USE OF NATIONAL HEALTH SERVICE GENERAL PRACTICE RECORDS IN EPIDEMIOLOGICAL INQUIRIES

DUODENAL ULCER—A TEST CASE

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The purpose of this paper is to show the potential value of the routine records of National Health Service general practice in the epidemiological study of chronic diseases.

The weaknesses of general practice records are well known. They are incomplete both in their clinical detail and in their coverage of the patients registered with the practice. The morbidity recorded is a function of the patient's threshold of discomfort, the doctor's interest and accessibility, and the doctor's criteria of diagnosis. The registered population (the list) may be difficult to define accurately; routine records may be out of date with the frequent movement of patients on and off the list. Finally, the level of morbidity in a particular area will depend on the accessibility of local diagnostic and therapeutic services.

In order to discover whether these weaknesses completely disqualify general practice National Health records from contributing to the study of chronic disease, duodenal ulcer was chosen as a test case. From population surveys and carefully matched comparisons between duodenal ulcer patients and "controls", from hospital studies and from industrial surveys, as well as from reports of individual cases of duodenal ulcer in families, certain epidemiological features of duodenal ulcer seem to be well established.

Three of these features are:

- (1) The higher incidence and prevalence of duodenal ulcer in men than in women (Ivy and Martin, 1949).
- (2) The association of duodenal ulcer with psychiatric disorder and also with chronic pulmonary

diseases (Latts, Cummins, and Zieve, 1956; Ellis, 1962; Sinclair-Gieben, Clark, and Dean, 1962; Wolf, 1949).

- (3) The familial concentration of duodenal ulcer and especially the importance of a family history of duodenal ulcer in women (Doll and Buch, 1950; Doll and Kellock, 1951; Rigal-laude, 1948).

If these features, which have been noted in epidemiological, genetic, and clinical studies, could be found from a simple indexing and cross-referencing of routine National Health Service records in general practice, this might encourage epidemiologists to take a closer look at the records of general practice in the study of the chronic and common diseases.

DESCRIPTION OF THE PRACTICE AND ITS RECORD SYSTEM

The figures presented here are based on a special record index of a wide range of chronic diseases, with a cross reference of patients related by descent or marriage. This index covers the routine National Health Service records of a group partnership of general practitioners in Edinburgh.

The practice population and the record system have been described elsewhere (Kuenessberg and Sklaroff, 1961). In brief, the population may be described as predominantly industrial, semi-skilled and unskilled in occupation, and living almost entirely in municipal housing estates.

Diagnostic facilities are readily available from a large teaching hospital within easy reach of the doctors and their patients,

RESULTS

The present analysis refers to the records of 13,131 registered patients, aged 15 to 69 years, in 1960. The record index showed that among these patients there were 559 with a record of duodenal ulcer, 416 of chronic bronchitis, 581 of psychoneurosis, and 472 of arthritis. Index cases of duodenal ulcer were all confirmed by x ray or at operation. Index cases of chronic bronchitis included patients who had had four or more episodes of cough with purulent sputum within any year. Index cases of neurosis included patients who had been referred to hospital for investigation or treatment and whose psychiatric diagnosis had been confirmed. The three groups do not, therefore, represent all the patients who, on further clinical examination and with proper screening tests, might be found to fit into one of these diagnostic groups. By insisting on the set criteria for recording in the index, however, some uniformity is achieved. The fact that the diagnoses were largely made at the one hospital further reduces the range of diagnostic variability.

In examining the association between two diseases, one has to consider the possibility that patients with two separately identified disorders might more readily consult the doctor than those with only one disorder. The associations between duodenal ulcer and chronic bronchitis and that between duodenal ulcer and psychoneurosis, have therefore been compared with the association between duodenal ulcer and arthritis. Arthritis was chosen as a disease with no statistically established link with duodenal ulcer. It might therefore serve as a means of checking the possibility of a consulting link between duodenal ulcer and the other selected diseases.

In the same way, because general ill health in parents may be associated with a recorded excess of chronic disease in their children, the offspring of duodenal parents have been compared with the offspring of parents with chronic bronchitis and also with the offspring of parents with psychoneurosis.

