The Epidemiology of Chronic Digestive Disease

M. J. S. Langman

The Epidemiology of Chronic Digestive Disease

M. J. S. Langman BSc, MD, FRCP
Professor of Therapeutics
University of Nottingham Medical School

Edward Arnold

First published 1979
by Edward Arnold (Publishers) Ltd
41 Bedford Square, London WC1B 3DQ

British Library Cataloguing in Publication Data
Langman, Michael John Stratton
The epidemiology of chronic digestive disease.
1. Digestive organs – Diseases
2. Chronic diseases 3. Epidemiology
I. Title
614.5'93 RC802
ISBN 0-7131-4329-0

Text set in 10/11 pt VIP Century, printed and bound in Great Britain at The Pitman Press, Bath

Preface

Chronic digestive disease is common, it is frequently disabling and, if due to cancer, is seldom curable. Knowledge of its root causes is fragmentary, but is increasing. The available information is scattered through a variety of sources which include epidemiological, clinical and basic scientific journals. This book sets out to provide an overall picture of digestive disease frequency and of the factors which predispose to it Liberal use has been made of illustrative tables designed to give examples of representative data.

I am grateful to the editors and authors for permission to use figures and tables on pages 22, 82, 44, drawn from *Gut*, the *Scandinavian Journal of Gastroenterology*, and *Science*. I am also grateful to my secretary Mrs. Janice Avery for typing the manuscript. I would have dedicated the book to my teachers, particularly Sir Richard Doll and Sir Francis Avery Jones, for stimulating my interest in the subject, but they deserve something better; or to my wife, but she deserves something different. Lastly I am grateful to my publishers for their patience and help.

Nottingham, 1979 MJSL

Contents

1

General introduction

Gastrointestinal disease is common, yet we have a poor insight into its root causes. Study of the distribution and determinants of individual diseases can yield valuable information about the patterns and behaviour of disease. Much information is already collected in routine statistics, and in understanding what is already available and what can be gained from special surveys and examinations, some simple epidemiological knowledge is required.

Terminology and descriptive methods

The fundamental basis for epidemiological studies is that they describe patients in relation to the population from which they come. Therefore frequency rates can be calculated which relate the number of individuals with a disease to the population from which they are drawn as, respectively, numerator and denominator. These sets of people may be national or regional populations, or some special subgroup according, for instance, to occupation, sex or age.

Incidence rates, prevalence rates and death rates

A critical distinction has to be made between the numbers or proportions of people in a given population who have a disease and the number of new cases arising within a set period. The difference may seem small, but there are likely to be gross variations where a disease persists lifelong.

Incidence rates

These describe the number of new cases arising in a set time period, for a given group of the population, and a convenient figure for chronic disease such as peptic ulcer or gastrointestinal cancer is the number of new cases arising per 100 000 population in a year. Interpretation of a simple figure of this type may still be difficult. Thus if fifty new cases of a disease arise each year per 100 000 population in an area where the population is a quarter of a million, then there will be expected overall to be 125 new cases a year.

Table 1.1 Calculation of standardized incidence rates: Gastric cancer.

Age	Observed incidence per 100 000 population	Standard population	∴ expected cases in standard population
Using a standard population with a lower proportion of elderly people			
0–20	0·0	30 000	0·00
21–40	6·2	40 000	2·48
41–60	40·1	20 000	8·02
61 and over	200·0	10 000	20·00
All ages		100 000	30·50
Using a standard population with a higher proportion of elderly people			
0–20	0·0	30 000	0·00
21–40	6·2	35 000	2·17
41–60	40·1	25 000	10·03
61–80	200·0	15 000	30·00
All ages		100 000	42·20

However, the simple statistics may conceal the fact, as with gastrointestinal cancer, that incidence rises markedly with age. Furthermore there is a commonsense need to consider the reality of the figures. Are all cases ascertained within the area under review? If not, is this because patients fail to present with the disease? Is it because diagnostic fashions vary from place to place? Is it because special centres outside the area under survey collect some of the disease population from the survey area and consequently that disease is under-registered within the area? Is it because the survey method is inappropriate?

Thus, in considering ulcerative colitis within a geographical region, mild cases may fail to present at all, and some cases may be unrecognized even if they do present if medical services are poor. Diagnostic fashion may dictate that the label of Crohn's disease is applied rather than ulcerative colitis; alternatively amoebiasis may be so common that non-specific inflammatory bowel disease goes unrecognized. Finally, if hospital admission statistics are used as a basis of case ascertainment they will undoubtedly miss many cases which are managed solely as outpatients.

