Outbreak investigations and response

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Session objectives

1. Review the pillars of the outbreak response
2. Review the key stakeholders in outbreak response
3. Describe the steps of an outbreak investigation
4. Highlight areas of reflection for practical application for journalists

Why investigate outbreaks?

- Identify source and limit dissemination
- Respond to public's concerns
- Conduct scientific studies in order to learn about new diseases and better understand old ones
- Test control strategies
- Construct links between clinicians and specialists in public health
- Political and legal issues
- Training opportunities

Pillars of outbreak response

Who responds to outbreaks?

Organizational

The affected population

Local Non-governmental organizations and Community based organizations

Government

International non-governmental organizations

International organizations

Technical (including, not limited to):

Coordination

Epidemiology/surveillance/laboratory

Case management/infection control

Water Sanitation and Hygiene (WASH)/ Environmental

Social mobilization/psychosocial support

Logistics

Who responds to outbreaks?

Preparation and logistics

- Available local and foreign resources?
  - Experts
  - Communication?
  - Transport?
- Team, roles, leadership?
- Medications/vaccines to protect the team?
- Study design and methods?
- Laboratory support?
- Sharing of data and responsibility for analysis, reports, and scientific publications?

In practice: Whose voice are your capturing?

Sources top left: VOA bottom left: The conversation, right: WHO

10 steps of outbreak investigation

1. Confirm the diagnosis
2. Confirm that an epidemic exists
3. Define a case and count them
4. Descriptive epidemiology: arrange the data
5. Determine who is at risk of disease
6. Implement methods of control and prevention
7. Analytic epidemiology: develop a hypothesis and test it
8. Environmental and laboratory investigation
9. Implement a surveillance system
10. Communicate your findings

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1. Confirm the diagnosis

Confirm existence of cases using multiple sources of information: clinical, laboratory, epidemiologic

Possible sources of artifacts (i.e. observed event):

- Lab errors
- New technique, method, or surveillance program
- Special interest
- Seasonal fluctuation

Sources of outbreak notification

- Astute clinician
  - Disease surveillance (reporting system)
- Review of epidemiologic data

