

What is the difference between a pandemic, epidemic, and an outbreak? There are many definitions for a pandemic. The *International Epidemiology Association's Dictionary of Epidemiology* defines pandemic as "an epidemic occurring worldwide or over a very wide area, crossing international boundaries and usually affecting a large number of people." The definition of the World Health Organisation is much simpler is, "the worldwide spread of a new disease."

However, the WHO no longer uses the term: "pandemic". Nevertheless, it has been used by the WHO during the COVID-19 because using it has an impact in the perceived level of risk posed by an outbreak. So we now know that there are multiple definitions of a pandemic, but they are all qualitative, and they all imply a very wide area and large numbers of people affected. So we can say a pandemic is a global epidemic.

Endemic is a disease that is present in a population or area all of the time. Diseases that are not endemic in certain areas might be because there are environmental factors that prevent the survival or spread of the transmission vector, like with malaria, or because there is geographic isolation of such an area from infected areas. That happens with strangles in Iceland.

It could be also due to tight and effective control measures, like rabies in the UK, or effective and successful vaccination and eradication strategies, as happened with smallpox. This means that the base levels of cases are 0. On the other hand, hyperendemic means that the endemic level of a disease in a population is persistently high.

So an outbreak is a greater than anticipated increase in the number of endemic cases. The terms epidemic and outbreak can often be used interchangeably, even in scientific literature. However an outbreak is a limited type of epidemic.

In the early stages of an outbreak, it is important to determine if the organism causing it could go on to generate an epidemic or a pandemic. For that we have epidemic nowcasting, which is, broadly speaking, the assessment of the current state of an ongoing outbreak by understanding its characteristics that include the pathogenic, epidemiological, clinical, and socio-behavioural factors that play into the development of an ongoing outbreak.

So when does an endemic disease become epidemic? Well, epidemic is the baseline level of a disease. An epidemic refers to the often sudden rise in the number of cases above the normal endemic level. For example, there is no established threshold for the number of cases, duration, or disease of geographical areas affected for something to be deemed an epidemic.

Seasonal influenza is often described as a seasonal epidemic. There is a fine balance between host factors, the cause of a disease (that can be a fungi, a virus, or a bacteria), and environmental factors, and a shift in any of these factors can result in a spike in the case numbers.

A pandemic then is a worldwide spread of a new disease or a strain of an existing disease to which the majority of the population does not have any immunity. The 1918 Spanish Flu epidemic that ripped across the globe after the World War I is a typical example of a pandemic. However, there are countless examples of pandemics throughout history.

Equally, a disease can go from being epidemic to then become endemic. Changes in the environment mean that a disease vector previously unable to survive in an area, for example, may now be able to survive, as has been seen with malaria, or the increased exposure to the disease may change the immunological landscape in the host, now allowing a disease to be endemic. Even changes in the pathogen, such as mutations, can make it better adapted to survive in a new host or environment, as happens with zoonotic diseases, and as we have observed with SARS-CoV-2.