

Outbreak investigation: Challenges and potential pitfalls for tracing analyses

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How to define a foodborne outbreak?

... an incident in which two or more persons experience a similar illness after ingestion of a common food

and

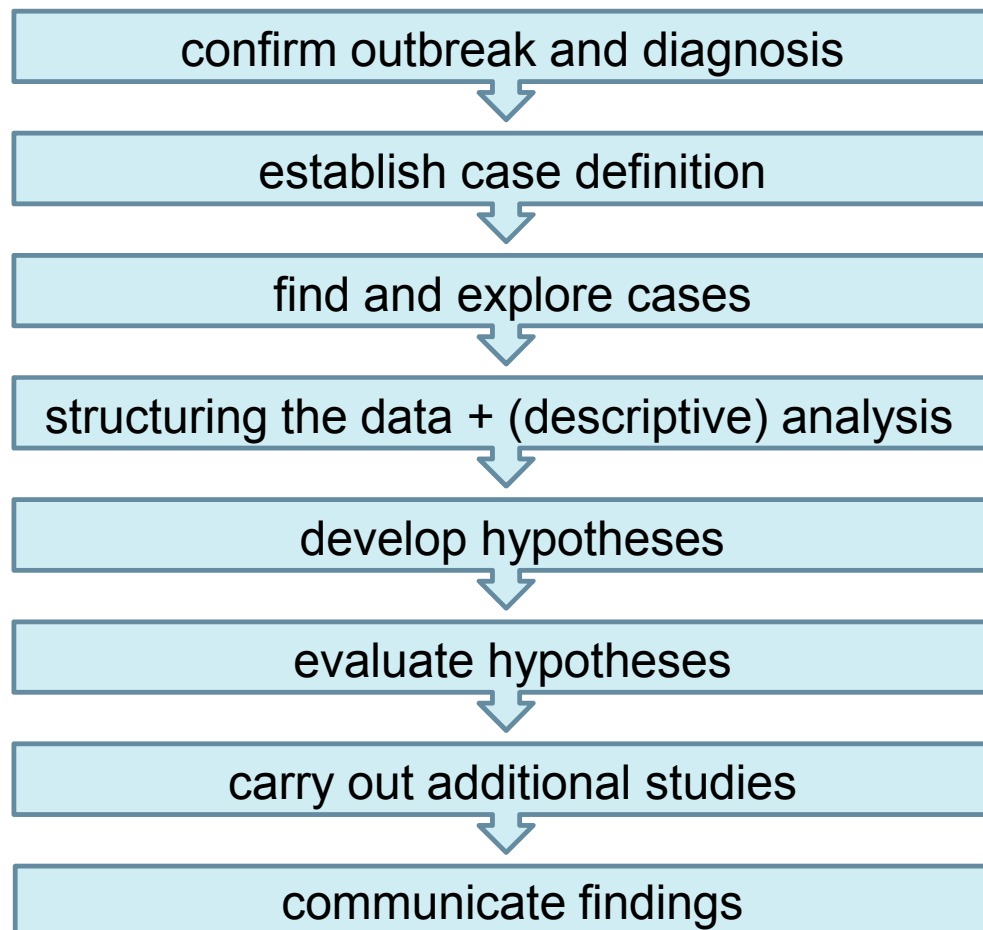
... epidemiologic analysis implicates the food as the source of the illness.

Three aspects of outbreak investigation

Epidemiological analyses	Microbiological analyses	Tracing analyses
<p>descriptive</p> <ul style="list-style-type: none"> systematic explorative interviews of cases (and controls) <p>analytical</p> <ul style="list-style-type: none"> case-control-studies cohort studies 	<p>detection of identical pathogen in</p> <ul style="list-style-type: none"> food, ingredient, production environment <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> case OR symptoms and timing of disease onset typical for pathogen found in the food 	<p>trace-back</p> <ul style="list-style-type: none"> of contaminated/suspected food leads to common source (e.g. processor, producer) <p>trace-forward</p> <ul style="list-style-type: none"> does distribution of contaminated food match distribution of cases?



