PAPERS AND ORIGINALS

The concept of disease

E J M CAMPBELL, J G SCADDING, R S ROBERTS

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Summary and conclusions

The connotations of the term "a disease" were investigated by studying the ways in which both medical and non-medical people used the word. A list of common diagnostic terms was read slowly to groups of non-medical academic staff of a university, secondary-school students, medical academics, and family practitioners, who then indicated whether they thought each word referred to disease.

All groups rated illnesses due to infections as diseases, but the doctors, and particularly the general practitioners, were more generous in accepting as diseases the terms for non-infectious conditions. Apart from the nature of the cause, the most influential factor in determining whether or not an illness was considered to be a disease was the importance of the doctor in diagnosis and treatment.

These findings provide further evidence that there is ambiguity about the meaning of the term disease. To the layman a disease seems to be a living agency that causes illness. Doctors have obviously accepted more heterogeneous defining characteristics but remain reluctant to adopt unequivocally nominalist ways of thought. The position is not unlike that in the physical sciences, in which there is a good precedent for distinguishing between the formal scientific and the everyday uses of terms such as "force" and "power."

Introduction

Medical discourse has largely been conducted in terms of "diseases." But there is no general agreement on the definition of "a disease,"¹⁻⁸ largely because of the difficulty of avoiding

tautology and because of the confusion between colloquial and medical usages. One of us (JGS) has been concerned for many years with the problems arising from this lack of agreement.⁹⁻¹³ The concept "a disease" is logically complex, in the sense that the name of a disease has implications of different sorts. It may refer to (a) a described and recognisable combination of symptoms and signs; (b) phenomena associated with a specified disorder of structure or function; or (c) phenomena due to a specific cause or causes. These considerations suggested the following definition:

"A disease is the sum of the abnormal phenomena displayed by a group of living organisms in association with a specified common characteristic or set of characteristics by which they differ from the norm for their species in such a way as to place them at a biological disadvantage."

This definition—which we shall call the general definition—allows for the logical heterogeneity of "diseases," since features derived from any of several fields of study may be specified to characterise the patients on the study of whom the description of an individual disease is based. The sorts of features commonly used can be ranged in a hierarchy rising from clinical description or syndrome, through abnormalities of structure and function, to causation. Each of these features tends to displace its antecedent as medical knowledge advances; and definition in terms of cause seems to be accepted as the desirable endpoint.

We tried to discover from the opinions of both laymen and doctors to what extent common usage corresponds to these or other views on the meaning of "a disease."

Methods

EARLY OBSERVATIONS

We first tested the hypothesis that a diagnostic term is more likely to be accepted as referring to a disease if it is definable in terms of cause. We constructed a grid of terms in which conditions definable by cause, structure, function, or syndrome were matched against traditional systems and subspecialties. Thus, amoebic dysentery was at the intersection of "cause" and "gastrointestinal disease"; bronchiectasis at the intersection of "structure" and "chest disease"; hypertension at the intersection of "function" and "cardiovascular disease"; rheumatoid arthritis at the intersection of "syndrome" and "connective-tissue disease." Some terms were also included which were assigned to only one column or row—for example, syphilis to "cause" and diabetes mellitus to "endocrine disease." The final grid contained 60 terms.

Cardiorespiratory Unit, McMaster University Medical Centre, Hamilton, Ontario, Canada L8S 4J9

E J M CAMPBELL, MD, physician
J G SCADDING, FRCP, visiting professor
R S ROBERTS, statistician

These terms were presented to four groups of doctors (n=78). All the terms which more than 95% of the doctors thought referred to a disease (measles, syphilis, whooping cough, amoebic dysentery, tuberculosis, gluten-induced enteropathy) contained (either explicitly or implicitly) information on cause. But all the terms which scored less than 50% (traumatic paraplegia, chronic mountain sickness, multiple traumatic fractures, accidental hypothermia, motor vehicle accident) could also be defined in terms of cause. The difference was in the nature of the cause (explicit or implicit): most of these doctors did not regard the effects of physical agents as diseases. Perhaps they were reflecting the conventional distinction between diseases and injuries (as in *Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death*).

