

Epidemiological Investigation of Outbreaks



Definition of an Outbreak

An outbreak is commonly defined as:

The occurrence in a community or region of cases of an illness with a frequency clearly in excess of normal expectancy. The number of cases indicating presence of an outbreak will vary according to the infectious agent, size and type of population exposed, previous experience or lack of exposure to the disease, and time and place of occurrence. Therefore, the status of an outbreak is relative to the usual frequency of the disease in the same area, among the same population, at the same season of the year.¹

Epidemiological Investigation

Regardless of the communicable disease, the procedure for the investigation of a suspected outbreak is the same:

1. **Establish the existence of an outbreak**
Compare current information with previous incidence in the community during the same time of year to determine if the observed number of cases exceeds the expected. Compare available information about new cases with a predetermined definition of an outbreak.
2. **Confirm the diagnosis**
Analyze clinical histories of cases and have standard laboratory tests performed to confirm or reject the suspected diagnosis and to determine the type of agent associated with the illness (e.g., bacterial, viral, other).
3. **Establish the case definition and count cases**
Develop a case definition and establish methods for identifying and counting cases.
4. **Relate the outbreak to time, place and person**
Characterize the outbreak according to person, place or time by interviewing known or selected cases to determine common experiences, such as when they became ill (**time**), where they became infected (**place**) and who they are (**person**).
5. **Determine who is at risk of becoming ill**
Count cases and relate these counts to the appropriate population to find the group(s) at risk. Contact those who can provide information on the illness or about the environmental circumstances that contributed to the outbreak.
6. **Formulate a tentative hypothesis**
Formulate a tentative hypothesis to explain the most likely cause, source and distribution of cases.
7. **Compare the hypothesis with the established facts**
The hypothesis will direct the course of the investigation, and will be tested by the various data gathered during the investigation. Several successive hypotheses may be required.
8. **Plan a detailed epidemiologic investigation**
Determine from the collected data what other information is needed and what resources are available to test the hypothesis. Develop or obtain interview forms, gather sampling equipment, and alert people who will take part in the investigation.
Carry out the investigation. Interview people who are similar or who had similar experiences to the ill with respect to time or place but who are not ill (controls); gather appropriate community and environmental information; investigate potential sources of the responsible agent and factors that contribute to the outbreak; and obtain specimens and samples.

Summarize and interpret all of the information that has been collected and examine the results of laboratory tests that have been conducted.

Construct epidemic curves, calculate rates, develop appropriate tables and charts, apply statistical tests to the data, and interpret the data.

On the basis of the available data and the appropriate calculations, accept or reject the hypothesis. For a hypothesis to be accepted, the patterns of disease in the host must relate to the nature of the agent, its source, its mode of transmission and the contributory factors that allowed the outbreak to occur. If the hypothesis is rejected, a second hypothesis must be developed and additional information must be gathered.

9. Prepare a written report

A written report should summarize the investigation and be prepared as soon as the investigation is completed. This report should include the various information listed in the example referenced (refer to “Report of an Investigation of an Outbreak”).

10. Implement control and prevention measures

Effective control measures should be developed using the evidence that has been uncovered. Use the information that has been collected during the investigation to control the current outbreak and also to prevent future problems in the community. Initiate or intensify surveillance of the disease and agent. If imminent danger exists, control measures should be initiated after a tentative hypothesis has been formed.

References:

1. Chin, James (Editor). *Control of Communicable Disease Manual*. American Public Health Association, Washington DC, 2000.
2. Greg, Michael B. (Editor). *Field Epidemiology*. Oxford University Press, New York, 1996.

Practical Considerations

- Each Regional Health Authority (RHA) or other health care jurisdiction should carry out routine surveillance to identify outbreaks early.
- Each RHA or other health care jurisdiction should have a plan for the investigation of outbreaks, based on the above model. The key public health officials should be clearly identified. In Regional Health Authorities, this will include, at a minimum, the Medical Officer of Health or designate and the communicable disease control contact person. Many investigations, including all suspected food- and water-borne outbreaks will require the services of the public health inspector.
- Each RHA or health care jurisdiction should establish direct contact with Cadham Provincial Laboratory (CPL) to ensure that the appropriate specimens are obtained, processed and results reported using an assigned outbreak code, as quickly as possible.
- At minimum, a line-listing of cases and contacts with other relevant data should be maintained electronically. The computer software, EPI INFO, is available in most Regional Health Authorities and is ideal for collecting and analyzing data from outbreak investigations.
- It is a requirement that outbreaks be reported to the Director of Communicable Disease Control using the outbreak reporting form (see **Forms** section of this manual).
- If media interest is likely, the RHA or other health care jurisdiction should establish one contact person as quickly as possible. Ideally, the Medical Officer of Health will be the contact if the outbreak is occurring within the community. Assistance is available from the communications staff at Manitoba Health.
- Refer to the **Protocol to Investigate Food Borne Illness and Suspected Food Borne Illness** if

food/water appears to be the source of an outbreak. This manual includes a section on investigation of outbreaks, with samples of forms which may be used to collect and summarize information.

