Field Epidemiology- Principles, Practice & Application Part I

Concept of Epidemiology

- EPI - Upon
- DEMOS - Population
- LOGOS – Study of

"Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems."

(Last, 2008).

Concept of Epidemiology (Contd)

- **Distribution-** within the population – by (type of) person, place and time.

  Epidemiological Triad of Distribution-Time, Place, Person

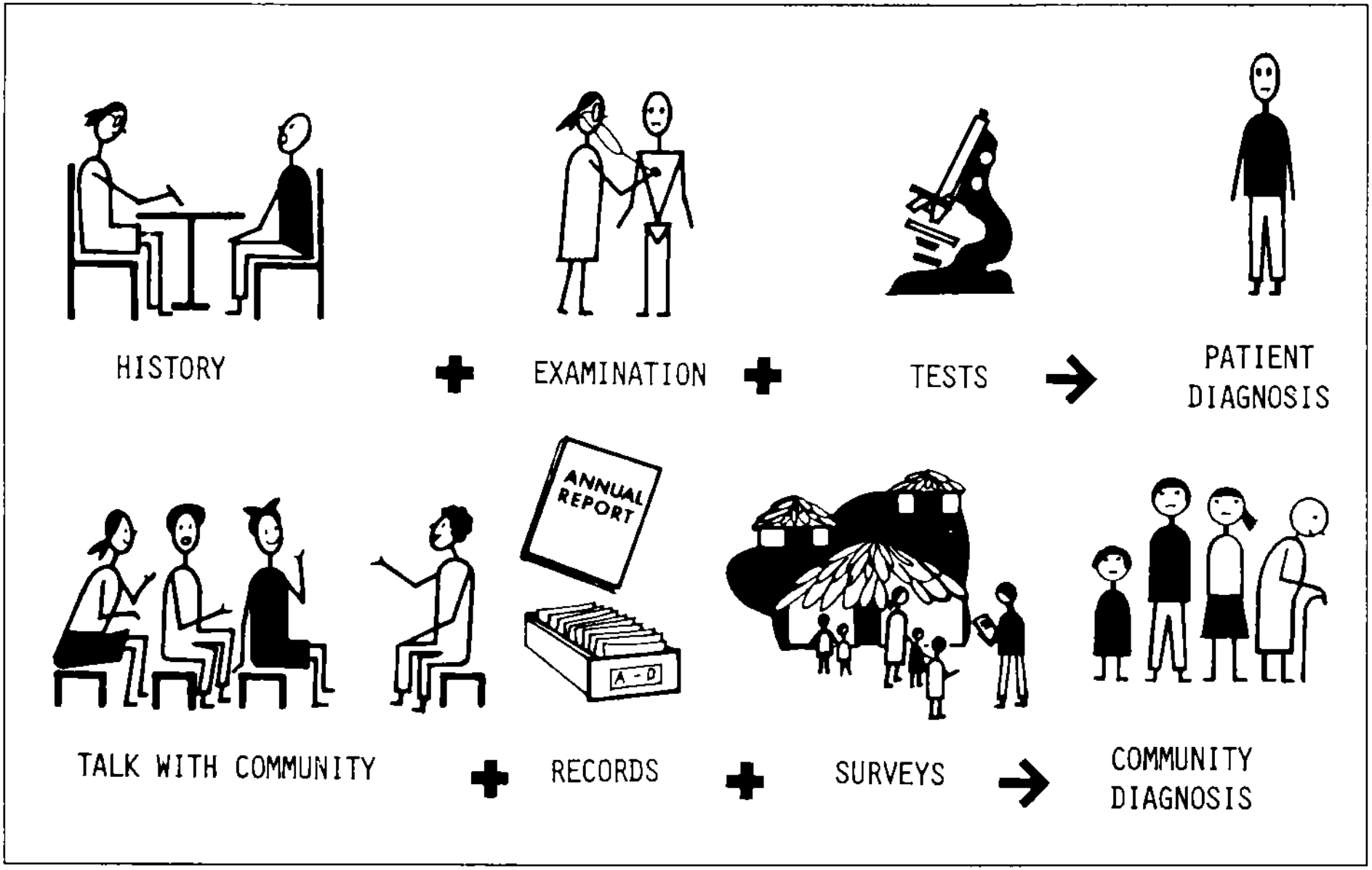
- **Determinants-** causes ("risk factors") and mechanisms underlying disease.

  Epidemiological Triad of Causation-Agent, Host, Environment

Concept of Epidemiology (Contd)

- **Control-** what to do about the problem? planning strategies, setting priorities, evaluating risks and benefits of interventions.
- **Diseases-** what is it (case definition)? What is its natural history?

Figure 1.3. Clinical diagnosis and community diagnosis compared



The Epidemiological approach

1. Asking questions: **What, Why, When, How, Where & Who**
2. Making comparison

The Epidemiological approach

1. Asking questions: **What, Why, When, How, Where & Who**

Related to health events

a. What is the event?

b. What is the magnitude?

c. Where, When & Why did it happen?

d. Who are affected?

Related to health actions

a. What can be done to reduce the problem ?

b. How can it be prevented in the future?

The Epidemiological approach

2. Making comparison

   Comparison of two(or more groups)

   One group have the disease (or exposed the risk factor)

   One group do not have the disease (or not exposed the risk factor)

The epidemiologic approach: Steps to public health action

SURVEILLANCE
- Detect outbreaks & threats
- Detect infectious cases
- Monitor trends in population
- Monitor exposed individuals
- Monitor treated individuals
- Direct interventions
- Evaluate interventions
- Generate hypotheses

DESCRIPTIVE
- What (case definition)
- Who (person)
- Where (place)
- When (time)
- How many (measures)

ANALYTIC
- Why (Causes)
- How (Causes)

MEASURES
- Count
- Time
- Rate
- Risk/Odds
- Prevalence

STUDY DESIGN
- Design
- Implementation
- Analysis
- Interpretation
- Reporting

THREATS TO VALIDITY
- Chance
- Bias
- Confounding

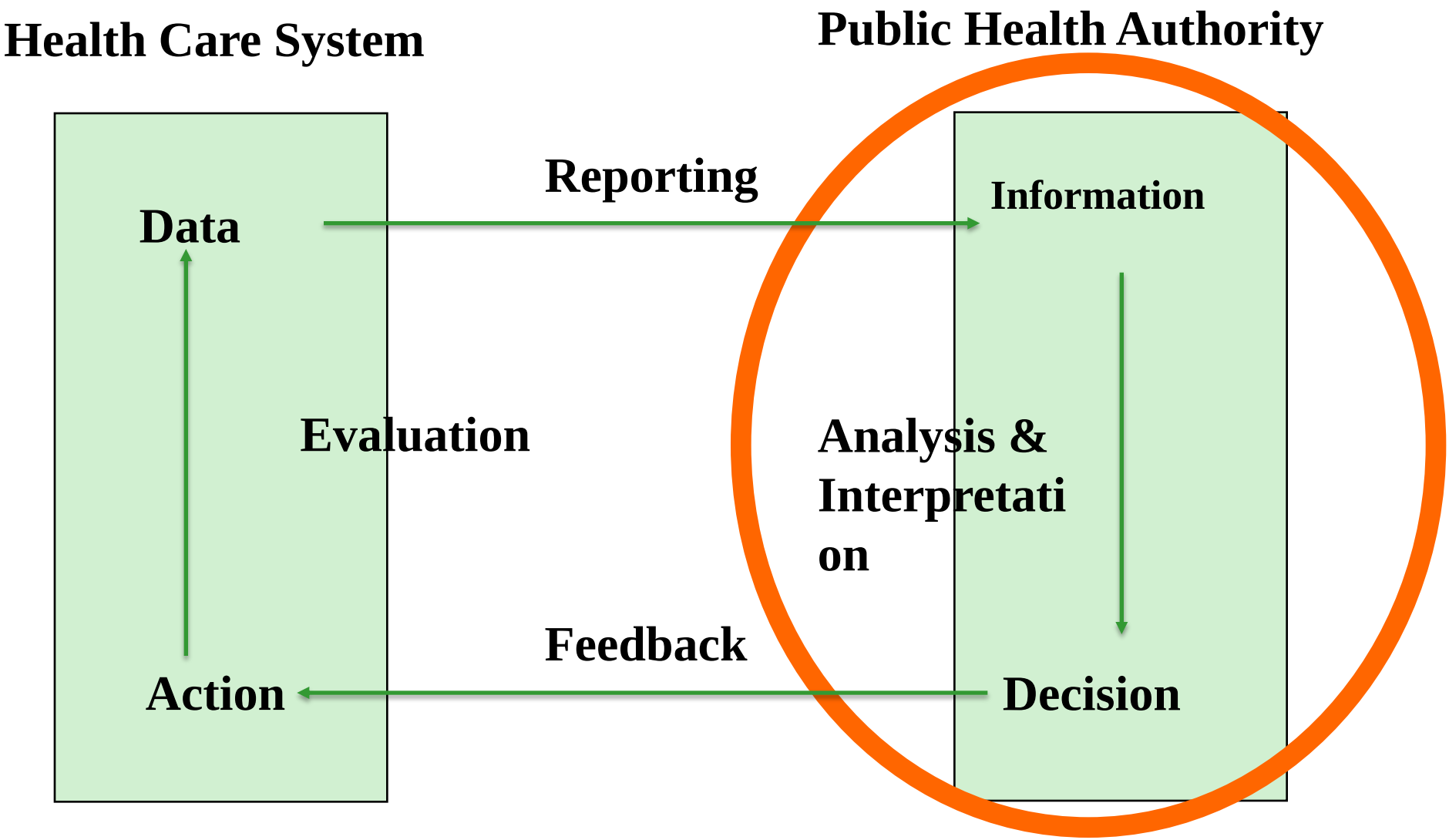
INFERENCES
- Epidemiologic
- Causal

ACTION
- Clinical
- Behavioral
- Community
- Environmental

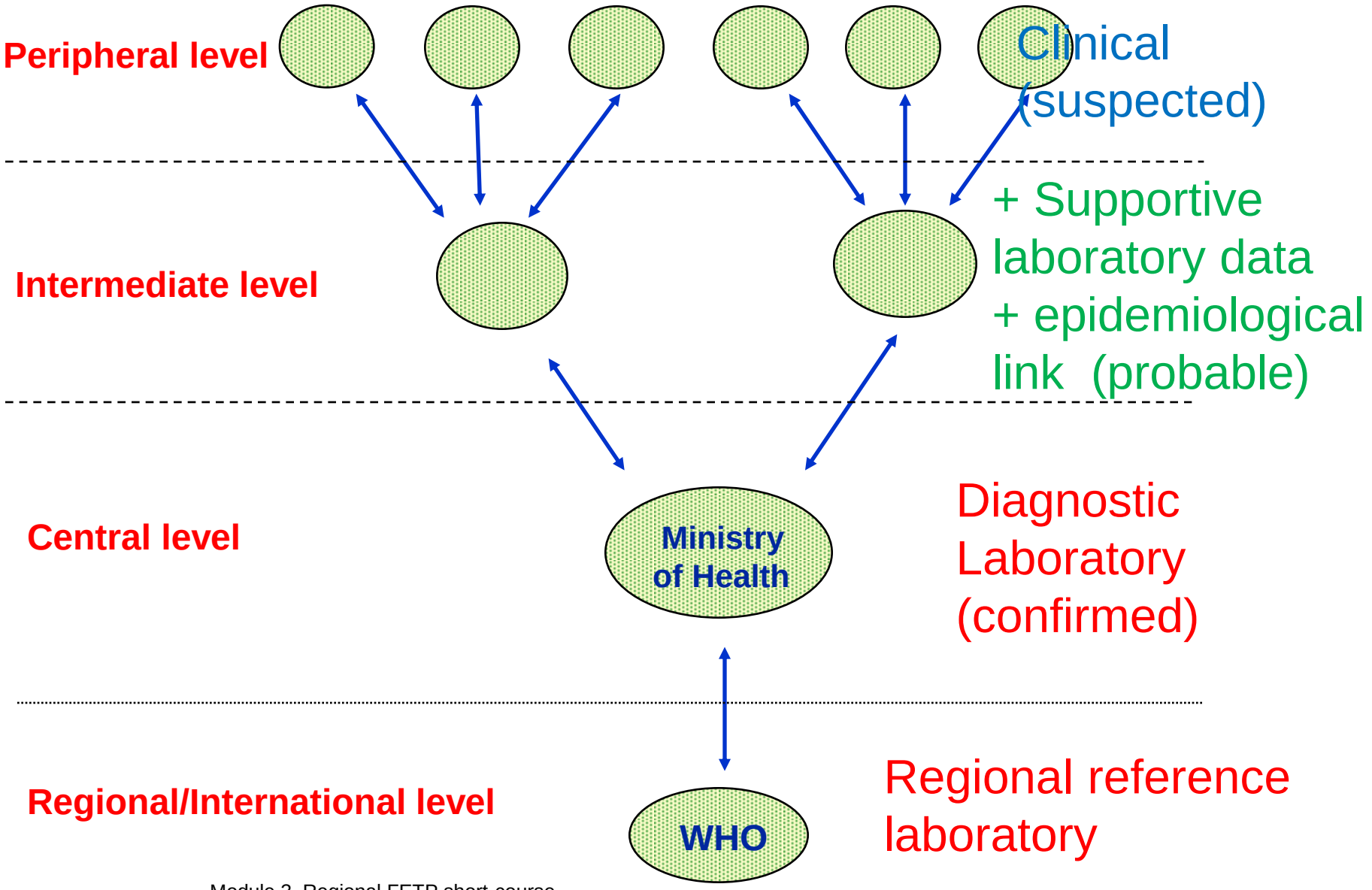
WHO Definition of Surveillance

Surveillance is the *ongoing systematic* collection, collation, analysis and interpretation of data; and the dissemination of information to those who need to know in order that **action** may be taken

