Epidemiology for the Uninitiated

Rates

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Rates are the hallmark of epidemiology, for they form the basis of comparisons between population groups. "Floating numerators" are anathema, for they cannot be interpreted.

A choice of denominators

Most rates take the form:

$$\frac{\text{Frequency of observed state or event}}{\text{Total No in whom this state or event might occur}}$$

The denominator consists of all those, and only those, who might appear in the numerator. Such a rate expresses the proportion of the population that is affected, and also the average risk of being affected for any particular member of it. In a survey, unexamined individuals are clearly not at risk of being recognised as cases, and rates are usually based on a denominator of respondents. This introduces an error, because rates in non-respondents are likely to be different.

In rates for populations and in follow-up studies the denominator may be constantly changing owing to births, deaths, migrations, and other losses. The denominator may then be taken as the average of the initial and final numbers. If losses occur irregularly during the study it is better to use the exact number of *person-years at risk*. In this way, the results in the table identified an association—still unexplained—between coronary heart disease risk and exposure to carbon disulphide. The same approach is useful in dealing with dropouts in clinical trials and follow-up studies.

The figure shows an apparently alarming increase in the proportion of anaesthetic deaths due to accidents, but the trend was due entirely to a large decline in the non-accidental deaths. This shows the danger of relating cases not to the real

Deaths under or connected with anaesthesia: total, and number and percentage attributable to accidents (England and Wales, moving averages).

"at risk" population, but to the "total of patients" (operations, hospital admissions, necropsies, GP consultations). Where the population is unknown there may, however, be no alternative.

Measures of disease frequency

Measures of disease frequency may express *morbidity*, which is the frequency of illness and disability, or *mortality*, the frequency of death. They may be classed also as measures of *prevalence* (static) or *incidence* (kinetic).

PREVALENCE RATE

This is the proportion of a defined group having a condition at one point in time. The prevalence of persistent phlegm production in middle-aged men in Britain has been estimated at about 10%, the condition being defined by response to a standard questionnaire. In 1977 the prevalence of cigarette smoking in middle-aged professional men civil servants was only 11%: here the condition was a disease-related habit. Prevalence is an appropriate measure only in such relatively stable conditions, and it is unsuitable for acute conditions.

Even in a chronic disease the manifestations are often intermittent. In consequence, a "point" prevalence rate, based on a single examination at one point in time, tends to underestimate the condition's total frequency. If repeated assessments of the same individuals are possible, a better measure is the *period prevalence rate*, defined as the proportion of a defined group having a condition at any time within a stated period. In one study the point prevalence rate of angina in middle-aged working men was estimated at 4%. The same interview technique applied annually

Death rates (age-adjusted) from coronary heart disease in a viscose rayon factory

Occupational group	Man years at risk	CHD mortality per 1000 man years
Viscose spinners	6087	9.0
Others	4970	3.7

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Some special rates

Birth rate	$\frac{\text{Number of live births}}{\text{Mid-year population}}$
Fertility rate	$\frac{\text{Number of live births}}{\text{Number of women aged 15-44 years}}$
Infant mortality rate	$\frac{\text{Number of infant (<1 year) deaths}}{\text{Number of live births}}$
Stillbirth rate	$\frac{\text{Number of intrauterine deaths after 28 weeks}}{\text{Total births}}$
Perinatal mortality rate	$\frac{\text{Number of stillbirths + deaths in 1st week of life}}{\text{Total births}}$
NB These rates are usually related to one year.	

in the same men yielded a five-year period prevalence rate of 10%: many men lost not only their symptoms but also, apparently, their memory of them. In this way many chronic conditions are probably much commoner than is supposed.

INCIDENCE RATE

This is the proportion of a defined group developing a condition within a stated period. In clinical use incidence often refers to a frequency, that is, a number of cases. Epidemiologically it is a proportion—that is, a number of cases related to a defined population and a stated period of time.