These findings emphasised that the issue has a cultural aspect, which may stem from a primitive view of diseases as causes of or explanations for illness needed only when no overt external event or agency is apparent to the patient. We explored this idea in the main study.

MAIN STUDY

The main study was performed using a set of terms which we thought were known to both lay and medical people; were used in approximately the same way in the UK and Canada; and would vary in their likelihood of being accepted as referring to a disease. Using the results of the first study and some preliminary trials as a guide we drew up a set of 38 terms (table I). The terms were randomised but certain pairs (lead poisoning and carbon monoxide poisoning; high blood pressure and hypertension; depression and schizophrenia; malnutrition and starvation; haemophilia and colour blindness) were "seeded" to keep them apart. For most studies the terms were read

TABLE I—List of terms used in main study (mode A)

1 Tuberculosis	14 Tennis elbow	27 Heatstroke
2 Hypertension	15 Alcoholism	28 Diabetes (mellitus)
3 Emphysema of the lungs	16 Lead poisoning	29 Barbiturate overdose
4 Colour blindness	17 Depression	30 High blood pressure
5 Hay fever	18 Duodenal ulcer	31 Asthma
6 Senility	19 Coronary thrombosis	32 Measles
7 Poliomyelitis	20 Haemophilia	33 Drowning
8 Carbon monoxide poisoning	21 Starvation	34 Malnutrition
9 Acne (vulgaris)	22 Schizophrenia	35 Gall stones
10 Muscular dystrophy	23 Malaria	36 Syphilis
11 Fractured skull	24 Piles (haemorrhoids)	37 Cirrhosis of the liver
12 Cancer of the lung (bronchus)	25 Pneumonia	38 Multiple sclerosis
13 Epilepsy	26 Hangover

FIG 1—Disease connotation as expressed when the terms were administered in the usual order (mode A) plotted against findings when they were administered in reverse order (mode B).

FIG 2—Agreement in percentage yes responses between Canadian and British groups.

in the same order (mode A), but in some cases the order was reversed (mode B) to determine whether there was any major order effect.

There were four main study groups and subgroups. A non-medical academic group (n=60) was composed of members of the faculties of business, engineering, and social studies at McMaster University. The secondary-school students (n=175) were 105 boys in the 6th form of an English grammar school and 70 girls and boys in grade 12 in a Canadian public high school. The academic internists (n=206) comprised 80 members of the department of medicine at McMaster University and 126 who attended an annual meeting of the Medical Research Society in London, England. The general practitioners consisted of 58 who practised in south-western Ontario and who were attending a refresher course at McMaster. Several smaller groups were also studied and will be mentioned where relevant.

With the agreement of an appropriate person (chairman, school-master, dean) one of us (EJMC) attended a gathering of the relevant group. He outlined the purpose of the study, distributed answer forms, and asked participants to state in the "yes" and "no" boxes on the forms whether they thought each of a number of terms he was going to read referred to a disease. He also asked them to indicate their degree of certainty about their decision by putting a mark on a horizontal line marked "certain" at one end and "uncertain" at the other. Questions and discussion that might bias responses were avoided. He then read the 38 terms at five-second intervals. Afterwards lay groups were asked how many of the terms they were unfamiliar with.

ANALYSIS

Individual responses for each term were coded as certain yes, uncertain yes, uncertain no, and certain no, and the percentage of each group who gave each response to individual terms was calculated. In describing the results we called the degree of agreement that a term refers to a disease "disease connotation." Generally we added the uncertain yes to the certain yes responses and compared the percentage yes rate among 38 terms or the percentage yes rate for single terms between the study groups.

To measure similarity between two groups in the rate at which they assigned the label "disease" across the 38 terms, we used the correlation coefficient calculated from the pairs of percentage yes rates corresponding to each term. Rank correlations were also calculated but are not reported since they agreed very closely with the percentage yes correlations.

Results

Before differences between the groups are discussed, the effects of (a) choosing a single measure of disease connotation, (b) the order in

which the terms were read, and (c) any transatlantic bias must be considered.

