# Day 4
# Lecture 1: Introduction to outbreak analysis

**Short course on modelling infectious disease dynamics in R**

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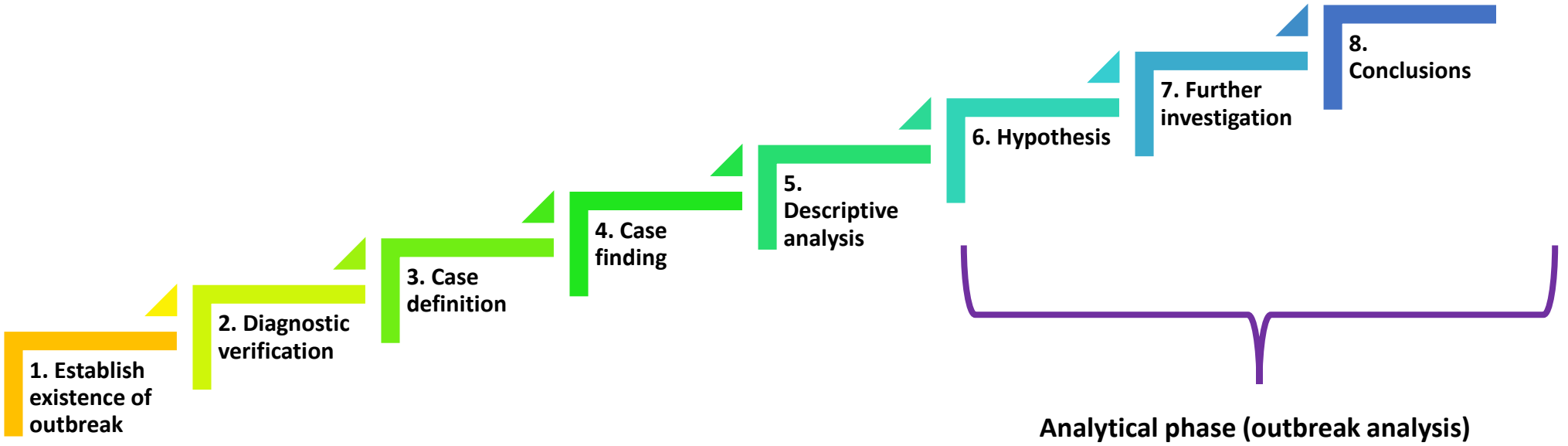
# Aims of the session

- Understand the basic principles for good practices of data collection during outbreaks
- Learn concepts of outbreak statistics:
  - Incubation period
  - Serial interval
  - Growth rates

# Multistep outbreak investigation process



# Establish existence of outbreak

- An outbreak is the occurrence of **more cases than expected** of a disease in a given area or among a group of people over a period of time: Person, Place and Time
- It is **unusual:** what is expected? (e.g., one Ebola case is never expected –outbreak, 1000 Flu cases in winter are expected – no-outbreak
- Surveillance helps build the “Expected” threshold. How does surveillance look in last 5 years?

# Diagnostic verification

- Identify specific pathogen:
  - Known transmission route, incubation period, exiting treatment and vaccines
  - Start communication to community and preparation for the field
- How:
  - Laboratory
  - Medical records
  - Interviews

# Case definition

- What being a ‘case’ means?
- Needs to be defined
  - All involved in have the same working definition
  - Data is collected accurately and can be analysed accordingly
  - Control can be directed effectively
- Can be refined and updated during investigation: data collection need to account for this

# Case definition

- Sensitive enough, specific enough
- Should consider person, place , time, clinical and laboratory findings
- Can be categorised as:
  - Confirmed: fits the case definition (high specificity)
  - Probable: typical case definition without lab confirmation
  - Possible: atypical but potential epidemiological link (high sensitivity)

# Case finding (Case ascertainment)

- Find as many cases as possible
- Can help refine case definition
- More cases, less bias on future estimates
- Easier to assess risk factors

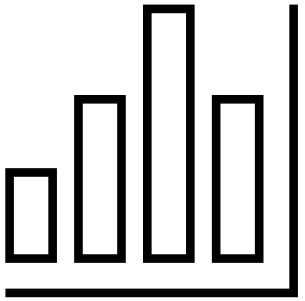
# Case finding (data collection)

- At this point, a systematic way of collecting data must be established
- Linelist:
  - Epidemiological database
  - Keep track of evolving outbreak
  - A basic one should at least ….

| ID | Sex | Age | Place | Time | Outcome | Lab |
|---|---|---|---|---|---|---|
| A1 | | | | | | |
| A2 | | | | | | |
| a3 | | | | | | |
| | | | | | | |
| | | | | | | |

