MedicalBiostatistics.com

Measures of Morbidity in a Community
Duration of Morbidity

Measures of morbidity

Prevalence and incidence

Capture-recapture methodology

Attack rates

Disease spectrum

For an improved version of this topic, see Fourth Edition (2018) of the book Medical Biostatistics, which has a large number of new topics and expanded discussion. This book available at https://www.routledge.com/Medical-Biostatistics/Indrayan-Malhotra/p/book/9781498799539 list price US$129.95) or go to for discounted price https://www.amazon.in/Medical-Biostatistics-Chapman-Hall-CRC-ebook/dp/B077S4XKDW

Adapted from Medical Biostatistics, Fourth Edition (MedicalBiostatistics.synthasite.com)
by A. Indrayan (indrayan.weebly.com)
Chapman & Hall/ CRC Press, 2008 US$99.95Available at https://www.routledge.com/Medical-Biostatistics/Indrayan-Malhotra/p/book/9781498799539

Acute conditions such as typhoid, malaria, and diarrhea last a few days but chronic conditions such as diabetes, malignancy, and epilepsy can go on for years. The duration depends on the course a disease takes. This, in turn, depends on its natural history, severity, adequacy of treatment if any, the subject's own capability to tolerate it, etc.

For duration of disease to be correct, it is necessary that the onset and the termination points are properly defined. The starting point could be the day of appearance of the first sign or first symptom, the day of diagnosis, the day of a positive test, the day of reporting, etc. The termination could be in terms of disappearance of complaints, ability to resume normal activities, negative test, discharge from the hospital, etc. Note how different definitions can yield very different duration of disease.

In case of acute conditions, a measure of the duration of sickness for a group is its mean or the median. It is also advisable to calculate the standard deviation and include this in the report so that the reader knows the extent of variation.

In the case of chronic conditions, the distribution of duration of sickness may be far from a Gaussian pattern. A longer duration will be more common than a shorter duration. This makes the distribution skewed to the right. If so, the mean may not be a true representative of the central value. The median and 3rd to 97th percentiles are calculated instead. If the disease is severe and end-point is death, such as in leukemia and acquired immunodeficiency syndrome (AIDS), the duration of sickness is the same as the duration of survival.

Duration of sickness has more exactitude when it is replaced by duration of activity restriction or duration of disability. In an economic sense, this can be measured in terms of loss of days of normal activity. Average duration of sickness can be computed separately for each disease or for each demographic group such as age 40-49 years and female gender. The methods for duration of survival (survival analysis) can also be used to analyze duration of morbidity.

Prevalence in Relation to Duration of Morbidity

Duration of morbidity does not affect incidence but severely affects prevalence. Prevalence tends to accumulate and becomes higher when the duration is long. Incidence is the in-flow, prevalence is the stock. Figure 1 illustrates the effect of duration on prevalence when the incidence is the same. The disease on the left side has shorter duration than the disease on the right side. The prevalence in the latter case is higher although the onset in both the cases is the same. For example, on day 6, the point prevalence is 3 cases on the left side and 10 cases on the right side.

If treatment reduces the duration of illness, then the prevalence rate would decrease. But if the treatment were such that it prevents death without full recovery, then, paradoxically, the prevalence would increase. On the other hand, if the decrease in duration were sufficiently large, the prevalence would decline even if the incidence increases.

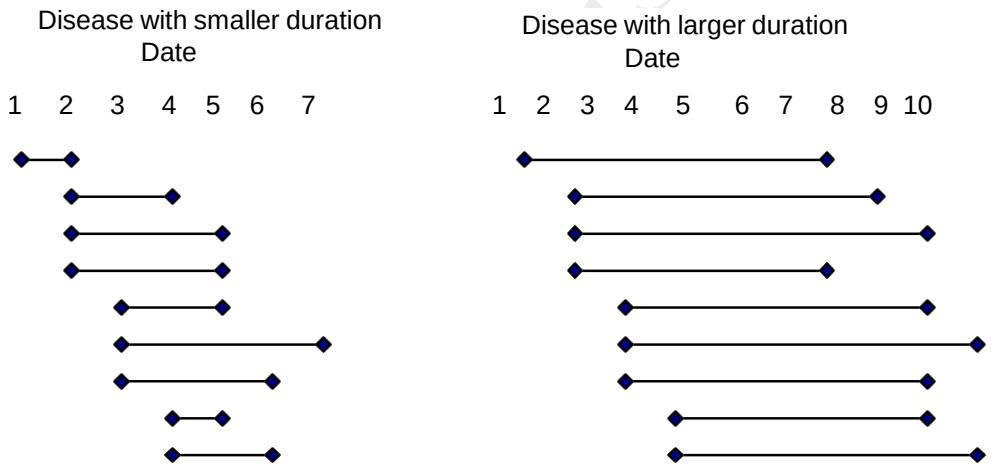

Figure 1 Effect of duration of morbidity on prevalence

Incidence from Prevalence

A follow-up study is relatively more expensive than a cross-sectional survey. Thus, it is easier to obtain prevalence than incidence. The duration of sickness can also be generally easily obtained. Because prevalence depends on the incidence and duration, the relationship can be exploited to find incidence on the basis of prevalence and duration. *If there are no intervening factors,* then

