Communicable disease outbreaks

Describing an epidemic

Jeanette E Ward

The role of the general practitioner (GP) as the medical expert at the centre of Australia's multidisciplinary primary healthcare system is never more acute than when populations are threatened by a communicable disease epidemic. This series is a refresher covering key concepts. This first article sets the scene by explaining terms used by public health authorities.

SPORADIC CASES of a known communicable disease can always occur. However, an outbreak is a sudden rise in the number of cases of that communicable disease in a specific community, setting or geographic area. Terminologically, 'outbreak' generally is used to refer to very local instances of disease increases greater than usual local epidemiology. An 'epidemic' is a comparable term also used when the number of cases of a disease exceeds the expected level in a specific population for a given period of time, but it is generally applied when numbers are considerably higher than expected or the affected location is somewhat larger. Deciding between the terms 'outbreak' and 'epidemic' is not especially critical, as both refer to changes in epidemiological patterns that can only be evaluated by having an accurate understanding of previous local epidemiological disease patterns. In the public's mind, declaring an epidemic is rightly considered a significant public health announcement. The term 'cluster' is sometimes used when there is more uncertainty about local epidemiology warranting an investigation. 'Cluster' is also used to denote a 'hot spot' of cases in an epidemic. Outbreaks and epidemics can be declared irrespective of whether the causative agent (virus, bacterium etc) is already well known to infect humans or is a novel strain that has not previously wreaked this level of havoc.

A pandemic is defined as an epidemic occurring over a very wide geographical area crossing international boundaries and usually affecting a large number of people. For example, an influenza pandemic is declared by the World Health Organization (WHO) when there is simultaneous transmission to epidemic proportions of a specific influenza strain worldwide. Logically, epidemics of the communicable disease must have been declared in several countries before a pandemic can be declared. Determination (or not) of a pandemic by the WHO can elicit controversy as there are no objective criteria by which to quantify spread, case fatality, seasonality or number of affected countries in order to trigger this declaration. Nonetheless, either pre-emptively or early in a pandemic, the WHO should alert unaffected countries about the risks of further global spread. Most early cases to appear in a previously unaffected country will be travellers from the original site/s of an epidemic or direct contacts of such travellers who were exposed when the traveller was infectious. Through prompt identification of these early imported cases and meticulous contact tracing, an epidemic can theoretically be suppressed or at least delayed in an otherwise unaffected country.

Early pandemic responses in an unaffected country can be compromised if cases are not easily identified or, especially when the 'infectiousness' of the early cases has likely passed, their contacts are not identified and quarantined in order to reduce their potential role in turn as 'spreaders' of the infection. However, if transmission routes are not well understood, as is the case when the pandemic is due to a virus not previously known to affect humans, the public health task is considerably complicated. Is the virus present on surfaces? If it is, can it still be transmitted and cause disease? Is it only spread by droplets? Is transmission faecal–oral? Is a case infectious before developing symptoms themselves? It is also very difficult if there is no accurate test to diagnose infection or, if one exists, it is not available in the places where it is needed.

Whether an outbreak, epidemic or pandemic, a key tool for public health decision-making is the 'epi curve' (shortened version of the correct term 'epidemiological curve'). Ironically, an epi curve is not really a curve; it is a histogram in which the number of cases of a specific communicable disease is meticulously illustrated on a day-by-day or week-by-week basis according to their clinical presentation. Epi curves are also used to predict the future pandemic pattern if disease characteristics are sufficiently known. This helps to predict the number of cases with serious complications and demand on health services. Where infection causes mostly mild disease that does not result in death, a pandemic will have little impact on the health system. In contrast, a disease caused by a pathogen that has a high rate of serious complications requiring hospital-based treatment, such as treatment in intensive care units for severe respiratory failure, will create a significant demand on the health system.

Critical to describing the public health threat is R_0. This is the 'basic reproduction number' quantifying the average number of infections of other people attributable to one case. Note the 'effective reproduction

number' is adjusted for the level of immunity in the exposed population. If R_0 for a novel virus is high and the rates of serious complications from infection are also high, then public health experts will likely advise strong, uncompromised measures to 'flatten the epi curve', which is shorthand for delaying the predictable number of cases to come by reducing the speed of transmission in the community. Effectively arresting communicable disease will affect the look of the epi curve and what it predicts. Public health measures may not always achieve absolute prevention of predicted cases, which is known as 'containment'. Usually, population-based preventive measures are taken to reduce transmission so that an intensive wave of serious clinical presentations does not overwhelm the hospital system; instead, presentations are spaced out. If the disease pattern is not well understood, it is difficult to design a proportionate public health response and balance the preventive steps recommended to those at risk with the costs of these steps to everyone else.

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