Prevalence rates

These describe the number of individuals suffering from a disease at

any particular time in a set population. For chronic diseases prevalence rates will be far higher than incidence rates, whereas for transitory illnesses like influenza the prevalence of active disease may, during an epidemic, be lower than the incidence of new cases, arising simply because a disease episode lasts a few days whilst the incidence rate may be calculated for, say, a full month.

Death rates

These may be as useful as incidence rates in measuring the impact of certain diseases where the chances of death from that disease are very high. Thus they can be taken as indicators of disease frequency in most varieties of gastrointestinal cancer, but it would be foolish to do the same with a disease like peptic ulcer where most people do not die.

Standardized rates

Where diseases vary greatly in their age distribution it is necessary to employ some procedure which allows like to be compared with like. Thus, gastric cancer rises in frequency with age and is comparatively common in the United Kingdom. By contrast, it is rare in most tropical areas. Could this difference be simply accounted for by the fact that Western populations contain a higher proportion of elderly people than do most tropical populations? To obtain comparability it is useful either to compare age-specific disease incidence or mortality rates or to standardize for age.

Age specific rates simply confine attention to all cases occurring in people of a set age, say 50 to 55 years, and relate the numerator of the number of diseased individuals to a denominator of the number of people of that age in the population.

Age standardized rates can be derived as single figures for a population of all age groups and are useful in broad comparisons of one group and another. They can be derived by taking age specific rates and applying them to a standard population which has predetermined proportions of individuals of set ages. The methods of calculation used in considering gastrointestinal cancer, and which can equally be applied elsewhere, are given in Table 1.1. Clearly, such a method will compensate for the effects of variations in the distribution of people of different ages in the original population. Equally, the age distribution of the standard population will weight the absolute figure obtained at the end of the calculation. The lower part of the table shows the effect of weighting the standard population with greater numbers of elderly people in considering a disease like gastric cancer which particularly affects the elderly.

Table 1.2 Calculation of standardized mortality ratios: Occupational mortality in Punch & Judy operators.

Number of men by age group	Number of men in population under study	Death rate in the general population per 100 000 per year
15–24	10 000	0
25–34	25 000	1·5
35–44	30 000	10·0
45–54	25 000	50·0
55–64	20 000	200·0

Total observed deaths in occupational population = 102.

Standardized mortality ratio = total number of actual deaths in population under study ÷ the expected number of deaths in each age group if death rates applicable to the general population had applied, multiplied by 100.

$$\text{Expected deaths} = 10\,000 \times \frac{0}{100\,000} + 25\,000 \times \frac{1{\cdot}5}{100\,000} + \cdots$$

$$= 0 + 0{\cdot}38 + 3{\cdot}00 + 12{\cdot}50 + 40{\cdot}00 = 55{\cdot}88$$

$$\therefore \text{SMR} = \frac{102}{55{\cdot}88} \times 100 = 183$$

Standardized mortality ratios

Comparisons of the mortality experience of people in different occupations are made more meaningful by taking into account the age of the individuals concerned. The Registrar General's tables in England and Wales employ the standardized mortality ratio (SMR) for this purpose, as do others. Basically the calculation is made by taking the total number of deaths in the people in the occupational category in question and dividing it by the sum of the numbers of men in each age group in that occupation, multiplied by the death rates which would have been obtained if the figures for the general population applied, and then multiplying the whole by 100. Table 1.2 illustrates such a calculation for men aged 15–64 years in an occupation where there is about twice the expected mortality from gastric cancer. It can be seen that by aggregating all deaths from the disease in question in the occupational group under study, the method ignores the random variations with age which can give rise to difficulties of interpretation when numbers in each age group are small. The method can equally be applied to other sub-groups of a population, such as religious groups, as to occupational groups.

Official statistics

The range of official statistics available for scrutiny is wide. The Registrar General publishes an Annual Statistical Review of England and Wales, and periodic supplements on cancer. Equivalent publications are available in many other countries. Sound interpretation demands two cardinal considerations. First, the techniques used in analysis must be examined and understood and second, the methods of collection of data must be considered for their appropriateness.

Mortality data

These have been considered earlier (p. 3). The use of mortality data is seldom helpful in examining secular and other trends in the behaviour of chronic digestive disease because the ratio of deaths to disease incidence is generally low. High death rates from, say, peptic ulcer may be associated with high overall incidence rates, but they may also reflect inadequacies in health care, a tendency for the disease in that area to affect the elderly, differences in the frequency of post mortem examinations or the assiduity with which the examination is conducted or even simply variations in coding practices on death certificates. Such problems do not automatically make mortality statistics valueless to the gastroenterologist, but they emphasize the care with which analyses must be conducted. Even when a disease is, for epidemiological purposes, uniformly fatal, like gastric cancer, care must still be exercised in comparing sets of data.