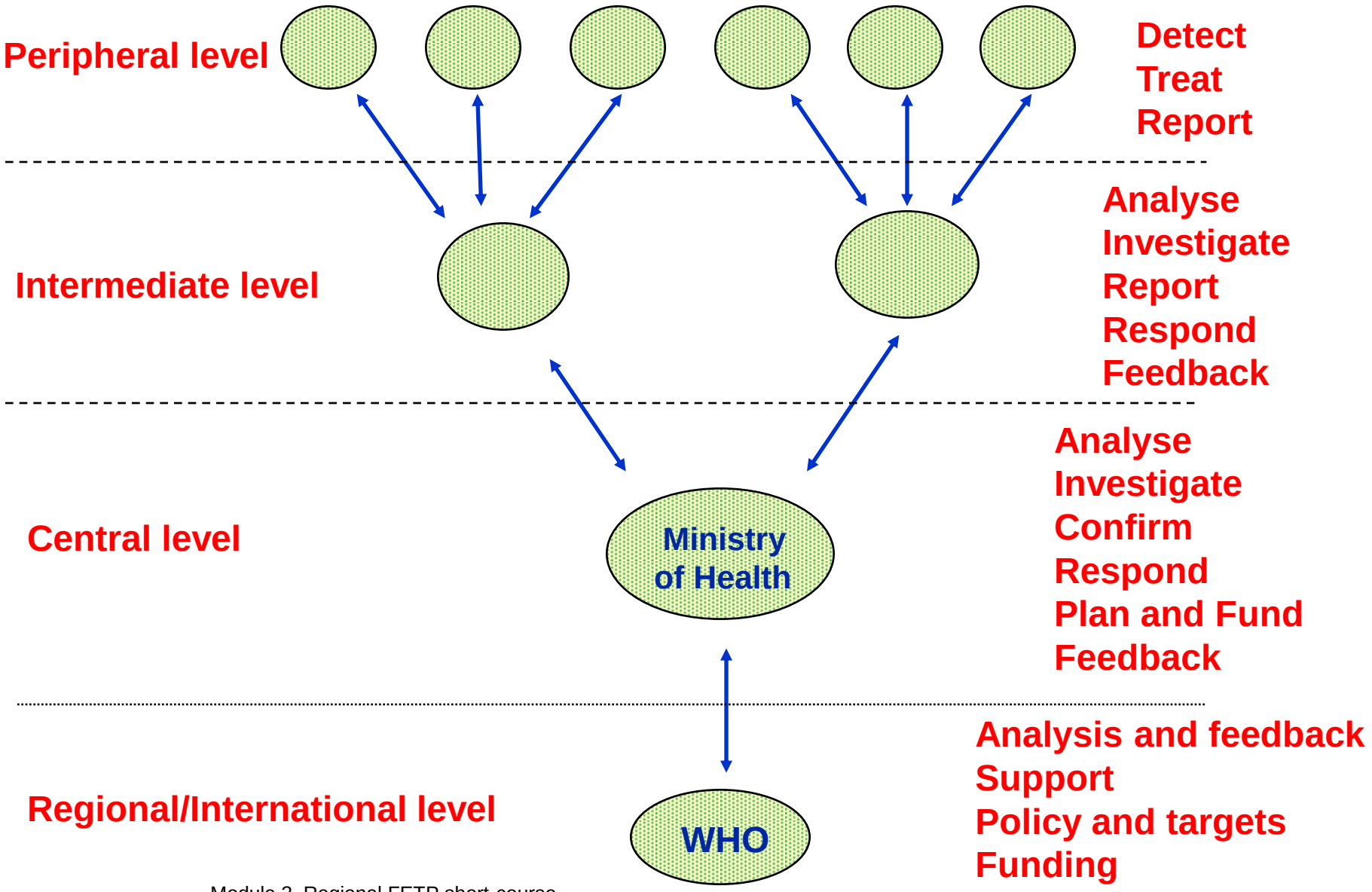
Public Health Surveillance cycle



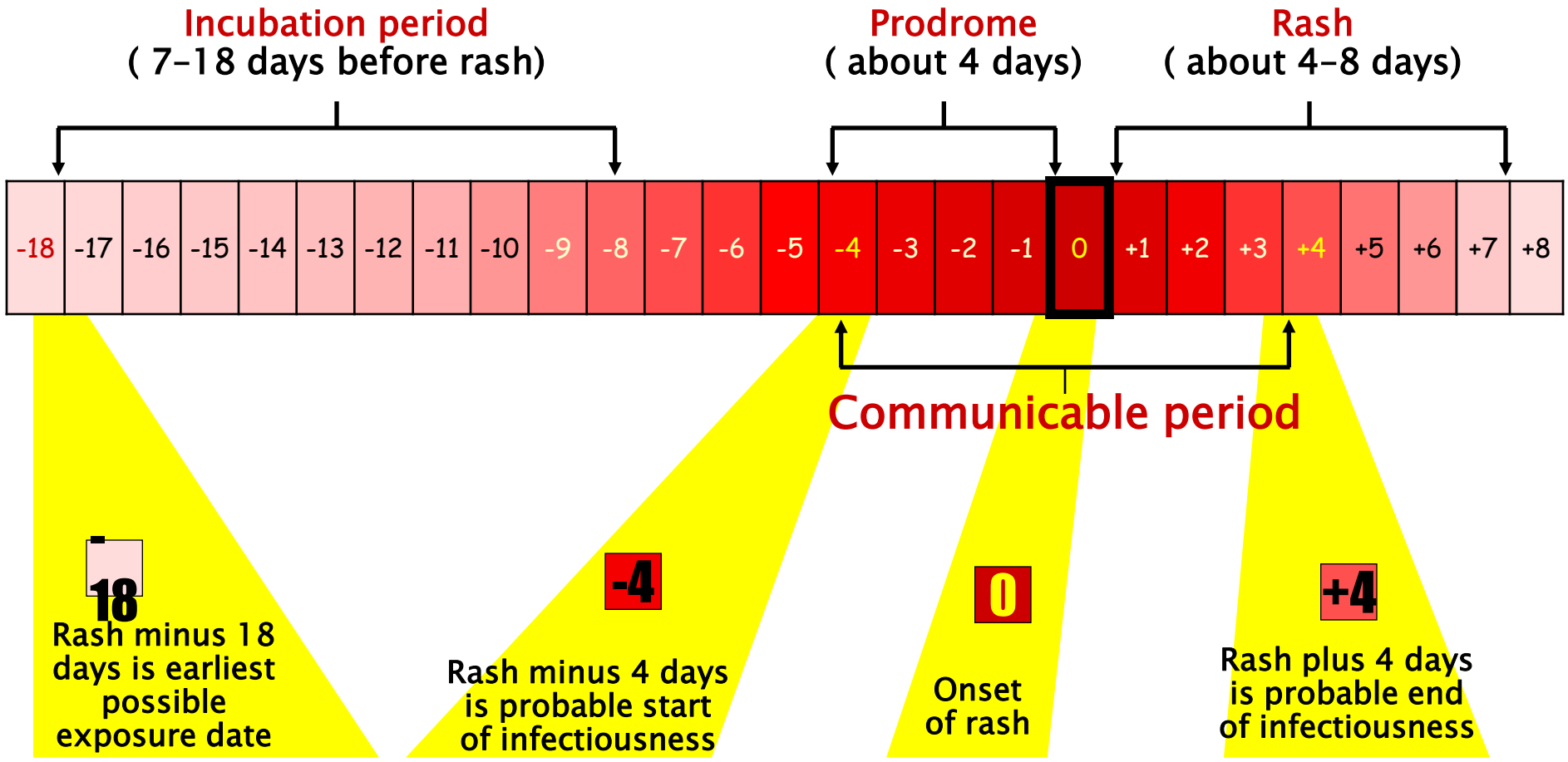
Surveillance: Data flow



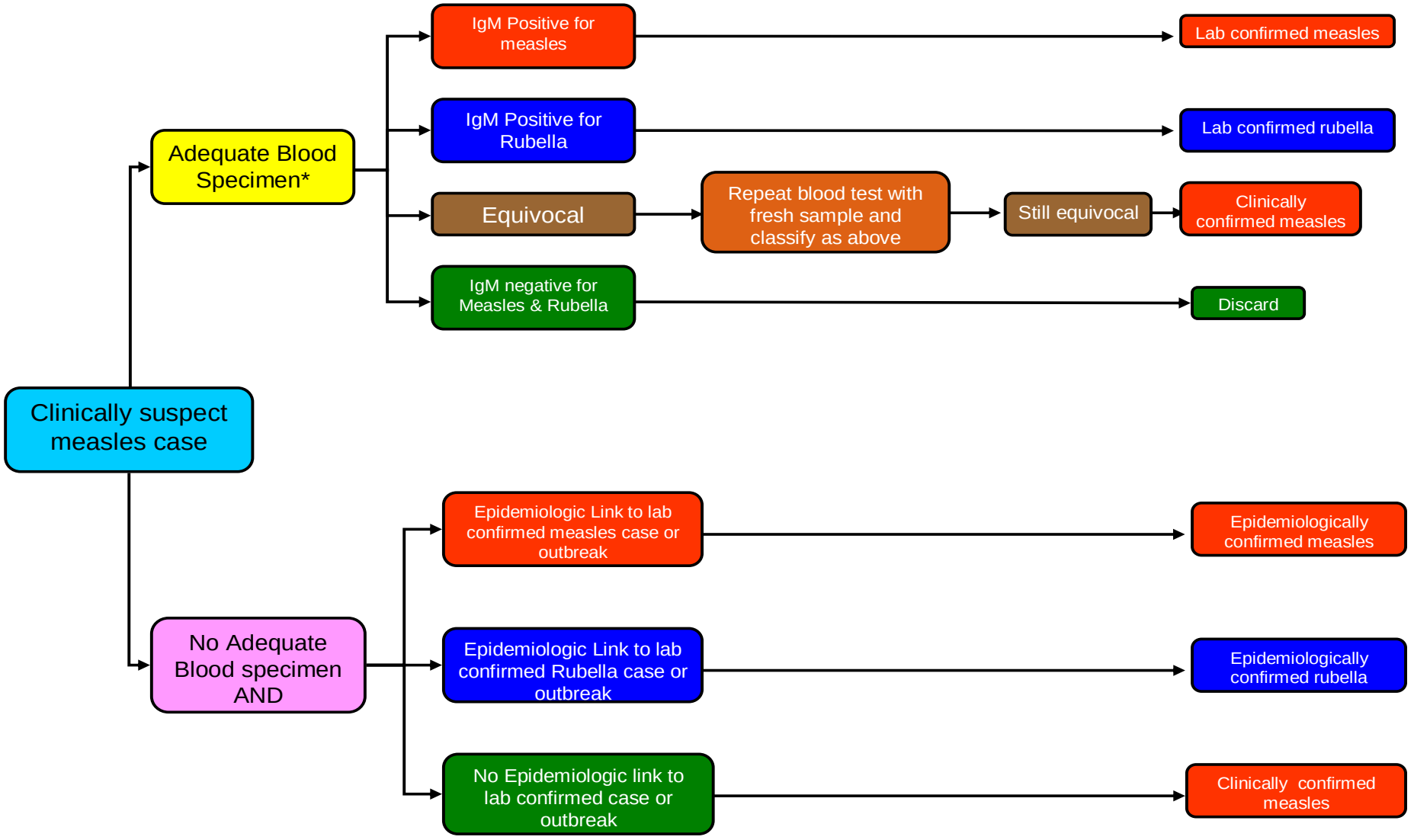
Surveillance: Tasks



Clinical course of measles



Measles Surveillance – Summary of Case Classification



*A single serum sample obtained at the first contact with the health care system within 28 days after onset is considered adequate for measles surveillance

Recommended case definition for Measles

Peripheral Level-Clinical case definition

- Any person in whom a clinician suspects measles infection, **or**
  Any person with fever **and** maculopapular rash (i.e. non-vesicular) **and** cough, coryza (i.e. runny nose) or conjunctivitis (i.e. red eyes)

Intermediate Level-Laboratory criteria for diagnosis

- Presence of measles-specific IgM antibodies

Measles - Case classification

Laboratory classification

- **Laboratory classification used for outbreak investigation*

Laboratory-confirmed: A case that meets the clinical case definition and is laboratory-confirmed

Epidemiologically confirmed: A case that meets the clinical case definition and is linked to a laboratory-confirmed case

Clinically confirmed: A case that meets the clinical case definition and for which no adequate blood specimen was taken

Discarded: A suspect case that does not meet the clinical or laboratory definition

Epidemiologically linked confirmed case of measles:

- **A suspected case of measles, that has not been confirmed by a laboratory**
- **but was geographically and temporally related, with dates of rash onset occurring 7 - 21 days apart to a laboratory confirmed case,**
- **or, in the event of a chain of transmission to another epidemiologically confirmed measles case.**

Meningitis Case Definitions-WHO

Suspected meningitis case:

- Any person with sudden onset of fever (>38.5 °C rectal or 38.0 °C axillary) and neck stiffness or another meningeal sign including bulging fontanelle in toddlers.

Probable meningitis case:

- Any suspected case with macroscopic aspect of CSF turbid, cloudy or purulent; or with a CSF leukocyte count >10 cells/mm3; or with bacteria identified by Gram stain in CSF.

Confirmed meningitis case:

- Any suspected or probable case that is laboratory confirmed by culturing or identifying (i.e. by polymerase chain reaction, immunochromatographic dipstick or latex agglutination) of *Neisseria meningitidis, Streptococcus pneumoniae or Haemophilus influenzae type b in the CSF or blood.*

Incidence thresholds for detection and control of epidemic meningococcal meningitis (2014)

	Population	
Intervention	**30 000–100 000**	**Under 30 000**
Alert threshold — Inform authorities — Strengthen surveillance — Investigate — Confirm (including laboratory) — Prepare for eventual response	3 suspected cases / 100 000 inhabitants / week (Minimum of 2 cases in one week)	2 suspected cases in one week *Or* An increased incidence compared to previous non-epidemic years
Epidemic threshold — Mass vaccination within four weeks of crossing the epidemic threshold — Distribute treatment to health centres — Treat according to epidemic protocol — Inform the public	10 suspected cases / 100 000 inhabitants / week	5 suspected cases in one week *Or* Doubling of the number of cases in a three-week period (e.g. *Week 1: 1 case, Week 2: 2 cases, Week 3: 4 cases)*

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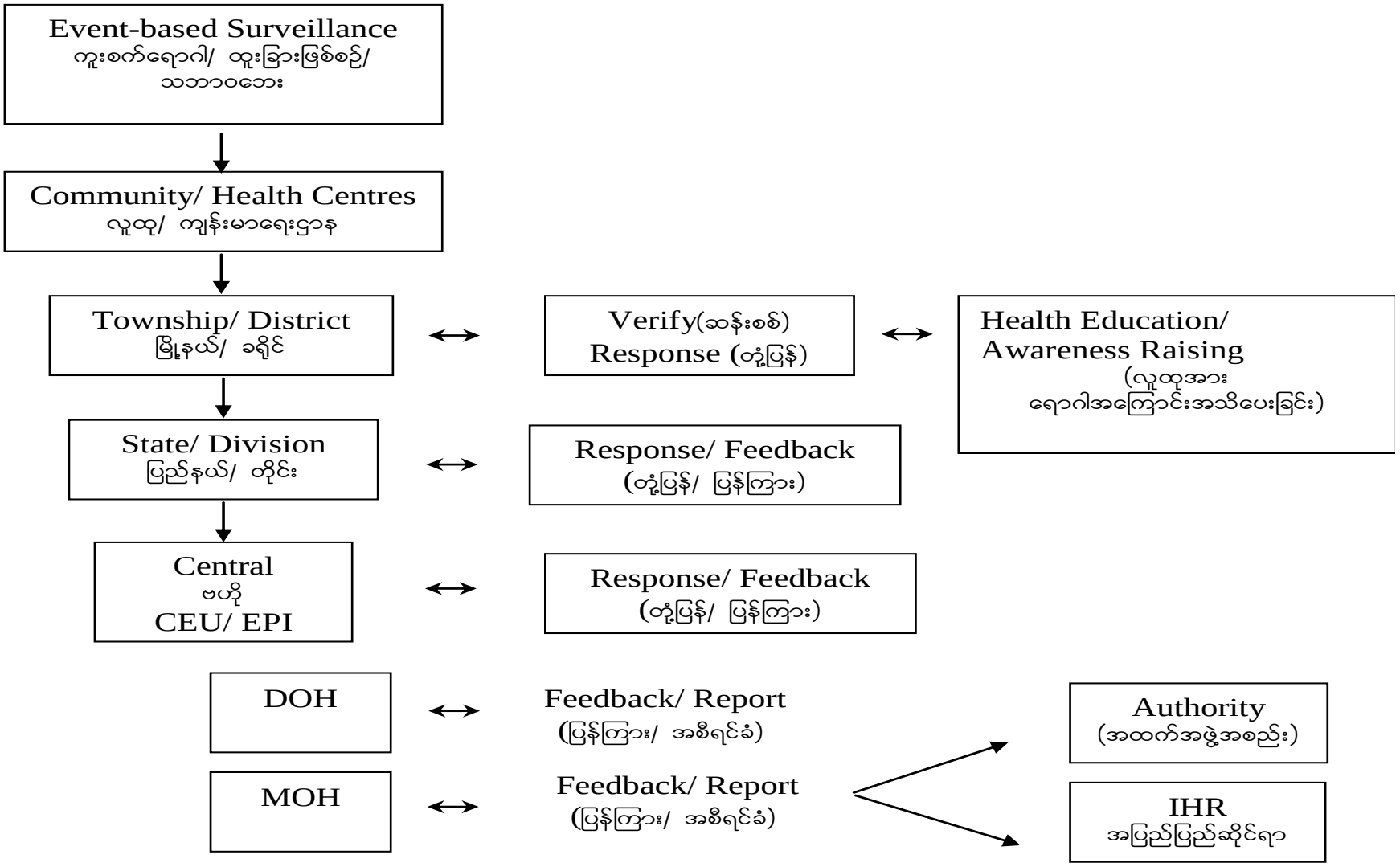
(Flow Chart of Surveillance & Reporting System)



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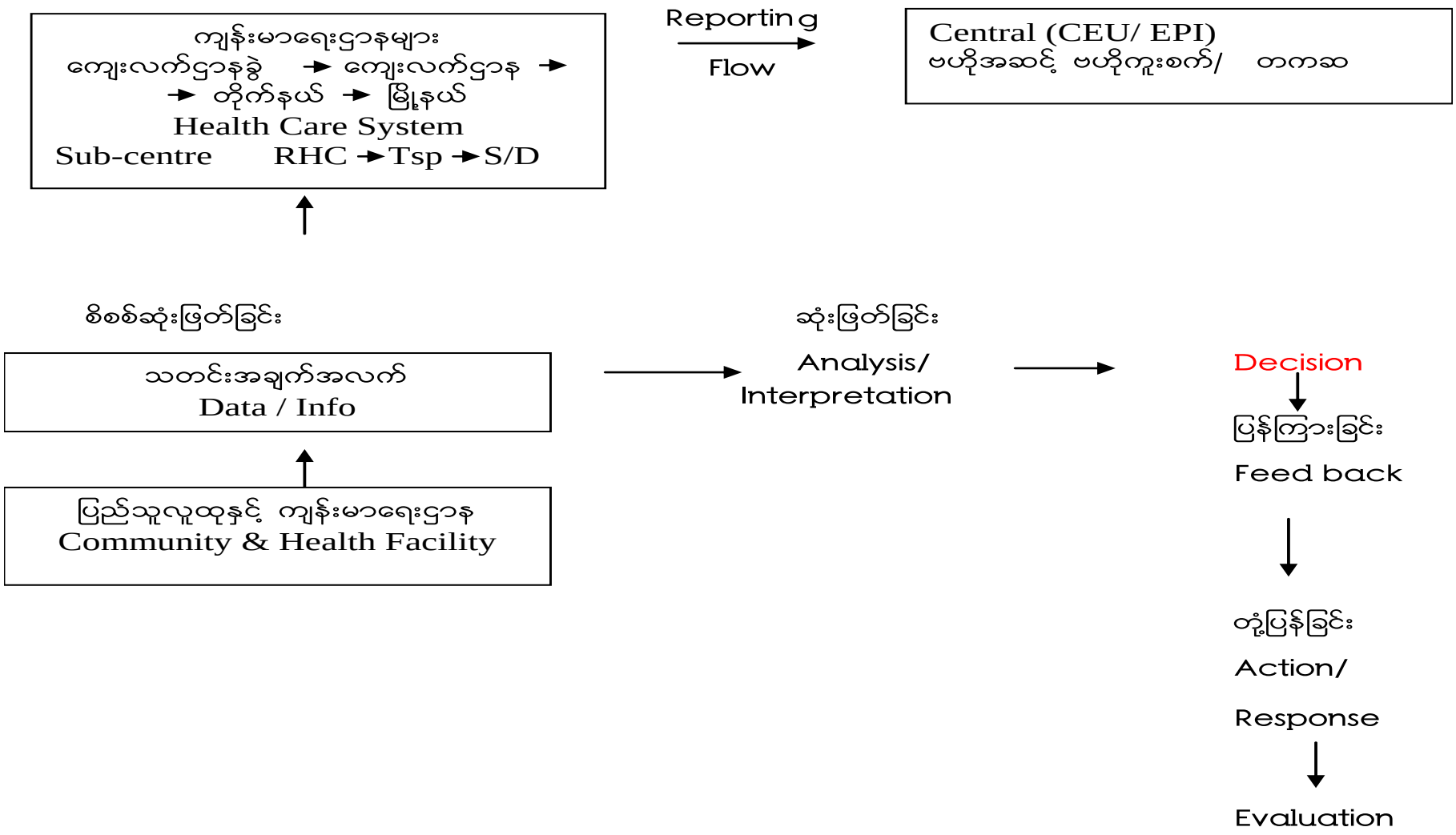


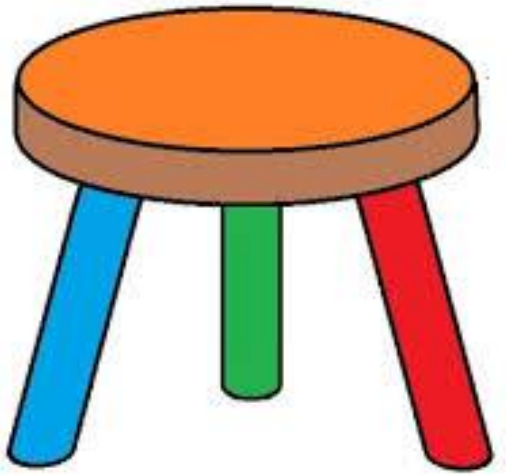
Field Investigations in Healthcare Facilities

- **Epidemiology determines questions to ask**
- **Laboratory provides answers**
- **Epidemiology and LAB together "solve" most outbreaks (especially true for outbreaks in healthcare facilities)**

Epidemiology + Microbiology = Outbreak Success

Components of an Outbreak Field Investigation

- Epidemiology
- Laboratory
- Environmental



The Principles of Field Epidemiology

Field Epidemiology

A definition has been proposed by Goodman. The essential elements are:

1. The problem is unexpected
2. An immediate response may be necessary
3. Epidemiologists must travel to & work on location in the field
4. The extent of investigation is likely to be limited because of imperative for timely intervention

The pace & commitment of Outbreak Investigation

✓There is often a strong tendency to collect what is "essential" in the field & then retreat to "home" for analysis.