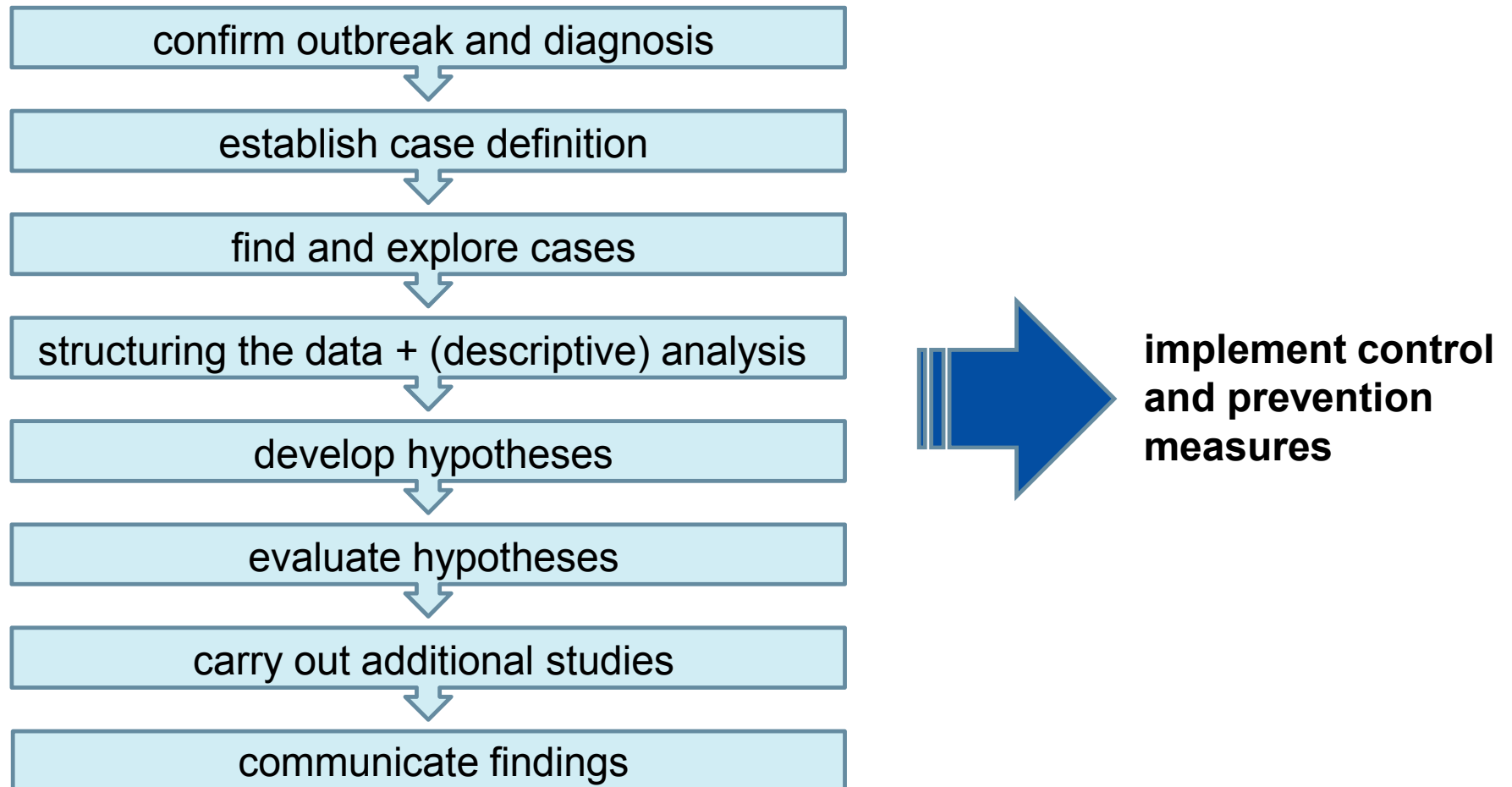
Steps of an outbreak investigation



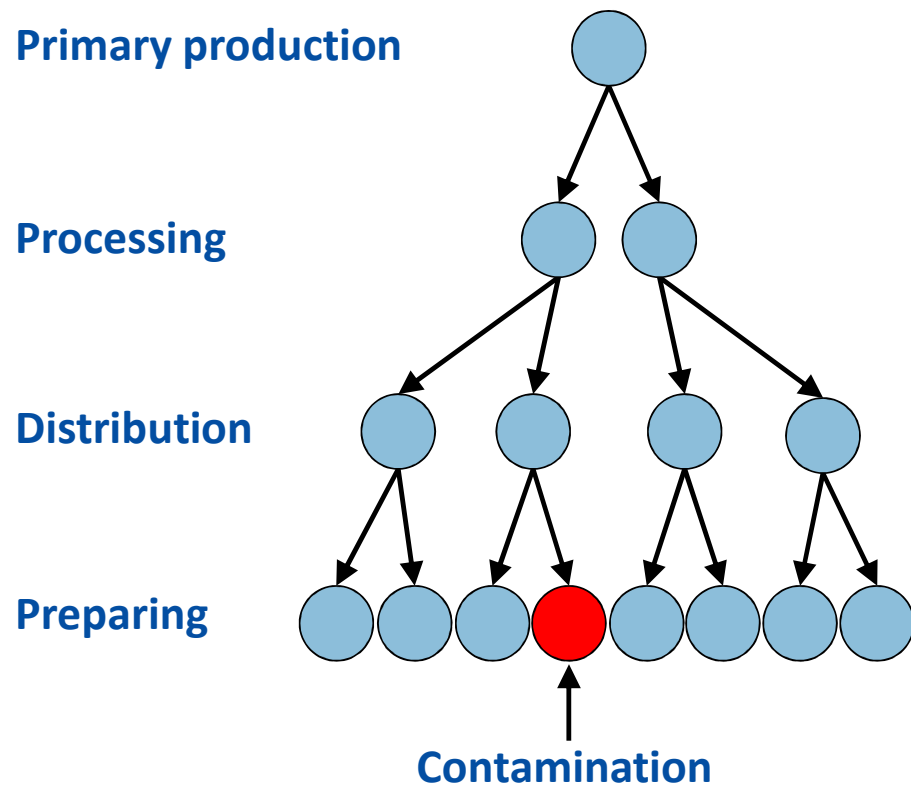
Food/feed safety partners often not primarily involved at those steps (public health/microbiologist competence)

