

UNIT NO. 2

OUTBREAK SURVEILLANCE AND RESPONSE – WHAT YOU NEED TO KNOW

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ABSTRACT

An outbreak is defined as the unexpected occurrence of two or more cases of a disease in a given area, or among a specific group of people, over a particular period of time. For an outbreak to happen, the basic elements of disease causation involving agent, host and environment, together with a chain of transmission must be in place. A well established surveillance system enables us to observe and predict dangers posed by the outbreak and to understand the factors contributing to its spread. In responding to outbreaks of public health importance, the primary objective is to break the chain of transmission. Speed and accuracy are essential to managing the outbreak, and the epidemiological approach involves a systematic series of steps. One important determinant of success or failure is communication of the epidemiological findings and actions taken to the public and all those who need to know.

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INTRODUCTION

One challenging task for a public health practitioner in a city state involves managing outbreaks. Frequently, large numbers of people are affected in an outbreak and the cause is unknown. Fears abound that the disease might spread unless the source is found and hostility may even be shown towards individuals or stake holders associated with the outbreak. Limited knowledge over the situation, little time for planning a scientific investigation, involvement of the press, and political pressure all add to the confusion. Into this setting comes the field investigator who must remain calm and collected, work under circumstances fraught with unknowns, and deliver quick actions.

Fortunately, we have in field epidemiology a time-tested approach towards managing outbreaks. This approach, which involves outbreak surveillance and response, is summarised herein for the aspiring epidemiologists among us.

WHAT EXACTLY IS AN OUTBREAK?

An outbreak is defined as the unexpected occurrence of two or more cases of a disease in a given area, or among a specific group of people, over a particular period of time. In an outbreak, we usually presume that the cases are related to one another or that they have a common cause. Contrary to popular opinion, it is not easy for an outbreak to occur. It requires the basic elements of disease causation and the chain of transmission to be all in place at the right time.

The three basic elements of disease causation comprise the agent, the host and the environment. The agent is a pathogen (e.g., virus, bacterium, parasite) that is necessary to cause human disease. The host is someone who is susceptible to the agent and his or her response may range from asymptomatic infection to illness to death. The environment is the physical, climatologic, biologic, social, and economic conditions that influence agent-host interaction.

The chain of transmission concerns the agent exiting from a source of infection, with appropriate mode of transmission and portal of entry into the host. Many different modes of transmission exist – the agent may be carried from the source to the host directly, as in the case of contact transmissible diseases, or indirectly, as in the case of air-borne, vector-borne and food-borne diseases. Air-borne infections are transmitted through inhalation of bioaerosols, vector-borne diseases through the bite of an infective live carrier (e.g., mosquito), and food-borne diseases through ingestion of contaminated food and water.

UNCOVERING OUTBREAKS THROUGH SURVEILLANCE

Outbreaks are usually uncovered by alerts from astute doctors and other healthcare providers. Occasionally, alerts may also come from the media or from members of the public who know of cases of a sudden illness. Data from various sources must be systematically brought together and evaluated for meaningful interpretation. This is the role of surveillance, which involves the ongoing collection, analysis and interpretation of case notifications, syndromic events, laboratory reports, and other health data essential for the planning, implementation and evaluation of disease control practices.

The surveillance system has to build up a total public health picture by tracking emerging diseases and by monitoring pathogens, vectors and other determinants. Outbreak surveillance essentially involves studying the disease patterns in detail to determine any abnormal increase in incidence. If the data show a sustained increase over the usual background level of reported cases of a particular disease, an outbreak is probable and requires further investigation.

A well established surveillance system provides early and prompt identification of an outbreak. It also enables us to observe and predict dangers posed by the outbreak, and to understand the factors contributing to its spread. At the same time, surveillance is closely integrated with timely dissemination of information to all those who need to know. Ongoing data exchange within the public health community is necessary to create situational awareness and facilitate disease control.

STEPS IN OUTBREAK RESPONSE

In responding to an outbreak of public health importance, speed and accuracy are essential or else, professional credibility could be compromised. The epidemiological approach to manage an outbreak involves the following eight steps:

- κ Establish proper case definition and existence of the outbreak
- κ Verify the diagnosis of reported cases
- κ Conduct active case finding and locate all cases
- κ Describe the outbreak in terms of time, place, and persons
- κ Undertake analytical studies (e.g., case-control study)
- κ Formulate and test our hypothesis on aetiology
- κ Institute control measures
- κ Communicate the findings and actions taken

While these steps are mentioned in conceptual order, several steps may take place concurrently or in a different order. For example, control measures should be implemented as soon as the source of infection and mode of transmission are known, which may be very early in an outbreak.