✓Such premature departure reflects lack of concern by the public, makes any further data collection or direct contact with the study population difficult.

✓ Once home, the team loses the urgency & momentum & the sense of relevancy of the epidemic.

✓**Don't leave the field without final results & recommendations.**

Trigger events & Warning Signals

1. Clustering of cases/deaths in time/space
2. Unusual increase in cases/deaths
3. Shift in age distribution of cases
4. High vector density
5. Acute hemorrhagic fever or acute fever with renal involvement/altered sensorium
6. Severe dehydration following diarrhea in patients above 5 years age
7. Unusual isolate

Preparedness for Field Epidemiology

1. Identify a focal person at state/district/tsp level
2. Strengthen routine surveillance system
3. Constitute rapid response teams
4. Train medical & other health personnel
5. Prepare a list of laboratories
6. List the “high risk” pockets
7. Establish rapid communication network
8. Undertake IEC activities
9. Ensure availability of essential supplies
10. Setup inter-departmental committees

Composition of typical field team

Specialists	Auxillaries
1. Epidemilogist	1. Nurses
2. Clinician	2. Specialist assistants
3. Microbiologist (pathologist)	3. Secretary/Interpreter
4. Veterinarian	4. Driver
5. Entomologist	
6. Mammalogist	
7. Sanitary engineer	
8. Toxicologist	
9. Information Specialist	

Search for the source of infection

- The main purpose here is to eliminate, terminate or isolate the source.
- The steps involved are – identify the time of disease onset, ascertain the range of incubation periods & look for the source in time interval between the maximum & the minimum IPs.
- In outbreaks with person-to-person transmission, all the contacts of the ***index case*** are to be searched (contact tracing).

Compile & Orient data

Identify when patients became ill (time), where patients became ill (place) & what characteristics the patients possess (person). The earlier one can develop such ideas, the more pertinent & accurate data one can collect.

(a) **Time**: The ***epi-curve*** gives the magnitude of outbreak, its mode of spread & the possible duration of the epidemic. The unit of time on X-axis are smaller than the expected incubation period of the disease.

(b) **Place**: It provides major clues regarding the source of agent and/or nature of exposure. ***Spot maps*** show a pattern of distribution of cases.

(c) **Person**: Examine characters such as age, sex, race, occupation or virtually any other character that may be useful in portraying the uniqueness of case population.

Perform Lab analysis

- It consists of collecting & testing appropriate specimens.
- To identify the etiologic agent, the collection need to be properly timed.
- Examples of specimens include - food & water, other environmental samples (air settling plates), and clinical (blood, stool, sputum or wound) samples from cases & controls.

Environmental Investigation

✓A study of environmental conditions & the dynamics of its interaction with the population & etiologic agents will help to formulate the hypothesis on the genesis of the epidemic.

✓Such actions assist in answering How? And Why? questions.

Control measures

❖Simultaneous to data collection & hypothesis formation, steps should be taken to contain the epidemic.

❖These measures depend upon knowledge of etiologic agent, mode of transmission & other contributing factors.

❖Protective measures are necessary for patients (isolation & disinfection), their contacts (quarantine) and the community (immunization, etc).

Post-epidemic Measures

✓The efficacy of control measures should be assessed day by day during the outbreak,

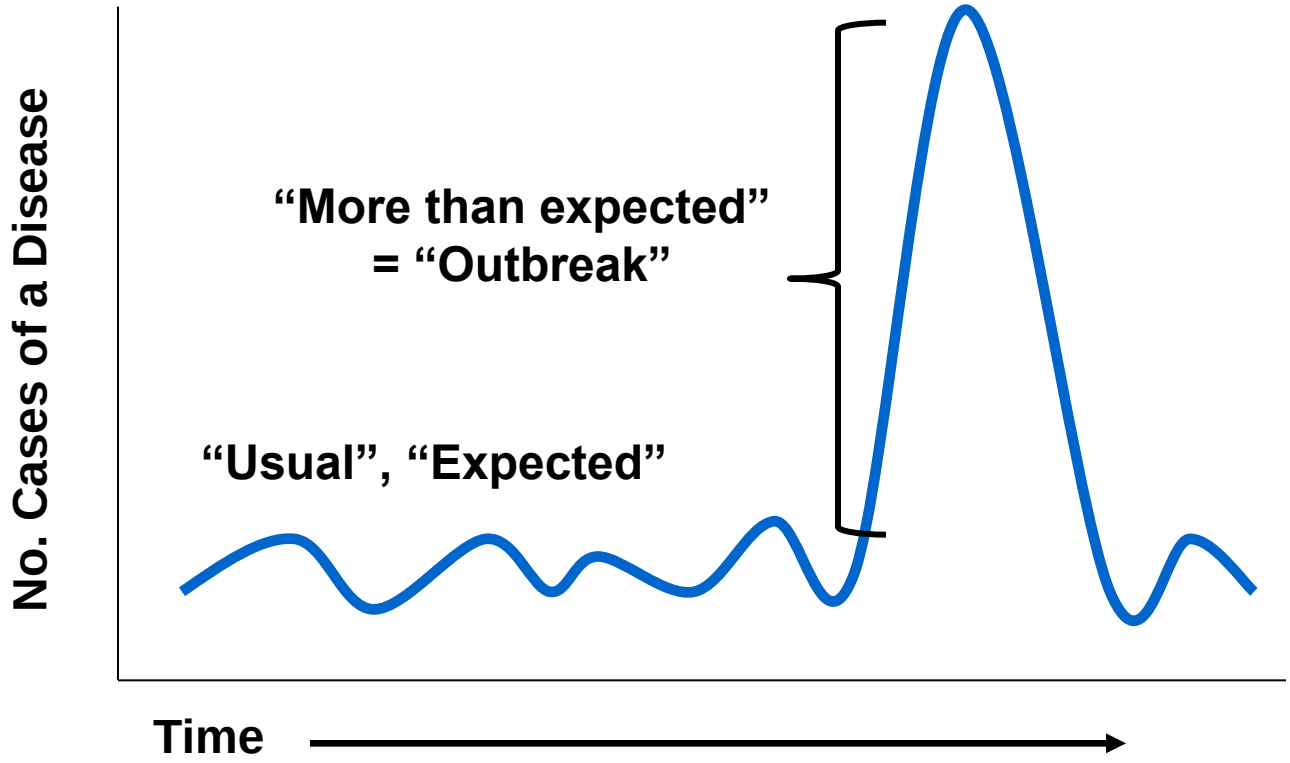
✓A final assessment being made after it has ended.

✓ This will provide a logical basis for post-epidemic surveillance & preventive measures aimed at avoiding the repetition of similar outbreaks.

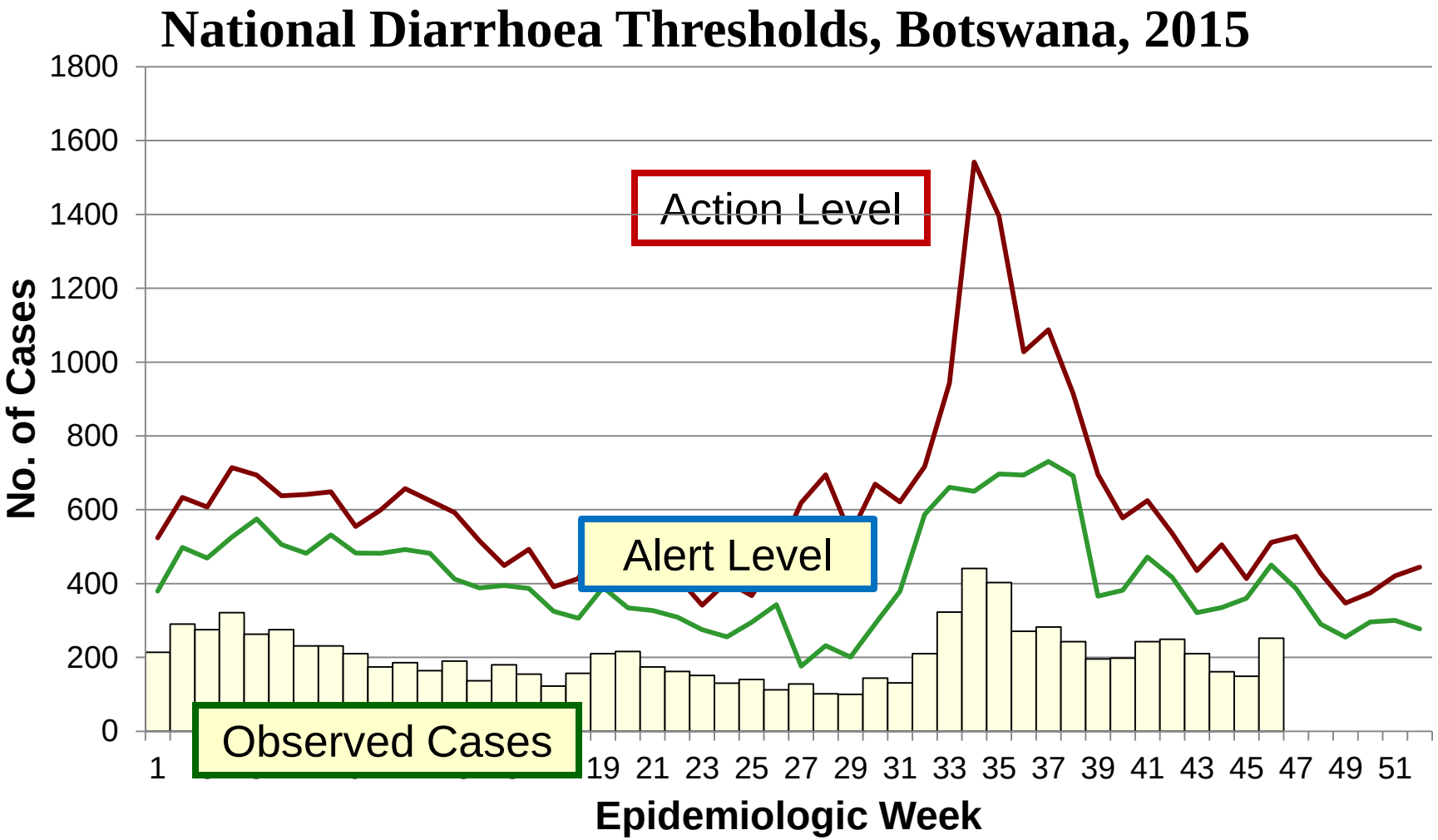
Practice & Application-
Field Investigation of
Suspected Disease Outbreaks

What is an outbreak?

The occurrence of more cases of a disease than expected for a particular place and time



Cases Exceed Threshold?



Source: Botswana IDSR Report, Week 46, 2015

Relative Priority of Investigative and Control Measures

Source/Mode of Transmission

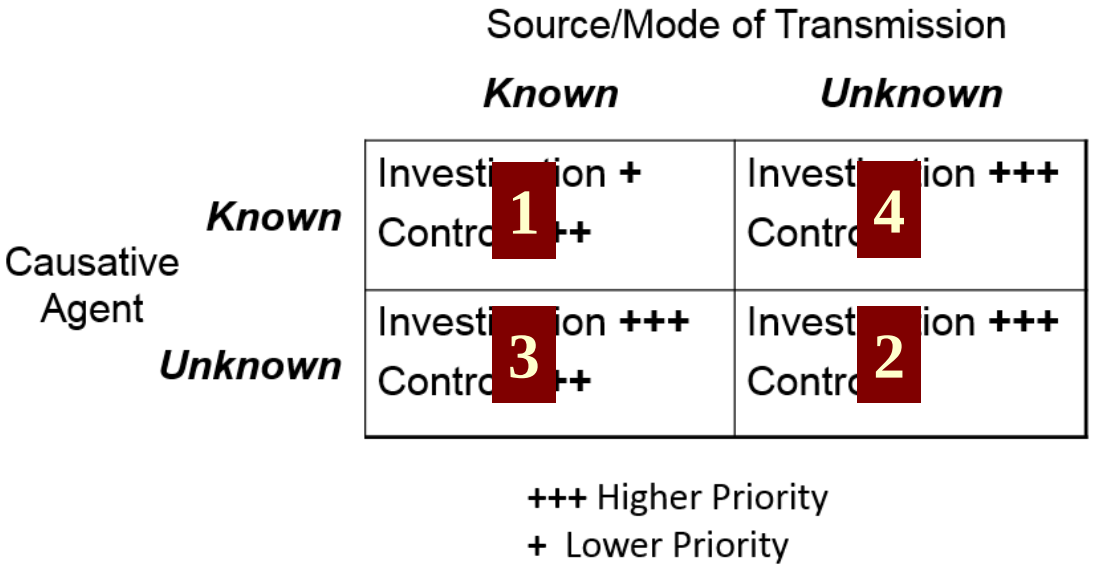
Causative Agent	***Known***	***Unknown***
Known	Investigation **+** Control **+++**	Investigation **+++** Control **+**
Unknown	Investigation **+++** Control **+++**	Investigation **+++** Control **+**

+++ Higher Priority

+ Lower Priority

Which box?

1. Cholera cases among persons using a well previously contaminated by an adjacent latrine
2. Unknown disease with unknown source
3. Unknown disease associated with food served at a restaurant
4. Anthrax cases without a known source



Exceptions to the Rule

If the source is suspected and still a threat to public health…

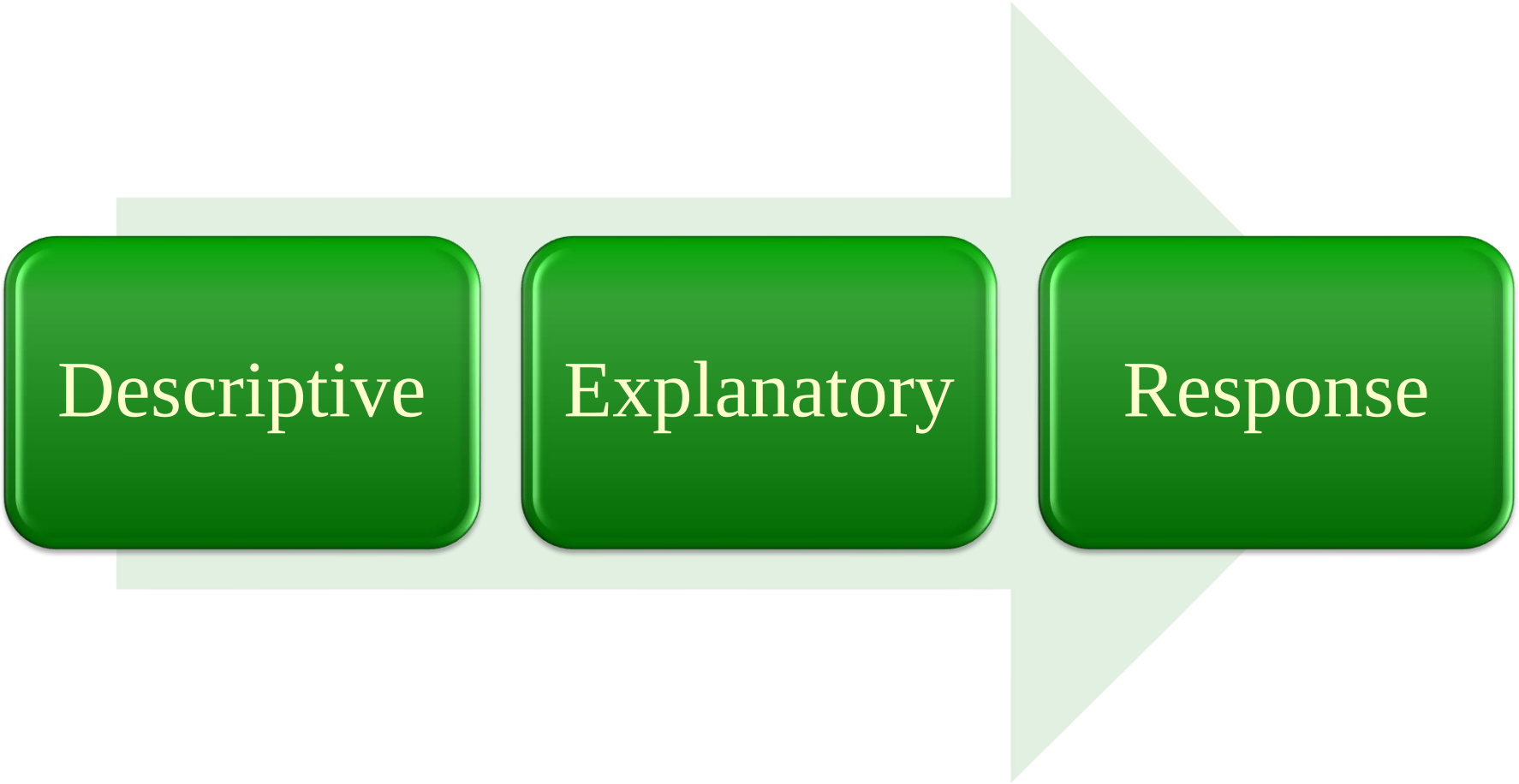
Take immediate control measures!