Patient

  - Food-borne
- Local press
- Community/ rumors □ Event based surveillance

Sources of outbreak notification: local press

HEALTH

When towns lose their newspapers, disease detectives are left flying blind

By HELEN BRANSWELL @HelenBranswell / MARCH 20, 2018

Reprints

Source:
STAT

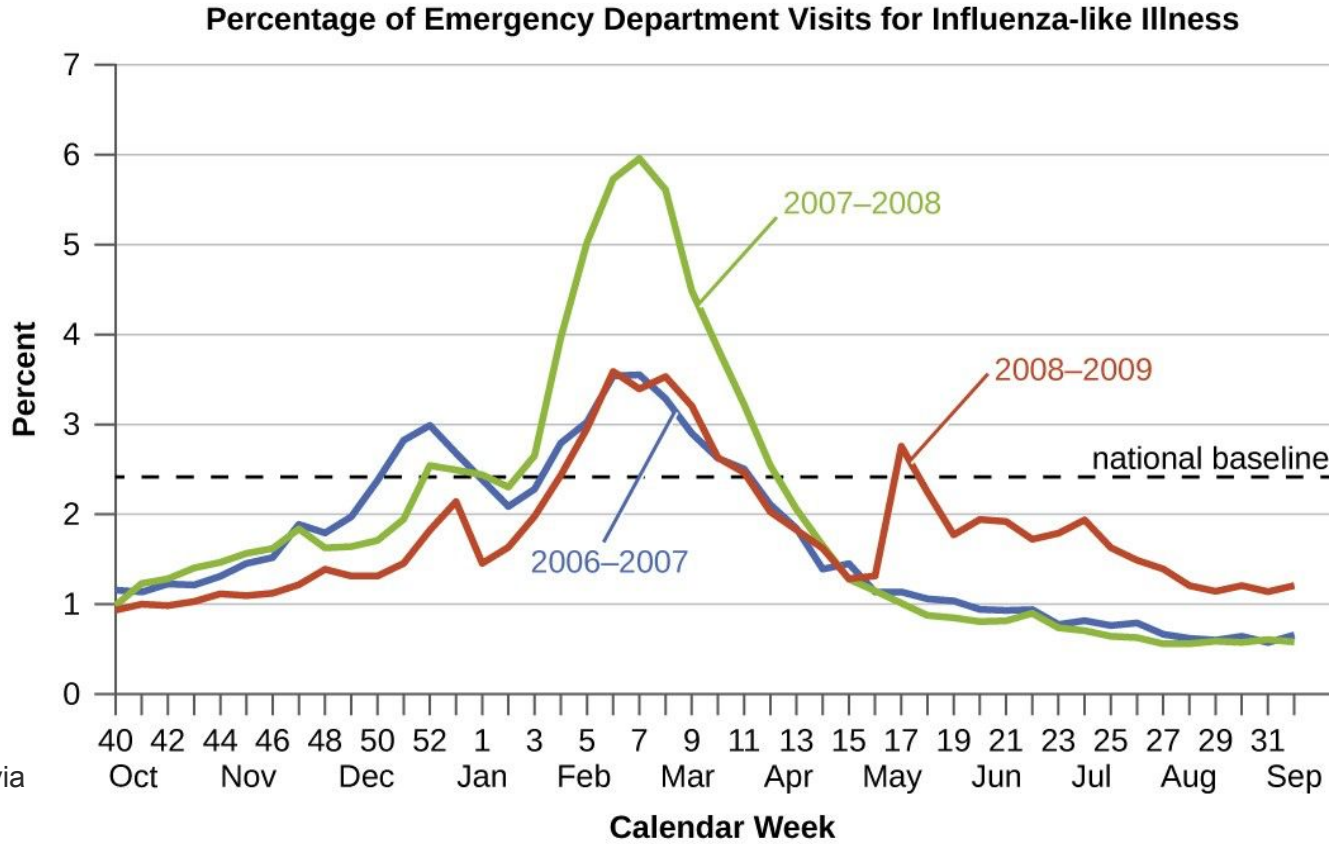
2. Confirm that an epidemic exists

Epidemic or outbreak: more than normally expected in a defined place and time

1. Establish baseline transmission

2. Compare the current problem with the baseline transmission

Establish baseline and compare current problem



Source: US CDC via Lumen learning

3. Define a case and count them

Case definition - set of uniform criteria used to define a disease for public health surveillance. Surveillance case definitions enable public health officials to classify and count cases consistently across reporting jurisdictions.

- Clinical criteria
- Laboratory criteria
- Epidemiologic linkage: person, place, & time
- Sensitive □ Specific

Case classification

- Suspected case definition
- Probable/presumptive case definition
- Interim case definition
- Primary or secondary case/contact

Source: CDC

Modifications in case definition: China & COVID19

Coronavirus: No change in outbreak despite China spike, WHO says

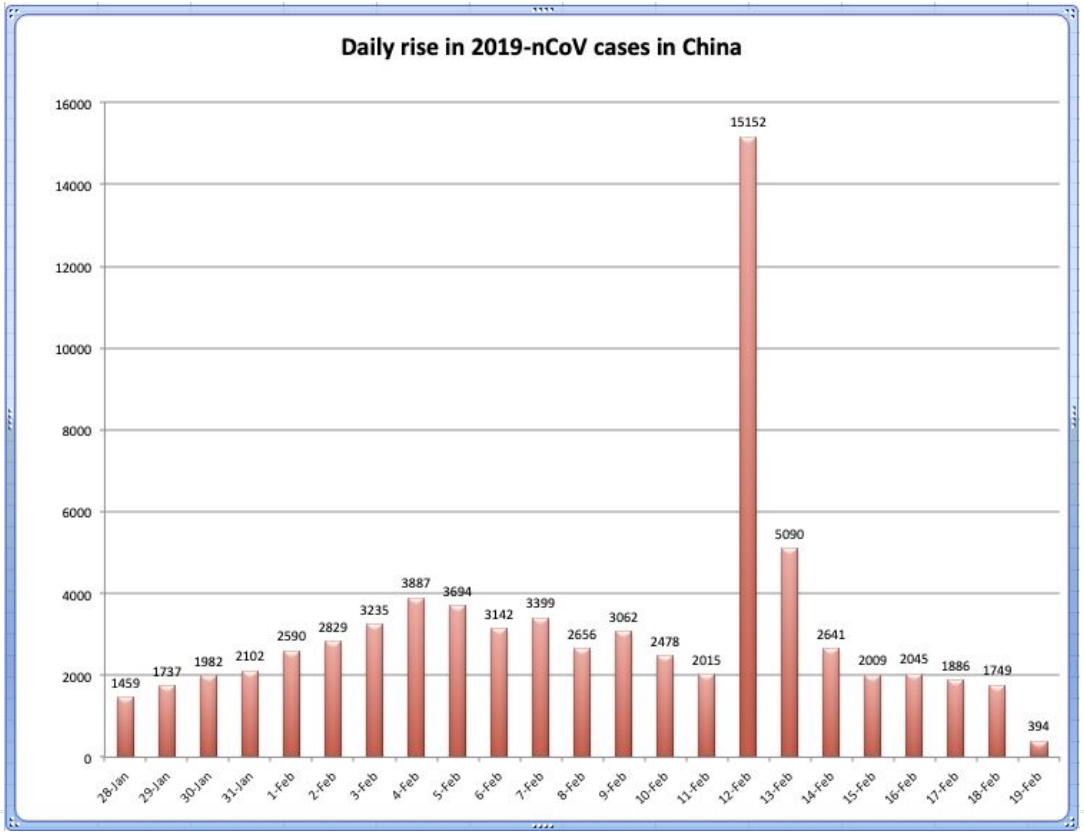
14 February 2020

Share

*"The total infections jumped by **5,090 to 63,851** cases on 13 February, the National Health Commission said on Friday"*