Incidence measures the rate of occurrence of new cases, and is appropriate to acute or short-lived conditions. At least two examinations are implied. At the first, cases already having the condition are excluded from further analysis. They cannot contribute to the numerator, which consists of new cases; and so they also cannot appear in the denominator, which consists only of persons at risk of qualifying for the numerator. Further, only those new cases must be counted who are included in the "at risk" population. Thus a general practitioner using his practice list to define the population must exclude from a consultation rate patients who are only visitors.

Incidence studies are more complex than prevalence studies and, because incidence rates tend to be low, they need large numbers.

INCIDENCE RATE (SPELLS)

Sometimes the same event can happen more than once to the same individual. For a conventional incidence rate only the first or new event qualifies, but in the absence of some form of record linkage it may be impossible to identify multiple events. This happens in the Hospital In-patient Inquiry, which is an

annually published analysis of hospital cases: the numerator is the total number of discharges (and deaths) for a particular disease, and there is no way of telling how many patients are concerned. The same often holds for general practice consultation rates, occupational sickness absence rates, and venereal disease diagnosis rates. Incidence must then be related to episodes, not persons; thus the "incidence rate (spells)" is the total number of episodes in a stated period related to the "at risk" population.

Such rates need to be interpreted with caution. For example, gonorrhoea notification rates have increased dramatically; but no one knows to what extent this is due to more people getting infected or to the same people getting infected more often.

Prevalence, incidence, and outcome

Each new (incidence) case enters the prevalence pool and remains there until either recovery or death:

If recovery and death rates are low, then chronicity is high and even a low incidence rate will produce a high prevalence:

$$\text{Prevalence} = \text{incidence} \times \text{average duration}$$

Surgical advances in the treatment of spina bifida dramatically reduced the mortality rate, but in the absence of true recovery this greatly increased the prevalence of serious disability. Prevalence rates cannot therefore be taken as simple reflections of incidence rates, because they depend also on outcome and the availability of effective treatment. An adequate description of disease in a population is kinetic as well as static.

Crude and specific rates

A crude rate is one which relates to results for the study population taken as a whole, without subdivision or refinement. To state that the crude mortality rate in England and Wales in 1975 was 11.9 per 1000 per year is medically uninformative: it can be used in demographic estimates of population size, but it tells us little about the health of the nation. The simplest refinement is a "cause-specific" rate, which permits comparisons between different causes within the same population. Nevertheless, if comparisons are to be made among groups, it may be helpful to break results down further, for example, by age and sex.

It is frustrating if results are given for 35-44 years in one report, 30-49 in another, and 31-40 in another. Where feasible, decade classes should therefore be 5-14, 15-24, and so on, and quinquennia should be 5-9, 10-14, and so on. Overlapping classes (5-10, 10-15) should be avoided.

Eventually this series will be collected into a book and hence no reprints will be available from the authors.

How early should a case of Dupuytren's contracture be treated?

Surgical treatment is indicated when the finger deformity is, or threatens to be, severe enough to cause material inconvenience. In most patients the need never arises. Palpable thickening of the palmar fascia is common in the elderly and occurs in about one man in every four or five, a little less often in women,¹ but few need active treatment. In younger patients the progress of the contracture is difficult to predict. In one review of 150 hands showing nodules or bands without contracture less than half progressed in the six to 12 years they were watched.² Bad prognostic features are said to include youth, a family history, multifocal disease with finger or plantar nodules as well as

palmar lesions, knuckle pads, recurrence after earlier surgery, epilepsy, and alcoholism. The disease in women has a more favourable outlook. It should be remembered that surgery may be expected to be more successful in correcting metacarpophalangeal joint contracture than interphalangeal. None of the non-operative regimens tried has ever proved consistently successful. Continued use of the hand is important for immobility induced by injury or disuse appears to make the contracture worse.

¹ Ling, R S M, *Journal of Bone and Joint Surgery*, 1963, 45B, 709.

² Millesi, H, in *Dupuytren's Disease*, ed J T Hueston and R Tubiana, 3rd edn. Edinburgh, Churchill Livingstone, 1974.