PREVALENCE RATES

The Figure (opposite) shows the recorded prevalence—properly described as the cumulative prevalence rate*—for the four diseases. Duodenal ulcer shows high rates varying between 10 and 15 per cent. for men over the age of 45 years. The higher prevalence of duodenal ulcer among men compared with women is once again shown.

Chronic bronchitis shows a marked increase with age, especially in men, rising from 5 per cent. in young men to 15 per cent. in men over 45 years of age. An interesting feature of these rates is that young women have higher rates than young men—a feature of chronic bronchitis which has previously been reported by Reid (1961) in England and Wales.

Arthritis, as a typically chronic disease, shows a marked rise with age, to above 5 per cent. in persons above 45 years. It is more commonly recorded for older women than older men. The label arthritis refers mainly to osteo-arthritis, but includes also a small group with rheumatoid arthritis.

The prevalence rates of hospital-referred psychoneurosis show the rise and fall with age which has been reported by other workers in general practice and population surveys (Kessel and Shepherd, 1962). The rate varies with age between 1 and 9 per cent., with women showing higher rates than men.

ANALYSIS OF ASSOCIATIONS

Prevalence rates for the four disease groups varied markedly with age and sex. In looking at the association between duodenal ulcer and other diseases, either in the individual patients or in the members of the family of the patient, it was therefore necessary to take into account their age and sex distribution. The method adopted was a simple one. The appropriate group of patients or relatives was classified by age and sex; the number of patients with a record of the disease in question was then compared with the number expected according to the age (quinquennial) sex-specific prevalence rates of the practice as a whole. In order to simplify the presentation, the actual and expected numbers were totalled in two main age groups: 20 to 44 and 45 to 69 years.

Duodenal Ulcer and Chronic Bronchitis in the Same Patient.—There was a clear association between chronic bronchitis and duodenal ulcer in men and women; of 556 patients aged 20–69 years with duodenal ulcer, fifty also had chronic bronchitis recorded. This was nearly twice as many as the expected number, 28·8. Table I (opposite) shows that the association was most marked in patients aged 45 to 69 years, and, interestingly, was found in both men and women.

Duodenal Ulcer and Psychoneurosis in the Same Patient.—Among the 556 duodenal ulcer patients aged 20–69 years, there were 48 patients with a record of psychoneurosis (Table I). This was clearly in excess of the expected number, 29·2. However, the association between these two diseases in the

* Cumulative prevalence rate may be defined as: "the number of persons alive at one time who have ever had a diagnosis of a chronic disease" divided by the population at that time.

FIGURE.—Prevalence rate per cent. of patients with duodenal ulcer, chronic bronchitis, psychoneurosis, and arthritis, by sex, registered with a group general practice in Edinburgh, 1960.

TABLE I
CHRONIC BRONCHITIS, PSYCHONEUROSIS, AND ARTHRITIS IN PATIENTS WITH DUODENAL ULCER
(as recorded in a N.H.S. Group General Practice, 1960)

Sex	Age Group (yrs)	Number with Record of Duodenal Ulcer	Number with Record of Chronic Bronchitis and Duodenal Ulcer		Number with Record of Psychoneurosis and Duodenal Ulcer		Number with Record of Arthritis and Duodenal Ulcer	
			Actual	Expected	Actual	Expected	Actual	Expected
Male	20-44	167	5	2.9	14	6.7	4	2.9
	45-69	227	33	20.1	22	12.3	19	18.9
Female	20-44	60	3	1.6	3	3.8	1	0.8
	45-69	102	9	4.2	9	6.4	9	9.7

individual patient appeared to be confined to men. In women, the actual number was twelve compared with an expected number of 10·3, whereas in men an actual number of 36 with both duodenal ulcer and psychoneurosis is to be compared with an expected number of nineteen.

Duodenal Ulcer and Arthritis in the Same Patient.—It was not expected that an association would be found between duodenal ulcer and arthritis, unless the simultaneous recording of these two diseases merely reflected a greater readiness on the patient's part to consult the doctor. There were 33 out of the 556 duodenal ulcer patients who also had a record of arthritis. This number is to be compared with an expected figure of 32·3—a remarkably close match! When the figures are examined separately for each sex and in two broad age groups, this equality between the actual and expected numbers is still found (Table I).

