Investigating an Outbreak (Part I)

One of the most exciting and challenging tasks faced by health personnel working in the public health sector is investigating outbreaks. Frequently, the cause and source of the outbreak are unknown. Sometimes large numbers of people are affected. Often, residents are concerned because they fear more people, including themselves, may become ill unless the cause is found quickly. There may be hostility and defensiveness if an individual, product or a company has been accused of being the source of the outbreak. Into this pressure-packed setting come the public health personnel from the health department, who must remain calm, professional and objective. Our knowledge and familiarity in investigating outbreaks would help us immensely in tackling these challenging circumstances successfully.

This is the first in a series of two articles on Outbreak Investigations.

Identifying Outbreaks

Outbreaks may be detected when routine, timely analysis of surveillance data reveals an increase in reported cases or an unusual clustering of cases. Health authorities may detect increases in or unusual patterns of disease from the weekly tabulations of case reports by time and place or from the examination of the exposure information on the case reports. Similarly, in a hospital, weekly analysis of microbiologic isolates from patients by organism and ward may reveal an increased number of apparent nosocomial (hospital-acquired) infections in one part of the hospital. Clinicians and members of affected groups are also important reporting sources for apparent clusters of both infectious and noninfectious diseases.

Why is it necessary to Investigate Possible Outbreaks?

Health authorities investigate suspected outbreaks for a variety of reasons. These include the need to institute control and prevention measures, the opportunity for research and training, program considerations, public relations, political concerns and legal obligations.

Steps in an outbreak investigation

1. Prepare for field work
2. Establish the existence of an outbreak
3. Verify the diagnosis
4. Define and identify cases
   - Establish a case definition
   - Identify and count cases
5. Perform descriptive epidemiology
6. Develop hypotheses
7. Evaluate hypotheses
8. As necessary, reconsider/refine hypotheses and execute additional studies
   - Additional epidemiological studies
   - Other types of studies – laboratory, environmental
9. Implement control and preventive measures
10. Communicate findings

Step 1-Prepare for field work

Anyone about to embark on an outbreak investigation should be well prepared before leaving for field investigations. Preparations can be grouped into three categories:

(a)   Investigation

The investigator must have appropriate scientific knowledge, supplies and equipment to carry out the investigation. The investigator should discuss the situation with someone knowledgeable about the disease, field investigations and review applicable literature including available questionnaires.

Consult laboratory staff before leaving for a field investigation to ensure that the appropriate laboratory material is collected in the proper manner and that the storage and transportation techniques are correct.

(b) Administration

The investigator must make travel and other arrangements and get them approved.

(c) Consultation

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The investigator must know his or her expected role in the field. For example, is the investigator expected to lead the investigation, provide consultation to the local staff that will conduct the investigation or simply lend a hand to the local staff? In addition, the investigator should know who the local contacts will be. These are especially applicable if the investigator is not from the same administrative area.

Step 2: Establishing the Existence of an Outbreak

An outbreak or an epidemic is the occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time. In contrast, a cluster is an aggregation of cases in a given area over a particular period without regard to whether the number of cases is more than expected. In an outbreak or epidemic, we usually presume that the cases are related to one another or that they have a common cause.

Many epidemiologists use the terms "outbreak" and "epidemic" interchangeably, but some epidemiologists restrict the use of the term "epidemic" to situations involving larger numbers of people over a wide geographic area.

One of the first tasks as a field investigator is to verify whether a purported outbreak is indeed an outbreak. Some will turn out to be true outbreaks with a common cause, some will be sporadic and unrelated cases of the same disease and others will turn out to be unrelated cases of similar but unrelated diseases. Often, it is necessary to determine that the expected number of cases before deciding whether the observed number exceeds the expected number, i.e., whether a cluster is indeed an outbreak.

Even if the current number of reported cases exceeds the expected number, the excess may not necessarily indicate an outbreak. Reporting may rise because of changes in local reporting procedures, changes in the case definition, increased interest because of local or national awareness or improvements in diagnostic procedures. A new physician, infection control nurse may report cases more consistently, when in fact there has been no change in the actual occurrence of the disease. Finally, particularly in areas with sudden changes in population size such as migrant farming areas, changes in the numerator (number of reported cases) may simply reflect changes in the denominator (size of the population).

Step 3: Verifying the Diagnosis

Closely linked to verifying the existence of an outbreak is establishing what disease is occurring. Usually, the investigator will be able to address these two steps at the same time. The aim of this is to

(a)To ensure that the problem has been properly diagnosed

(b) To rule out laboratory error as the basis for the increase in diagnosed cases.

The investigator should review the clinical findings and laboratory results when verifying the diagnosis. If you have any question about the laboratory findings, i.e., if the laboratory tests are inconsistent with the clinical and epidemiologic findings, the laboratory techniques should be looked into and further tests can be conducted to verify the diagnosis.