Measure of disease connotation—The total (certain plus uncertain) yes and the certain yes responses correlated at a level of 0.97 or over in each group. One of these measures therefore conveys all available information, and we chose the total percentage yes.

Order of terms—To assess the effect of reading the terms in a certain order (mode A) we reversed the order (mode B) for some groups. The Canadian and British schoolchildren were each divided into two groups. The correlation in percentage yes responses between mode A and mode B was 0.93 among Canadian students and 0.96 among British students (fig 1). Mode B seemed to produce slightly higher scores in British students. Any order effect should have been reasonably consistent in Canadian and British students—for example, if the Canadian students recorded 75% yes for "depression" on mode

subgroups, and we looked for any differences in their response. Fig 2 shows a general correspondence in the rate of disease connotation for each term. A non-specific transatlantic bias was suggested by the higher rates assigned by British medical academics to almost all terms. Two outlying terms—gall stones and asthma—suggested possible term-specific biases, although some odd points would be expected by chance alone. No transatlantic bias was suggested by the student studies, and only the high blood pressure point seemed unusual.

DIFFERENCES BETWEEN GROUPS

Figure 3 shows results in the four main groups. Taking the non-medical academics as the reference group, we ranked the 38 terms in descending order of their acceptance as diseases. The academics were

FIG 3—Results of the main study. Place of term in normal order of reading (mode A) is given in parentheses. Note that the medical groups lie to the right.

A and only 50% on mode B we should have expected to see a similar pattern among the British students. We correlated across terms the difference between percentage yes for modes A and B among the Canadian students with the equivalent difference among the British students. The correlation coefficient was 0.32, indicating a tendency for the order effect to be related in the two sets of data, thus supporting the existence of a mild order bias. But the correlation was almost entirely due to the term "malnutrition," which showed large swings in both the Canadian and British data. In fact all terms which showed swings of more than 25% between mode A and mode B occurred early in either list, usually within the first five terms. We thus concluded that rather than an order effect there was a practice or learning effect. The responses to the early terms probably reflected some randomness which declined as respondents became more consistent in their judgments. We therefore combined modes A and B results in groups where both modes were used and ignored mode in general when comparing groups. By averaging we produced more representative rates for disease connotation for those early terms that were sensitive to a practice effect.

Transatlantic bias—Two of the study groups, secondary-school students and academic internists, had both Canadian and British

chosen because they were of comparable age and education to the doctors we studied, and their points formed a relatively smooth decreasing curve. Secondary-school students resembled the non-clinical academics while the two groups of doctors, particularly the general practitioners, were more likely to accept terms as referring to diseases.

Level of uncertainty—While few subjects were uncertain when they thought a term referred to a disease, many more were uncertain when they thought it did not (table II (miniprint)). There was no difference between the laymen and doctors in their level of certainty or uncertainty.

DIFFERENCES BETWEEN TERMS IN DISEASE CONNOTATION

We analysed our findings according to four factors which we thought might be important in determining whether or not a person was likely to accept a term as referring to a disease: (a) whether the term was thought to refer to an illness due to an external cause, associated with an abnormality of structure or of function, or recognised only as a clinical syndrome; (b) if the term was accepted as referring to an illness due to an external cause, whether this was an

infection or a physical or chemical agent; (c) the role of the doctor in diagnosis or treatment; and (d) among medical respondents, the particular interest arising from specialist training or experience.

Initially, two of us (EJMC, JGS) grouped the terms into categories relevant to *a*, *b*, and *c*. There were only small differences in disease connotation rates for diseases definable in terms of cause, structure, function, and syndrome (table IIIm). Both doctors and laymen accepted words referring to illnesses caused by infectious agents as connoting diseases. Both also gave terms referring to the effects of chemical and physical agents a lower disease connotation, but doctors were more likely to regard these as diseases than laymen (table IVm).

The importance of the role of the doctor bore a strong relation to disease connotation. Conditions in which the doctor has a definite part to play were regarded as diseases by 69% of laymen and over 80% of the doctors, while those in which the doctor is unlikely to be important were rated as diseases in about 16% of cases by laymen and 32% by the doctors.

