

**2. Case Definition in Health Surveillance & Outbreak Investigation**

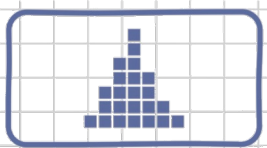
...a set of criteria to be fulfilled that defines whether an individual has a particular health condition, e.g., a disease, and, thus, identifies as a case, usually following an agreed-upon standard in order to ensure comparability of case reports from different temporal and spatial context. During an outbreak investigation, case definitions are usually tailored to the local situation, considering the level of knowledge about the health condition and diagnostic capacity. Criteria of a case definition include clinical features, such as a combination of symptoms, objective physical findings, confirmatory laboratory testing, among others. Moreover, criteria on time, place, and/or individuals are specified to further define the scope of an outbreak event. In addition, exclusion criteria may be defined. Case definitions may change over time as more information becomes available.

- Cluster** ...describes a number of cases of a disease aggregated in place and time that are suspected to exceed the number of expected cases, even though this number may not be known.
- Outbreak** ...occurrence of a disease, often sudden, with greater extent than the expected number of cases at a particular time and place. For example, two associated cases of a rare disease can already define an outbreak.
- Epidemic** ...refers to the same definition of „Outbreak“ but often with larger geographic extent, usually affects a larger region of a country or a group of countries.
- Pandemic** ...a disease outbreak affecting countries worldwide with a large number of cases over a period of time
- Outcome** ...an event of (health) endpoint under study
- Exposure** ...risk factors associated with the event or (health) endpoint under study

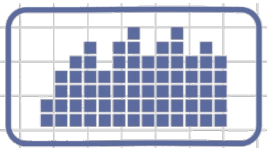
- No Case** ...criteria specific to a confirmed, probable, possible or suspected case are not met
- Suspected/possible case** ...unknown health outcome/disease with specific clinical features
- Probable case** ...unknown health outcome/disease with specific clinical and laboratory criteria and/or an epidemiological link
- Confirmed case** ...health outcome/disease with specific clinical features and laboratory confirmation and an epidemiological link
- Time** ...specific temporal context like time of disease onset or when exposure to risk factor emerged
- Place** ...specific spatial context like geographic extent of the outbreak or specifics on site of infection, e.g., residence or workplace
- Person** ...specific population criteria like age, sex, ethnicity, occupation or other characteristics

## 3. Epidemiological Metrics and Tools

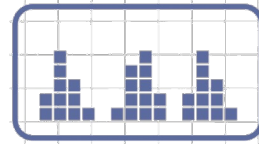
- Rate** ...the number of cases over a specified period of time divided by the size of the population (per unit of time)
- Proportion** ...a specific type of ratio in which the numerator is included in the denominator, often expressed in the form of a fraction
- Prevalence** ...proportion of all individuals who present with a (health) condition at or over a particular time period - includes new + pre-existing cases
- Incidence** ...proportion of all individuals who develop a (health) condition at or over a particular time period - includes only new cases
- Epidemic curve** ...number of new cases during an epidemic plotted over time, resulting in a thematic graph (usually histogram)
- Epidemic map** ...number of cases during an epidemic plotted over space, resulting in a thematic map (usually choropleth map)
- Epidemic pattern** ...overall, four main types of epidemic patterns exist:



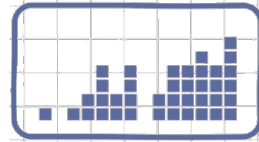
**Point source**  
...all individuals exposed to the same source of infection over a short period of time (e.g., single meal or other event)



**Continuous common-source:**  
...exposure to infection not linked to one point in time, over an extended period of time depending on how long the exposure may persist



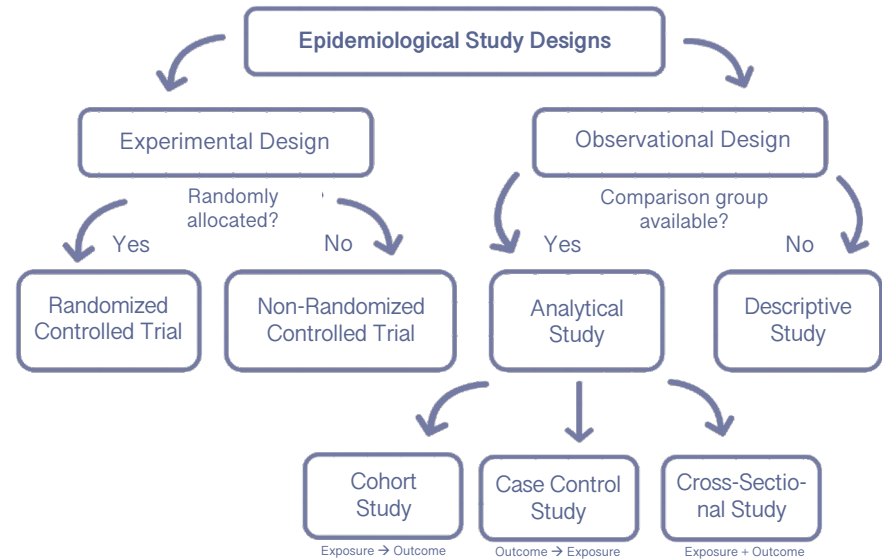
**Intermittent source**  
...exposure is intermittent with multiple peaks, epidemic pattern is similar to continuous trend