The investigator should always summarize the clinical findings with frequency distributions and such frequency distributions are useful in characterizing the spectrum of illness, verifying the diagnosis and developing case definitions.

Step 4a: Establishing a Case Definition

The investigator must establish a case definition. A case definition is a standard set of criteria for deciding whether an individual should be classified as having the health condition of interest. A case definition includes clinical criteria and particularly in the setting of an outbreak investigation, restrictions by time, place and person. The investigator should base the clinical criteria on simple and objective measures such as elevated antibody titers, fever > 101°F etc. Whatever the criteria, the investigator must apply them consistently and without bias to all persons under investigation.

Early in an investigation, investigators often use a sensitive or "loose" case definition which includes confirmed, probable and even possible cases. Later on, when hypotheses have come into sharper focus, the investigator may "tighten" the case definition by dropping the possible category.

Step 4b: Identifying and Counting Cases

When it is necessary to identify cases, use as many sources as possible. Methods for identifying cases must be appropriate for the setting and disease in question.

Case finding efforts should be directed towards health care facilities at first, where the diagnosis is more likely to be made. In some outbreaks, public health officials may decide to alert the public directly, usually through the local media.

If an outbreak affects a restricted population (e.g. in a school or at a worksite) and if a high proportion of cases are unlikely to be diagnosed (e.g. many cases are mild or asymptomatic), it may be necessary to conduct a survey of the entire population. A questionnaire can be administered to determine the true occurrence of clinical symptoms or laboratory specimens can be collected to determine the number of asymptomatic cases.

Finally, it is advisable to question the case-patients about other ill patients, as one person with an illness knows or hears of others with the same illness frequently.

Regardless of the particular disease you are investigating, you should collect the following types of information about every case:

- Identifying information
- Demographic information
- Clinical information
- Risk factor information
- Reporter information

Risk factor information must be appropriate for the specific disease in question. For example, in an investigation of hepatitis A, you would ascertain exposure to suspected food and water sources.

Once data is collected, important data can be extracted to form a line listing. In a line listing, each column represents an important variable, such as name or identification number, age, sex, case classification, etc., while each row represents a different case. Thus, a line listing contains key information on every case and can be scanned and updated as necessary.

Table 1: Vaccine-preventable Diseases & AFP   16th – 22nd 2012 (25thWeek)

Disease	No. of Cases by Province									Number of cases during current week in 2012	Number of cases during same week in 2011	Total number of cases to date in 2012	Total number of cases to date in 2011	Difference between the number of cases to date in 2012 & 2011
	W	C	S	N	E	NW	NC	U	Sab					
Acute Flaccid Paralysis	00	01	00	00	00	00	01	00	00	02	01	42	46	- 08.7 %
Diphtheria	00	00	00	00	00	00	00	00	00	-	-	-	-	-
Measles	00	00	00	00	00	00	00	00	00	00	02	23	72	- 68.1 %
Tetanus	00	00	00	00	00	00	00	00	00	00	00	05	12	- 58.3 %
Whooping Cough	00	00	00	00	00	00	00	00	00	00	00	34	17	+ 100.0 %
Tuberculosis	75	18	19	03	05	00	24	10	00	155	101	4223	4160	+ 0.87 %

Table 2: Newly Introduced Notifiable Disease   16th – 22nd 2012 (25thWeek)

Disease	No. of Cases by Province									Number of cases during current week in 2012	Number of cases during same week in 2011	Total number of cases to date in 2012	Total number of cases to date in 2011	Difference between the number of cases to date in 2012 & 2011
	W	C	S	N	E	NW	NC	U	Sab					
Chickenpox	01	00	01	00	00	00	02	00	00	04	60	2138	2428	- 11.9 %
Meningitis	00	00	00	01 JF=01	01 BT=1	00	00	00	00	02	13	266	447	- 40.5 %
Mumps	00	00	00	00	01	01	00	00	01	03	59	2037	1280	+ 59.1 %
Leishmaniasis	00	00	00	00	00	00	21 AP=21	00	00	02	22	292	347	-15.9 %

Key to Table 1 & 2

Provinces: **W**: Western, **C**: Central, **S**: Southern, **N**: North, **E**: East, **NC**: North Central, **NW**: North Western, **U**: Uva, **Sab**: Sabaragamuwa.

DPDHS Divisions: **CB**: Colombo, **GM**: Gampaha, **KL**: Kalutara, **KD**: Kandy, **ML**: Matale, **NE**: Nuwara Eliya, **GL**: Galle, **HB**: Hambantota, **MT**: Matara, **JF**: Jaffna,
KN: Killinochchi, **MN**: Mannar, **VA**: Vavuniya, **MU**: Mullaitivu, **BT**: Batticaloa, **AM**: Ampara, **TR**: Trincomalee, **KM**: Kalmunai, **KR**: Kurunegala, **PU**: Puttalam,
AP: Anuradhapura, **PO**: Polonnaruwa, **BD**: Badulla, **MO**: Moneragala, **RP**: Ratnapura, **KG**: Kegalle.