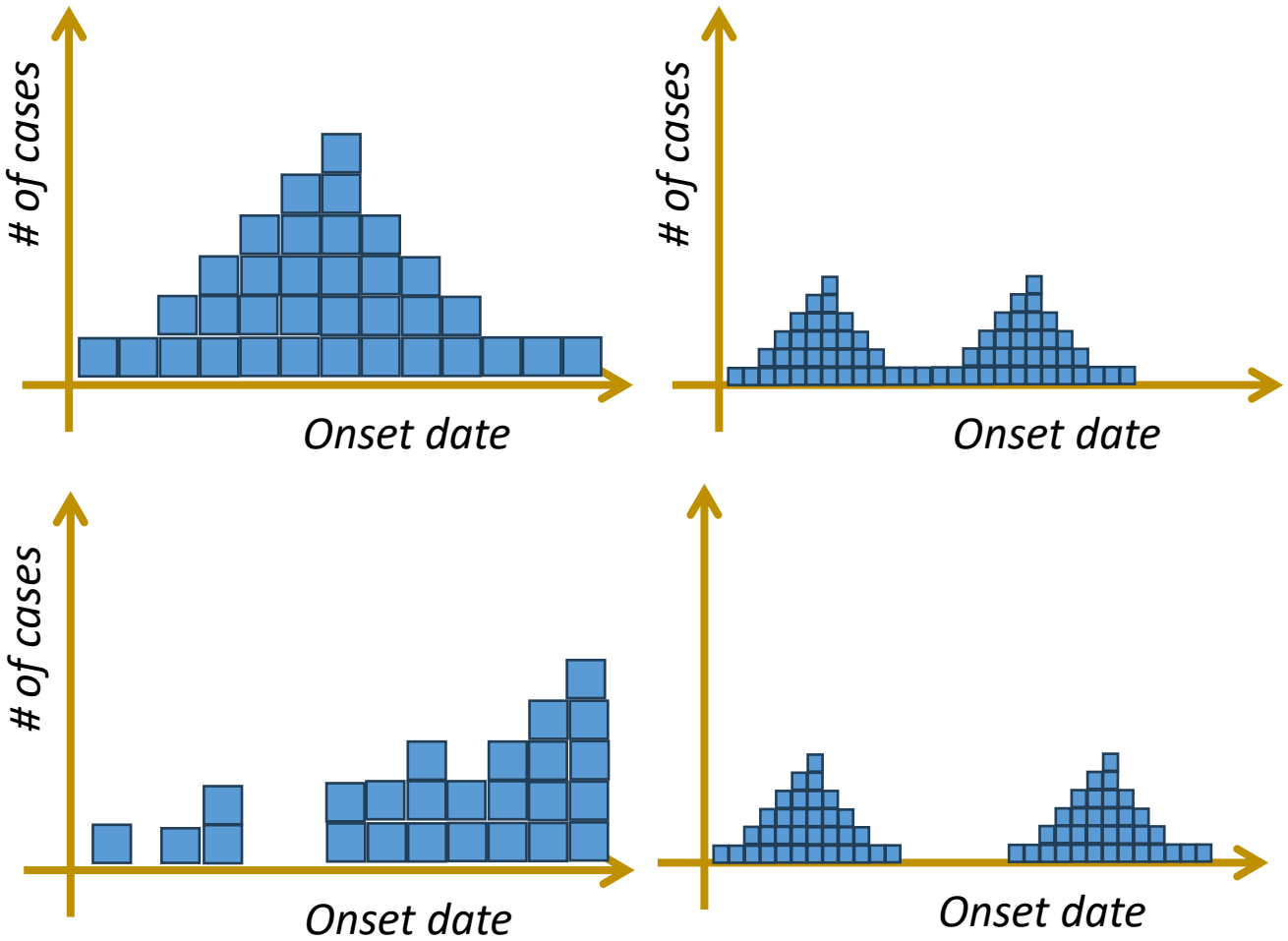
# Descriptive analysis

- Explore the size of the outbreak so far
- Identify time patterns: changes in days, or hours or weeks?
- Explore patterns by sex, age and location
- Hypothesis generation
- Histograms, bar charts, maps, boxplots



# Descriptive analysis: epicurve

- Epicurves track the number of incident cases by time of onset of symptoms
- Should be constantly updated
- Basis for estimating incubation, serial interval etc



# Generate hypothesis

- Hypothesis about source and mode of transmission
- Trawling questionaries to gather more data
- Conduct studies : case-control or cohort studies
- Generate measures of association between risk factors and outcomes

# Further investigation

- May be needed if source is not established yet
- Risk of spread to further communities
- Could be policy, lab or environmentally related

# Draw conclusions

- Interpret all the data and analysis
- Can we call causality?
- Sometimes we just arrive at correlations.

# Summary

- Outbreak investigation has several important steps from establishing existence to drawing conclusions
- Past surveillance is key for establishing if an outbreak occurs
- Defining a case thoroughly is key to further analysis
- Systematic data collection will help assess important statistics of the outbreak
- Epicurves summarize and track the evolving outbreak and are the base for most important estimates in outbreak analysis