Source: BBC

Modifications in case definition: China & COVID19



Source: Stat news

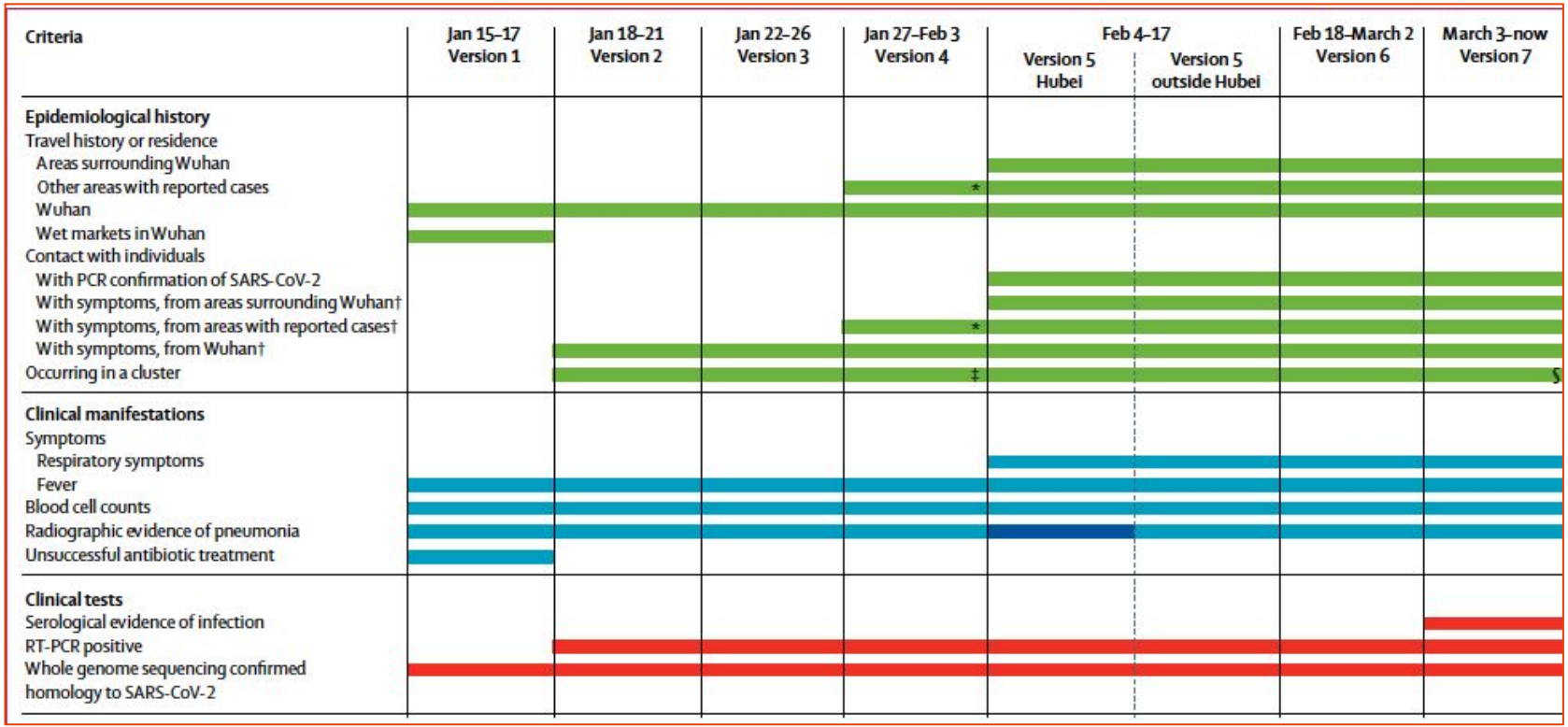
Modifications in case definition: China & COVID19

Effect of changing case definitions for COVID-19 on the epidemic curve and transmission parameters in mainland China: a modelling study

"From Jan 15 to March 3, 2020, seven versions of the case definition for COVID-19 were issued by the National Health Commission in China. ***... If the fifth version of the case definition had been applied throughout the outbreak with sufficient testing capacity, we estimated that by Feb 20, 2020, there would have been 232,000 (95% CI 161,000–359,000) confirmed cases in China as opposed to the 55508 confirmed cases reported."***

Source: Tsang, Tim K., et al. "Effect of changing case definitions for COVID-19 on the epidemic curve and transmission parameters in mainland China: a modelling study." *The Lancet Public Health* (2020).