DUODENAL ULCER, CHRONIC BRONCHITIS, AND PSYCHONEUROSIS IN THE OFFSPRING OF PARENTS WITH DUODENAL ULCER

In order to examine the association of duodenal ulcer in parents and children, all patients aged 40 years or more with a record of duodenal ulcer were identified. The family cross-reference system was then used to trace and identify all the children who were registered patients of the practice in 1960. These children were then classified by sex in 5-year age groups. The expected number of children with a record of duodenal ulcer, chronic bronchitis, or psychoneurosis, was then obtained in the same way as earlier described; on the basis of the rates for the practice as a whole. At the time of analysis, the age structure of the practice made it possible to obtain

adequate numbers of expected cases among offspring within the age range 15 to 39 years. Within this age range, 292 sons and 275 daughters were traced through the record system. Among these 567 offspring, 37 cases of duodenal ulcer were recorded (i.e. 6·5 per cent.), the expected number being 8·8. The excess of duodenal ulcer is most marked in the daughters; there were fourteen daughters with duodenal ulcer compared with an expected number of 1·9 (Table II).

There was a possibility that the offspring of patients with duodenal ulcer would have an excess of chronic disease in general. Since the figures for chronic bronchitis and psychoneurosis had already been obtained as age and sex rates for the practice as a whole, it was also possible to see if there was an excess of these two conditions in the offspring of duodenal ulcer parents. Table II shows that in the sons there was no excess of either chronic bronchitis or psychoneurosis, nor was there any excess of psychoneurosis in the daughters of duodenal ulcer parents. There was, however, some indication of an excess of chronic bronchitis in the daughters of duodenal ulcer parents.

DUODENAL ULCER, CHRONIC BRONCHITIS, AND PSYCHONEUROSIS IN THE OFFSPRING OF PARENTS WITH CHRONIC BRONCHITIS

If the association of duodenal ulcer in parents and children were one depending on the indirect effect of any chronic disease on the other members of a family, then one would have expected the children of chronic bronchitic parents to have generally more than average chronic disease, including duodenal ulcer. Table II shows that there was no excess of duodenal ulcer in either the daughters or the sons

TABLE II

DUODENAL ULCER, CHRONIC BRONCHITIS, AND PSYCHONEUROSIS IN SONS AND DAUGHTERS OF INDEX PARENTS AGED 40 YEARS OR OVER WITH A RECORD OF DUODENAL ULCER, CHRONIC BRONCHITIS, AND PSYCHONEUROSIS (as recorded in a N.H.S. Group General Practice, 1960)

Parents aged 40 yrs or Over	Children aged 15-39 yrs	With Record of Duodenal Ulcer		With Record of Chronic Bronchitis		With Record of Psychoneurosis	
		Actual	Expected	Actual	Expected	Actual	Expected
With Record of Duodenal Ulcer	292 Sons	23	6·9	4	3·7	7	6·5
	275 Daughters	14	1·9	8	4·1	5	7·0
With Record of Chronic Bronchitis	251 Sons	6	6·5	5	3·1	10	5·9
	245 Daughters	2	2·1	11	4·0	10	7·9
With Record of Psychoneurosis	186 Sons	5	3·8	3	2·4	7	3·9
	171 Daughters	3	1·3	2	2·6	10	4·5

of parents with chronic bronchitis. Neither was there any excess of chronic bronchitis in the sons of chronic bronchitic parents. There was however, an excess of chronic bronchitis in the daughters of chronic bronchitic parents, and there was a slight suggestion of an excess of psychoneurosis in the sons and daughters, taken together, of chronic bronchitic parents.