Objectives of a Field Investigation

- Identify the:
  - agent
  - source, and/or
  - mode of transmission
- Characterize the extent of the outbreak, e.g., who has been affected, who is at risk
- Identify exposures or risk factors that increase risk of disease
- Develop and implement control and prevention measures

Steps of an Outbreak Investigation

General Phases of an Outbreak Investigation



Descriptive Phase

1. Prepare for fieldwork
2. Confirm existence of an outbreak
3. Verify the diagnosis

Done simultaneously or in any order

4. Construct a case definition
5. Find cases systematically and record information
6. Perform descriptive epidemiology

Explanatory Phase

7. Develop hypotheses
8. Evaluate hypotheses epidemiologically
9. Reconcile epidemiology with laboratory and environmental findings
10. Conduct additional studies as necessary

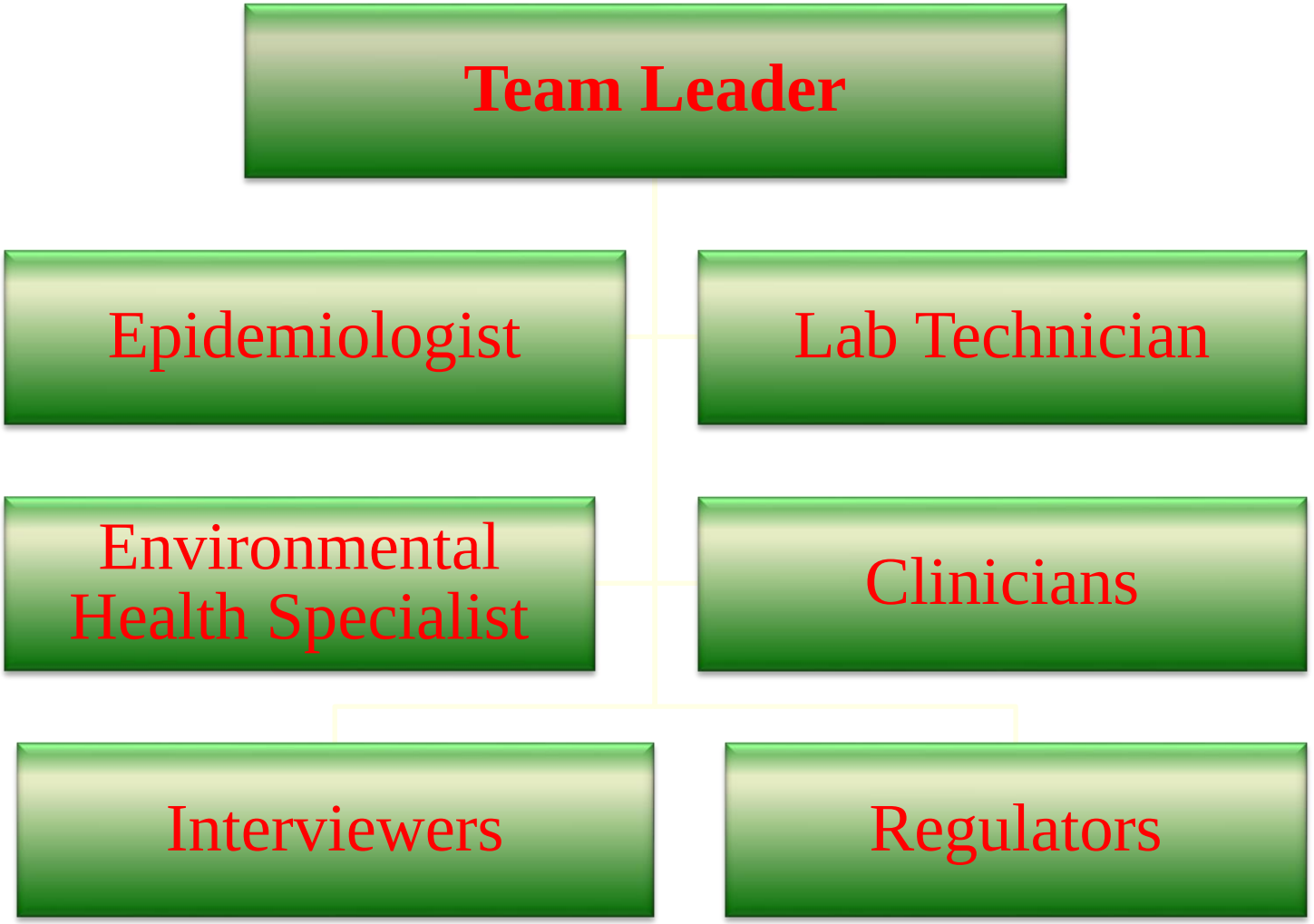
Response Phase

11. Implement and evaluate prevention and control measures
12. Initiate or maintain surveillance
13. Communicate findings

Step 1: Prepare for field work

- Form a team
- Learn about the disease
- Make necessary administrative, personnel, and logistical arrangements
- Coordinate with partner agencies and local contacts

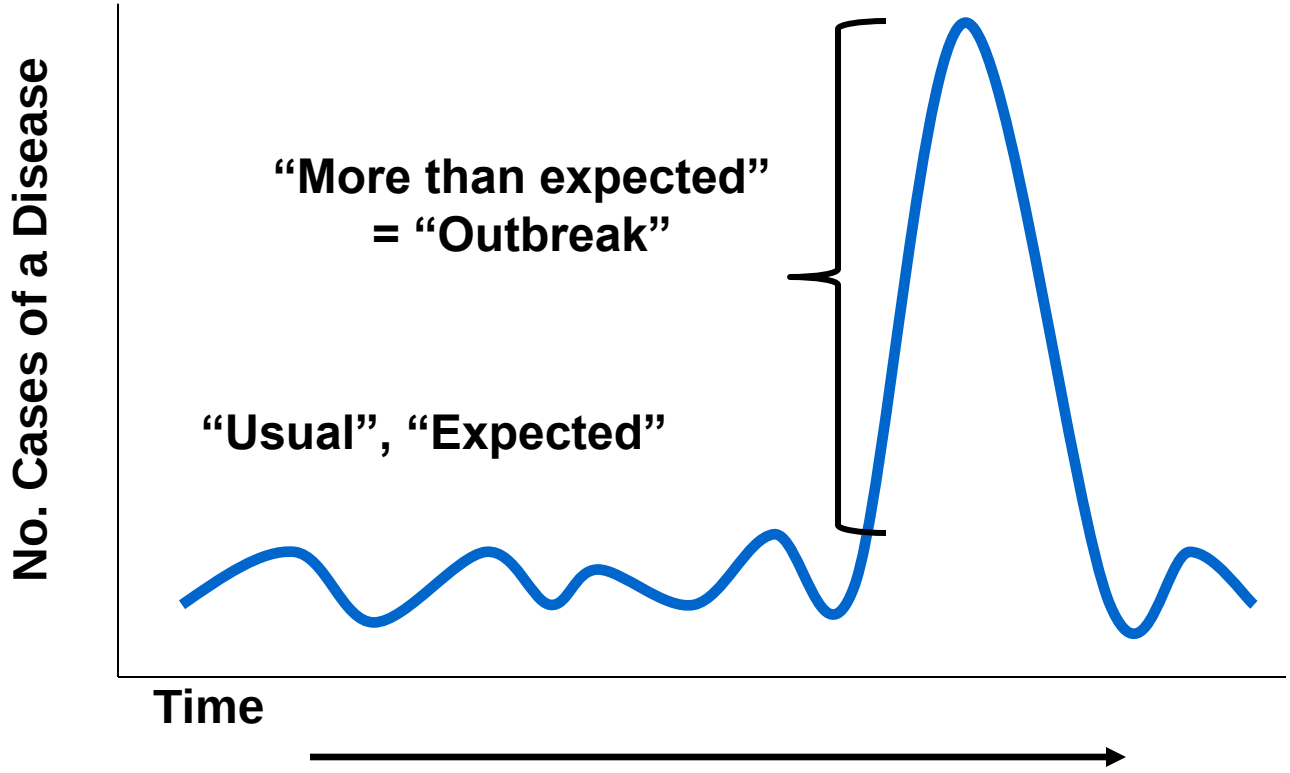
Form a Team


Team Leader
Epidemiologist
Lab Technician
Environmental Health Specialist
Clinicians
Interviewers
Regulators

Step 2: Confirm Existence of an Outbreak

More than expected?

The occurrence of more cases of a disease than expected for a particular place and time



What is an “Outbreak”

- The occurrence of cases of an illness, specific health-related behaviour, or other health-related events clearly in excess of normal expectancy. The area and the period in which the cases occur are specified precisely.

What is an "Outbreak"

- An increase in the 'expected' frequency of a disease or illness
  - for a defined population
  - over a defined period of time
- Can be just one case

Excess of normal expectancy ?

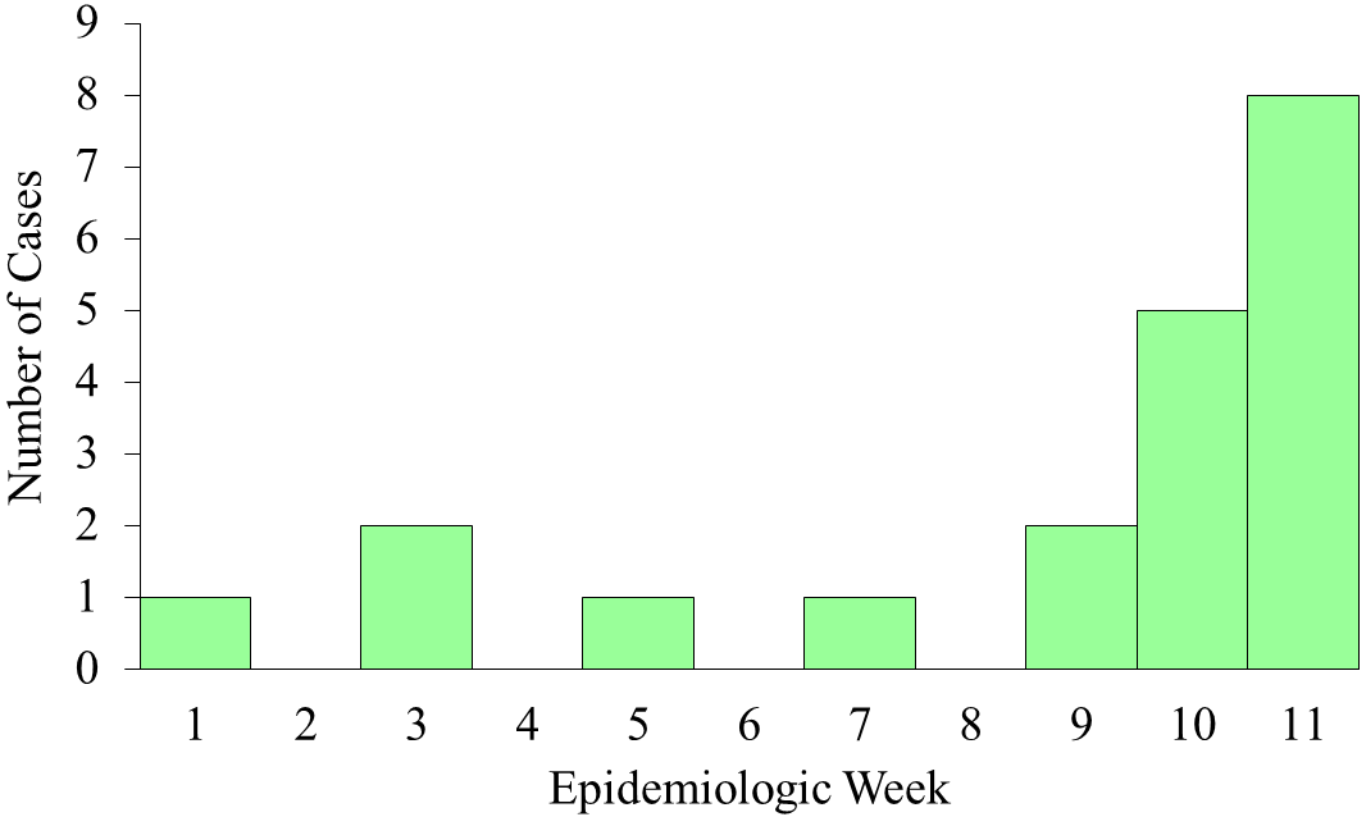
- More than
  - 5-Yr median or
  - Average number + 2 SD of previous 5 yrs or
  - Average number of previous few wks or months
- 2 cases with epidemiologic linkage in short time
- 1 case of a new emerging disease

Review Case Reports To Confirm the Existence of an Outbreak

- Review the reports or data
- Confirm that cases are the same disease
- Confirm that the number of cases exceeds the usual or expected number

➔ Remember: Not all increases in cases represent outbreaks, but you cannot assume that it is NOT an outbreak

Number of Reported Cases of Dysentery by Epidemiologic Week, City X, 2015



Step 3: Verify the Diagnosis

Evaluate the Clues to Verify the Diagnosis

- Laboratory confirmation?
- Clinical presentation consistent with diagnosis?
  - Signs and symptoms
  - Clinical laboratory findings
  - Clinical course
- Compatible exposure, e.g., to a known case?

Laboratory Confirmation

- Most definitive method for verifying diagnosis
- Pathogens have characteristic incubation periods that may help identify exposure period
- Don’t wait for laboratory diagnosis to proceed

Step 4: Construct an Outbreak Case Definition

Components of an Outbreak Case Definition

- Clinical criteria
  - Characteristic symptoms and clinical signs
  - Laboratory data
- Epidemiologic criteria (especially for outbreaks)
  - Time
  - Place
  - Person (epidemiologic link, otherwise uncommon)
- Criteria must be as OBJECTIVE as possible
- Should ***not*** include the suspected exposure

Case definition

- Components
  - Time
  - Place
  - Person
  - Clinical symptoms & signs

- Sources
  - Textbook
  - Expert

Case definition: example

Patient older than 5 years

with severe dehydration or dying of acute watery diarrhoea

in town “x”

between 1 June and 20 July 1999

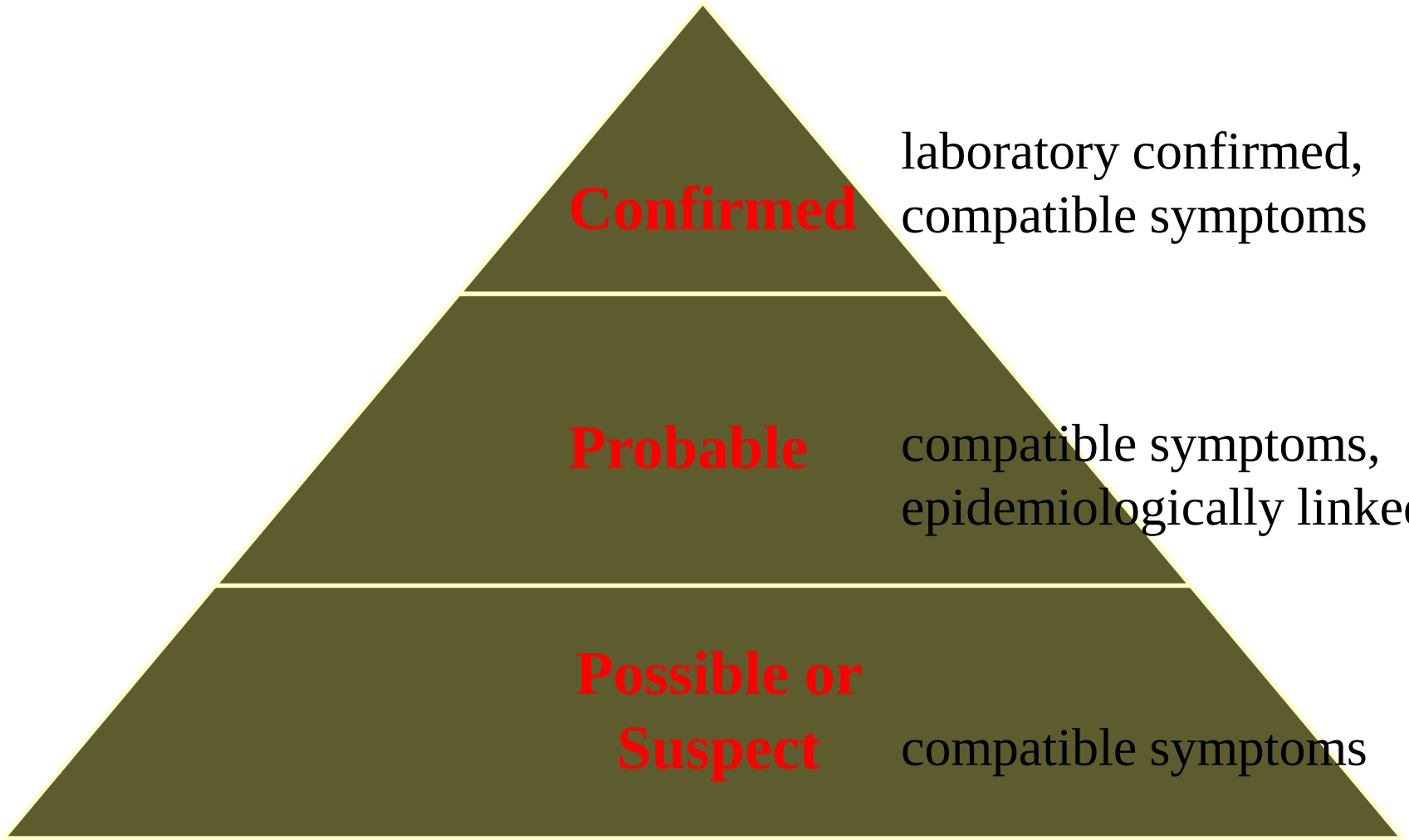
Clinical criteria, restrictions of time, place, person

Simple, practical, objective

Multiple case definition

- **Suspect**
  - Patient with severe diarrhoea ...
- **Probable**
  - Patient older than 5 years with severe dehydration or dying of acute watery diarrhoea ...
- **Confirmed**
  - Isolation of *Vibrio cholerae* from stool of patient ...