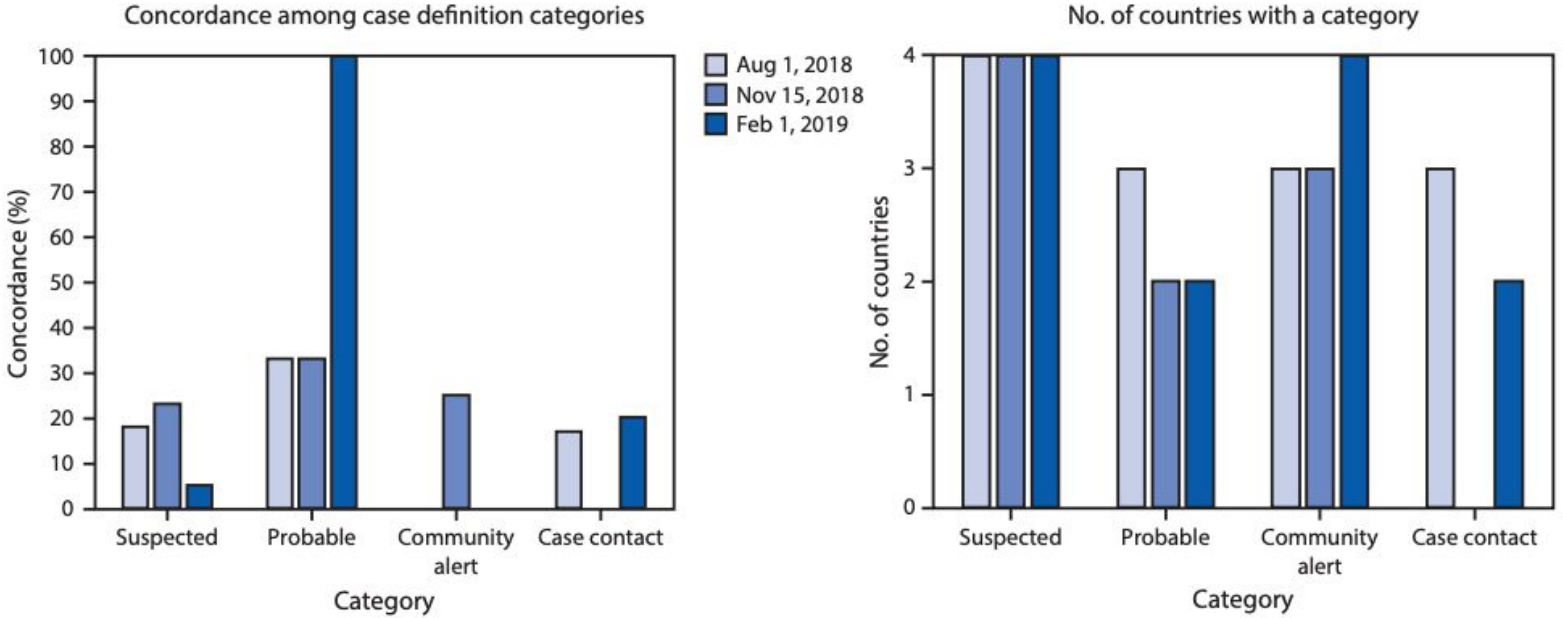
Modifications in case definition: China & COVID19



Source: Tsang, Tim K., et al. "Effect of changing case definitions for COVID-19 on the epidemic curve and transmission parameters in mainland China: a modelling study." *The Lancet Public Health* (2020).

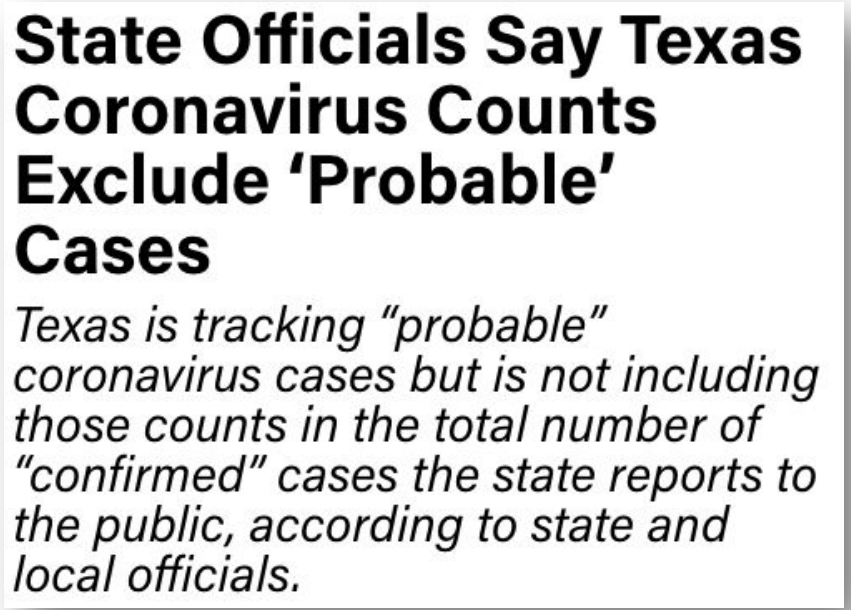
Modifications in case definition: DRC & Ebola

Comparison of case definitions in DRC, Rwanda, South Sudan, Uganda



Source: Medley, Alexandra M., et al. "Case Definitions Used During the First 6 Months of the 10th Ebola Virus Disease Outbreak in the Democratic Republic of the Congo—Four Neighboring Countries, August 2018–February 2019." *Morbidity and Mortality Weekly Report* 69.1 (2020): 14.