Since the doctor's role seemed to be an important factor we developed two three-point scales to rate the role of the doctor in diagnosing and in treating each condition: 112 internists at McMaster and 80 secondary-school children in Hamilton were asked to rate each condition. We calculated the mean diagnosis score and the mean treatment score for each term and correlated these scores with disease connotation scores previously obtained for each of the various subgroups of the study. Correlations for the diagnosis score clustered around 0.62 and for the treatment score 0.45 (table Vm), confirming the importance of the role of the doctor. No differences between laymen and doctors were apparent, but disease connotation was more influenced by the doctor's role in diagnosis than in treatment.

In our list of terms there were enough relevant to respirology for us to compare the response of chest physicians to terms used in their own specialty with the response of the whole group of medical academics. We also did the same for psychiatry. Table VIIm shows that the specialists showed no significant differences from other medical academics.

MINIPRINT TABLES

TABLE II—Comparison of degree of certainty in disease connotation for top and bottom 10 terms

Study group	Average of the top 10 terms		Average of the bottom 10 terms	
	Uncertain yes	Uncertain no	Uncertain yes	Uncertain no
Non-medical academics	0.6	2.0	0.6	1.1
Secondary-school students	5.8	2.9	1.3	17.4
Medical academics	2.3	1.3	5.5	19.4
General practitioners	0.4	0.2	1.9	17.0
All groups	3.1	1.8	4.0	16.7

TABLE III—Disease connotation of the terms grouped according to their main defining characteristics. Results are percentage yes responses

Study group	Cause	Structure	Function	Syndrome	Uncertain
Non-medical academics	51.0	60.7	50.7	54.0	66.7
Secondary-school students	51.5	66.5	47.5	55.9	62.2
Medical academics	60.2	72.6	48.3	62.4	70.8
General practitioners	66.9	82.2	72.7	75.1	86.0

TABLE IV—Terms implying cause grouped by whether this is an infection, an external chemical factor, or an external physical factor. Results are percentage yes responses

	Non-medical	Medical
Infection	96	99
Measles	92	99
Polymyositis	91	95
Syphilis	97	99
Tuberculosis	99	99
External chemical	10	52
Barbiturate overdose	12	65
CD poisoning	17	54
Hangover	32	63
Lead poisoning	32	63
External physical	5	24
Drowning	5	24
Fractured skull	7	52
Heat stroke	16	56

Discussion

Before we interpreted our findings we had to consider whether our groups of respondents were representative and whether the selection of terms was adequate. We believe that our groups were large enough and their responses similar enough to justify our broad generalisations. The terms we selected seemed to meet our general criteria: they were understood by both Britons and North Americans, they included terms with a range of (implicit) defining characteristics; they were understood by laymen as well as doctors—no participant was unfamiliar with more than 10% of the terms; and they produced a range of

responses which were not clustered in a bipolar distribution. Some participants objected to the limited time permitted to reach a decision, but five seconds is much longer than one has available to interpret words in conversation or reading.

In general there was a consistent pattern in designating the terms as diseases common to all groups. But the medically qualified were consistently more generous in their acceptance of disease connotation than the laymen. Indeed, for all terms the general practitioners were more inclined to accept disease connotation than the laymen. The only terms which had a disease connotation for academic internists less than that for non-medical academics by more than 10% were emphysema, muscular dystrophy, epilepsy, and high blood pressure.

The hypothesis that the effects of known causal agents are more likely to be regarded as disease than are illnesses of undetermined cause was valid only for microbiological agents: it did not apply consistently to the effects of physical and chemical agents, though doctors were more inclined to regard these as diseases than were laymen. We think that this inconsistency in relation to the effects of known agents is of little importance. Whether they are called injuries, poisonings, or diseases matters little, since whatever term is used clearly refers to the effects of a specified agent.

Our results therefore pose two questions: firstly, what accounts for the overall pattern? Secondly, what accounts for the medical-lay difference?