Death certificates are primarily legal instruments and secondarily sources of information about disease patterns. The accuracy of death certificates is not checked routinely in this country, and substantial errors can arise either through variations in coding practices or from simple errors through clinical mis-diagnosis. Data derived from death certificates are adjusted if the results of post mortem examinations are known and reported, but post mortem examinations are seldom conducted on patients who die outside hospital unless death is sudden and unexpected, and, in England, Wales and possibly elsewhere, the frequency of post mortem examination of patients dying in hospital has fallen, and tends to be especially low in the elderly. Until 1975 the primary cause of death only was coded, this being done, as now, according to the International Classification of Disease published by the World Health Organization. This has changed, and all causes of death given on certificates are now coded so that two or more coincident diseases can be recognized officially as well as clinically.

Occupational mortality The recording of peoples' occupations on

death certificates allows figures to be compiled about death rates in different occupations. Roughly every ten years the Registrar General publishes analyses of occupational mortality which include figures for individual occupations, and according to five broad social groups, which are:

Social class I – Higher professional and administrative
II – Intermediate occupations
III – Skilled occupations
IV – Partly skilled occupations
V – Unskilled occupations

These figures are valuable and show large fluctuations, for instance in mortality rates from gastric cancer by social class. Difficulties of interpretation may arise, such as in deciding whether the lower mortality rates which tend to prevail in social classes I and II are due to a greater ability to obtain good medical care than in classes IV and V. In addition the occupation which is coded is the last held by the individual who has died, yet any relevant occupational exposure to health risks may have taken place ten or more years before, when the individual held a different job.

Hospital admission statistics Figures giving the diagnoses of patients admitted to hospital are available in many areas. Thus in England and Wales the Registrar General collects a 10% sample of all discharges and deaths, and publishes a yearly analysis of this Hospital Inpatient Enquiry (HIPE). In addition, details of all hospital admissions are now collected by Hospitals Activity Analysis (HAA) in a survey which overlaps and complements HIPE.

These figures can be used for such purposes as reviewing temporal and geographical patterns of distribution. Much the same precautions must be taken in reviewing such figures as in considering mortality statistics. Though admission or discharge data relate to a far greater proportion of individuals having chronic digestive diseases than do mortality statistics, they cannot be accepted as a random sample of all those actually suffering from the diseases in question. Thus, hospital admissions for peptic ulcer now consist mainly of those with complications of bleeding and perforation or who have had sufficiently persistent or disabling symptoms to justify operation. The assumption that this has always been so would be unjustified; attitudes to the virtues, or probable lack of virtue of courses of inpatient medical treatment coupled with the availability of new potent anti-ulcer drugs has almost certainly reduced the demand for admission, though the scale of the change is hard to determine.

A particular subgroup of individuals with a disease is sometimes used as an index for gauging comparative frequencies from time to time or from place to place. Such figures have their virtues but

again, there are possible errors, thus diseases are not necessarily of equivalent severity in different places or at different times.

Sickness returns Such returns compiled for health insurance purposes can be used to look at disease trends with time, or from place to place. Before accepting such figures at their face value it is essential to consider whether the data are truly comparable. Certificates of disability may have a medical diagnosis attached, but this label is there to give an acceptable reason for illness both to the insurance system and to the doctor and patient. Psychiatric illness may be given a physical disease label, some physical diseases may be currently fashionable and some of the labels, such as gastritis, are so vague as to be almost meaningless. Evidence derived from health insurance data can be taken to support other figures but it is seldom possible to place great reliance on the figures.

Cancer registration In the United Kingdom, like many other countries, cancer registries have been established. In this country individual hospitals are responsible for registration, and this is generally done by clerical staff and not clinicians. Cancer registration is not a legal necessity and it can be incomplete; likewise disease coding may not be uniform, though this is probably a greater problem with extra-gastrointestinal tumours. The Registrar General sends to individual cancer registries copies of death certificates of patients who are recorded on those certificates as having cancer and who have died in that registry's area.