→ but implications on tracing investigations

Steps of an outbreak investigation



Local foodborne outbreak

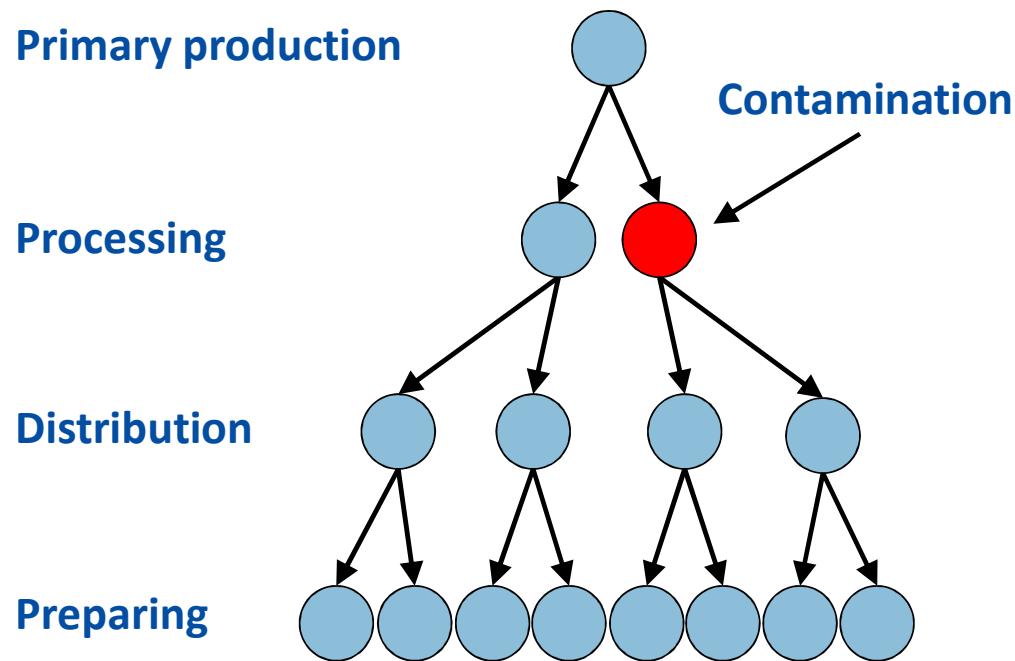


- mistake during preparing
- single source, exists only for short time
- high dosis
- high rate of infection
- local accumulation of cases
- local investigation

e.g. street vendor

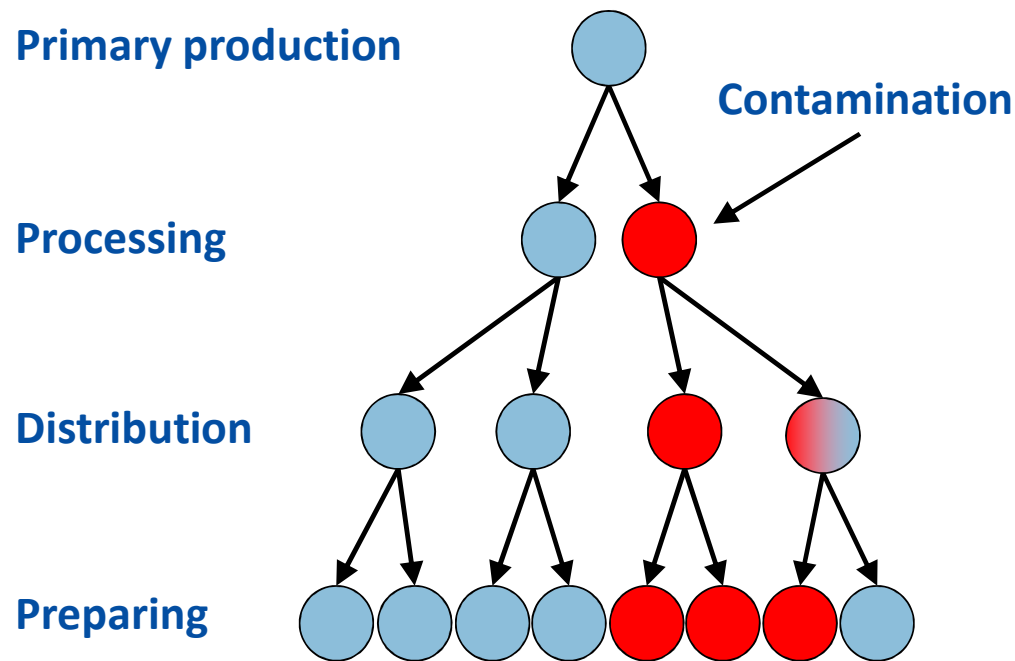


Foodborne outbreak affecting multiple locations/countries



- contamination during production/processing
- low dosis
- low rate of infection
- diffuse distribution of cases
- complex investigation

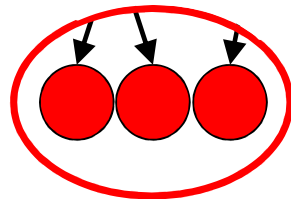
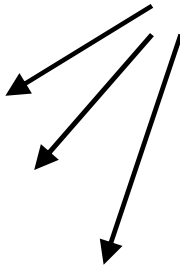
Foodborne outbreak affecting multiple locations/countries



- contamination during production/processing
- low dosis
- low rate of infection
- diffuse distribution of cases
- complex investigation

Foodborne outbreak affecting multiple locations/countries

Contamination?



- contamination during production/processing
- low dosis
- low rate of infection
- diffuse distribution of cases
- complex investigation

The outbreak investigation team can only see **cases**

Tracing

When to trace? Further indications

Pathogen

- is uncommon
- is emerging/re-emerging
- causes severe diseases
- limited knowledge about pathogen → gain experience about its ecology

Food

- expected to be eaten raw or lightly heated (vegetables, shell eggs, shellfish)
- unlicensed, illegally sold food involved
- food is adulterated

Unusual source of contamination

New or unusual vehicle

When and what to trace?

Tracing is resource-intensive

- coordination of many investigators, different authorities, many counties/countries
- decide when and what to trace

**You might not have the resources to trace all suspected foods.
Some paths might be misleading.
You have to weigh the effort and benefit.**

→ review all available data

detailed information on cases, delivery dates, quantities, sources + conditions of food received, shipping containers, labels, documents, lot numbers, facilities involved

→ together with epidemiologists

What is tracing?