ESSENTIALIST V NOMINALIST INTERPRETATION

Most people without medical training seem to think of a disease as an agent causing illness. The common concept of "disease" is essentialist: diseases exist, each causing a particular sort of illness. Doctors tend to adopt a more nominalist position but they obviously retain remnants of belief in the real existence of diseases. Scadding's general definition is nominalist: it indicates how to translate into terms of observation sentences in which the names of diseases appear. It does not endow diseases with metaphysical reality, existing in some undefined sense independently of diseased organisms. It answers the question "What do you mean when you use the name of a disease?" not "What is a disease?" Possibly Scadding's general definition is not generally accepted¹⁴ because it means abandoning in current nosology any possibility of a "unified concept of disease."⁷

Our findings suggest that the presumed importance of the role of the doctor may be a factor in encouraging an essentialist idea of diseases as causes of illness and militating against a nominalist view. The doctor may ask: "Is it useful when dealing with a patient to call his illness a disease?" Likewise, the layman may ask: "Do I need a doctor to explain or treat this illness?" Possibly "hangover" scored poorly because the answer to both questions is "no."

Naming a disease as the cause of a patient's illness may have a useful function in the doctor-patient relationship, especially the general practitioners': the disease becomes a third party, the real enemy. If this speculation has any substance it is small wonder that both doctors and laymen have difficulty in renouncing an essentialist view of diseases.

Since doctors' usages agreed more with the nominalist general definition than those of laymen, medical education and practice seem to favour a move in this direction. This idea was supported by the responses of two groups of McMaster medical students, not reported in detail here, which were consistently intermediate between those of the medically qualified and non-medical groups.

We think it would be possible to formulate definitions of each of the terms used in the questionnaire as the name of an individual disease by inserting into Scadding's general definition a specification of the characteristics of the group of patients on the study of whom the description is to be based. The question then becomes, not "Is this a disease?" but "Is it useful in medical discourse to recognise and name as a disease the group of phenomena so defined?"

This approach can be illustrated by considering the suggestion that poverty might be called a disease on the general definition. "Poverty" could be used as the causal basis of the definition of a disease, just as infection with the tubercle bacillus is the defining characteristic of tuberculosis. For clarity one would then need to adopt a word or phrase distinct from "poverty" to refer to this disease, just as there are separate words for tuberculosis and tubercle bacillus. But it is doubtful whether it would be useful to regard the totality of the ill effects of poverty as a disease and find a name for it. There are many elements in poverty, and the biologically unfavourable factors it may entail are various. The disease defined as that caused by poverty would therefore be a very diffuse concept, and would include some diseases recognised and defined more precisely. Therefore although it would be logically proper to define a disease as "that caused by poverty" and devise a name for it, the resulting concept would be so wide as to be of little value in medicine: it is more useful to discuss the diseases caused by various elements in or consequences of poverty than the broader concept of the biological disadvantages of poverty.

PROBLEMS IN MEDICAL DISCOURSE

Problems arise in medical discourse in relation to diseases of unknown, partially known, or multifactorial causation. Discussion, especially of differential diagnosis, is apt to be confused unless the participants agree initially on the defining characteristics of diseases of this sort. Confusion can happen in two ways.

Firstly, discussants may be using the name of a disease with different defining characteristics in mind. Some may be thinking of it as a clinical syndrome, others as defined by a specified morbid anatomical change, others as defined by specified abnormalities of function, and others by various combinations of these. Presumably those who are content to continue such a discussion without preliminary agreement about defining characteristics have an essentialist viewpoint and think that these characteristics derived from different fields of study identify the same disease, existing independently of its manifestations in patients. This may be illustrated by the discussion of a case of a fully investigated patient with glomerulonephritis, during which a pathologist remarked "In minimal change, you do not get crescents." If "minimal change" refers, as the nominalist would expect, to a specified histopathological pattern, the term "minimal-change glomerulonephritis" used as the name of a disease refers to the sum of the abnormalities associated with this pattern; and the pathologist's contribution to the discussion would be expressed more clearly as: "If I see crescents, I do not categorise the histology as minimal change." But the words actually used suggest the existence of a disease which tends to cause this sort of histopathological change, and in fact the discussion continued as if most of the discussants held this view; though a few crescents were present, the clinical course had been such that some held that nevertheless the condition was "really" minimal-change glomerulonephritis.