In practice: Is your reporting capturing potential case definition modifications?



State Officials Say Texas Coronavirus Counts Exclude 'Probable' Cases

Texas is tracking "probable" coronavirus cases but is not including those counts in the total number of "confirmed" cases the state reports to the public, according to state and local officials.

Source: Texas scorecard.com

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4. Descriptive epidemiology (aka disease detective work)

1. Orient the data with respect to time, place and person
2. Construct a simple line list of cases/data: age, sex, ethnicity, residence, occupation, **travel**, others
3. Epidemic curve
4. Construct map
   - Use of global positioning systems (GPS)

Case investigation

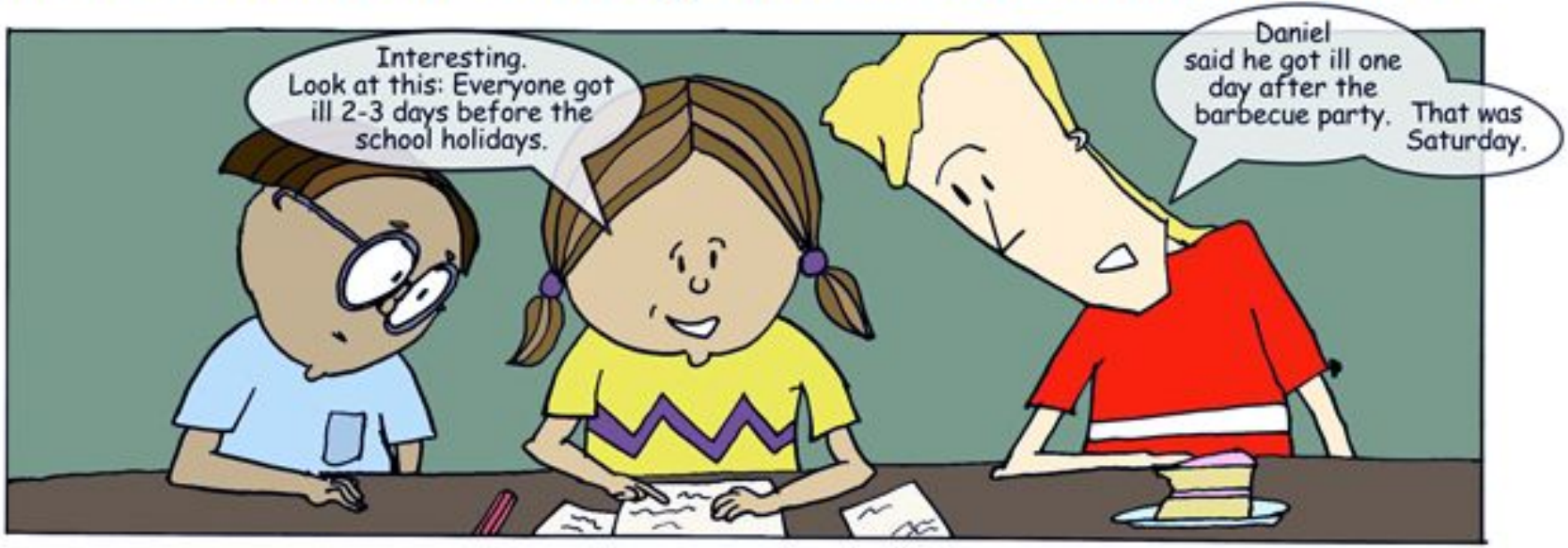
Source: Dan Bausch, LSHTM & PHE

Mystery outbreak: Line list

DATE OF ONSET	NUMBER OF CASES	DEATHS	FLAVOURS OF ICE CREAM EATEN
18 May	4	1	Chocolate
19 May	7	2	Chocolate
20 May	7	0	Chocolate
21 May	1	0	Chocolate and vanilla
22 May	1	0	Chocolate and vanilla
23 May	1	0	Chocolate and vanilla
24 May	1	0	Chocolate and vanilla
25 May	1	0	Chocolate and vanilla

Adapted from ECCD course, LSHTM

The Disease Detectives detect patterns of disease in their line list



Mystery outbreak: Attack rate

- Flavor attack rate (cumulative incidence):
  - Chocolate only18/18
  - Vanilla only: 0/4
  - Had chocolate: 23/23
  - Had vanilla: 5/9
  - Chocolate + Vanilla: 5/5

Mystery outbreak: Formulate a hypothesis

"Mrs. Y, the maker of the chocolate ice cream, and her daughter ate the ice cream and suffered from nausea, vomiting and diarrhea"

Could it be typhoid?

