTERIOSCLEROTIC HEART DISEASE IN MEN
IN THE THREE AREAS OF WALES 1958–1962

	Deaths		
	Observed	Expected	Ratio
High Welsh	3277	2728.1	120.1
Medium Welsh	10,478	9023.6	116.1
Low Welsh	4906	4299.8	114.1
Total	18,661	16051.5	116.3

Received March 17, 1967.

* Part of this material was presented at the IXth conference of the International Society of Geographic Pathology, September 1966, Leiden, Holland.

TABLE III
WELSH NAMES IN CASES OF MYOCARDIAL
INFARCTION AT MORRISTON HOSPITAL

Residence	Posterior Infarction			Anterior Infarction		
	No. of Cases	Welsh Names		No. of Cases	Welsh Names	
		Ob-served	Ex-pected		Ob-served	Ex-pected
Swansea	407	217	177	326	156	142
Glamorgan	214	154	120	182	132	98
Carmarthen	160	116	110	147	96	101

Total Welsh names: observed 871; expected 748

available to me by my colleague Dr. E. A. Danino. These were analysed for the prevalence of surnames from a list of 96 of the commonest Welsh surnames in the Principality (Ashley and Davies, 1966a). The expected number of Welsh surnames was determined from a sample survey of the lists of electors on the electoral registers. The cases were further subdivided into those with electrocardiographic changes of anterior cardiac infarction and those with posterior cardiac infarction. There is a significant excess of men with Welsh surnames in each of the groups of cases (Table III).

Deaths in Swansea County Borough. The registers of death notices for the County Borough of Swansea for the years 1957 to 1961 were made available to me by Dr. E. B. Meyrick, the Medical Officer of Health. The names of men and women who had the certified causes of death, coronary thrombosis, coronary artery occlusion, myocardial infarction, coronary atheroma, and cardiac infarction were extracted and were classed either as Welsh or non-Welsh (Table IV). There is an excess of Welsh names both in males and in females over the number expected on the basis of the survey of electoral registers. The deaths were subdivided into males under and over the age of 60 years (Table V). There is an excess of Welsh names among the men in each group, this excess is much larger in the older age-group.

TABLE IV
DEATHS FROM CORONARY ARTERY DISEASE IN THE
COUNTY BOROUGH OF SWANSEA: 1957-1961

	Males		Females	
	Total	Welsh Name	Total	Welsh Name
1957	197	96	117	64
1958	207	93	122	55
1959	240	108	104	47
1960-61	507	235	232	121
	1151	532	575	287
Welsh names expected		501.8		250.7
Observed/Expected		106		114

TABLE V
DEATHS FROM CORONARY ARTERY DISEASE IN
MEN IN SWANSEA 1957-1961 BY AGE

Age (yr.)	Welsh Names		Non-Welsh Names
	Observed	Expected	
< 60	166	164	210
> 60	365	338	410

Serum Cholesterol Levels. The level of serum cholesterol is related to the prevalence of arteriosclerosis, and it has been suggested (Shaper and Jones, 1959) that the difference in incidence of cardiac infarction between the Asians and the Africans of Uganda may be related to dietary differences reflected in the serum cholesterol level. A consecutive series of 516 estimations of the level of serum cholesterol in male in-patients and out-patients at this hospital was analysed (Table VI). The mean levels of serum cholesterol were: for the 300 men with Welsh names, 215 mg./100 ml. and for the 216 men with non-Welsh names, 223 mg./100 ml. There was no significant difference in the distributions of the individual values.

TABLE VI
SERUM CHOLESTEROL LEVELS IN MEN

Serum Cholesterol (mg./100 ml.)	Welsh Name	Non-Welsh Name
< 200	135	90
200-250	79	60
251-300	57	38
> 301	29	28

Discussion

The data presented in this paper show that there is an association between 'Welshness' and a higher mortality and morbidity rate from coronary artery disease. The corrected S.M.R. for arteriosclerotic heart disease is highest in the part of Wales in which Welsh is most frequently spoken, and there is an excess of Welsh surnames among those men who were treated at Morriston Hospital, Swansea, for this condition and among those who died in the county borough of Swansea in the years 1957 to 1961. When the data from the death registers were subdivided by age a greater excess of Welsh names was found among the older men but the proportions in the older and younger age-groups were not significantly different.

The excess of Welsh names among the women of Swansea who died of coronary artery disease was greater than that in men and was statistically significant. This is an unexpected finding as the surname of most women is an acquired characteristic

rather than a hereditary one as a woman assumes the surname of her husband on marriage. The presence of a difference in this respect, however, is related to the higher frequency with which women whose maiden names are Welsh marry men whose surnames are also Welsh rather than men who carry English surnames (Ashley and Davies, 1966a).

An alternative suggestion to explain the excess of Welsh names in the local cases, but not the excess of deaths in the high and medium Welsh speaking areas, is that the local population is stratified and that there is a greater proportion of older men with Welsh names than younger men. In the series of deaths 44% of the men under 60 had Welsh names while 47% of the men over 60 had Welsh names. Both groups, however, had Welsh names in excess of the number expected on the basis of the sample survey of the population (43.6%). If the greater proportion in the older men was entirely due to stratification, it would be expected that the proportion of Welsh names in the younger men would be lower than the average while that among the older men would be higher. In this case, however, both proportions were greater than would have been expected. The validity of the method is also borne out by the observation that the proportion of Welsh names among women delivered of children in Morriston Hospital corresponded almost exactly with the proportion of Welsh names expected from my analysis of the electoral registers.

These observations add another to the group of conditions in which the Welsh as a racial group, having a slightly different gene pool from their English neighbours, are at a disadvantage relative to the English. This disadvantage was not related to a difference in serum cholesterol levels.

The observations also add to the accumulating evidence that cardiac disease of degenerative type may have an underlying genetic component (Oldham, Pickering, Roberts, and Sowry, 1960; Slack and Evans, 1966). They are of particular interest in that it seems that environmental differences among the Welsh and the English in Wales are at a minimum (Ashley and Davies, 1966a), so that the observed differences are more likely to be truly genetic than for example the differences in cardiac morbidity between the Asian and African components of the population of Uganda (Shaper and Jones, 1959) or the international differences between the people of America and those of Japan and Italy (Grande, 1963) where major differences in dietary habits may be of greater importance than differences in the genotype.

It should be emphasized that the role of genetic factors in a disease such as this is not directly causa-

tive. The phenotype, in this instance the effect of arteriosclerotic narrowing of the coronary arteries, is related to the interaction between the genotype, the genetic constitution, and the environment. The genetic disadvantage which the Welsh suffer is that of an increase in susceptibility to the adverse environmental conditions which ultimately lead to coronary artery disease. It is, indeed, possible that in such a population a disproportionate benefit may be obtained by alterations in the environmental conditions under which those people live.

Summary

Data are presented to show that the high incidence of coronary artery disease in Wales is related to genetic differences between the indigenous and immigrant populations of the Principality. The difference is not related to a difference in serum cholesterol level.

It is suggested that the gene pool of the Welsh people is such that there is an increased susceptibility to the environmental factors also concerned in the aetiology of arteriosclerotic heart disease.

This work was carried out under a research grant from the Welsh Hospital Board.

I am indebted to Dr. E. A. Danino and Dr. E. B. Meyrick for allowing me access to data under their control.

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