Secondly, differential diagnosis may include diseases definable in nominalist terms in different fields of study. Unless this is explicitly recognised, discussion is likely to be fruitlessly prolonged by confusion between logical and factual elements in it, especially if some discussants retain an essentialist idea of diseases as causes of illness. The bronchopulmonary diseases associated with airflow limitation provide good examples of the difficulties arising from this.^{10 14-17} Airflow limitation is an easily detectable and quantifiable disorder of function, which constitutes a useful defining characteristic for an important diagnostic category. Within this, correlations with and between the clinical syndrome, chronic bronchitis, and morbid anatomical changes in large and small airways and in pulmonary acini can be discussed, as can causal factors relevant to each of these. The association between chronic bronchitis and airflow limitation is complex and inconstant. Appropriate questions are: How

much emphysema is present? Is there evidence of changes in the small airways? How much does each of these contribute to the airflow limitation? Nevertheless, the falsely antithetical question "Chronic bronchitis or emphysema?" is often asked. A nominalist definition of asthma primarily in pathophysiological terms with subcategorisation in other fields of study when justified, especially immunology, similarly promotes clear communication and in practice is often implicitly adopted.^{18 19} Nevertheless, there is reluctance to accept it in principle: one study group could not agree to such a definition because some members objected that it did not conform to their concept of what a disease is, though they were unable to formulate a clear statement of this concept.¹⁴

Since such confusions arise in technical medical discourse it seems advisable to recognise two levels of discourse: the scientific-medical, in which a nominalist approach should be obligatory; and the everyday, in which definition need not be objective and quantifiable, and in which it is not so necessary to be on guard against essentialist assumptions. There is a respectable precedent for this sort of dual standard in the physical sciences. The acceptance of formal definitions of force, energy, work, and other complex physical concepts in terms of the basic dimensions of length, time, and mass entails a convention that words that are in everyday use with a variety of meanings shall in scientific discourse refer only to those formally defined quantities. Because this convention has been accepted for a long time, there is little or no risk of confusing the scientific and the colloquial uses of these words.

THE NOMINALIST DEFINITION

To emphasise the nominalist nature of the scientific-medical use of terms for diseases we suggest that Scadding's definition should be reworded:

In medical discourse, the name of a disease refers to the sum of the abnormal phenomena displayed by a group of living organisms in association with a specified common characteristic or set of characteristics by which they differ from the norm of their species in such a way as to place them at a biological disadvantage.

This usage is not generally adopted in colloquial discourse (a) if the cause of the abnormal phenomena is an event or physical agent otherwise obvious to the patient or (b) if the medical profession is not important in diagnosis or treatment.

This nominalist statement requires that in individual definitions the fields of study to which the defining characteristics of each disease belong must be clear. In practice, it is useful to distinguish between diseases with defining characteristics in one field only, and those with characteristics in more than one.^{11 18 19} These can be called simple and compound diagnostic categories respectively. It may be obvious that the name of a disease refers to a compound diagnostic category. For instance, "varicella pneumonia" combines two primary diagnostic categories—"varicella," now defined causally, and "pneumonia," defined in terms of morbid anatomy. An account of it would be included in comprehensive descriptions of either of these. But sometimes reference to a compound category is implicit in established usage, though not verbally explicit—for example, *tabes dorsalis* is defined by reference not only to certain morbid anatomical changes in the nervous system but also to causation by syphilis.

If the names of diseases are to be used with clarity in medical discourse, an analytic approach of this sort is essential. Diseases defined in different fields of study cannot be assumed to be mutually exclusive, and the idea of diseases as causes of illness, implicit in colloquial usage, must be rejected as misleading.

We are grateful to the many participants who co-operated by responding to a questionnaire whose purpose was necessarily obscure.