Pathogen: Salmonella typhi (*S. typhi*) bacteria

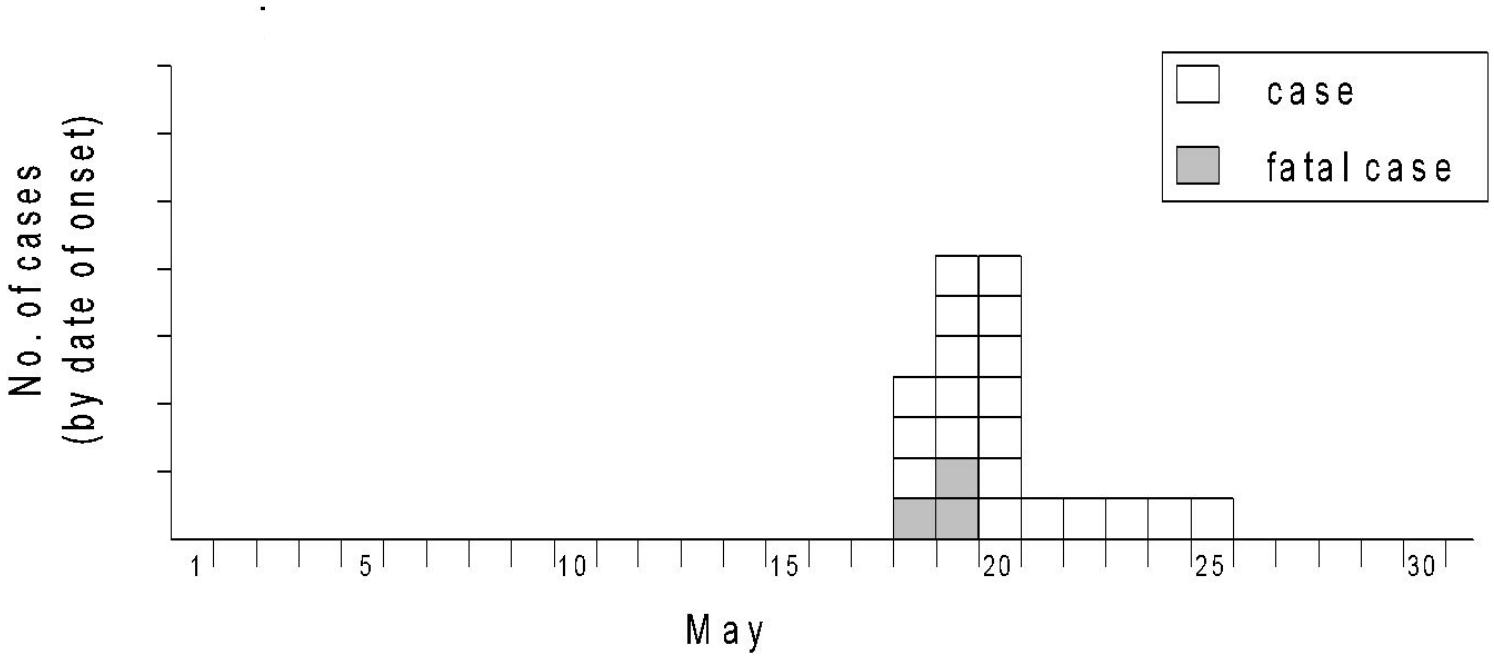
Mode of transmission: Fecal-oral; humans only reservoir

The infection is often passed on through contaminated food and drinking water,

Symptoms: Typhoid is a bacterial infection that can lead to a high fever, diarrhea, and vomiting. It can be fatal.

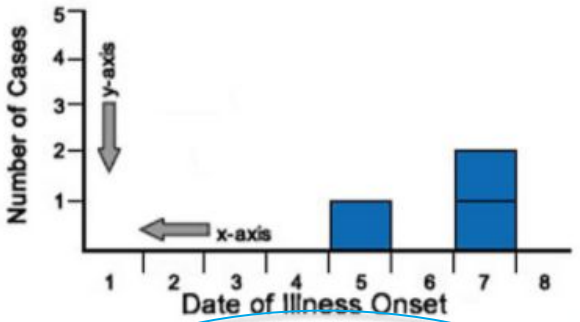
Other information: associated with poor hygiene (e.g. poor hand washing), inadequate sewage disposal

