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Measures of Morbidity in a Community Disease Spectrum

[Measures of morbidity](#)

[Prevalence and incidence](#)

[Capture-recapture methodology](#)

[Duration of morbidity](#)

[Attack rates](#)

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 <https://www.amazon.in/Medical-Biostatistics-Chapman-Hall-CRC-ebook/dp/B077S4XKDW> for discounted price

Adapted from Medical Biostatistics, Fourth Edition (MedicalBiostatistics.synthasite.com) by A. Indrayan (indrayan.weebly.com)

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The term spectrum of disease is used in at least three senses. This can be illustrated by considering pain. First, one can think of pain characteristics such as throbbing, intermittent, local, etc. Second, is the magnitude of pain – mild, moderate, severe, etc., or 7 on a 10-point scale. Prognostic severity such as stage of cancer also comes under this category. Third can be possibly called progression described for infection from susceptibility to virulence. This is illustrated in Fig. 1. This figure shows as though a large percentage of exposed cases get the infection and a substantial portion manifest, but actually these proportions are small in practice.

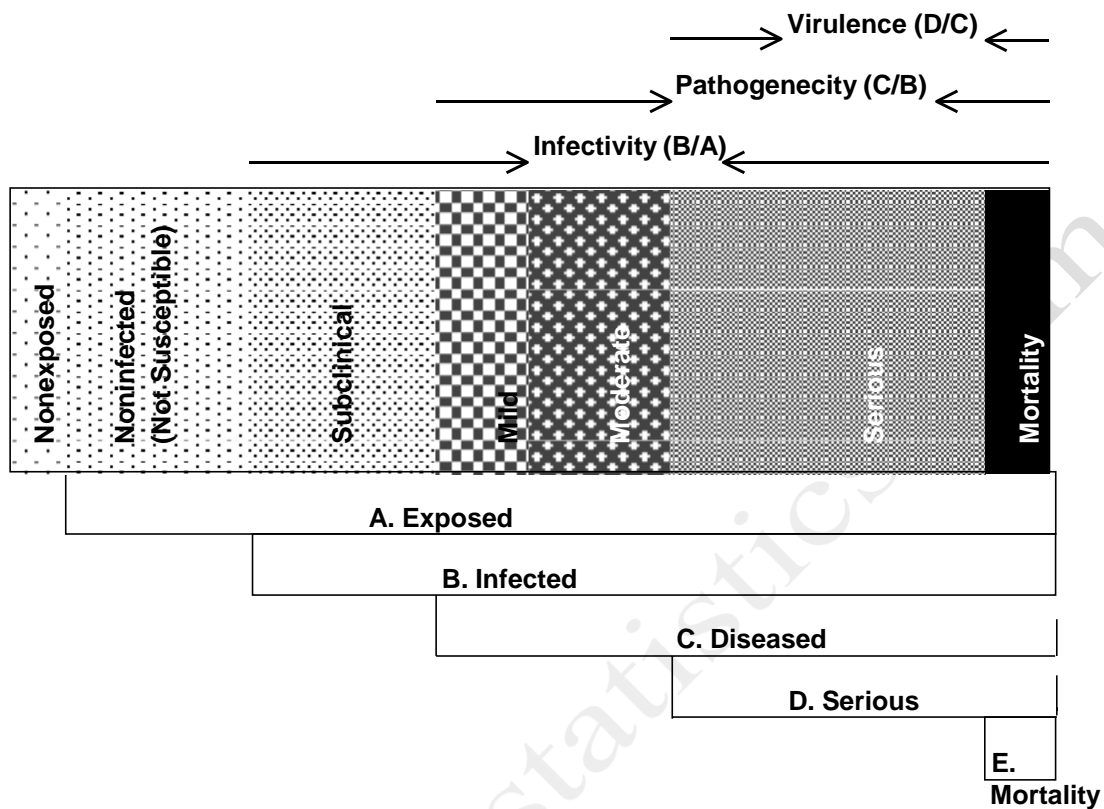


Figure 1 Disease spectrum

Susceptibility is proneness. An effectively immunized person against diphtheria, pertussis and tetanus (DPT) is not susceptible to these diseases for at least one year. A child is not susceptible to myocardial infarction. Susceptibility is a property of the host. Infectiousness is the property of the agent that causes infection. Measles virus is highly infectious for a susceptible but HIV is not. Infectivity is the actual performance in terms of the percentage infected when exposed. Infection may or may not manifest the disease. The percentage of susceptibles that gets the actual disease after the exposure can be called pathogenicity. Out of those diseased, many will get mild episode and recover easily. The percentage that gets severe form of disease requiring hospitalization and have risk of death can be called virulence of the disease. Cholera is highly pathogenic but less virulent whereas rabies is less pathogenic but more virulent. AIDS is less infective but very pathogenic and highly virulent. At the end of this spectrum is mortality, which is the ultimate for virulence. Mortality can be measured per 1000 population or as percent affected. The latter is called case-fatality as already defined.

The following indicators can be calculated to delineate the spectrum of a disease.

$$\text{Infectivity} = \frac{\text{number of subjects infected}}{\text{number of subjects exposed}} * 100$$

$$\text{Pathogenicity} = \frac{\text{number of subjects manifesting the disease}}{\text{number of subjects infected}} * 100$$

$$\text{Virulence} = \frac{\text{number of subjects with serious disease (including mortality)}}{\text{number of subjects with disease}} * 100$$

The terms pathogenic and virulent are drawn from infectious diseases but can be used for chronic diseases as well so long as the meaning is explained. Division of cases into such spectrum can be a big help in choosing treatment strategies and in prognostic assessments.

Disease spectrum is likely to be very different during the times of epidemics than in normal times. **Epidemic** is said to have occurred when the incidence is clearly in excess of the usual rate. Although a statistical scale such as (usual + 2SD) can be used to assess that the occurrence is clearly in excess of the usual or not but practically this is rarely done. If hospitals and health centers find a sudden rise in cases amongst the patients they attend, epidemic can be safely presumed. Calling slight excess as epidemic and getting a premature alarm is not as bad as being caught unawares for high occurrence. Thus, even a suspicion of increased incidence is good for health managers to take preventive steps.

Another related concept is transmissibility. If an infectious person is able to infect at least one person on average during the entire period of infectivity then the infection will sustain or increase. This is called **reproductive rate of infection**. In countries where hepatitis-B infection is on the rise, this rate is more than one. If reproductive rate is less than one, expect that the infection will die down or stabilize at a low level.