Regulation (Ec) No. 178/2002, Article 3+18

- **Traceability** is the ability to follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution.
- „ **Stages of production, processing and distribution**“ : import, primary production, storage, transport, selling, selling to consumer; relevant for food and feed

Food and feed business operators need to

- have information on their direct supplier and direct customer
- make data available to the authorities on demand



Basis for tracing analysis

Purpose of tracing

- identify source of contamination
- identify distribution of contaminated food



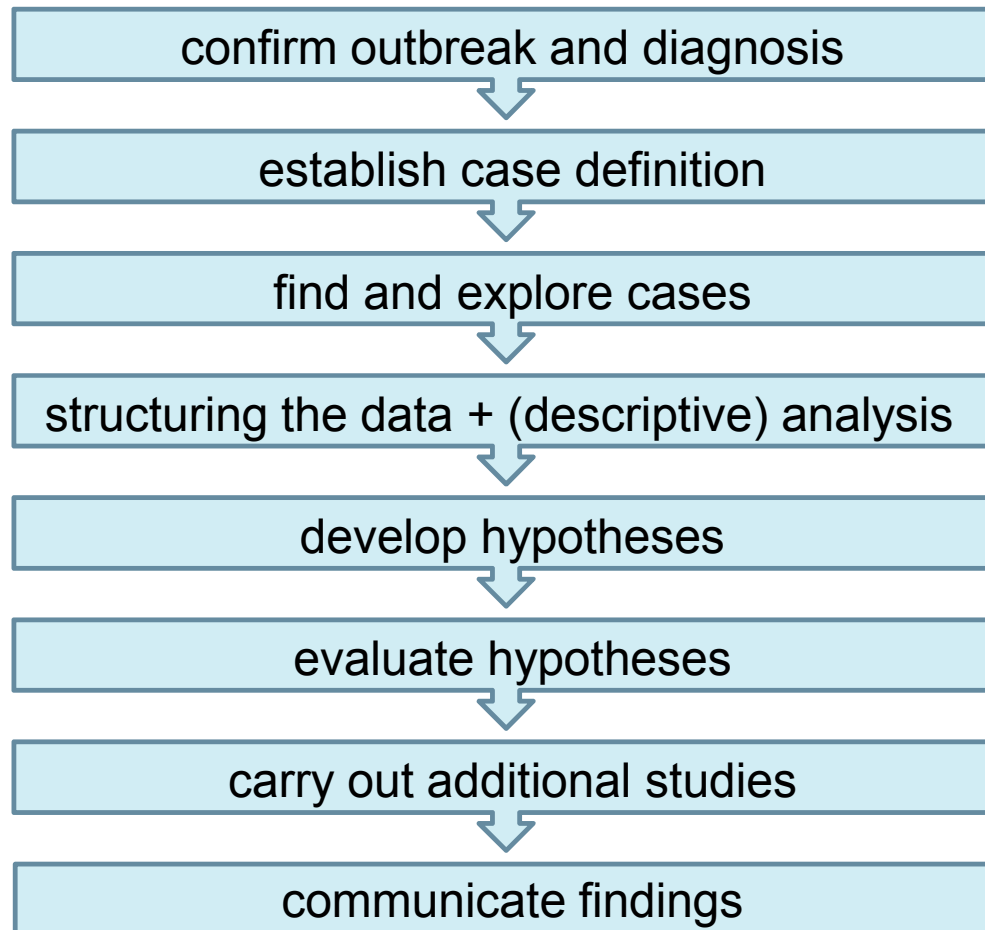
warning of consumers
remove contaminated food from market