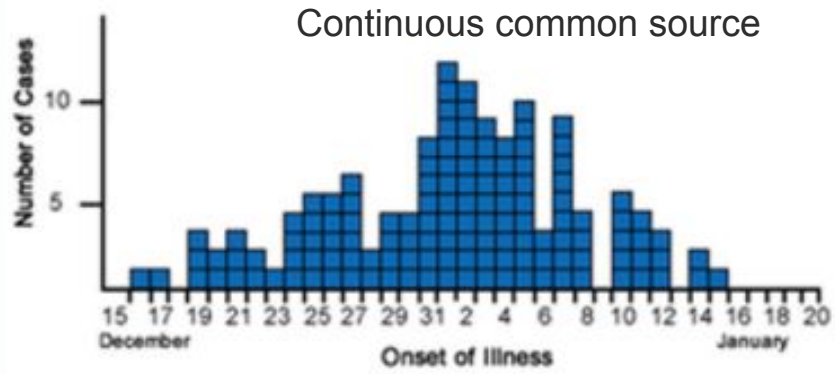
Mystery outbreak: Epidemic curve

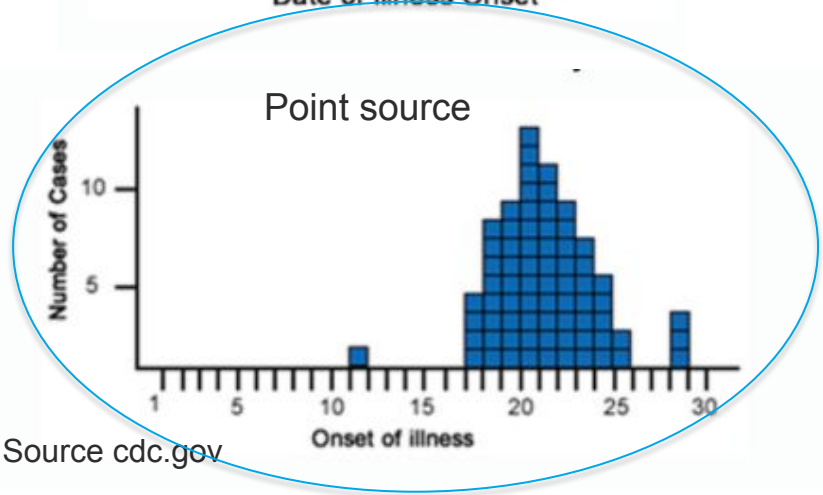


Adapted from ECCD course, LSHTM

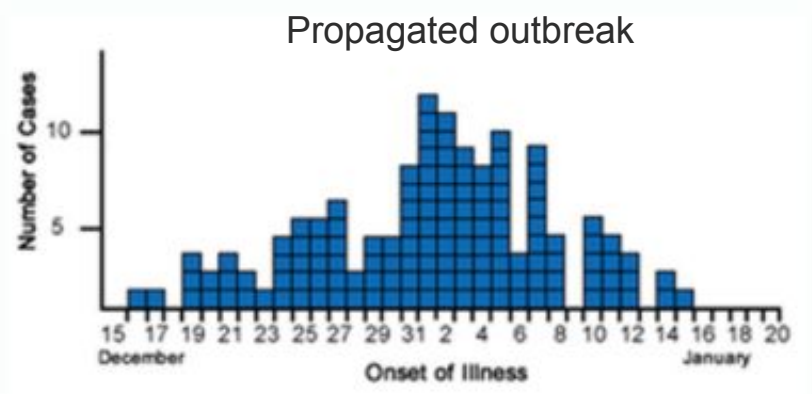
Epidemic curve – What is it and what can it tell us?