DUODENAL ULCER, CHRONIC BRONCHITIS, AND PSYCHONEUROSIS IN THE OFFSPRING OF PARENTS WITH PSYCHONEUROSIS

The association in individual patients, mainly men, between psychoneurosis and duodenal ulcer might lead us to expect a similar association in the family setting between psychoneurosis in parents and duodenal ulcer in children. Within the age group 15-39 years the number of sons and daughters and the prevalence rates of psychoneurosis are too low to provide reliable figures (Table II); nevertheless, there is no marked excess of duodenal ulcer in the offspring of psychoneurotic parents; the actual number being eight compared with an expected number of 5.1. Similarly there was no excess of chronic bronchitis in the offspring of psychoneurotic parents. There was however, a significant excess of psychoneurosis in the offspring of psychoneurotic parents. The agreement of these findings with other studies of psychoneurosis in families (Post and Wardle, 1962) increase, if only to a small extent, one's confidence in analysing the associations found between duodenal ulcer and psychoneurosis.

DUODENAL ULCER AND PSYCHONEUROSIS IN HUSBAND AND WIFE

The association of duodenal ulcer in one spouse and psychoneurosis in the other may be examined by taking either of these conditions in turn as the index disease. That is, one can first identify all spouses with psychoneurosis, then identify their

spouses and tabulate them by age, and then examine the expected and actual recorded prevalence of duodenal ulcer in the spouses. In adopting this procedure, one might be regarding psychoneurosis in one spouse as leading to or as antecedent to duodenal ulcer in the other. This is, however, only a possibility, and no such interpretation can be forced on the figures presented. One has to take into account the possibility that within a family the investigation of psychoneurosis in one spouse may lead to a more searching inquiry into the health of the other. It is therefore useful to compare the association between duodenal ulcer in one spouse and psychoneurosis in the other with the association between a record of psychoneurosis for one and a record of bronchitis or arthritis in the other. Table III shows that there is no association between duodenal ulcer in the husband and psychoneurosis in the wife; the expected number was 18.1 and the actual sixteen. Neither is there an excess of duodenal ulcer in the wives of husbands with a record of psychoneurosis. Similarly, there is no association between psychoneurosis in one spouse and psychoneurosis in another (Kreitman, 1962).

In none of these comparisons is the difference between the actual and expected cases statistically significant at the .05 level.

CHRONIC BRONCHITIS AND PSYCHONEUROSIS IN THE SAME PATIENT

Since, in men at least, chronic bronchitis and psychoneurosis have been shown to be related to duodenal ulcer, it is relevant to examine the association between chronic bronchitis and psychoneurosis separately.

Table IV (overleaf) shows an association between psychoneurosis and chronic bronchitis in young men and in young women, but not in older men or older women, *i.e.* those over 45 years of age. This association between chronic bronchitis and psychoneurosis does not account for the association between each

TABLE III

DUODENAL ULCER, CHRONIC BRONCHITIS, PSYCHONEUROSIS, AND ARTHRITIS IN THE SPOUSES OF PATIENTS WITH A RECORD OF HOSPITAL-REFERRED PSYCHONEUROSIS
(as recorded in a N.H.S. Group General Practice, 1960)

Spouses of Psychoneurotics	With Record of Duodenal Ulcer		With Record of Chronic Bronchitis		With Record of Psychoneurosis		With Record of Arthritis	
	Actual	Expected	Actual	Expected	Actual	Expected	Actual	Expected
206 Husbands aged 25-69 yrs	16	18.1	13	9.8	14	9.9	10	9.2
156 Wives aged 20-64 yrs	6	4.9	5	4.9	14	9.9	5	7.0

TABLE IV
PSYCHONEUROSIS IN PATIENTS WITH CHRONIC
BRONCHITIS
(as recorded in a N.H.S. Group General Practice, 1960)

Sex	Age (yrs)	Number of Patients with Record of Chronic Bronchitis	Number of Patients with Record of Psychoneurosis and Chronic Bronchitis	
			Actual	Expected
Male ..	20-44	55	10	2.1
	45-69	163	11	8.6
Female	20-44	87	12	5.3
	45-69	93	6	5.7

of these conditions and duodenal ulcer. This is partly because the association between chronic bronchitis and duodenal ulcer occurs in the older age groups as well as in the younger groups, whereas psychoneurosis and chronic bronchitis are associated with each other only in the young. Much more important is the fact that in the whole series there were only three patients who had all three conditions.