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Diet and Crohn's disease: characteristics of the pre-illness diet

J R THORNTON, P M EMMETT, K W HEATON

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Summary and conclusions

Thirty newly diagnosed patients with Crohn's disease were interviewed about their habitual, pre-illness diet and compared with 30 healthy controls, matched for age, sex, social class, and marital status. The patients ate substantially more refined sugar, slightly less dietary fibre, and considerably less raw fruit and vegetables than the controls.

A diet high in refined sugar and low in raw fruit and vegetables precedes and may favour the development of Crohn's disease.

Introduction

The incidence of Crohn's disease is increasing in industrialised nations,¹⁻⁹ but the condition is almost unknown in developing countries.^{10 11} Food is the major factor affecting the intestinal environment, and the considerable change in dietary habits during this century¹² may explain why Crohn's disease has become more common. In 1976 workers in Marburg¹³ and Düsseldorf¹⁴ reported that before developing Crohn's disease patients had eaten more refined sugar and foods containing it than matched controls. In these studies dietary data were collected up to 12 years after diagnosis. It is doubtful whether people recall their eating habits of many years previously with any accuracy. Furthermore, neither study included information on dietary fibre, although a low-fibre diet has been suggested as causal factor.^{11 15 16} In view of continuing ignorance about the cause of Crohn's disease, we decided to investigate the possible role of dietary fibre and at the same time to see if these German results could be confirmed with improved methods.

Patients and methods

Thirty consecutive newly diagnosed patients were studied. The diagnosis of Crohn's disease was made by experienced gastroenterologists and supported by typical radiological changes and often by histological examination of tissue. All patients were interviewed within three months of diagnosis. The median duration of symptoms before diagnosis was five months (range 1-92). A single dietitian used the dietary history method¹⁷ to question each patient about his or her habitual, pre-illness diet. Using a specially designed questionnaire, she determined the frequency of consumption and the size of helpings of each of a comprehensive range of foods and drinks. Special care was taken with items containing refined sugar or dietary fibre. Refined sugar was defined as any fibre-depleted sugar, including brown sugar. These data were analysed by computer, using a programme specially compiled from the recent edition of McCance and Widdowson's food tables,¹⁸ to determine the average daily intake of different food components. These tables are the first to contain values for dietary fibre as opposed to crude fibre, which is an inaccurate measurement.^{19 20}

Control subjects were otherwise healthy people who had recently attended the fracture clinic with minor fractures or orthopaedic conditions. They were matched for age (± 5 years), sex, social class,²¹ and marital status, and were closely similar to the patients in height and weight (table I). The controls were interviewed about their diet in the same manner as the patients. Neither group was informed of the purpose or possible findings of the study. The statistical significance of differences was calculated by Student's *t* test or the Wilcoxon rank sum test for paired data, as appropriate.

Results

The patients' intake of refined sugar (median 122 g/day) was considerably greater than the controls' (median 65 g/day, $P < 0.002$; fig 1). Table II shows that the patients consistently took more sugar in both food and drink. Intake was higher in both sexes and with all sites of disease. Sugar consumption was similar in patients whose symptoms had lasted for more and less than 12 months before diagnosis (median 112 and 128 g/day respectively). The patients ate more carbohydrate than the controls but this difference was almost entirely due to their greater consumption of sugar. The two groups ate almost identical quantities of protein and fat.

Dietary fibre intake in the patients (17.3 ± 0.6 g/day) was slightly lower than in the controls (19.2 ± 0.9 g/day, $P < 0.05$), and the patients ate considerably less raw fruit and vegetable fibre (median 0.6 g/day *v* 2.3 g/day in controls; $P < 0.001$; fig 2). As with sugar, this finding was independent of sex, the site of disease, or the duration of symptoms. Thus, median raw fibre intakes in patients who had had symptoms for more and less than 12 months before diagnosis were 0.6 and 0.7 g/day respectively. Intakes of cereal fibre and cooked fruit and vegetable fibre were similar in patients and controls. There was no significant

University Department of Medicine, Bristol Royal Infirmary, Bristol BS2 8HW

J R THORNTON, MB, MRCP, research fellow
P M EMMETT, BSC, SRD, senior dietitian
K W HEATON, MD, FRCP, reader in medicine