Case Classification Levels



Step 5: Find Cases Systematically and Record Information

Find Cases Systematically

- Contact health facilities
- Contact laboratories
- Contact community health workers
- Contact other districts
- Talk to patients
- Media?

Record Information Systematically — Line List

		Signs/Symptoms			Labs	Demographics	
Case #	Date of Symptom Onset	Diarrhea	Vomiting	Fever >37°C	Stool culture Result	Age	Gender
1	22/10/14	Y	Y	Not done	Positive	19	M
2	25/10/14	N	Y	N	Negative	17	M
3	22/10/14	N	Y	N	Positive	23	F
4	27/10/14	Y	?	?	Pending	18	?
5	23/10/14	N	Y	N	Positive	21	M
6	21/10/14	Y	Y	Y	Not done	18	F

Step 6: Perform Descriptive Epidemiology

The Five W's of Journalism / Epidemiology

Journalism	Epidemiology		
▪ What	= Clinical	or	**Descriptive Epidemiology**
▪ When	= Time		
▪ Where	= Place		
▪ Who	= Person		
▪ Why / How	= Cause, Risk factors, modes of transmission		**Analytic Epidemiology**

Clinical Features

- Symptoms – what patient feels
- Signs – what the clinical exam reveals
- Laboratory results
  - Definitive diagnosis
  - Clinical results

Descriptive: Clinical

Clinical findings, human brucellosis, E. Anatolia, Jan. 2010 (1 of 2)

Characteristic	Number	(%)
	n=44	
Fever	28	(64%)
Arthralgia	24	(55%)
Myalgia	19	(43%)
Fatigue	8	(19%)
Back pain	7	(16%)
Headache	5	(11%)
Lack of appetite	2	(9%)
Weight loss	2	(5%)

Aypak C, Altunsoy A, Celik AK. J Nippon Med Sch 2012;79: 343-348.

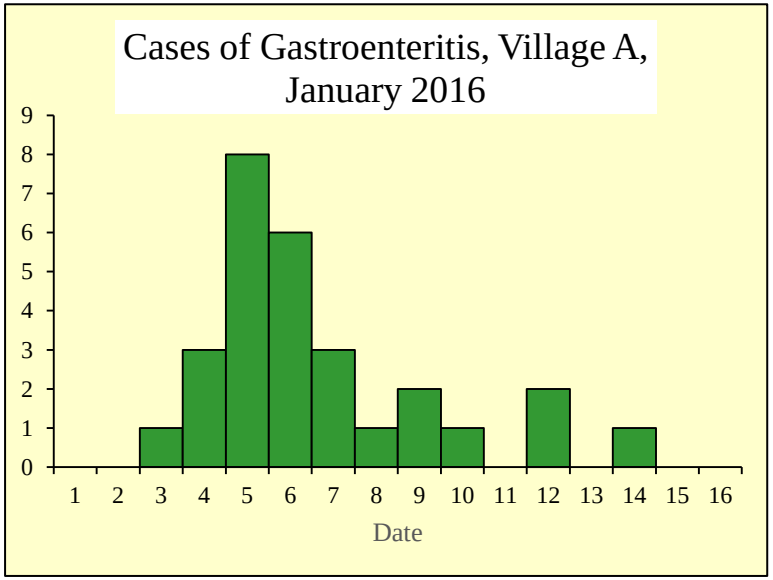
Time, Place, Person

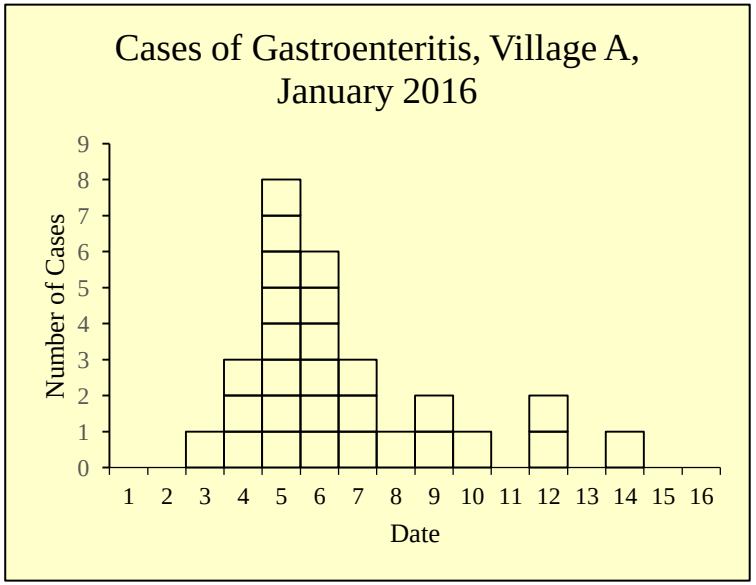
- **Time *(epidemic curve)***
  - Ideally: when were they infected?
  - More practically: when did they become ill?
- **Place *(spot map, shaded map)***
  - Ideally: where were they infected?
  - More commonly: where do they live, work?
- **Person *(tables)***
  - Who was infected?
  - Numerators and denominators
  - What do the cases have in common?

Descriptive: Time

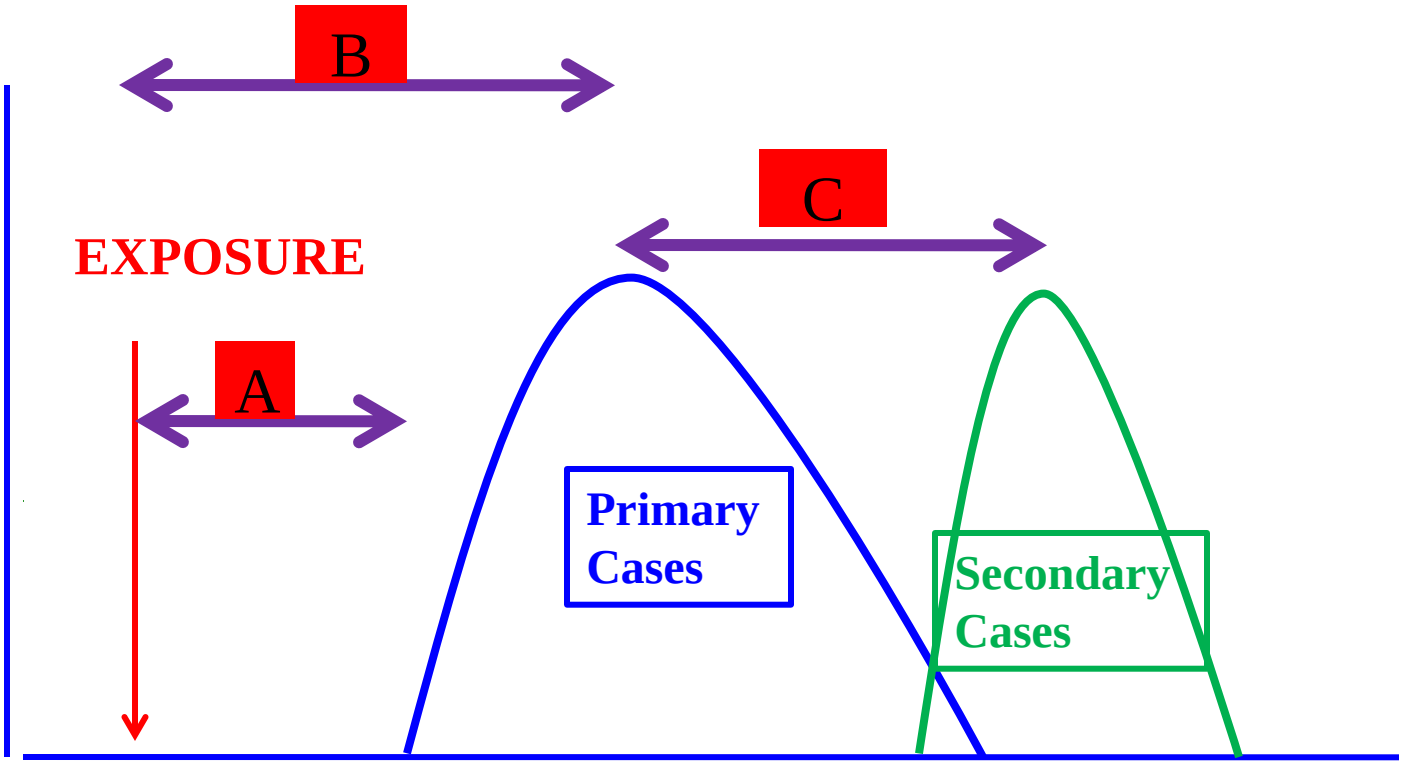
Time: Epidemic Curves

- Histogram (no space between adjacent columns)
- X-axis: Date of onset (by hour, day, week, month)
- Y-axis: Number of cases
- Can display columns or "stack of boxes"





EPIDEMIC CURVE SHOWING INCUBATION PERIODS



A **Minimum Incubation period**

B **Median Incubation period**

C **Estimate of Average Incubation period**

Descriptive: Time

Dates of Onset of Disease X, District Y, October 2015

Dates of Onset (n=57)					
9 Oct	14 Oct	15 Oct	16 Oct	17 Oct	19 Oct
11 Oct	14 Oct	15 Oct	16 Oct	17 Oct	20 Oct
13 Oct	14 Oct	15 Oct	16 Oct	17 Oct	20 Oct
13 Oct	14 Oct	15 Oct	16 Oct	17 Oct	22 Oct
13 Oct	14 Oct	15 Oct	16 Oct	17 Oct	23 Oct
14 Oct	15 Oct	15 Oct	16 Oct	17 Oct	25 Oct
14 Oct	15 Oct	15 Oct	16 Oct	18 Oct	
14 Oct	15 Oct	15 Oct	16 Oct	18 Oct	
14 Oct	15 Oct	16 Oct	16 Oct	18 Oct	
14 Oct	15 Oct	16 Oct	17 Oct	19 Oct	

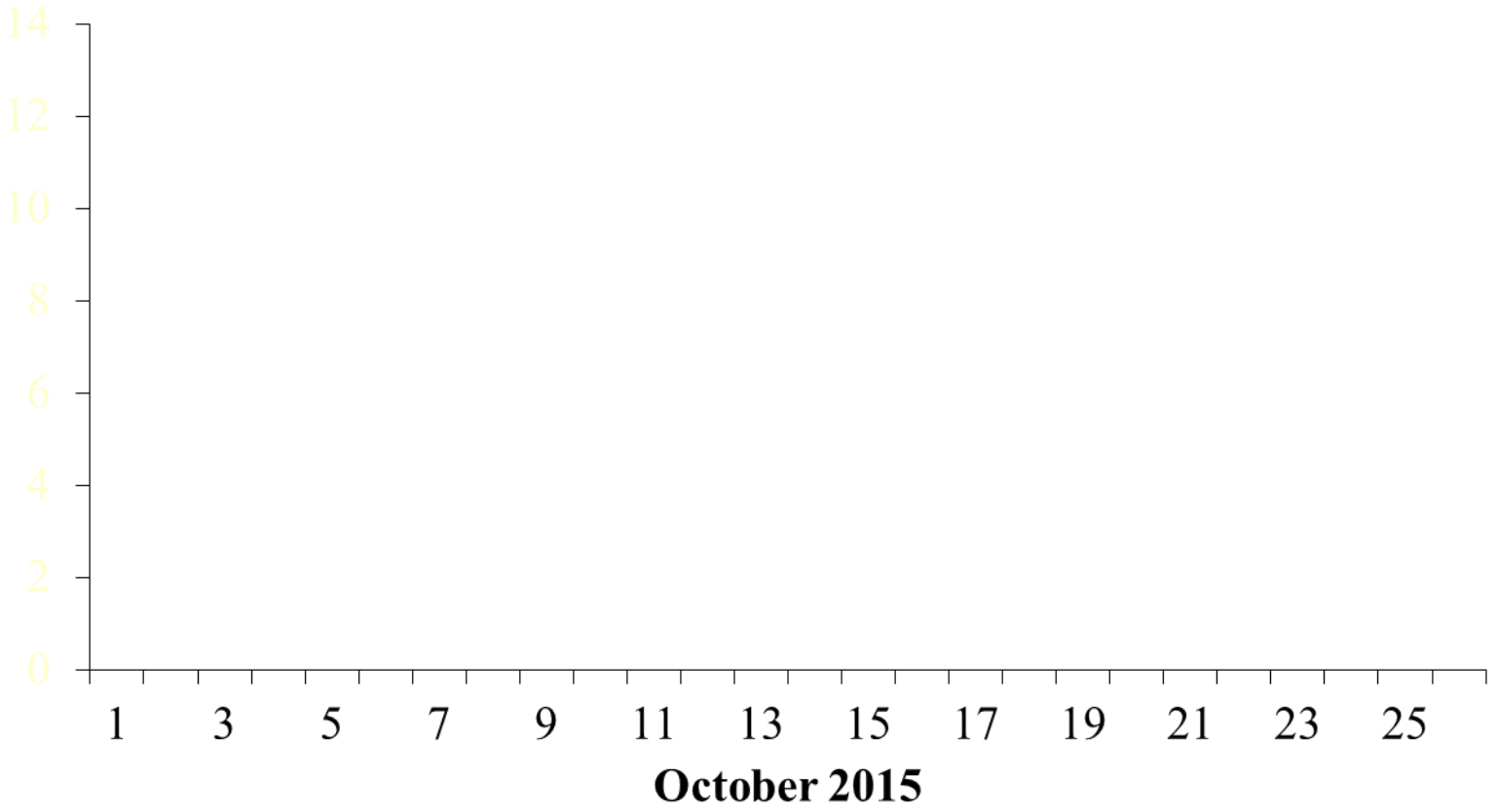
Oct.	No. Cases
1–8	0
9	1
10	0
11	1
12	0
13	3
14	1
15	0
16	1
17	3
18	1
19	1
20	1
21	7
22	3
23	
24	
25	

What range for X-axis do you suggest?

Descriptive: Time

X-axis

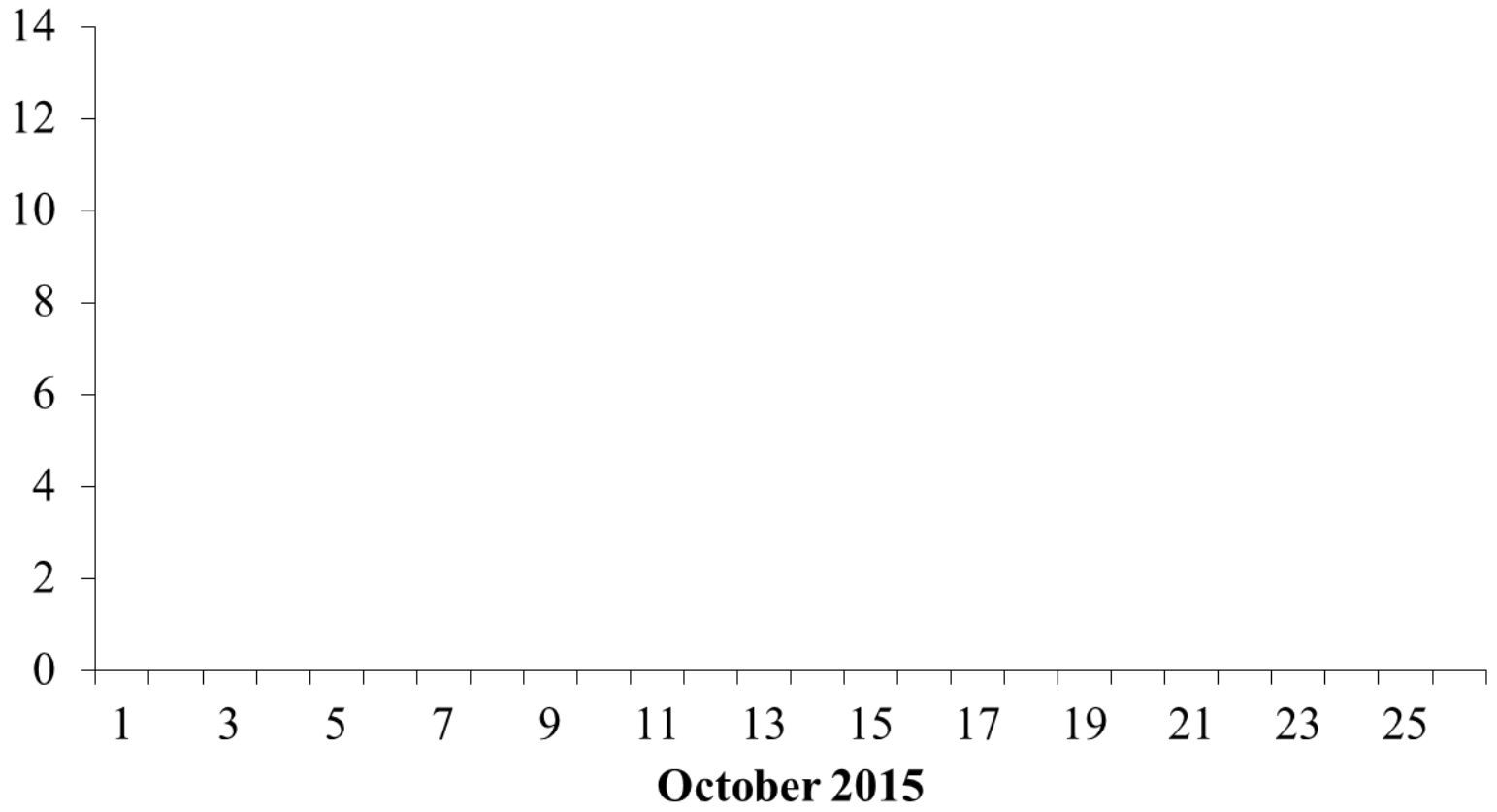
What range do you suggest for the Y-axis?