- compare distribution of cases + contaminated food

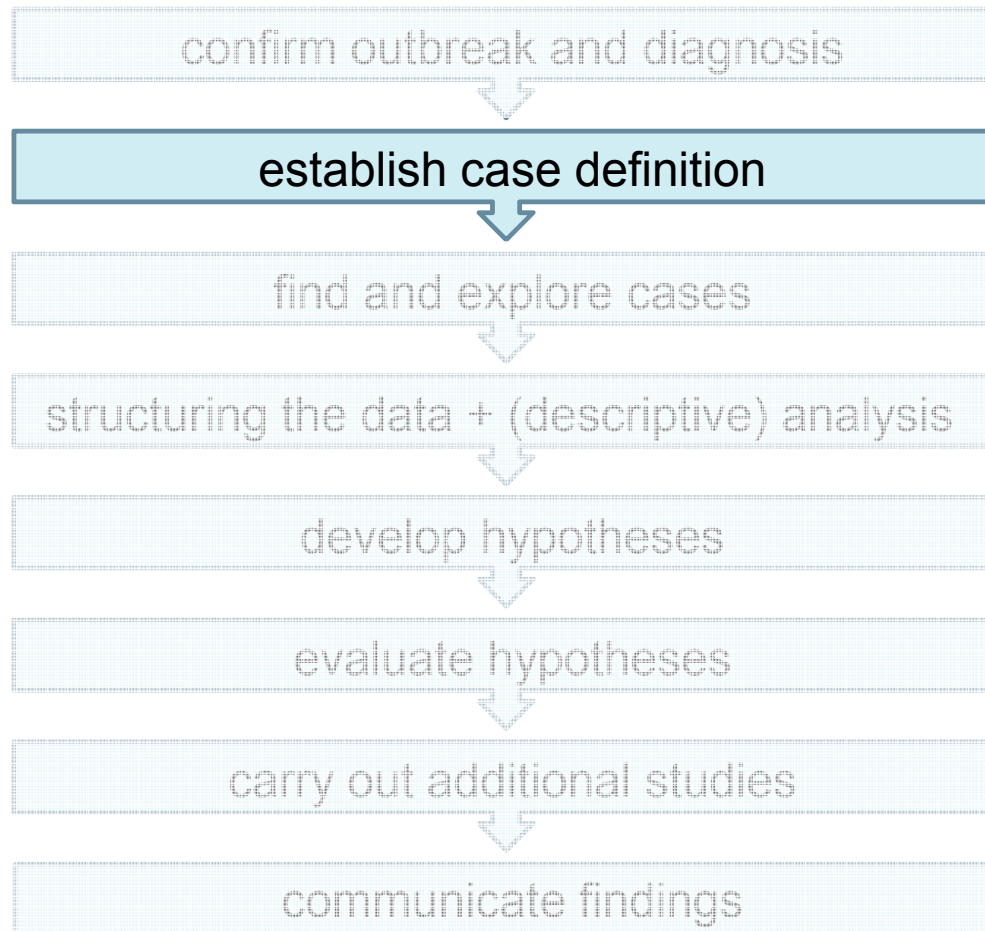


strengthen epidemiological association

Steps of an outbreak investigation – implications on tracing



Steps of an outbreak investigation – implications on tracing



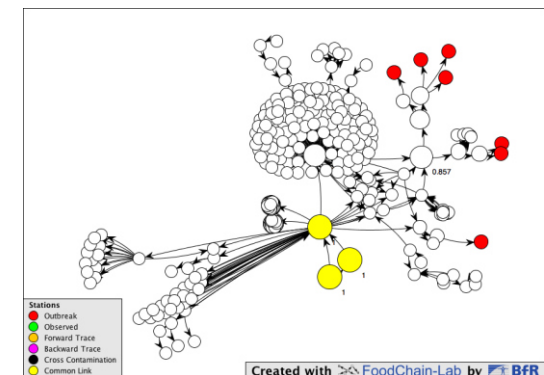
Case definition – which cases to trace back?

Exclusion criteria:

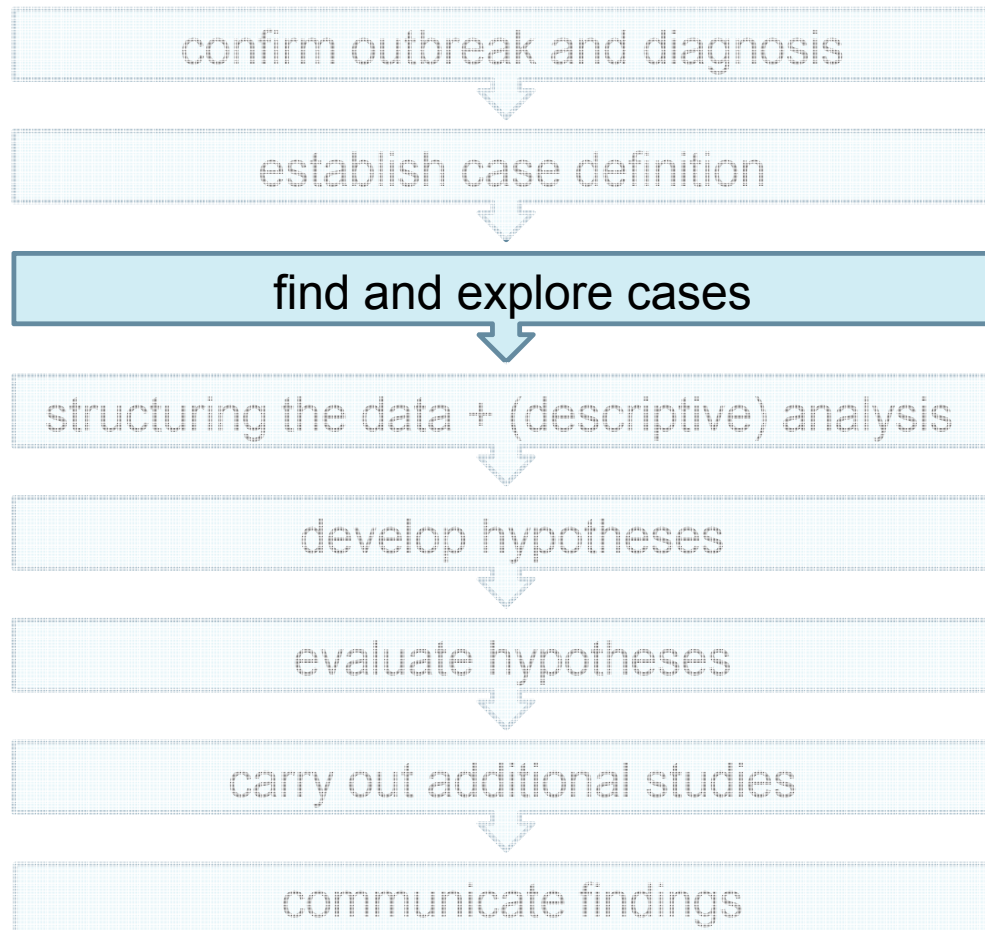
- genotype of isolate different from outbreak strain
- secondary cases
 - infection transmitted person-to-person
 - no exposure to contaminated food item
- travel-related cases
 - travel history abroad prior to a certain period of time before onset of symptoms
 - relevant for e.g. HAV outbreak

If many cases: select the most promising ones to trace back

- e.g. EHEC outbreak 2011 → 4000 cases → only 7 cases traced back (most different from each other)



Steps of an outbreak investigation – implications on tracing



Explore cases

Explore cases:

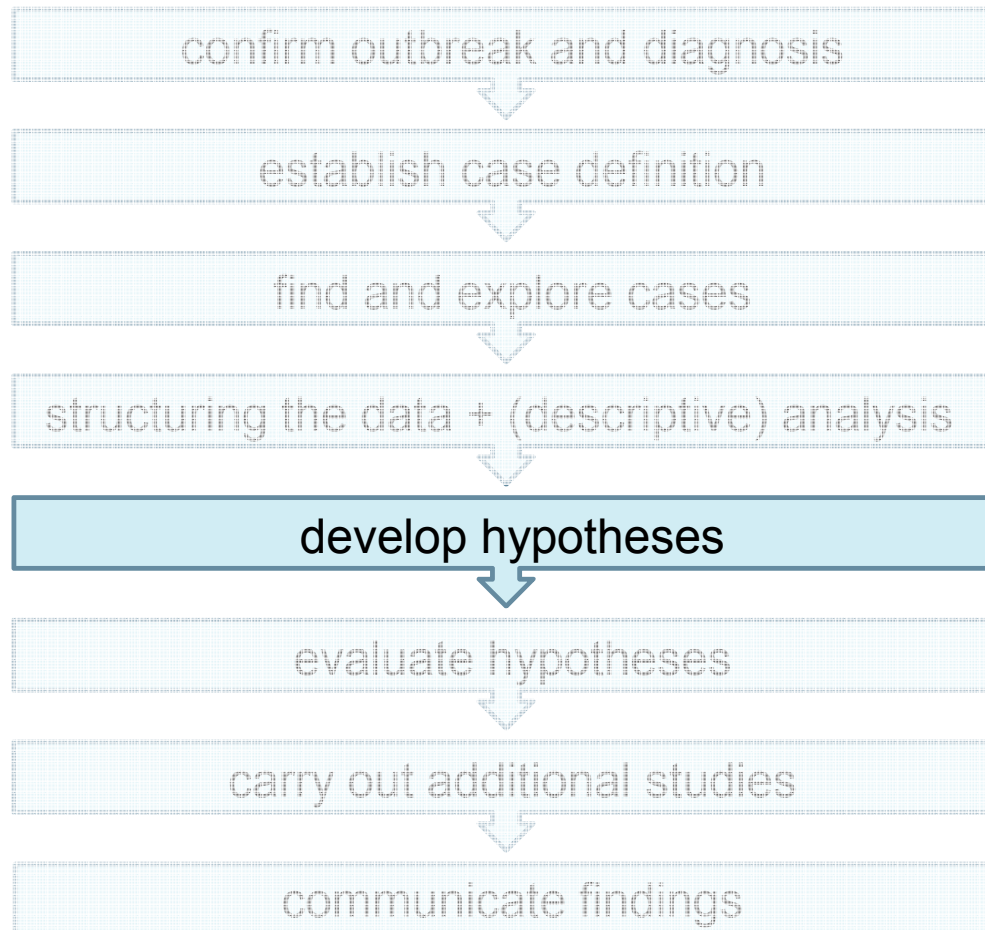
- ask for relevant exposure (food intake (what/where), other diseases, travel history, sexual contacts) → identify what is common to all cases

Who ate what, when, how much and how?

For traceback analyses:

- usual consumption and shopping habits
- fotos of fridge
- fotos of packaging of (suspect) product → product name, weight, lot number, best before date, ...

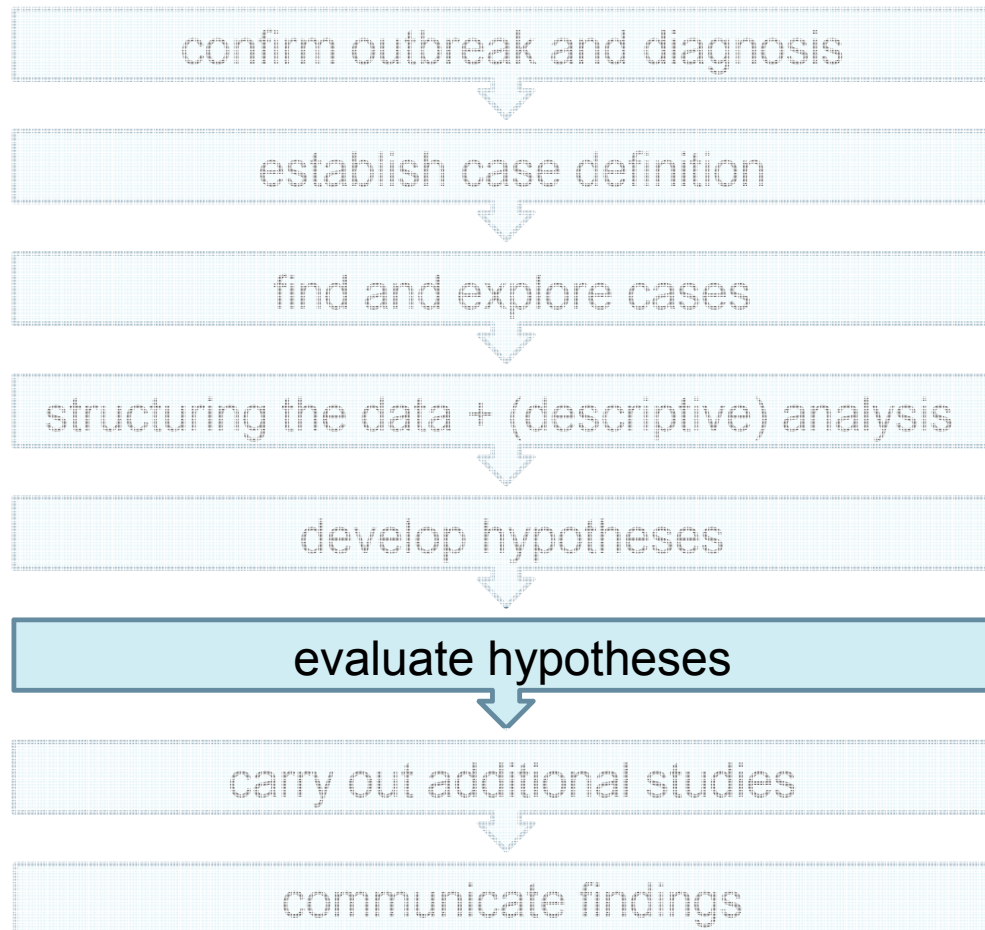
Steps of an outbreak investigation – implications on tracing



Food and feed safety partners involved as soon as food is suspected as vehicle of infection



Steps of an outbreak investigation – implications on tracing



Evaluate hypotheses

Interpreting example from EHEC, 2011:

b. Matched case control study in 3 hospitals focussed on fruits and vegetables, May – June 2011