Special surveys From time to time surveys are conducted which enquire into specific problems. Apart from those carried out by individuals with interests in certain diseases large scale surveys have been conducted in a variety of situations. The Registrar General has published a series of reports on medical and population subjects, including one on the accuracy of certification of death. In 1955–56 the Royal College of General Practitioners collected records of consultations in a large group of practices throughout the country. In the USA there have likewise been many specific enquiries including Vital and Health Statistics Reports which appear regularly.

Methods of population survey

Cross-sectional surveys These should identify all individuals who have a disease at a specific time and therefore, if sampling is properly done, should give estimates of disease prevalence. They can also be used to enquire into causative factors by looking back at antecedent features of patients' lives. Such retrospective data are often hard to interpret because patients' opinions about their earlier

lives are likely to be coloured by the existence of disease. A further problem is that if patients have certain characteristics it is usually impossible to decide if the disease predisposed to those characteristics or the characteristics predisposed to the disease.

Longitudinal surveys Such a study starts with a survey which defines the initial characteristics of a population including those with disease and those who are disease-free. Subsequently it is possible to measure the incidence of new disease by follow up of those who were initially disease-free, in addition it may be possible to delineate risk factors for disease if the initial survey has included analyses of possible factors. The Framingham study has been used to identify risk factors, such as overweight, for gallbladder disease by examining the incidence of the disease in people who were initially healthy and who, at the start of the survey, had their body weights noted. Longitudinal studies are expensive, time consuming and need clear planning to ensure that enough individuals are included initially for a reasonable number to develop disease later and to include at the start a reasonable range of possible risk factors for later examination.

General references

Alderson, M. (1976). *An Introduction to Epidemiology*. London, MacMillan.
Armitage, P. (1971). *Statistical Methods in Medical Research*. Oxford, Blackwell.
Barker, D. J. P., Rose, G. (1976). *Epidemiology in Medical Practice*. Edinburgh, Churchill Livingstone.
Hill, A. B. (1977). *A Short Textbook of Medical Statistics*. London, Hodder and Stoughton.
MacMahon, B., Pugh, T. F. (1970). *Epidemiology. Principles and Methods*. Boston, Little Brown.
Snedecor, G. W., Cochran, W. G. (1967). *Statistical Methods*. (6th Edition). Iowa State University Press.

2

Peptic ulcer

Peptic ulcer is a general public health problem throughout the world. Statistics from all sources indicate that 10% or more of Western populations may be afflicted by the disease at some time in their lives. Peptic ulcer also accounts for approximately 10% of all adult admissions to general medical and surgical hospitals and for an appreciable proportion of all new cases attending outpatient clinics.

Progress in understanding the predisposing causes of peptic ulcer and its true frequency is hindered by a number of problems. Though there is clear evidence that gastric and duodenal ulcer are different diseases, epidemiological analyses often do not distinguish between them and hence are greatly reduced in value. Even when the distinction is made, there is still considerable difficulty in finding reliable bases for comparison. The sources of information on the incidence of peptic ulcer disease are:

(1) Mortality rates. These are of limited value, because gastric and duodenal ulcers seldom cause death and may well not be noted even if known to be present as ancillary conditions.

(2) Post-mortem surveys. Provided special attention is paid to gastroduodenal examination, such studies can provide much useful information, though few attempts have, in fact, been made.

(3) Clinical statistics. These may provide information about the number of times the disease was diagnosed in relation to the number of hospital admissions or patient visits within a given period of time. However, the hospital population itself may be highly selected, reflecting referral patterns to the hospital and the specialized interests and skills of the hospital staff. Admission with uncomplicated ulcer is relatively infrequent, except for elective surgery, and the criteria for admission for elective medical and surgical treatment probably vary so much that useful comparisons between areas and times can seldom be made. Analyses of complication rates of acute bleeding, and, particularly, perforation are probably more reliable but suffer from the disadvantage that complications only occur in a minority of ulcer patients, and

conclusions reached in these few may not necessarily apply to the majority.

(4) Prevalence and incidence studies. Population survey in a defined locality, where either the whole population or a random sample of a population of known age and sex structure are investigated forms the best method of determining ulcer frequency. Using this method, disease incidence (the number of new cases in a known time interval for a set population) or prevalence (the total number of patients having the disease irrespective of date of diagnosis in a set population) can be measured by, for instance, investigating radiologically all those with significant dyspepsia in whom no search for ulcer has already been made. Such surveys are clearly tedious and time consuming.

Despite all the difficulties, large amounts of data have been collected and show obvious variations in ulcer frequency throughout the world.