Descriptive: Time

X-axis, Y-axis

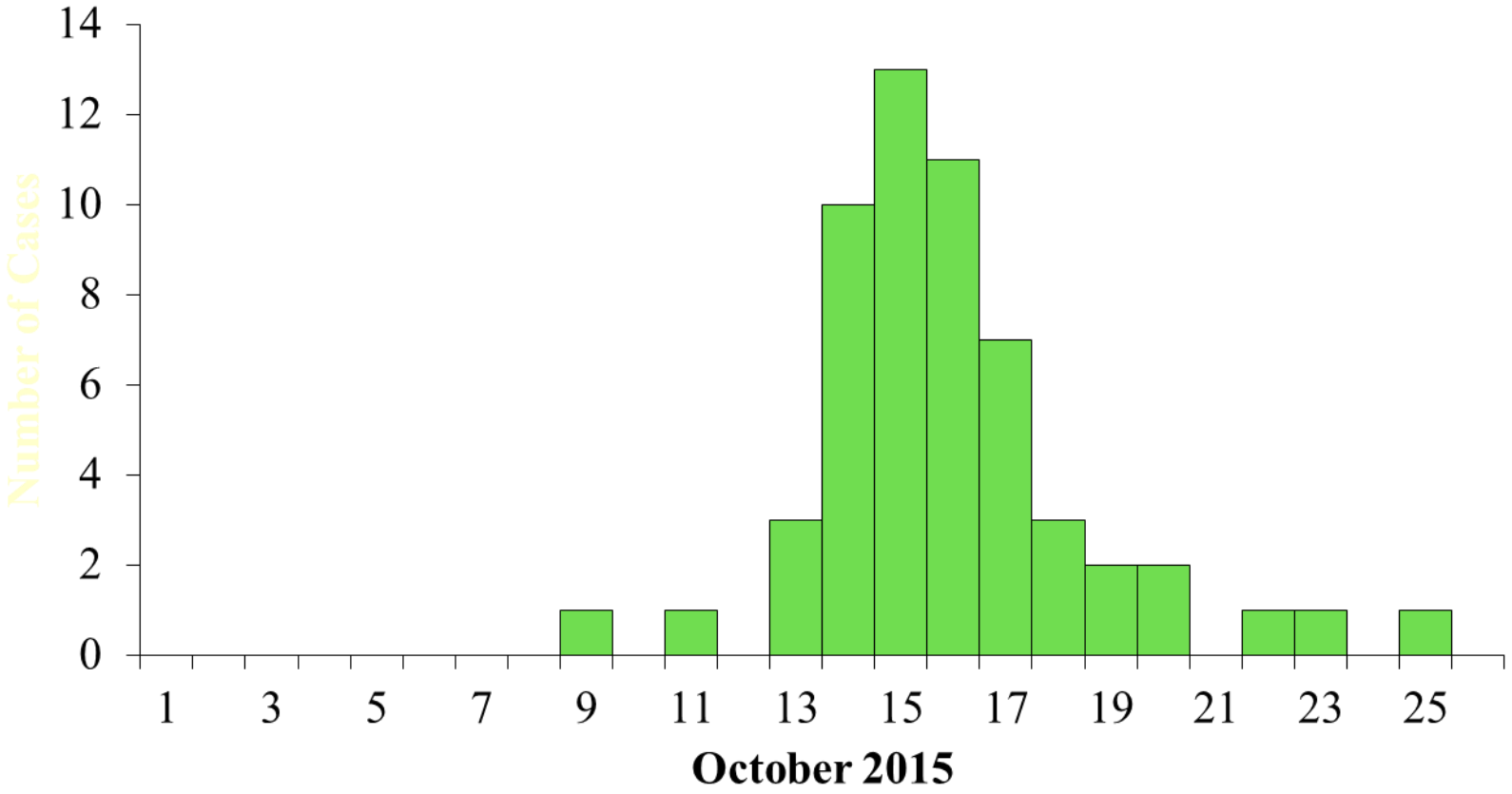
Now add the data



Descriptive: Time

With data

Now add axis labels

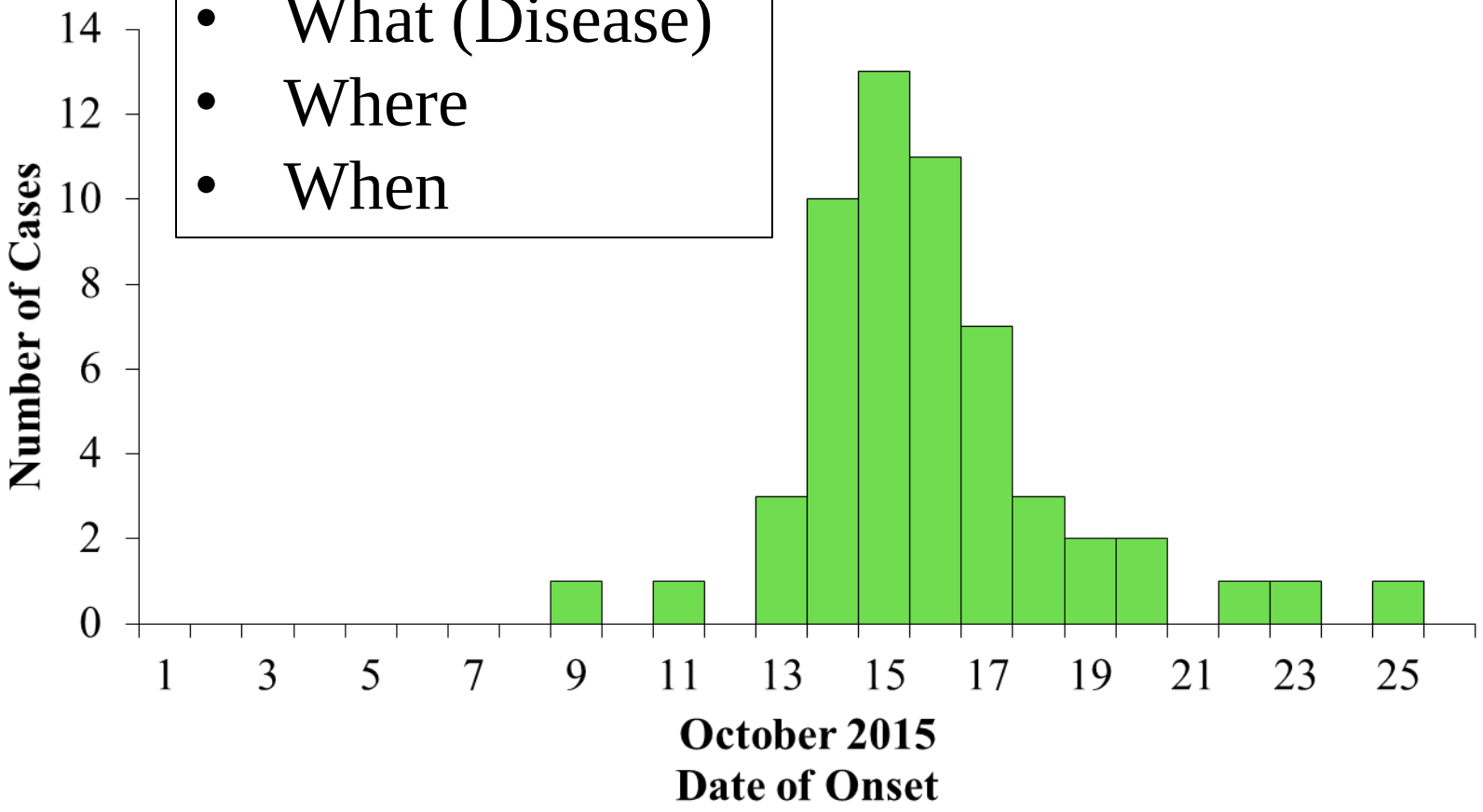


Descriptive: Time

With axis labels

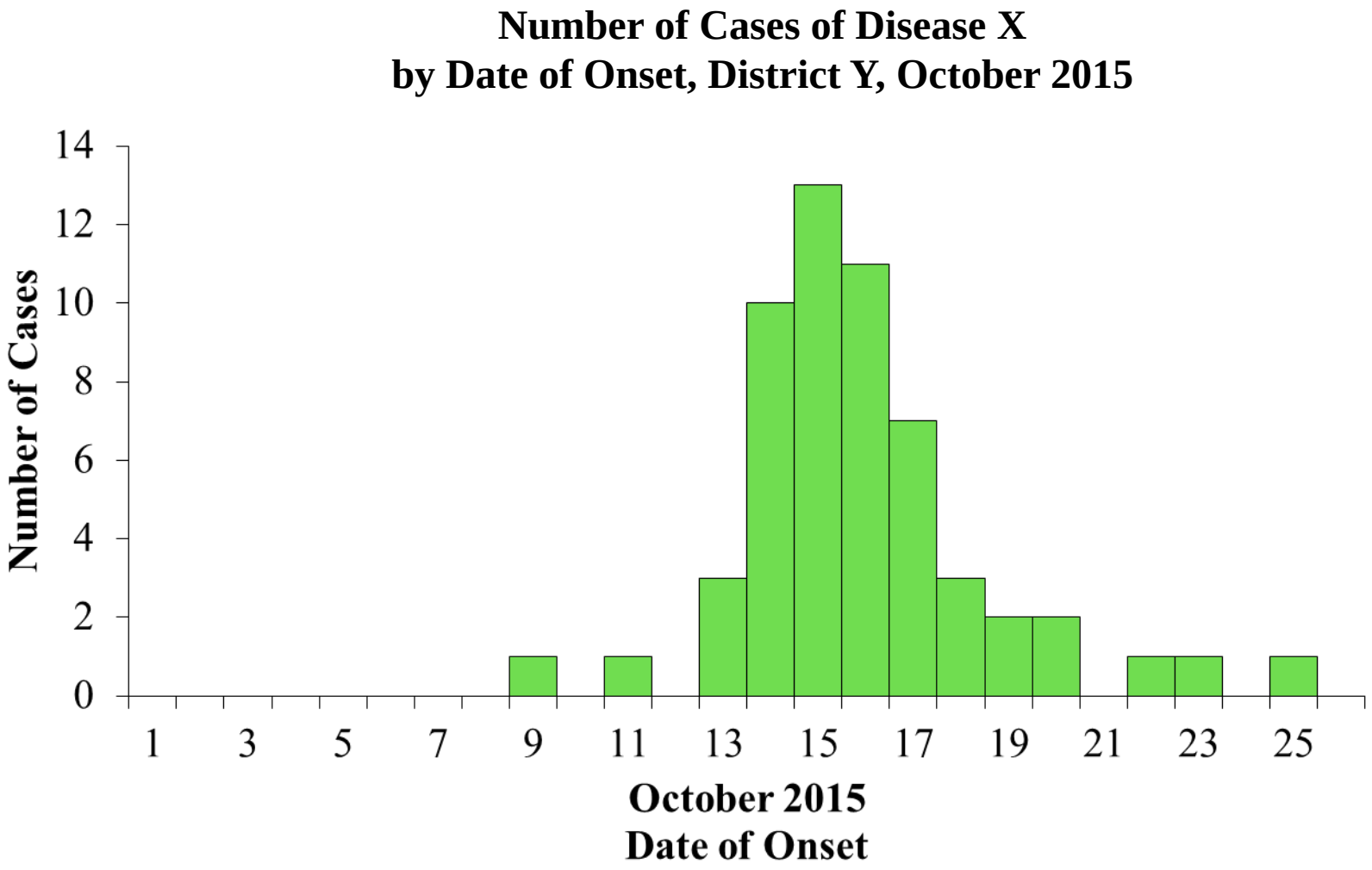
Now add title:

- What (Disease)
- Where
- When



Descriptive: Time

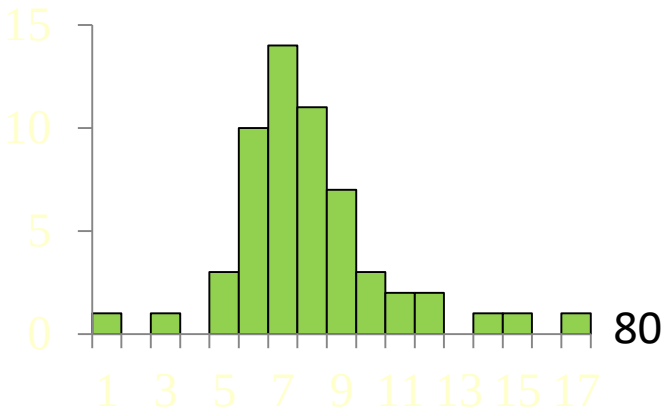
Completed Epidemic Curve (axes, data, labels, title)



Descriptive: Time

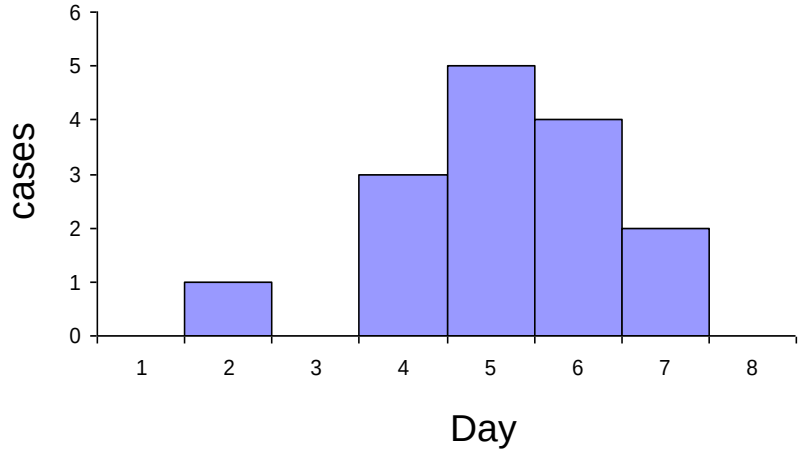
Value of an Epidemic Curve

- Shows the magnitude of the outbreak
- Shows the time course of the outbreak
- Can show the pattern of spread
- Can help determine the incubation period or exposure period
- Highlights outliers

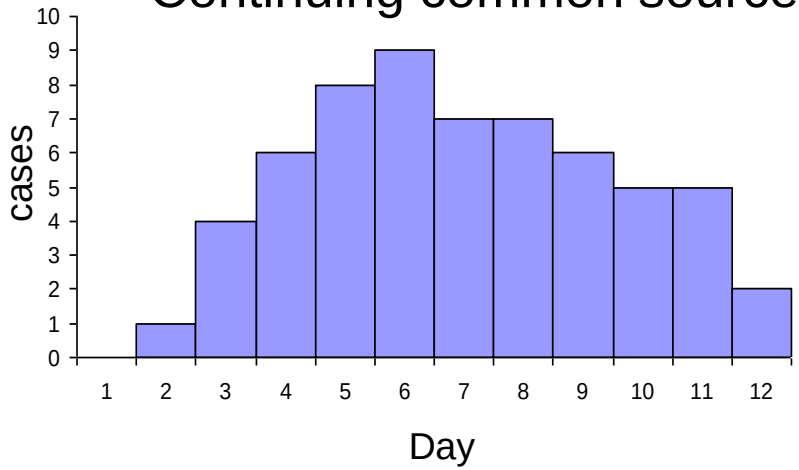


Epidemic Curves and Manner of Spread

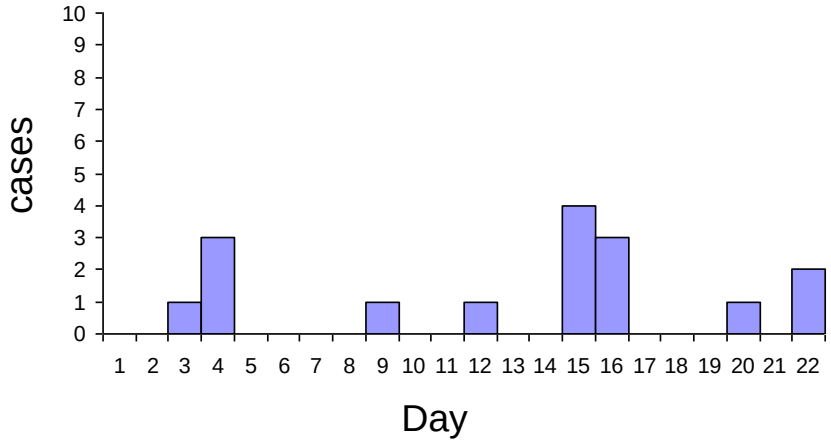
Point source (single exposure)