- The RHA or other health care jurisdiction may request assistance from Manitoba Health with the investigation of an outbreak. Where required, the Manitoba Provincial Outbreak Response Plan (ORP) will be implemented (refer to “Manitoba Provincial Outbreak Response Plan (ORP) in the intro section of this manual).

Management of Outbreaks in Institutions

- All of the above considerations apply to the investigation of outbreaks in health-care or residential-care facilities. However, there are several additional items for consideration.
 - Each facility should have a plan in place for routine surveillance and for outbreak investigation. The Regional Health Authority should be aware of this plan and be available to assist where required. In most facilities, the infection control practitioner is responsible for surveillance, and initiation and execution of outbreak investigations.
 - The successful control of outbreaks within institutions requires a team approach by the facility staff and Regional Health Authority (usually the Medical Officer of Health or delegate).
 - The Provincial Infection Control Nurse will provide training to health-care facilities and assist them in developing infection control policies and procedures. An integral part of the team, the Provincial Infection Control Nurse should be informed of and involved in the outbreak investigation.
 - It may be difficult to recognize an outbreak in a health-care facility. Diarrhea, for example, is not uncommon in residents of personal care homes. The Regional Health Authority or other health-care jurisdiction should establish circumstances under which they are to be notified. Circumstances should include diseases which have the potential for involvement beyond the facility, and those where public health intervention or expertise may be required (e.g., food-borne illness, influenza).
 - It is very important that food-borne outbreaks in institutions be recognized immediately since the potential for spread is great in these facilities. In these instances, early consultation with a public health inspector, Provincial Infection Control Nurse and staff within the RHA or other health-care jurisdiction responsible for communicable diseases is strongly recommended.

Example

Report of an Investigation of an Outbreak

Reason for Investigation

- Include a statement describing how the outbreak was identified (i.e., unusual number of cases).

Investigation

- Present a general summary characterizing the outbreak by person, place and time.
 - Include the date the investigation began and individuals interviewed.
 - State the number of cases ill and number of individuals at risk.
 - If the number of cases is small (e.g., 25 or less), a table may be constructed such that relevant data (e.g., age, gender, date of onset) are presented for each individual.
 - If the number of cases is large, the data may be summarized and presented in tabular or graphical format (e.g., age distribution, epidemic curve).
 - Compare the observed number of cases with that expected for the same population during the same time period.
- Present a clinical description of cases
 - Describe the symptoms and physical findings, including the results of laboratory examinations.
 - If a table of individual cases is included, incorporate the more important clinical and laboratory findings in the table; otherwise, summarize the findings numerically.
 - Present a summary of the epidemiologic data and findings.
 - State pertinent information describing the distribution of cases which would indicate the source (e.g., outbreak confined to customers of a particular restaurant).
 - If an outbreak is localized to a group, such as an institution or in connection with a dinner, provide the total population at risk (total population potentially exposed).
 - Present in tabular form any associated individual characteristics (e.g., age, history of previous attack, immunization) with the cases. Where possible, compare these case characteristics with unaffected individuals.
 - Present in tabular form, the association of cases with various environmental factors such as water, milk supply, foods, etc. Compare these cases with the general population when possible.
- Summarize results of an investigation of common food and drink supplies
 - If the outbreak investigation required data from the water or milk supply, summarize the findings of the engineer, public health inspector or veterinarian.
 - Summarize the results of bacteriologic examination of any other food suspected as the source.
 - Provide details of preparation, handling and storage of suspected foods, brands of these foods, and places from which they were purchased.
 - State information as to illnesses or infections among those handling the suspected food.

Discussion as to Source

- State reasons for suspecting or excluding milk, water, and each article of food or other possible medium of infection.

Conclusions

- State your opinion regarding:
 - Nature of the illness.
 - Source of the outbreak.
 - Method of transmission.

Summary of Control Measures Implemented or Recommended

- State control measure for immediate control.
- State control measures for future prevention.