CONCLUSIONS

This somewhat crude analysis of routine National Health Service records of duodenal ulcer suggests, independently of the general literature on the subject, that duodenal ulcer is a common disease, especially among men; that in men, but not in women, it is associated with hospital-referred psychoneurosis; that in both sexes it appears to be associated with chronic pulmonary disease; that it is a disease in which family history is of undoubted importance as a diagnostic aid, particularly in the case of younger women.

In examining the associated diseases of duodenal ulcer in the same patient or among his relatives, one is also forced to look at the associations between these other diseases. This leads directly to further epidemiological queries. For example, there appears to be some evidence that the daughters but not the sons of parents with either chronic bronchitis or duodenal ulcer have an excess of chronic respiratory disease.

DISCUSSION

Although this preliminary analysis of duodenal ulcer from the routine records of a group general practice has yielded results similar to those obtained from more specifically-designed epidemiological inquiries, these results may still be subjected to careful scrutiny for the influence of the types of bias mentioned at the beginning of this paper.

To what extent does the general practice population—the list—represent the population of the area in which the practice is situated? Up-to-date figures from the 1961 census are not yet available. Figures published for an earlier socio-medical survey of the same area (Stein and Sklaroff, 1952) show that there was a reasonably close approximation of the proportionate age-sex distribution of the practice to that of municipal ward population according to the 1951 Census.

To what extent has the incomplete registration of families influenced the possible "loading" of the families registered with the practice? For example, are some of the wives of husbands with duodenal ulcer registered with a different practice? If so, do these wives have more psychoneurosis than wives who are registered with the same practice as the husband? Are the children who have left the practice the healthy sibs of those with duodenal ulcer who have remained? In the next stage of analysis, it is hoped to obtain firm answers to some of these questions. For the moment an indirect check can be obtained by comparing the annual rates of departure from the practice list of patients with duodenal ulcer, chronic bronchitis, and psychoneurosis respectively.

The patients whose diseases were recorded for analysis in this paper in 1960, and the number of those who left the practice during 1961, have been used to calculate departure rates. There were no significant differences between the sexes in the rate of departure from the list in any of the three disease groups, and the figures are therefore presented in Table V for both sexes combined, and in two broad age groups. The Table suggests that, in the younger age group, 20 to 44, duodenal ulcer patients left the practice more commonly than patients with chronic bronchitis or psychoneurosis, 8.8 per cent. compared with 2.1 and 4.6 per cent. respectively. This difference is significant, $P < .02$.

TABLE V

DEPARTURE RATES OF PATIENTS WITH DUODENAL
ULCER, CHRONIC BRONCHITIS, AND PSYCHONEUROSIS
FROM THE PRACTICE, BY AGE GROUP

Age Group (yrs)	Disease	Patients on List 31 Dec., 1960	Patients leaving List Jan. to Dec., 1961	
			No.	Per cent.
20-44	Duodenal Ulcer ..	227	20	8.8
	Chronic Bronchitis ..	142	3	2.1
	Psychoneurosis ..	325	15	4.6
45-69	Duodenal Ulcer ..	329	6	1.8
	Chronic Bronchitis ..	256	12	4.7
	Psychoneurosis ..	240	9	3.8

In the older age group, 45 to 69, there was no correspondingly higher rate of departure of the duodenal ulcer patients and the differences were not of statistical significance, $P > 0.1$.

Thus there was evidence that the younger duodenal ulcer patients were less likely to remain with the practice than the other younger patients. Among the older patients, the reverse was the case. The high figures of duodenal ulcer prevalence found in the population might still be attributed to the selective effects of even higher rates of departure among healthy patients. This remains to be examined. The fact that the psychoneurotic patients, in the year of observation, left less commonly than the duodenal ulcer patients, may well have influenced the association between duodenal ulcer and psychoneurosis. It is possible that the "mentally healthy" duodenal ulcer patient goes, and the "anxious" duodenal ulcer patient stays.