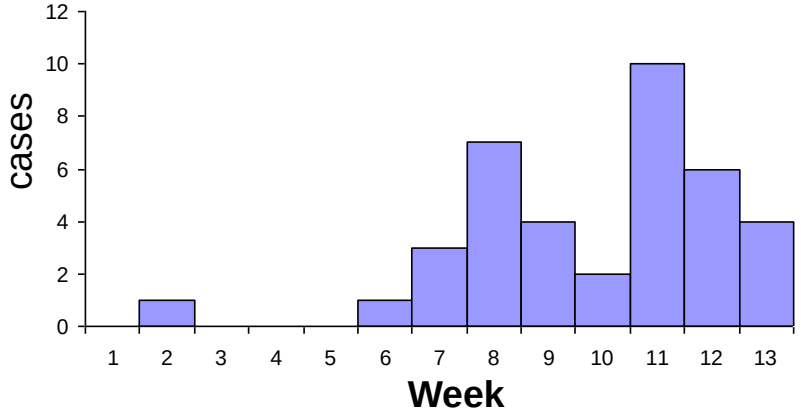
Continuing common source



Intermittent source



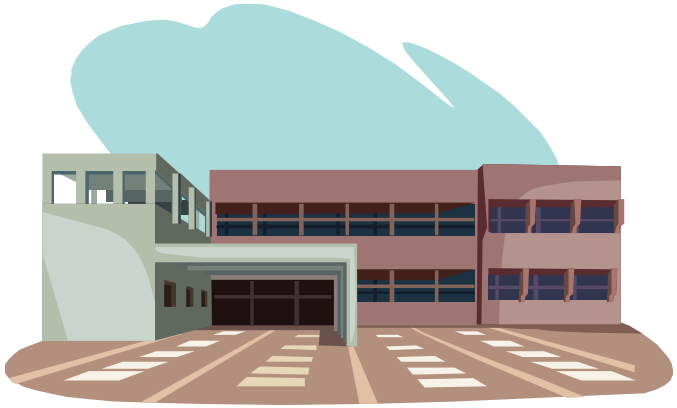
Propagated spread



Descriptive: Place

Describe and Orient the Data by Place

- Description
  - Hospital
  - School
  - Community

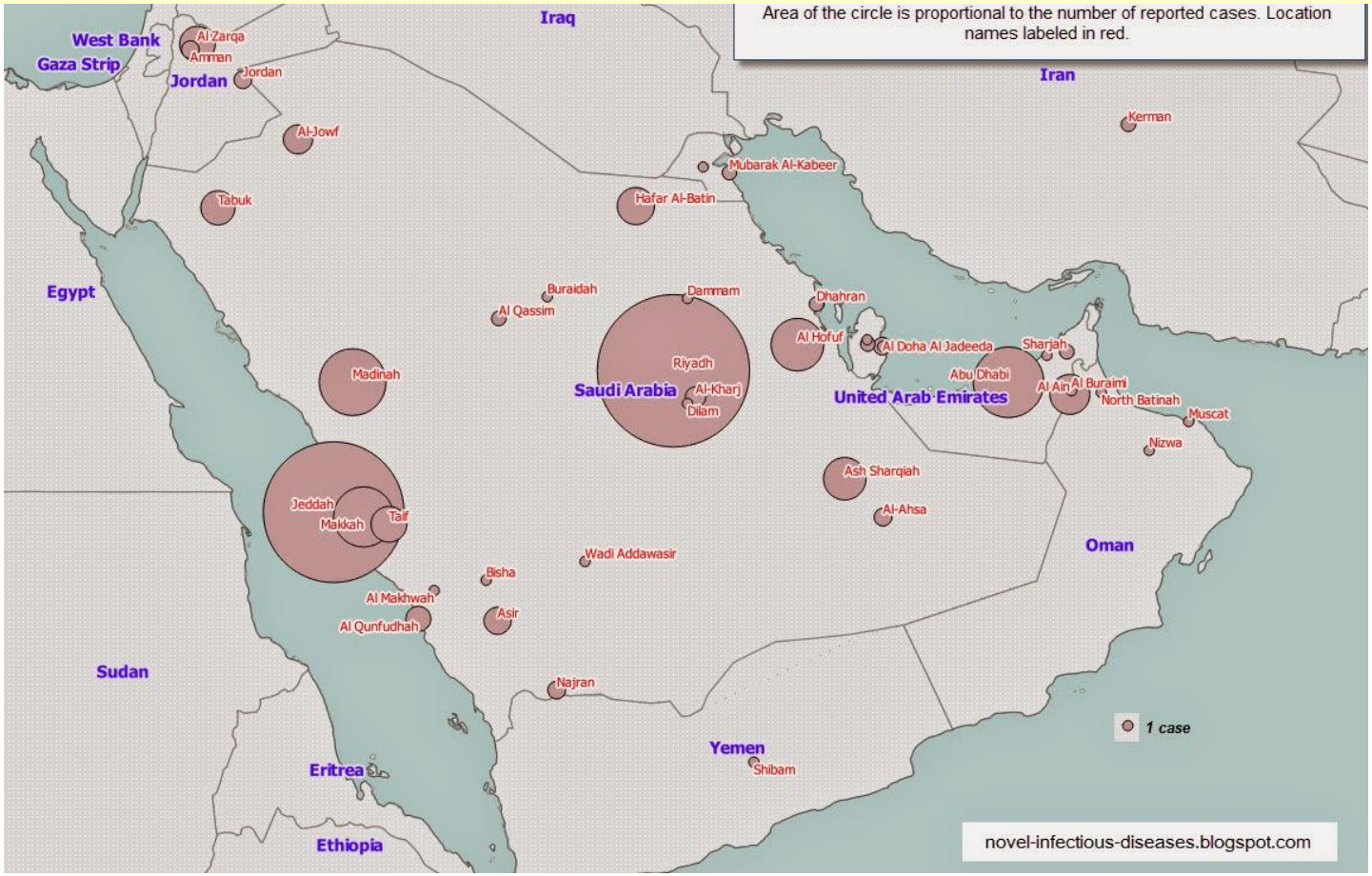


- Maps
  - Spot
  - Area

Descriptive: Place

Spot Map: MERS-CoV detections in KSA

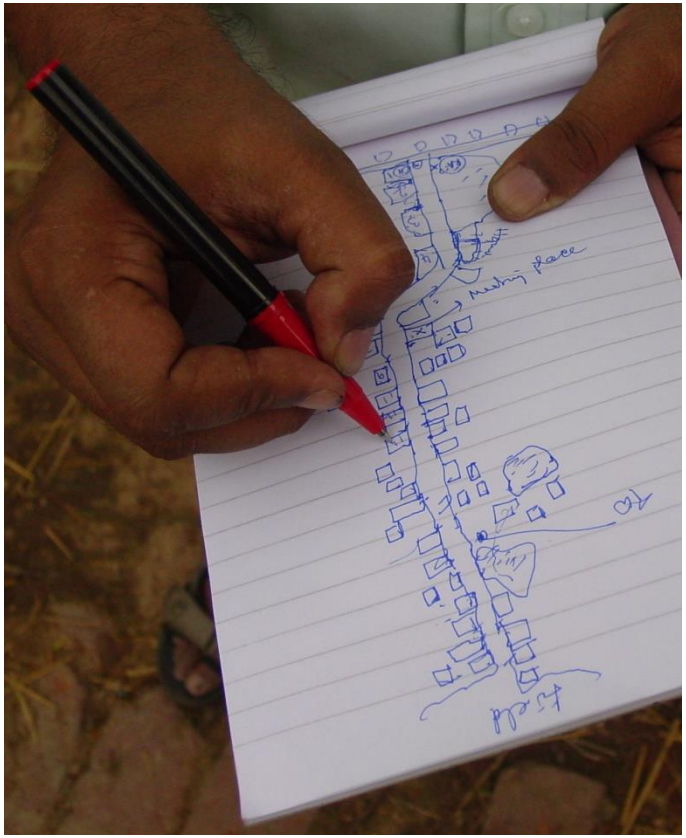
Confirmed cases of MERS-CoV in KSA, June-July 2014



Outbreak Investigation

Drawing a spot map during an outbreak investigation

- Rough sketch of the setting of an outbreak
- One dot = One case
- Other locations of potential importance are also recorded
- Does not adjust for population density (OK in small places)

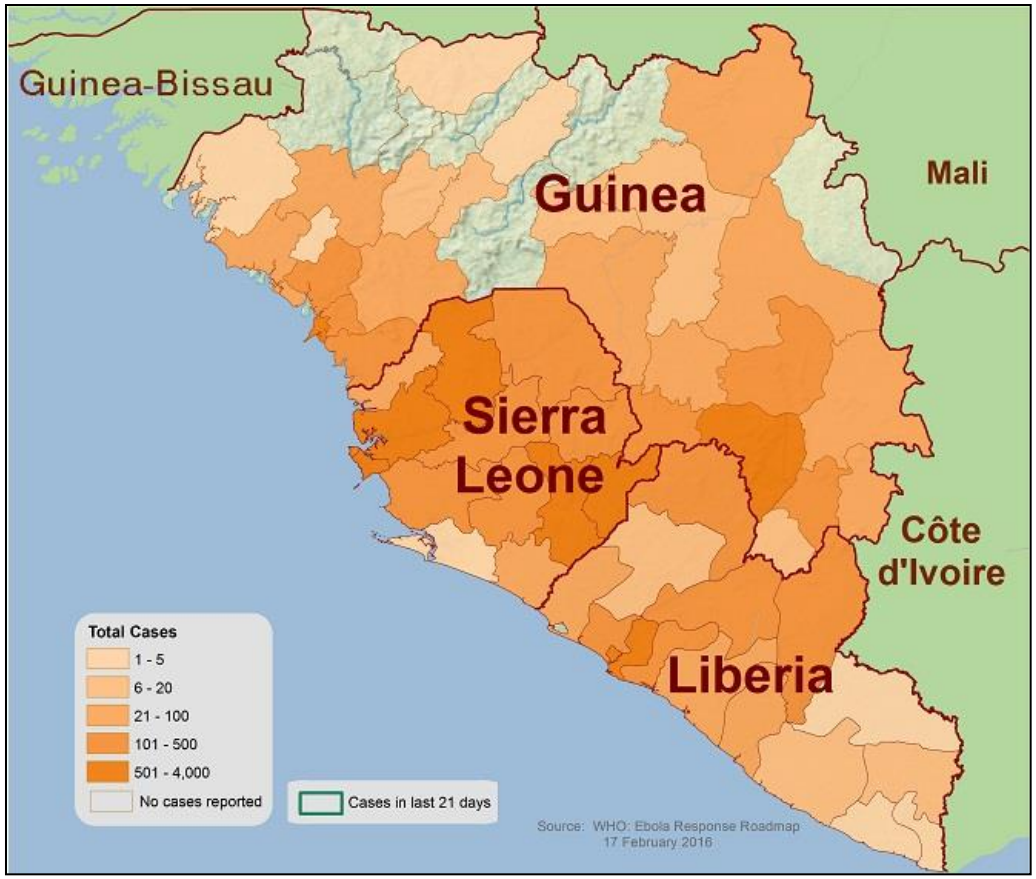


Field epi map

Descriptive: Place

Area Maps

Cumulative Number of Ebola Virus Disease Cases by Region, West Africa, 2014-2015



www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/distribution-map.html. (accessed 25 Feb 2016)

Descriptive: Person

Person Characteristics

- Age
- Sex
- Tribe or other affiliation
- Occupation
- Income
- Marital status
- Underlying medical conditions
- Many others

HIV+ Residents, Fishing Community Study, Kenya, 2010

Age (yrs)	Male	Female	Total
≥55	10	3	13
45–54	17	13	30
35–44	47	25	72
25–34	45	50	95
15–24	10	22	32
	129	113	242

Omolo J, Arvelo W, Abade M, et al. *In preparation (Jan. 2013)*

Outbreak Investigation Steps 1–6

1. Prepare for fieldwork
2. Confirm existence of an outbreak
3. Verify the diagnosis

Done simultaneously or in any order

4. Construct a case definition
5. Find cases systematically and record information
6. Perform descriptive epidemiology

Outbreak Investigation Steps 7–13

7. Develop hypotheses
8. Evaluate hypotheses epidemiologically
9. Reconcile epidemiology with laboratory and environmental findings
10. Conduct additional studies as necessary
11. Implement and evaluate prevention and control measures
12. Initiate or maintain surveillance
13. Communicate findings

EQUIPMENT CHECK LIST FOR FIELD INVESTIGATION

EQUIPMENTS

Personal Equipment
Wet weather jacket
Gumboots/Boots
Protective eyewear
Protective gloves
Latex gloves
Masks (N95)
Hand sanitiser
Insect repellant
First aid kit
Toilet paper
Drinking water

Water purification tablets
Torch and batteries
Camera
Radio
Medications (antibiotics, ORS)
Mobile phone, recharge cards,
list of numbers
Sunscreen
Disinfectant
Long lasting insecticidal net
Camping gear and personal belongings as appropriate

STATIONERY

Note book
Clipboard
Graph paper
Standard questionnaires
Standard line lists
Outbreak Manual
Maps and street directories
Calculator
Tape measure
Pens /pencils
Plastic document pouches
Marking pen

EQUIPMENT CHECK LIST FOR FIELD INVESTIGATION

SAMPLE COLLECTION EQUIPMENT

Water sample containers
Field test kit for water testing
Swabs: Nasopharyngeal, throat, rectal
Transport media (appropriate for investigation and likely samples)
frozen ice packs
Stool sampling jars, sterile spoons,spatulas

Tourniquet, alcohol swabs, needles, syringes and blood tubes (if collecting blood samples)
Specimen bags
Sharps container
Screw top sterile jars
Waste bags

Get ready to go:

Before deployment

☑ Brief team/consult head of unit

☑ Review/adapt field tools, guides

☑ Letter to state health department

☑Check needs, re-check if ready

☑ Develop field standard operation procedures (roles, communication, field conduct, etc.)

☑ Establish communication channel with your institution while in field

In the field:

- *In ongoing outbreaks, the main output of field investigation is quality information that can guide to initiate public health action.*

In the field:

While in the field…

Do's and Don'ts

☑ Do promote team work

☑ Do involve key stakeholders

☑ Do assign specific tasks either as individuals or sub-teams (Do Not duplicate efforts among team)

☑ Do focus on saving lives and prevention of further spread (Do Not wait for final confirmation to initiate public health action)

☑ Do transfer skills to local health workers (as a live outbreak model for *Learning-by-doing*).

In the field:

While in the field…Do's and Don'ts

☑ Document every detail; getting it later is DIFFICULT (Do Not assume you can get it later)

☑ Do regularly update authorities, preferably including site visits (Do Not exaggerate or understate the situation).

☑ Collate and do preliminary analysis of the information (Do NOT wait for final data….rather develop a working diagnosis)

☑ Initiate preventive/ control measures (Do NOT wait for lab confirmation or recommendations!)

☑ With more incoming information, analyse daily and update your interventions (Do Not have a pre-decided diagnosis of an event).

In the field:

Before departure

☑ Debriefing with local authorities

☑ Provide preliminary report

☑ Agree on follow-up actions

☑ Establish communication channel

Diseases and pathogens encountered in outbreak investigations

SYNDROME	DISEASES /PATHOGENS
Acute Diarrhoeal Syndrome	Amoebic Dysentery, Cholera, Cryptosporidiosis, Ebola and other haemorrhagic fevers, E.coli (enterotoxigenic and enterohaemorrhagic), Giardiasis, Salmonellosis, Shigellosis, Viral gastroenteritis (Norwalk-like and rotavirus)
Acute Haemorrhagic Fever Syndrome	Crimean-Congo HF, Dengue HF, Ebola HF, Hantaan viruses, Lassa fever, Marburg HF, Rift Valley fever, South American Arenaviruses, Tick-borne flaviviruses, Yellow fever
Acute Jaundice Syndrome	Hepatitis A, B, E, Leptospirosis, Yellow fever
Acute Neurological Syndrome	Enteroviral meningitis, Japanese encephalitis, Leptospirosis, Malaria, Nipah virus, Meningococcal meningitis, Poliomyelitis, Rabies and other Lyssaviruses, Tick-borne encephalitis viruses, Trypanosomiasis

Diseases and pathogens encountered in outbreak investigations

SYNDROME	DISEASES /PATHOGENS
Acute Respiratory Syndrome	Anthrax, Diphtheria, Hantaan virus Pulmonary Syndrome, Influenza, Mycoplasma, Legionellosis, Pertussis, Pneumonic plague, Respiratory syncytial virus, Scarlet fever
Acute Dermatological Syndrome	Chickenpox, Cutaneous anthrax, Measles, Monkeypox, Parvovirus B19, Rubella, Chikungunya, Typhus, Hand – foot and Mouth Disease
Acute Ophthalmological Syndrome	Epidemic adenoviral keratoconjunctivitis, Haemorrhagic enteroviral conjunctivitis, Trachoma
Acute "Systemic" Syndrome	Anthrax, Arboviral fever, Brucellosis, Dengue fever, Hantaviral disease, Lassa fever, Leptospirosis, Lyme disease, Plague, Relapsing fever, Rift Valley fever, Typhoid fever, Typhus, Viral hepatitis including Yellow fever

Incubation periods of important infections

6.7 Incubation periods of important infections[1]

Infection	Incubation period
Short incubation periods	
Anthrax, cutaneous[3]	9 hrs–2 weeks
Anthrax, inhalational[3]	2 days[2]
Bacillary dysentery[5]	1–6 days
Cholera[3]	2 hrs–5 days
Dengue haemorrhagic fever[6]	3–14 days
Diphtheria[6]	1–10 days
Gonorrhoea[4]	2–10 days
Influenza[5]	1–3 days
Meningococcaemia[3]	2–10 days
SARS coronavirus[3]	2–7 days[2]
Scarlet fever[5]	2–4 days

Intermediate incubation periods	
Amoebiasis[6]	1–4 weeks
Brucellosis[4]	5–30 days
Chickenpox[5]	11–20 days
Lassa fever[3]	3–21 days
Malaria[3]	10–15 days
Measles[5]	6–19 days
Mumps[5]	15–24 days
Poliomyelitis[6]	3–35 days
Psittacosis[4]	1–4 weeks
Rubella[5]	15–20 days
Typhoid[5]	5–31 days
Whooping cough[5]	5–21 days

Long incubation periods	
Hepatitis A[5]	3–7 weeks
Hepatitis B[4]	6 weeks–6 months
Leishmaniasis, cutaneous[6]	Weeks–months
Leishmaniasis, visceral[6]	Months–years
Leprosy[3]	5–20 years
Rabies[4]	2–8 weeks[2]
Trypanosoma brucei gambiense infection[6]	Months–years
Tuberculosis[5]	1–12 months

6.18 Antimicrobial options for common infecting bacteria

Organism	Antimicrobial options*
Gram-positive organisms	
Enterococcus faecalis	Ampicillin, tigecycline, vancomycin/teicoplanin
Enterococcus faecium	Tigecycline, vancomycin/teicoplanin, linezolid
Glycopeptide-resistant enterococci (GRE)	Linezolid, tigecycline, quinupristin-dalfopristin
MRSA	Clindamycin, vancomycin, rifampicin (never used as monotherapy), linezolid, daptomycin, tetracyclines, tigecycline, co-trimoxazole
Staph. aureus	Flucloxacillin, clindamycin
Strep. pyogenes	Penicillin, clindamycin, erythromycin
Strep. pneumoniae	Penicillin, macrolides, cephalosporins, levofloxacin, vancomycin

Gram-negative organisms	
E. coli, 'coliforms' (enteric Gram-negative bacilli)	Trimethoprim, cefuroxime, ciprofloxacin, co-amoxiclav, amoxicillin (resistance common)
Enterobacter spp., *Citrobacter* spp.	Ciprofloxacin, meropenem, aminoglycosides
ESBL-producing Enterobacteriaceae	Ciprofloxacin, meropenem, piperacillin-tazobactam, aminoglycosides, tigecycline
Haemophilus influenzae	Amoxicillin, co-amoxiclav, macrolides, cefuroxime, cefotaxime, ciprofloxacin
Legionella pneumophila	Azithromycin, levofloxacin, doxycycline
Neisseria gonorrhoeae	Ceftriaxone/cefixime, spectinomycin
Neisseria meningitidis	Penicillin, cefotaxime, chloramphenicol
Pseudomonas aeruginosa	Ciprofloxacin, piperacillin-tazobactam, aztreonam, meropenem, aminoglycosides, ceftazidime/cefepime
Salmonella typhi	Ciprofloxacin, ceftriaxone, chloramphenicol (resistance common)

Strict anaerobes	
Bacteroides spp.	Metronidazole, clindamycin, co-amoxiclav, piperacillin-tazobactam, meropenem
Clostridium difficile	Metronidazole, vancomycin (oral)
Clostridium spp.	Penicillin, metronidazole, clindamycin
Fusobacterium spp.	Penicillin, metronidazole, clindamycin
Other organisms	
Chlamydia trachomatis	Azithromycin, doxycycline
Treponema pallidum	Penicillin, doxycycline

*Antibiotic selection depends on multiple factors, including local susceptibility patterns. There are many appropriate alternatives to those listed.

