

## Measures of disease occurrence review

Marcello Melini, Mariana Kikuti, Xiaomei Yue, Emily Geary, Cesar A Corzo  
University of Minnesota

The MSHMP weekly report contains the graphic representation of the occurrence and dynamics of specific swine pathogens using epidemiologic tools that measures of disease occurrence such as, prevalence, cumulative prevalence and incidence. In this science page we would like to reacquaint our audience with a few of these tools.

**Prevalence** refers to the number, expressed as a proportion of the population, of cases of a disease that occur in a determined time point. When time is not specified in a report or study it is called “point prevalence”, the time can be attributed to a particular moment, and “period prevalence” is referred as the number of occurrences of a disease known to have happened in a specific period (e.g., year, semester).

A simple way to calculate prevalence is:

$$\text{Prevalence} = \frac{\text{number of individuals having a disease at a particular point in time}}{\text{number of individuals in the population at risk at that point in time}}$$

Example:

A clinic wants to know how many of the 50 sow farms in a specific county have an ongoing PRRSV outbreak. They sample each farm once during June 2022. Laboratory results confirm that 19 of those farms are positive to the virus, therefore, the prevalence of PRRSV positive farms in that county during June 2020 is 0.38 or 38%.

**Incidence** is the number of new cases that occur in a defined population in a specific period. Studies based on incident cases of disease are also used to identify the factors associated with the animals becoming infected or ill.

Cumulative incidence refers to the proportion of animals or farms that do not have the disease at the beginning of a period of study and become positive during this time. In this case, the unit of analysis (animals or farms) need to be sampled at least twice throughout the period of interest. This measurement indicates the risk of a disease developing in a specific point in time.

Cumulative incidence can be calculated the following way:

$$\text{Cumulative Incidence} = \frac{\text{number of individuals that become diseased during a particular period}}{\text{number of healthy individuals in the population at the beginning of that period}}$$

Example:

Using the previous scenario, the clinic now conducts additional testing to the 31 remaining negative farms in the county during July 2022 in order to assess how many have now become positive for PRRS. The results indicate that there are now 13 new PRRSV positive farms. The cumulative incidence would be 0.42 (13/31) for the sow farms of that county during July 2022.

Another kind of incidence is the “incidence density”. This is similar to cumulative incidence in the sense that it is an estimation of new cases, however, it allows for dynamic populations (i.e. animals/farms enter or leave the study throughout the period of interest). The contribution time of each unit of analysis (animals or farms) is now taking into consideration in the calculation of incidence. This gives us an idea of time to outcome.

Example:

In the previous scenario, the clinic continues to follow up the 18 farms that remained negative at the end of July. Those were re-sampled during August 2022 and they now found two additional cases. The incidence density would be 30 cases per 100 farm-month, or 30 new cases if we have followed 100 farms for a month. This is calculated by dividing the total number of cumulative new cases (13 in July plus 2 in August) by the total contribution time of each farm (13 farms follow for a month plus 18 farms followed for 2 months = 49 farm-month).

References: 1) Slater, M. R. (2003). *Veterinary Epidemiology*. Butterworth-Heinemann. 2) Thrusfield, M., & Christley, R. (2018). *Veterinary Epidemiology* (4th ed.). Wiley-Blackwell. 3) Dohoo, I. R., Martin, S. W., Martin, W. S., & Stryhn, H. (2003). *Veterinary Epidemiologic Research*. AVC Incorporated.