To what extent do the criteria of classification distort the epidemiological picture? In choosing criteria for indexing diagnoses which are fairly uniformly based on hospital investigation, levels of morbidity are reached which are typical neither of general practice nor of the hospital. For example, the prevalence figures for psychoneurosis lie between the levels reported for these two sources (Kessel and Shepherd, 1962). In adopting a hospital criterion, the less severe forms of the condition are ignored and it may be argued that this omission may alter the epidemiological picture. For example, in the case of the occurrence of duodenal ulcer and psychoneurosis within the family, there is some evidence (Post and Wardle, 1962) of the interaction of psychiatric illness and duodenal ulcer within the family. At the present time the facilities for psychiatric diagnosis are not equal to those for diagnosing duodenal ulcer. A more generally available psychiatric diagnostic service might bring out from general practice records some of the features recorded in more intensive family psychiatric investigations (Goldberg, 1958).

How is the association between duodenal ulcer and another condition to be interpreted? In the first place, a careful record of the details of onset of the two conditions is required in order to see which came first. This is now under study. One must also allow that the association between duodenal ulcer and bronchitis, for example, represents one segment only of a syndrome in which the circulatory system is also involved. This may be explored, to some extent, by examining the association of cardiac disease with duodenal ulcer and chronic bronchitis.

The association between psychoneurosis and duodenal ulcer may be further complicated by the

indirect effects of treatment. Surgical facilities are readily available in the area and more than one-third of the duodenal ulcer patients had had a gastrectomy. Sinclair-Gieben and others (1962) have suggested that gastrectomy itself may lead to psychiatric illness.

This study has been based on cumulative prevalence rates. It refers to persons who were currently registered with the practice and who had had the specified disease some time in the past. In so far as our interest is in the chronic, recurrent, or progressive diseases this is not such a disadvantage as it would be with the acute diseases. As Doll (1959) has emphasized, however, it is the incidence or attack rate of new cases that helps to reveal the aetiological features of a disease. One of the advantages of using routine National Health Service records is that the family diseases known at one time may be used to define groups of patients who are at special risk to develop other diseases. It is not difficult for a general practitioner to provide a simple system of showing the incidence rate of new cases (Committee for Research in General Practice of Medical Research Council, 1960; Eimerl, 1960).

Finally, many of the limitations mentioned in connexion with the interpretation of the National Health Service routine records, apply also to other forms of epidemiological study, *e.g.* the selective migration of healthy persons. Epidemiological tools have to be selected to fit the particular job of analysis, and it is rare for one technique to be able to provide all the answers. This paper has been written in the hope that one tool—the routine records of National Health Service General Practice will not be neglected in the age of sophisticated epidemiology. The contents of two recent epidemiological textbooks (Witts, 1959; MacMahon, Pugh, and Ipsen, 1960) suggest that there is a danger of this happening.

SUMMARY

(1) A special index of chronic diseases and of kinship in a National Health Service group practice has been used to analyse routine clinical records so as to reveal certain epidemiological features of duodenal ulcer in association with chronic bronchitis, psychoneurosis, and arthritis.

(2) Figures are presented of the recorded prevalence of these four diseases, according to age and sex, in the practice as a whole. These rates are used to calculate the expected number for comparison with the actual number of patients with one or other of these conditions.

(3) The following results were obtained:

(a) Duodenal ulcer and chronic bronchitis were significantly associated with one another in both men and women, especially in persons over 45 years.

(b) Duodenal ulcer was significantly associated with psychoneurosis in men, but not in women.

(c) No association was found between duodenal ulcer and arthritis which had been taken as a "control" condition.

(d) The children aged 15-39 years of parents with duodenal ulcer had a significant excess of duodenal ulcer, which was more marked in the daughters than in the sons.

(e) The children of parents with chronic bronchitis showed no excess of duodenal ulcer.

(f) The children of parents with psychoneurosis had no significant excess of duodenal ulcer in the observed age group 15-39 years.

(g) There was no evidence that psychoneurosis in either husband or wife was associated with duodenal ulcer in the spouse.

(h) Chronic bronchitis and psychoneurosis were found to be significantly associated with each other in the same patients, but this association did not account for the association of duodenal ulcer with either of these two conditions.

(4) The value of National Health Service group practice records in the epidemiological study of chronic diseases is discussed in the light of these results.

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