Antimicrobial prophylaxis

6.20 Recommendations for antimicrobial prophylaxis in adults*

Infection risk	Recommended antimicrobial
Bacterial	
Diphtheria (prevention of secondary cases)	Erythromycin
Gas gangrene (after high amputation or major trauma)	Penicillin or metronidazole
Lower gastrointestinal tract surgery	Cefuroxime + metronidazole, gentamicin + metronidazole, or co-amoxiclav (single dose only)
Meningococcal disease (prevention of secondary cases)	Rifampicin or ciprofloxacin
Rheumatic fever (prevention of recurrence)	Phenoxymethylpenicillin or sulfadiazine
Tuberculosis (prevention of secondary cases)	Isoniazid ± rifampicin
Whooping cough (prevention of secondary cases)	Erythromycin

Viral	
HIV, occupational exposure (sharps injury)	Combination tenofovir/ emtricitabine and lopinavir/ ritonavir. Modified if index case's virus known to be resistant
Influenza A (prevention of secondary cases in adults with chronic respiratory, cardiovascular renal disease, immunosuppression or diabetes mellitus)	Oseltamivir
Fungal	
Aspergillosis (in high-risk haematology patients)	Itraconazole or posaconazole
Pneumocystis pneumonia (prevention in HIV and other immunosuppressed states)	Co-trimoxazole, pentamidine or dapsone
Protozoal	
Malaria (prevention of travel-associated disease)	Specific antimalarials depend on travel itinerary (p. 352)

*These are based on current UK practice. Recommendations may vary locally or nationally. There is currently no recommendation in the UK to administer antimicrobial prophylaxis for infective endocarditis during dental procedures.

Epidemic Report

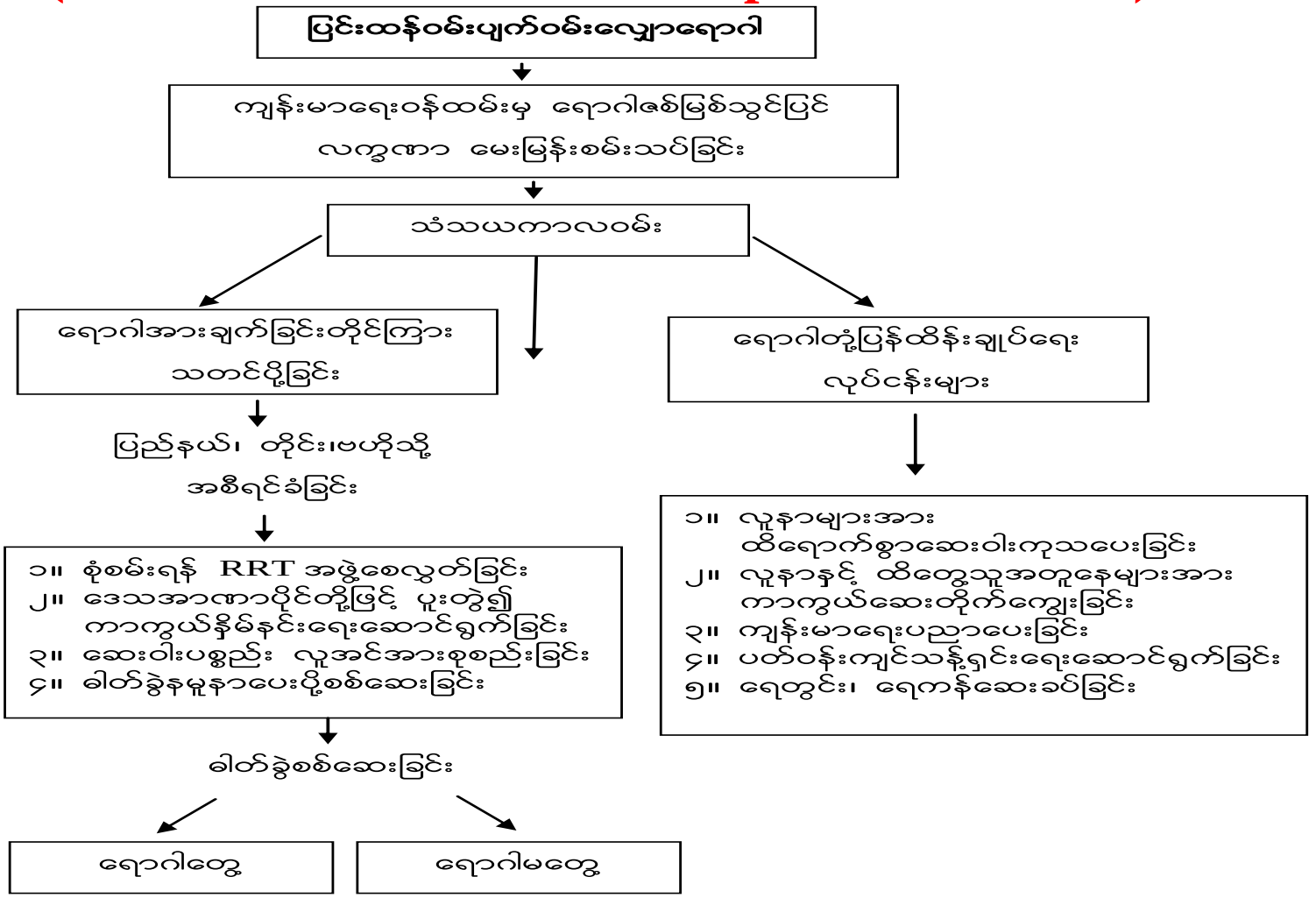
- ☑ Background & Historical data
- ☑ Objective of investigation
- ☑Methodology of investigation
  - ✓Field team
  - ✓Case definition
  - ✓ Tools used
  - ✓Surveillance/survey used
  - ✓Lab specimens and tests
- ☑ Findings: analysis of data
  - ✓Clinical data
  - ✓Epidemiological data
  - ✓ Mode(s) of transmission
  - ✓Laboratory data
  - ✓Interpretation of data
- ☑ Control measures
- ☑ Discussion
- ☑ Conclusion & Recommandation

10 Steps of a Field Investigation

1. Organize Team (လှုပ်ရှားတပ်ဖွဲ့ဖွဲ့စည်းခြင်း)
2. Organize supply/ Equipments (ဆေးဝါးပစ္စည်းများစုဆောင်းရေး)
3. Prepared for field visit (ကွင်းဆင်းရန်ပြင်ဆင်ခြင်း)
4. Case-based Investigation (ရောဂါစုံစမ်းစစ်ဆေးခြင်း)
   - Symptom Analysis
   - Epidemic Curve
   - Attack rate, CFR
   - Transmission (Mode & Source)
5. Active case search (လူနာသစ်ရှာဖွေခြင်း)
   - At adjacent area
   - Home Isolation
   - Visitor Restriction
6. Case Management ရောဂါကုသခြင်း
   - For current infection and complication
   - Refer to Hospital
7. Lab investigation (ဓါတ်ခွဲစမ်းသပ်စစ်ဆေးခြင်း)
   Specimen collection AFP- Stool
   Measles- Serum
   Diphtheria- Nasal/ Throat Swab
   Whooping Cough- Nasal/ Throat Swab
   Tetanus- No
8. Other control measure
(အခြားကာကွယ်နှိမ်နင်းရေးလုပ်ငန်းများ)
   - Vitamin A for Measles
   - Environment sanitation for Polio etc.
   - Infection control
   - Outbreak Response Immunization (ORI)
   - Restriction on 'Soon' offering & refreshment at funeral
9. Health Education
   Communication ပြန်ကြားဆက်သွယ်ခြင်း
   Awareness အသိပညာပေးမြှင့်တင်ခြင်း
10. Reporting အစီရင်ခံခြင်း
    - Initial ကနဦး
    - Daily နေ့စဉ်
      Hospital
    - Weekly အပတ်စဉ် Township
    - Final နောက်ဆုံး
      Div.

ပြင်းထန်ဝမ်းပျက်ဝမ်းလျှောရောဂါတုံ့ပြန်ထိန်းချုပ်ခြင်း

(Flow Chart for outbreak response of cholera)



ဗဟိုမှ WHO သို့ သတင်းပို့ခြင်း
ရောဂါထိန်းချုပ်သည်အထိ
ဆောင်ရွက်ခြင်း

ထပ်မံလိုအပ်သည့်စုံစမ်းစစ်ဆေးမှုများ
ဆောင်ရွက်ကာ ရောဂါဖြစ်ပွားမှု
အကြောင်းရင်းများကို ရှာဖွေခြင်း

ကပ်ရောဂါအားတုံ့ပြန်ထိန်းချုပ်ခြင်း (Outbreak Response)

- ရောဂါများပေါ်မူတည်၍ သံသယကူးစက်ရောဂါတွေ့ရှိရမှု ပမာဏဦးရေကိုမူတည်၍ ကပ်ရောဂါ (Outbreak) ဟုသတ်မှတ်ထားရှိပါသည်။ ဥပမာ– ပလိပ်ရောဂါ၊ ဂျပန်ဦးနှောက်ရောင်ရောဂါ၊ ဆုံဆို့နာ စသည်တို့တွင် သံသယလူနာ (၁)ဦးတွေ့လျှင်ပင် ကပ်ရောဂါဟုသတ်မှတ်သည်။ နေရာဒေသ (၁)ခုတွင် ဝက်သက်လူနာ (၅)ဦး တချိန်တည်း တွေ့ရှိလျှင် ကပ်ရောဂါဟုသတ်မှတ်သည်။
- ဤသို့ကပ်ရောဂါဖြစ်သည်ဟုသတ်မှတ်လျှင် ကျန်းမာရေးဌာနအဆင့်ဆင့်သို့ ချက်ချင်း သတင်းပို့ကာ ကာကွယ်ထိန်းချုပ်ရေး လုပ်ငန်းများကို စတင်ဆောင်ရွက်ရမည်။
- အလားတူလူနာသစ်များပြန့်နှံ့ဖြစ်ပေါ်နေခြင်း ရှိ၊ မရှိ သိရန် ကပ်ရောဂါဖြစ်ရာ ရပ်ကွက်၊ ကျေးရွာရှိ လူနာအိမ်ဝန်းကျင် မီတာ (၁၀၀၀) ဝန်းကျင်ရှိ အိမ်များ၊ ကျောင်းများ၊ မူကြိုကလေးထိန်းကျောင်းများတွင် အလားတူရောဂါမျိုးရှိ၊ မရှိကို စနစ်တကျ ကွင်းဆင်းရှာဖွေဖော်ထုတ်ရမည်။

- ဆေးရုံပို့သင့်သောလူနာများကို ဆေးရုံပို့ ကုသခံယူစေမည်။ ဆေးခန်း၊ အိမ်တွင်ကုသပေးနိုင်သော လူနာများကို ကုသမှုပေးရမည်။ လူနာနှင့်နီးကပ်စွာနေထိုင်သူ (Contact) များကိုလည်း ရောဂါပေါ် မူတည်၍ လိုအပ်သောကာကွယ်ဆေးကျွေးခြင်း၊ ကာကွယ်ဆေးထိုးခြင်းများကို ဆောင်ရွက်ပေးရမည်။ (ဥပမာ– ပြင်းထန်ဝမ်းလျှောရောဂါတွင် Contact များကို ကာကွယ်ဆေးကျွေးခြင်းနှင့် AFP လူနာ တွေ့ရှိလျှင် Outbreak Response Immunization (ORI) အဖြစ် ပိုလီယိုကာကွယ်ဆေး တိုက်ကျွေးခြင်း လုပ်ငန်းကိုဆောင်ရွက်ရမည်။)
- နီးစပ်၊ ထိစပ်ရာ၊ ကျန်းမာရေးဌာနအပိုင်များ (သို့မဟုတ်) မြို့နယ်များကို လတ်တလော ဖြစ်ပွားနေ သော ကပ်ရောဂါအား ကြိုတင်သိရှိ၍ လိုအပ်သည်များ ပြင်ဆင်သွားနိုင်စေရန် တပ်လှန့် သတင်းပေးပို့ရမည်။
- လူနာများကို ထိရောက်စွာ ကြပ်မတ်၍ ဆေးဝါးကုသမှုကို ပေးရမည်။ ရောဂါ အရှပ်အထွေးများ ပေါ်ပေါက်လာနိုင်သည်ကိုစောင့်ကြပ်၍ ထိရောက်စွာ ကုသပေးရမည်။

- ကပ်ရောဂါအဖြစ်တုံ့ပြန်ဆောင်ရွက်ရာတွင် အဆိုပါရောဂါကို အတည်ပြုနိုင်ရန် အတွက် လိုအပ်သော စမ်းသပ်ရမည့် နမူနာ (Specimens) များကိုရယူ၍ လိုအပ်လျှင် (Cold Chain) စနစ်ဖြင့် သယ်ယူကာ သက်ဆိုင်ရာ ဓါတ်ခွဲခန်းသို့ ပေးပို့၍ ဓါတ်ခွဲစစ်ဆေးမှုများကို ခံယူရမည်ဖြစ်ပါသည်။
- ရောဂါဖြစ်ပွားနေသော ကာလတလျောက် နေ့စဉ်၊ အပါတ်စဉ်၊ ကြားဖြတ် အစီရင်ခံစာများကို အထက်အဖွဲ့အစည်းသို့ ဆက်သွယ်နေပြီး အစီရင်ခံပေး နေရမည်ဖြစ်ပါသည်။ သို့မှ ပြည်နယ်၊ တိုင်းနှင့် ဗဟိုတို့မှ အခြေအနေကို သုံးသပ်ခြင်း၊ Feedback ပေးခြင်းတို့ကိုဆောင်ရွက်နိုင်မည်ဖြစ်သည်။ ကူးစက် ရောဂါကို ထိန်းချုပ်နိုင်ပြီဖြစ်သောအချိန်တွင် ဗဟိုသို့ နောက်ဆုံးအသေးစိပ် အစီရင်ခံစာ (Final Report) ကို အစီရင်ခံတင်ပြရမည်ဖြစ်ပါသည်။

ကူးစက်ရောဂါကာကွယ်နှိမ်နင်းရေး၊လိုက်နာဆောင်ရွက်ရမည့်(၁၃)ချက်

(၁)ရောဂါဖြစ်ပွားသည့်အိမ်ကကျန်းမာရေးဌာနသို့တိုင်ကြားခြင်း(Notification)

(၂)ရောဂါဖြစ်ပွားသည့်ဒေသသို့ ချက်ခြင်းလိုက်သွား၍ မည့်သည့်ရောဂါဖြစ်ကြောင်း အမည်တပ်ပြီး လူမမာအားသင့်တော်သည့်ဆေးဝါးကုသပေးခြင်း(Early Diagnosis and Prompt Treatment)

(၃)ရောဂါစတင်ဖြစ်ပွားပုံ၊ကူးစက်ပြန့်နှံ့ပုံကိုအသေးစိတ်လေ့လာခြင်း(Epidemiological Investigation)

(၄) ကျန်းမာရေးဌာနအဆင်ဆင့်သို့ဆင့်ကဲဆင့်ကဲအစီရင်ခံခြင်း(Reporting)

(၅) လူမမာအားသီးခြားခွဲထားခြင်း(Isolation)

(၆)လူနာနှင့်အတူနေများအပါအဝင်လူနာနေအိမ်ကို အဝင်အထွက် ပိတ်ပင်တားဆီးခြင်း(Quarantine)

ကူးစက်ရောဂါကာကွယ်နှိမ်နင်းရေး၊လိုက်နာဆောင်ရွက်ရမည့်(၁၃)ချက်

(၇) ရောဂါပိုးသုတ်သင်ခြင်း(Disinfection)

(၈) ပိုးမွှားတိရိစ္ဆာန်များသုတ်သင်ခြင်း(Disinfestation)

(၉) ပတ်ဝန်းကျင်သန့်ရှင်းရေးကောင်းမွန်အောင်ဆောင်ရွက်ခြင်း (Sanitation)

(၁၀)ကာကွယ်ဆေးထိုးခြင်း(Immunization)

(၁၁)ရောဂါဖြစ်သူနှင့်အတူနေအိမ်သားများအားဆေးကျွေး၍ရောဂါကာကွယ်ခြင်း (Chemoprophylaxis)

(၁၂) ကျန်းမာရေးပညာဖြန့်ဖြူးခြင်း (Health Education)

(၁၃)လူနာသစ်ဖြစ်ပွားမှုရှိ မရှိ သိရှိနိုင်ရန်ရောဂါရှာဖွေခြင်း(Case detection/ Active case search)