Prevalence and incidence

Autopsy studies Though great variations in ulcer frequency have been reported following post-mortem surveys conducted throughout the world, much of this fluctuation can probably be ascribed to the differing criteria applied in judging whether there was evidence of active or previous ulceration. Failure, for instance, to ensure that the duodenal bulb was examined both internally and externally could lead to many ulcers being missed.

Another obvious source of difficulty lies in deciding whether there is or is not significant scarring indicative of past, but now healed ulceration.

Even when these problems are borne in mind it is clear that ulcer can be very common. Watkinson[1] has emphasized the value of data obtained in post-mortem surveys in patients dying suddenly in hospital, or in all hospital deaths when special attention was paid to the routine examination of the stomach and duodenum. He found that in Leeds, England approximately 20% of all men and 10% of women had evidence of present or previous ulcer. Similar high frequencies have been found in Sweden, and also in the Netherlands[2] where nearly a quarter of all patients had evidence of ulcer disease. Table 2.1 illustrates some of these findings. In all such surveys it must be emphasized that the proportion of patients dying of ulcer would in fact be a small fraction of the number found to have evidence of ulcer.

Ulcer mortality Gastric and duodenal ulcer account for a minor proportion of deaths compared with cardiovascular disease and cancer of the digestive and extra-digestive systems, and Table 2.2

Table 2.1 Frequency of peptic ulcer found at necropsy.

	Leeds[1] 1930–49		Rotterdam[2] 1940–59	
	Men	Women	Men	Women
Chronic gastric ulcer				
active	2·4	1·3	8·5	5·6
inactive	1·5	1·6		
Chronic duodenal ulcer				
active	5·5	1·5	10·2	5·4
inactive	6·7	3·3		
Combined ulcer				
active	1·5	0·6	1·1	0·6
inactive	0·8	0·5		
Acute and subacute ulcer	2·7	2·2	7·5	6·2
Totals	20·5	11·0	27·3	17·2

Table 2.2 Deaths from peptic ulcer and other causes in England and Wales, 1967.[3]

Peptic ulcer	3 861
Cancer of the stomach	12 936
Malignant disease outside the gut	71 378
Disease of the central nervous system	84 960
Disease of the respiratory system	95 118
Degenerative heart disease	148 869
Deaths from all causes	542 516

illustrates this contrast. The tendency for deaths to be more common in men than women reflects the overall frequency pattern of ulcer, but the tendency for gastric ulcer to be almost as common a cause of death as duodenal ulcer (Table 2.3) is almost certainly due to the tendency for gastric ulcer to affect the elderly, whereas duodenal ulcer is more a disease of middle age.

Ulcer mortality rates vary greatly with socioeconomic status, and these trends are well illustrated by figures obtained in the USA[5] and in the United Kingdom.[6] Poorer people in westernized communities have probably always been more prone to die from gastric ulcer than richer people, but the tendency for poorer people to be prone to duodenal ulcer death as well seems to be a more recent trend.

Table 2.3 Average number of ulcer deaths per 100 000 population, England and Wales, 1968.[4]

		Age		
		0–44	45–64	65+
Gastric ulcer	Men	2·6	113	613
	Women	1·6	39	419
Duodenal ulcer	Men	3·0	151	812
	Women	0·5	29	268

Mortality is as much a measure of the age distribution of the population with ulcer and of the quality of medical care as of true ulcer behaviour, and therefore it seems preferable to depend upon morbidity statistics as measures of ulcer frequency wherever possible.

Ulcer morbidity and population surveys The best method of assessment would in theory be by population survey, but few such attempts have been made and reliance frequently has to be placed upon simpler clinical statistics such as hospital admission and complication rates. These are cruder measures but they can still emphasize large variations in disease frequency, for instance in different areas of Africa and India where sophisticated analytical methods have not been applied. Table 2.4 compares the reported frequency of ulcer during surveys conducted in various parts of the world. These figures, obtained within areas where ulcer is very

Table 2.4 Frequency detected in some population surveys.

	Frequency percentage		
	Diagnosed ulcer	Likely ulcer	All dyspepsia and ulcer
Australia 1968[7]	7·2	—	—
India, Assam 1968[8]	8·4*	15·1	28·4
Israel[c,9]	8·9*		
United Kingdom			
London 1946[a,10]	5·2*	1·3	31·0
Aberdeen 1961[b,11]	9·9*	5·2	35·2
USA 1965–67[d,12]	2·5*	—	

* Men only

a Questionnaire and clinical and radiological examination where relevant

b Questionnaire, hospital record check and three year follow-up

c Questionnaire, clinical examination and five year follow-up

d Questionnaire alone