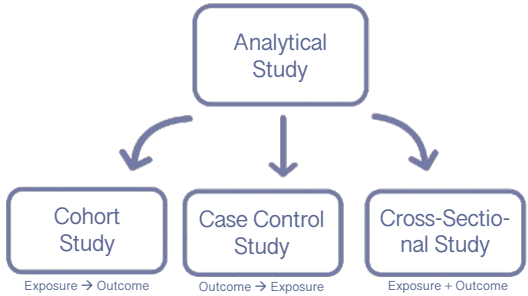


**Propagated source:**  
...infection with no common source but instead spread among susceptible individuals, e.g., person-to-person or via intermediate hosts, pattern with irregular peaks

## 4. Epidemiological Study Designs

- Descriptive Epidemiology** ...characterizing the cases according to time, place, and population, mainly to generate hypothesis: Who? What? When? Where?
- Analytical Epidemiology** ...studying the exposure-outcome associations (causes and effects), mainly by comparing case and control groups: Why? How?





**Cross-sectional Study**

...also called „prevalence study“

...exposure and (health) outcome status are determined at the same specific time and the presence of a disease/symptoms of exposed individuals is compared with unexposed individuals. The aim is to estimate the prevalence of an outcome, with (prevalence) risk factors and (prevalence) odds ratios to be determined

**Cohort study**

...the study population is allocated into groups by exposure status (exposed vs. non-exposed), groups are then followed to determine if they develop(ed) the (health) outcome under study

...design can be prospective, given that the exposure is assessed at the beginning of the study and followed prospectively until the outcome occurs

...design can be retrospective, given that the exposure had been assessed at some point in the past and the outcome already occurred

...e.g., to determine whether smoking is associated with a higher risk of developing lung cancer

**Case-control Study**

...the study population is allocated into groups by (health) outcome status (cases with outcome vs. cases without outcome), the past exposure status is then determined

...e.g., to determine an association between Cholera infection and using water for drinking from a particular source

	<u>Cohort Study</u>	<u>Case-Control Study</u>
<u>Applied when</u>	Study participants are easily identifiable	Identifying a large cohort would be too costly and/or time consuming
	Study participants are easily accessible	Accessing a large cohort would be too costly and/or time consuming
	Multiple outcomes may be involved	The outcome under study is rare
<u>Study Group</u>	Exposed individuals	Individuals with outcome (cases)
<u>Comparison Group</u>	Non-exposed individuals	Individuals without outcome (controls)

5. Measures of Association

**Measures of association/ risk metrics**

...assessing the level of an association between the exposure(s) and the outcome(s) under study

...indicates how more or less likely an individual is to develop the outcome under study as compared to another (case vs. control)

...two key measures: Relative Risk (RR), Odds Ratio (OR)

**2x2 table**

...applied to summarize counts of outcome(s) and exposure(s) under study in order to calculate measures of association

## 2x2 Table

Exposure	Outcome	
	Yes	No
Yes	a	b
No	c	d

**a** Number of exposed individuals and with the outcome

**b** Number of exposed individuals and without the outcome

**c** Number of non-exposed individuals and with the outcome

**d** Number of non-exposed individuals and without the outcome

**a+b** Total number of exposed individuals

**c+d** Total number of non-exposed individuals

**a+c** Total number of individuals with the outcome

**b+d** Total number of individuals without the outcome

**a+b+c+d** Total study population

**Odds with the exposure** ...odds to develop the outcome if exposure is present = cohort study

**Odds without the exposure** ...odds to develop the outcome if exposure is absent (baseline odds) = cohort study, case-control study

**Odds Ratio (OR)** ...odds of an event occurring in an exposed group relative to the baseline odds = cohort study, case-control study  
 'ad/cb' or '(a/b) / (c/d)'

**Risk Difference** ...absolute risk difference between the exposed and the non-exposed group = cohort study  
 '(c/(c+d)) - (a/(a+b))'

**Relative Risk (RR)** ...risk of an event occurring in an exposed group relative to the risk of an event occurring in a non-exposed group (baseline risk) = cohort study  
 '(a/(a+b)) / (c/(c+d))'

**Relative Risk Reduction** ...proportion of the baseline risk when the exposure is removed = cohort study  
 '1-RR'

**Interpretation** ...both the OR and the RR are interpreted as follows  
 = 1 indicates no association  
 > 1 indicates a positive association  
 < 1 indicates a negative association

**References**  
 Coolboy101pk (2011). Descriptive and Analytical Epidemiology. Online: <https://www.slideshare.net/coolboy101pk/descriptive-and-analytical-epidemiology> licensed under CC-BY-SA 4.0 (<https://creativecommons.org/licenses/by-sa/4.0/>) / Last access: 2021/03/12  
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