Data Sources:

Weekly Return of Communicable Diseases: Diphtheria, Measles, Tetanus, Whooping Cough, Chickenpox, Meningitis, Mumps.

Special Surveillance: Acute Flaccid Paralysis.

Leishmaniasis is notifiable only after the General Circular No: 02/102/2008 issued on 23 September 2008.

Dengue Prevention and Control Health Messages

To prevent dengue, remove mosquito breeding places in and around your home, workplace or school once a week .

Table 4: Selected notifiable diseases reported by Medical Officers of Health

16th – 22nd 2012 (25th Week)

DPDHS Division	Dengue Fever / DHF*		Dysentery		Encephalitis		Enteric Fever		Food Poisoning		Leptospirosis		Typhus Fever		Viral Hepatitis		Human Rabies		Returns Received
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	%
Colombo	72	3333	2	51	0	5	1	88	0	24	0	66	0	2	1	27	0	2	08
Gampaha	0	2219	0	34	0	5	0	33	0	13	0	81	0	6	0	101	0	0	00
Kalutara	0	834	0	35	0	2	0	17	0	3	0	97	0	2	0	11	0	1	00
Kandy	0	729	0	37	0	1	0	11	0	11	0	27	0	64	0	15	0	0	00
Matale	0	185	0	38	0	4	0	7	0	4	0	19	0	2	0	10	0	0	00
Nuwara	0	125	0	64	0	1	0	17	0	1	0	14	0	31	0	9	0	1	00
Galle	0	455	0	36	0	3	0	6	0	10	0	59	0	21	0	1	0	0	05
Hambantota	0	216	0	18	0	1	0	2	0	10	0	28	0	22	0	5	0	0	00
Matara	0	580	0	30	0	4	0	9	0	16	0	64	0	36	0	48	0	0	00
Jaffna	0	201	0	85	0	6	1	176	0	27	0	2	0	235	0	4	0	0	25
Kilinochchi	0	20	0	6	0	1	0	18	0	39	1	4	0	26	0	4	0	1	25
Mannar	0	73	0	11	0	2	0	13	0	13	0	15	0	35	0	1	0	0	00
Vavuniya	0	30	0	7	0	19	0	6	0	5	0	15	0	0	0	1	0	0	75
Mullaitivu	0	5	1	9	0	1	0	4	0	1	0	2	0	5	0	0	0	0	25
Batticaloa	3	555	2	76	0	2	0	12	0	30	0	5	0	0	0	4	0	3	50
Ampara	0	54	0	42	0	0	0	3	0	5	0	16	0	0	0	2	0	0	00
Trincomalee	0	90	0	76	0	1	0	15	0	2	0	31	1	5	0	2	0	0	25
Kurunegala	14	597	0	54	0	6	0	46	0	21	0	67	0	16	0	38	0	2	09
Puttalam	0	356	0	23	0	4	0	5	0	1	0	20	0	9	0	1	0	0	00
Anuradhapu	6	169	0	29	0	1	0	4	0	2	0	49	0	18	1	36	0	1	26
Polonnaruw	0	82	0	11	0	0	0	1	0	0	0	18	0	2	0	26	0	1	00
Badulla	0	88	0	33	0	2	0	16	0	1	0	17	0	24	0	20	0	0	00
Monaragala	1	88	2	36	0	4	0	10	0	4	0	45	0	42	0	103	0	1	18
Ratnapura	33	891	0	93	0	23	1	30	0	5	0	128	0	19	0	50	0	1	17
Kegalle	0	646	0	27	0	7	0	12	0	5	0	58	0	29	0	210	0	0	00
Kalmune	0	126	0	83	0	1	0	5	0	27	0	2	0	0	0	6	0	1	00
SRI LANKA	129	12747	07	1044	00	106	03	566	00	280	01	949	01	651	02	735	00	15	10

Source: Weekly Returns of Communicable Diseases WRCD).
*Dengue Fever / DHF refers to Dengue Fever / Dengue Haemorrhagic Fever.
**Timely refers to returns received on or before 22nd June, 2012 Total number of reporting units 329. Number of reporting units data provided for the current week: 32
A = Cases reported during the current week. B = Cumulative cases for the year.

Comments and contributions for publication in the WER Sri Lanka are welcome. However, the editor reserves the right to accept or reject items for publication. All correspondence should be mailed to The Editor, WER Sri Lanka, Epidemiological Unit, P.O. Box 1567, Colombo or sent by E-mail to **chepid@sltnet.lk.**

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