The primary objective of outbreak response is to control the outbreak by breaking the chain of transmission. This must be the priority, especially when cases are continuing to occur frequently. We do this by characterising those at risk in the outbreak, and formulating control measures to prevent additional cases. The success of control measures depends on how much we already know about the agent and its mode of transmission, since we cannot institute control measures without this information.

A secondary objective of outbreak response is to understand disease aetiology, i.e., the cause of the outbreak. This shifts the focus towards identifying why the outbreak occurred and using that information to prevent future recurrence. Each outbreak offers a unique opportunity to study the natural history of the disease in question.

In addition to the above, there are other objectives in outbreak response. For a newly recognised disease, we see opportunities to study the clinical spectrum of the illness and specific risk factors. For a familiar disease, we learn more about the impact of various control measures and the usefulness of different epidemiological and laboratory techniques. Such information is useful to improve control and prevention efforts.

IMPORTANCE OF RISK COMMUNICATIONS

One crucial consideration in managing outbreaks is the communication of epidemiological findings and actions taken to the public and all those who need to know. This feedback process is important and may take the form of a media conference or press release. Credibility is built up when we

are able to describe in a scientifically objective manner what happened, what was found, and what is being done about it. The professional recommendations must be logical and defensible based on the evidence.

When an outbreak is in the limelight, public, political, and legal concerns might override scientific concerns. Also, from time to time, rumors of something strange going around in the environment require investigators to “chase” potential health hazards. Such investigations almost never identify a link between the disease and the suspected source. Nevertheless, it is essential to be responsive to public concerns, even if the concern has little scientific basis. We also see these instances as opportunities to educate the public.

At the end of each outbreak, it is recommended that the lessons learnt be documented in the form of a peer reviewed scientific publication. This extra effort is desirable because it subjects our actions to scrutiny and improvement, and serves as a reference for professionals encountering similar situations in the future. A report that finds its way into the medical literature contributes to the scientific knowledge base of epidemiology and public health.

CONCLUSION

Managing outbreaks requires proper surveillance, response and communications. It involves a combination of diplomacy, logical thinking, problem solving, quantitative skills, epidemiological know-how, and judgment. These skills can only improve with practice, mistakes, and more practice. An integrated and well-run surveillance and response system empowers decision-making because it establishes baselines and epidemic thresholds, identifies trends of new and emerging threats, and guides resource allocation for disease control.

FURTHER READING

1. Saw SM, Ooi PL, Tan TH. Risk factors for contact lens-related *Fusarium* keratitis. *Arch Ophthalmol* 2007;125:611-7.
2. Ooi PL, Lim S, Chew SK. Use of quarantine in the control of SARS in Singapore. *Am J Infect Control* 2005;33:252-7.
3. Fiore BJ, Hanrahan LP, Anderson HA. State health department response to disease cluster reports: a protocol for investigation. *Am J Epidemiol* 1990;132:S14-22.
4. Ooi PL, Goh KT, Lee KM. Local transmission of *P. vivax* malaria in Singapore. *Annals Acad Med* 1997;26:588-92.
5. Ooi PL, Goh KT, Neo KS, Ngan CCL. A shipyard outbreak of salmonellosis traced to contaminated fruits and vegetables. *Annals Acad Med* 1997;26:539-43.
6. Bender AP, Williams AN, Johnson RA, Jagger HG. Appropriate public health responses to clusters: the art of being responsibly responsive. *Am J Epidemiol* 1990;132:S48-52.
7. Neutra RR. Counterpoint from a cluster buster. *Am J Epidemiol* 1990;132:1-8.
8. Ooi PL, Goh KT. Sick building syndrome: an emerging stress-related disorder? *Int J Epid* 1997;26:1243-9.

LEARNING POINTS

By the end of this session, learner should be able to:

- understand common terms used in communicable diseases epidemiology
- define an outbreak and describe the chain of transmission
- introduce the role of outbreak surveillance
- describe the systematic steps involved in outbreak response
- consider the importance of outbreak communications and strategies for management