

Bundesinstitut für Risikobewertung

Introduction to outbreak investigation

- using the example of foodborne infections -

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How to define an outbreak?

- More incident disease cases than expected in a certain period of time, area or population
 - \rightarrow need to know baseline rate
- ≥ 2 incident disease cases with similar symptoms and an epidemiological link



Why to investigate outbreaks?

- gain practice \rightarrow natural experiment, can be used for training
- define magnitude
- determine the source, conditions or factors responsible
- basis to implement control measures \rightarrow prevent new cases, stop outbreak
- gain experience \rightarrow prevent future outbreaks







...the reality









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Confirm outbreak

reportable diseases

• surveillance data



non-reportable diseases

- vital statistics, disease registries, hospital records
- always look at the <u>numerator</u> (number of cases) AND <u>denominator</u> (size of population from which cases arise)



Confirm outbreak

CAUTION: pseudooutbreak

 \rightarrow artifacts in the numerator

- increased awareness \rightarrow higher motivation to report cases
- enhanced diagnostic tests
- changes in case definition/reporting procedures
- data input errors
- \rightarrow artifacts in the denominator
 - sudden change in population (students return to school in fall, influx of migrant workers, refugees)



Confirm diagnosis

1. specify the symptoms and identify possible diagnoses

- together with clinicians, specialists
- examine frequency of symptoms among cases
- 2. verify diagnosis with laboratory tests
 - in at least a subset of cases







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Case definition

... to define whether ill person belongs to outbreak

- clinical information (e.g. symptoms, lab results)
- time
- place
- persons (e.g. certain age group)
- exposition





Case definition

Exclusion criteria:

• genotype of isolate different from outbreak strain

... in case of trace back analyses

- 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







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Find and explore cases

Find cases:

- to assess magnitude and scope of outbreak
- passive surveillance (report to state/local health departments) not sufficient
- stimulated passive surveillance
 - alert physicians, laboratories to trigger reporting
- active surveillance: physicians, laboratories, contact persons

Explore cases:

- ask for relevant exposure (food intake (what/where), other diseases, travel history, sexual contacts) → identify what is common to all cases
- pitfall: onset of disease during evening \rightarrow last meal/lunch suspected

→ basis to generate hypotheses later



Find and explore cases

Documentation via line list:

- one case per line
- updated constantly
- prepares (automated) descriptive analysis
- should contain:
 - personal information (name, address, phone number, age, sex, race, occupation)
 - relevant symptoms (e.g. HAV: fever, nausea, vomiting, anorexia, fatigue, dark urine, jaundice)
 - \rightarrow helps confirming diagnosis and case status
 - laboratory results
 - relevant exposures (e.g. HAV: sources of food/water (especially uncooked), raw shell fish consumption, travel history, sexual contacts)

ID	age	Sex	ill	onset of disease		microbiological	time of	straw-	ice	minced
				date	time	proof	meal	berries	cream	meat
1	35	f	у	16.03.2017	15:00	у		у	n	у
2	71	m	у	15.03.2017	02:45	n		у	n	n
3	59	f	у	17.03.2017	21:45	у		у	У	У
4	63	m	у	17.03.2017	17:30	у		у	n	У







Structuring the data and (descriptive) analysis

Time:

- sort cases according to onset of disease \rightarrow epicurve
- pattern of disease occurrence hints towards source of infection (information on disease and incubation period needed as well)





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Structuring the data and (descriptive) analysis

Place:

 sort cases according to place of residence, workplace, country, room plan, ...



HAV outbreak

- \rightarrow mapping of cases according to affiliations of company X
- → accumulation of cases in affiliations with baked goods sale compared to affiliations without baked goods sale



Structuring the data and (descriptive) analysis

Person:

• sort cases according to age, sex, occupation, risk factors, ...

Salmonella agona outbreak 2003, cases stratified by age.

- \rightarrow accumulation of cases in age group <1 years of age
- ightarrow aniseed-containing herbal tea







Develop hypotheses









Evaluate hypotheses

Cohort study (retrospective):

- compares exposed to unexposed regarding disease risk
- to be used in outbreak with small, well-defined source population and if disease outcome is frequent → e.g. outbreak in attendees of a school luncheon



Case control study:

- compares diseased cases to healthy controls regarding specific exposures
- when source population is large and ill-defined and if disease outcome is uncommon







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Carry out additional studies

... to complement epidemiological evidence

Microbiological studies:

- test food item/ingredient/food production facilities AND patient (or symptoms of patient typical for outbreak strain)
- typing (identical strains)

Food tracing:

- trace back to find source (e.g. processing plant, primary producer)
- trace forward to find unidentified affected stations











Communicate findings

during investigation:

- regular meetings
- written interim reports
- press release

after end of investigation:

- always: written final report with recommendations (control + prevention measures)
- publication







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Thank you for your attention

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