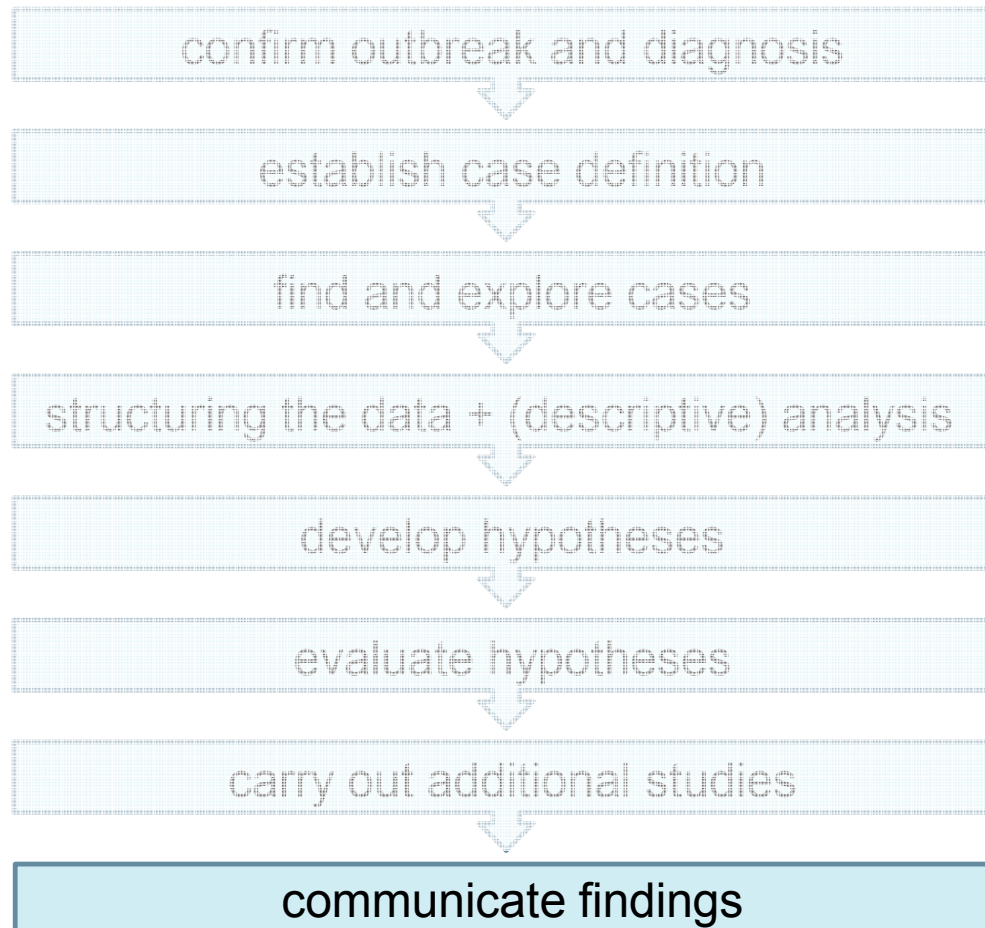
Table 1. Vegetables or Fruits Evaluated in a Case–Control Study in the German Outbreak.*

Food Item	Case Subjects Exposed <i>no./total no. (%)</i>	Control Subjects Exposed <i>no./total no. (%)</i>	Matched Odds Ratio (95% CI)	P Value
Sprouts	6/24 (25)	7/80 (9)	4.35 (1.05–18.0)	0.04
Cucumbers	22/25 (88)	52/79 (66)	3.53 (0.96–12.9)	0.06
Apples	22/24 (92)	57/81 (70)	3.91 (0.86–17.7)	0.08
Peppers	16/24 (67)	35/80 (44)	2.66 (0.90–7.9)	0.08
Strawberries	19/26 (73)	43/81 (53)	2.33 (0.90–6.0)	0.08

Buchholz et al., N Engl J Med 2011; 365:1763-1770

What food item would you like to trace?

Steps of an outbreak investigation – implications on tracing



Communication to public/media: implications on companies vs. authorities

Tracing investigations → irreparable reputational damage to food companies

→ every investigation step (also epidemiological, microbiological) + communication to media/public must be accurate

→ otherwise: legal disputes, compensation claims

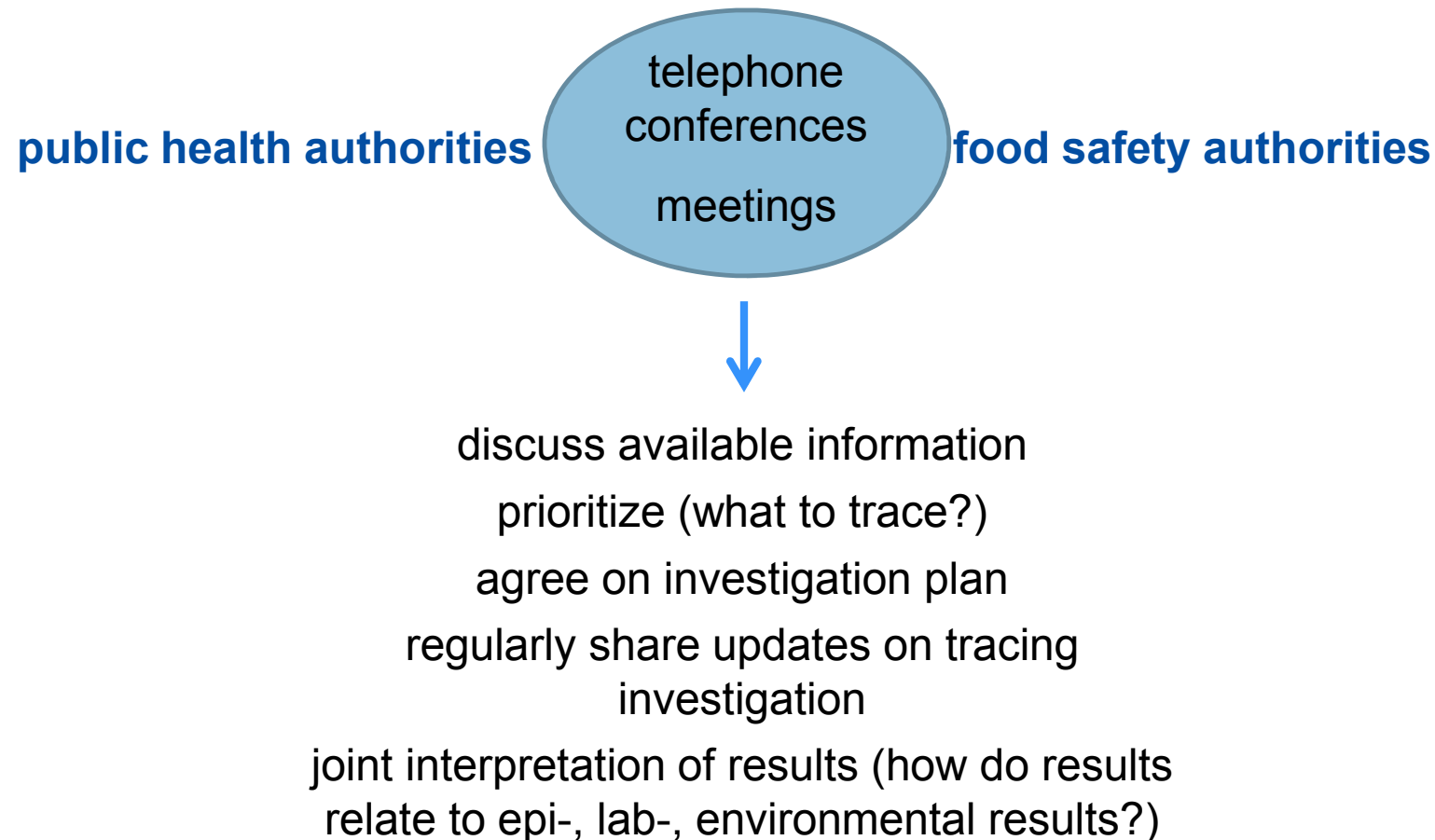
E.g. EHEC outbreak 2011 with 4000 cases (53 deaths)

