

## Incident vs. Prevalent Cases and Measures of Occurrence

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To determine which factors impact health outcomes at the population level, epidemiologists employ a number of different study designs. These designs are used to examine the relationship between exposures (or determinants) and health outcomes. A health outcome may be a disease, condition, death, event or a change in health status or behavior. For example, in addition to diseases, we may study health events such as injuries or the occurrence of an “event” such as preterm birth. Persons who experience the outcome of interest are commonly referred to as cases.

One of the first things to consider when developing a study is whether you will measure prevalent or incident cases.

Prevalent cases are all individuals living with the outcome of interest within a specified timeframe, regardless of when that person was diagnosed or developed the health outcome.

### Example

In a study of prevalent cases of diabetes with a one year time period, anyone who has diabetes during the one year study period would be counted as a case.

These prevalent cases would include both people who have diabetes at the outset of the study year as well as any who developed diabetes over the course of the study.

*Incident cases* are all individuals who change in status from non-disease to disease – or from one state of a health outcome to another – over a specific period of time. In other words, “incidence” refers to the occurrence of new cases.

### Example

For example, in a study of incident cases of diabetes with a one year time period, only those who developed diabetes over the course of the one year study period are considered incident cases.

### Measures of frequency

#### *Prevalence*

Prevalence is the proportion of a population living with a specific health outcome within a specified time. It is the only measure of occurrence calculated with prevalent cases. To calculate prevalence, the number of prevalent cases (numerator) is divided by the total population at risk



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(denominator.) The total population at risk denominator includes the prevalent cases. Prevalence is often reported as a percentage.

$$\text{Prevalence} = \text{Prevalent cases} / \text{Total population}$$

Depending on the type of prevalence being calculated, the denominator can be either an average of the population over time or a single measurement at a specific point of time.

Prevalence can either be calculated as a *point prevalence* or *period prevalence*. A point prevalence is calculated with data from one specific point in time, while a period prevalence is calculated over a range of time.

Prevalence is directly affected by the incidence and duration of the health outcome under study, which makes it a poor choice for diseases or outcomes with a short duration or high mortality rate.

#### Example

For example, *Vibrio vulnificus* – a disease caused by consumption of raw shellfish – has a low incidence and short duration. Therefore, the few new (incident) cases that arise will remain prevalent in the population for only a short time before the cases recover or die. However, for a disease like diabetes, which has a higher risk or rate and longer duration, the prevalence will be higher than the risk or rate and is a valuable measure of the burden of disease in the population.

$$\text{Prevalence} = \text{Rate} \times \text{Duration}$$

#### Risk

Like prevalence, risk is also a measure of the extent of a health outcome in a population. However, unlike prevalence, risk is the proportion of an at-risk population that develops a specific health outcome within a specified amount of time. The numerator for risk is incident cases, and the denominator includes only those at-risk of developing the outcome of interest at the beginning of study follow-up.

#### Example

If the disease under study is ovarian cancer, which obviously only affects women, the denominator should consist only of women in the population who, at the start of study observation, do not have ovarian cancer and are capable of developing ovarian cancer.

$$\text{Risk} = \text{Incident cases} / \text{Population at-risk}$$

Risks are often reported as a scaled value, such as cases per 1,000; 10,000; or 100,000 population.

#### Rate

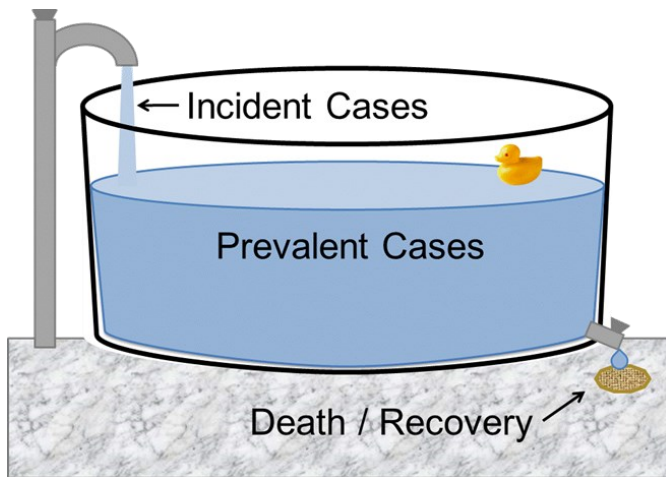
Rate is another measure of health outcome occurrence calculated with incident cases of the health outcome. However, the denominator for a rate is the total amount of person-time at-risk. Person-time is an estimate of the actual time-at-risk – in years, months, or days – that all participants contributed to a study. In its simplest form, person-time is a sum of each study participant's time at risk before experiencing the outcome of interest or exiting the study. This is a better estimate of the true at-risk population because it excludes time for participants who are no longer eligible to experience the outcome of interest. Thus, rates are a better reflection of health outcome occurrence in a dynamic population, where participants may exit the study or become no longer at-risk.

$$\text{Rate} = \text{Incident cases} / \text{Total person-time at-risk}$$

The unit for a rate is “cases per person-time.” Rates are often reported as a scaled value with a time unit relevant for the study, such as cases per 1,000 person-years, 12,000 person-months, or 365,000 person-days.

Rates are favored if the rapidity with which new cases of the health outcome or new events are occurring in the population is of interest.

### Comparing Measures of Occurrence



The image of the bathtub below graphically represents the relationships between prevalence, risk, and rate.

In this analogy, prevalence is the proportion of the tub (the total population) filled with any water (prevalent cases and incident cases). Risk is the proportion of the tub filled with new, flowing water (incident cases). Rate is a measure of how quickly the water flows into the tub. Prevalent cases only leave the prevalence pool by either recovery, death, migration out of the population or loss of study follow-up via the bathtub drain.

#### References

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#### Terminology

*Prevalent cases* – all individuals living with the health outcome of interest within a specified timeframe, regardless of when that person was diagnosed or developed the health outcome

*Incident cases* – all individuals who change in status from one state of health to another (such as non-disease to disease) over a specific period of time

*Prevalence* – the proportion of a population living with a specific health outcome within a specified timeframe

*Risk* – the proportion of an at-risk population that develops a specific health outcome within a specified amount of time

*Rate* – the frequency of incident cases per unit of person-time

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