$$\text{Incidence} = \frac{\text{prevalence}}{\text{average duration of sickness}}, \qquad (1)$$

where incidence and duration are in the same time unit. If the annual incidence is to be calculated, then the duration too is to be measured in terms of years. If the average duration of

sickness for a particular disease is 15 days then this is 15/365 = 0.041 years. If the prevalence rate is 1.2 per thousand and the duration 15 days, then the incidence rate is 1.2/0.041 = 29 per thousand per year. If the prevalence rate is per 1000 persons, then incidence too is a rate per 1000 persons. Incidence can be calculated for specific groups, such as by age, gender, occupation and region, by inserting the prevalence and duration for that group in Eq. (1).

The concept of duration of sickness is applicable to all acute conditions but not so much to chronic conditions. Some not so severe conditions such as hypertension, varicose veins and lower vision can seldom be fully reversed in a manner that would allow normal life without on-going treatment. For such conditions, the duration of disease is anybody's guess. If the condition is more concentrated in the elderly, such as diabetes mellitus, mortality affects the prevalence. Mortality itself may be higher in the group with disease than in the nondiseased group. Such conditions interfere with Eq. (1) and invalidate it. More elaborate calculations may be required to estimate the incidence from the prevalence of such conditions.

There is yet another set of chronic ailments that are reversed in some subjects but not in all subjects. This can happen with any disease but is very common with conditions such as cataract blindness. This is reversed by surgery, but many affected subjects may not use the facility for various reasons. An additional consideration in cataract blindness is that it is a disease of old age, when mortality is high. Also, this is an example of a disease in which the death rate among the diseased is generally higher than among the nondiseased. Formula (1) is not applicable to such conditions. Podgor and Leske [4] have given the procedure for estimating incidence from the prevalence of such conditions, although they consider only irreversible diseases.

Epidemiologically Consistent Estimates

It is easy to understand that the incidence, prevalence, duration, remission, and case fatality for any disease are interrelated (Fig 1). Also, age at onset, remission, and duration are related to age-specific mortality for that disease. Quite often these are estimated from disparate sources, such as prevalence and age-specific mortality from a cross-sectional survey, incidence from one cohort study, and remission, duration, and case-fatality from another longitudinal study. There is a great likelihood in this case that various rates are not internally consistent. Age-specific mortality may not be the same as expected on the basis of age at onset, duration, and case- fatality, or prevalence may not be the same as expected from the incidence, duration, remission, and mortality estimates. A package, called DISMOD, is available from a WHO web site that can be used to check the internal consistency of these estimates. In case they are not internally consistent, the more reliable rates can be used to generate consistent estimates of the other rates.

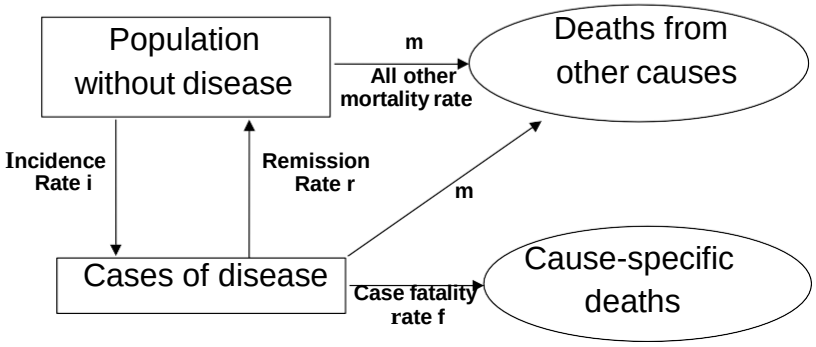

Figure 1 Interrelations for epidemiologic consistency of data

Source: Murray and Lopez

This package can also be used to generate estimates of rates that are not available at all. The generated rate would be epidemiologically consistent but may not be plausible in terms of the knowledge of the experts. In that case, some iterations may be needed in terms of reentering a new set of known rates so that the final estimates are not only internally consistent but also plausible.