- press conference of city of Hamburg → found EHEC on Spanish cucumbers + associated it with outbreak
- later it turned out it was not the outbreak EHEC strain
- city of Hamburg sentenced to pay compensation to Spanish cucumber producers

- the actual source were fenugreek seeds

© BILD newspaper: „The deadly germ comes from Spain“

Communication between authorities during investigation

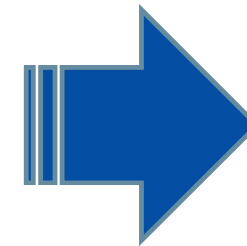
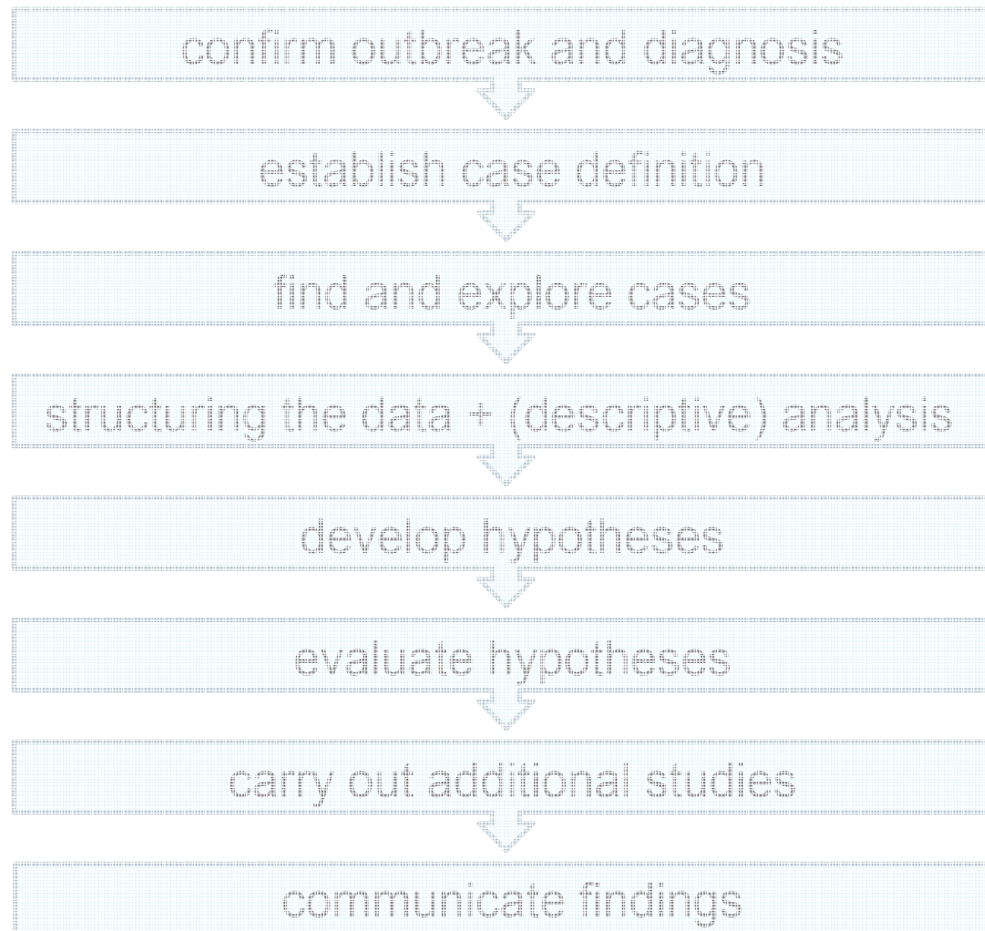


Ideally even before crisis:



build functional network, set up contact list, set up tracing system, develop joint protocols

Steps of an outbreak investigation – implications on tracing



**implement control
and prevention
measures**

Control measures

- recall + confiscation of food
- warning consumers of a potential risk + consumer advice
- closing of facility + facility improvement (cleaning/decontamination procedures, optimization of production process)

**Outbreak solved
and stopped**

Thank you for your attention

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