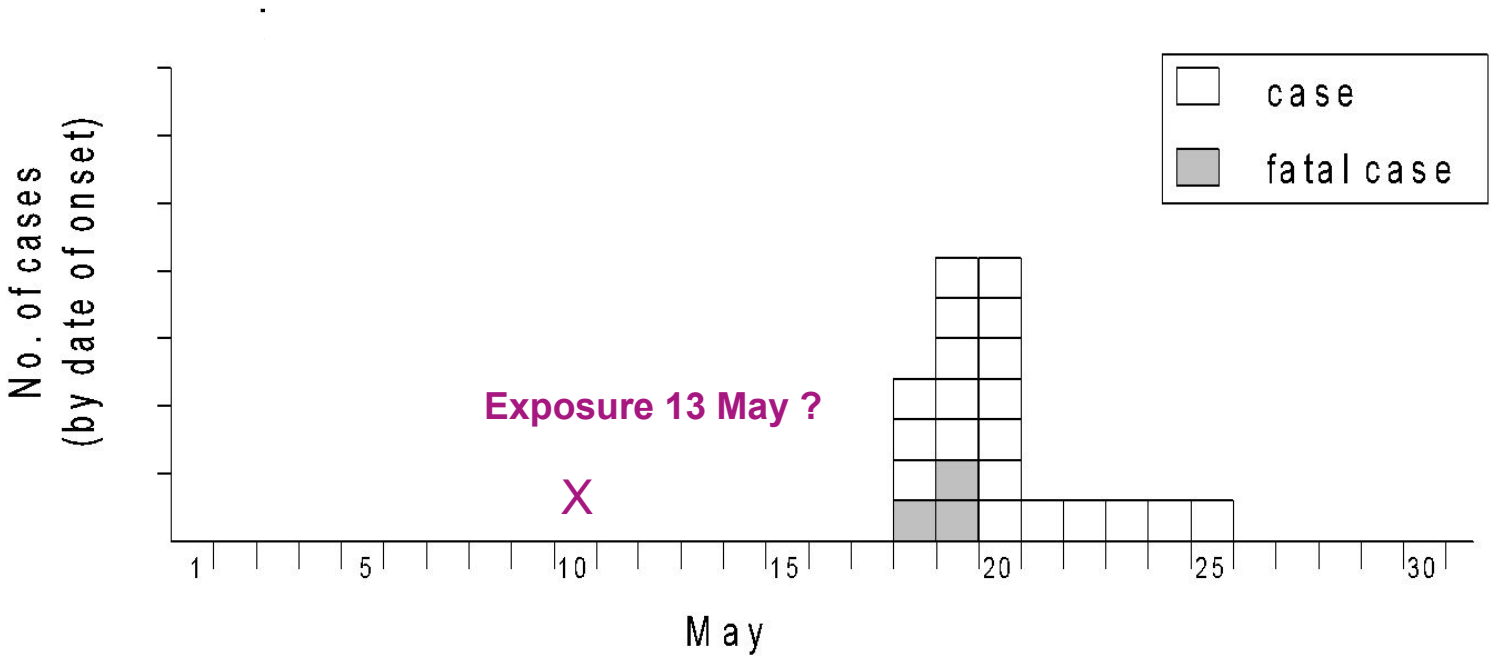


Source cdc.gov



Mystery outbreak: Line list

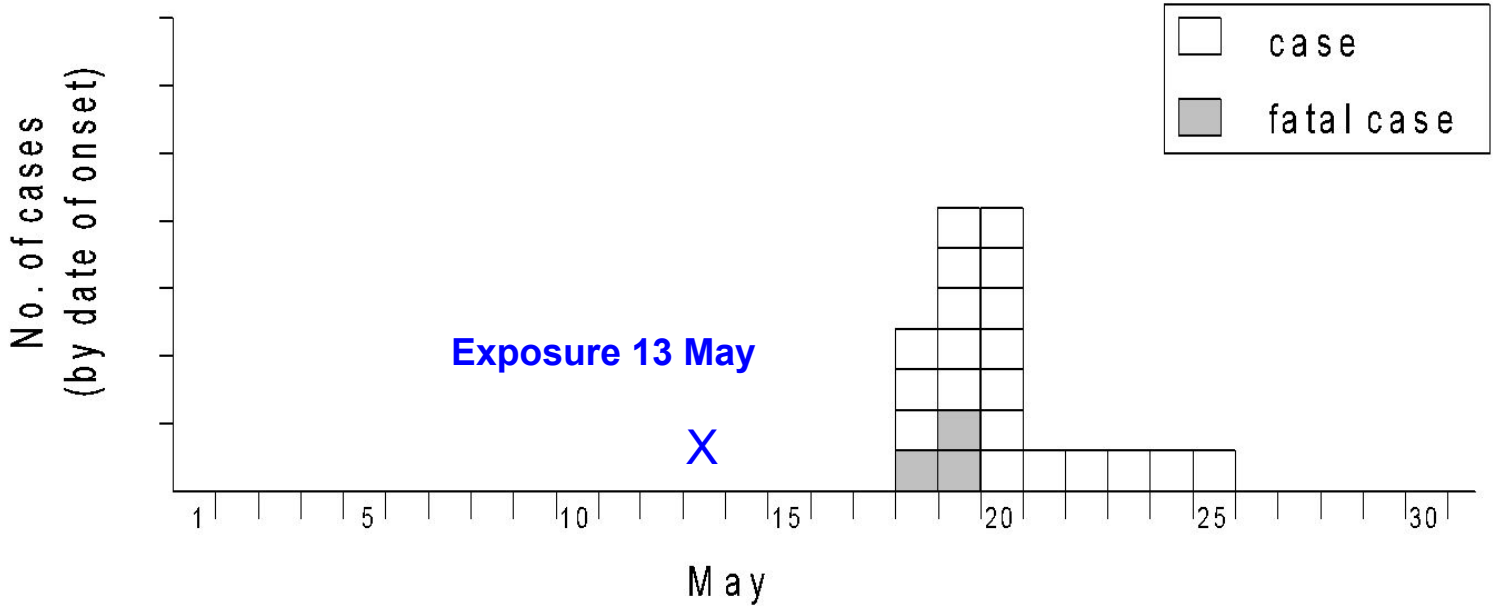
The incubation period for typhoid fever is usually 8–14 days



Adapted from ECCD course, LSHTM

Mystery outbreak: Line list

The incubation period for typhoid fever is usually 8–14 days, but this depends on the infective dose and can vary from 3 days to 1 month.



Adapted from ECCD course, LSHTM

Secondary transmission

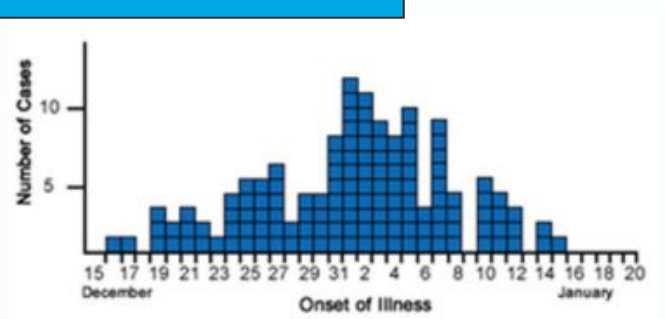
Example: Marburg: Secondary Transmission in the Home

Maria Thompson
Daughter
Onset 22/4/99; Died: 24/4/99
Suspected

Othea Arumbi
Daughter
Onset 1/5/99
Confirmed

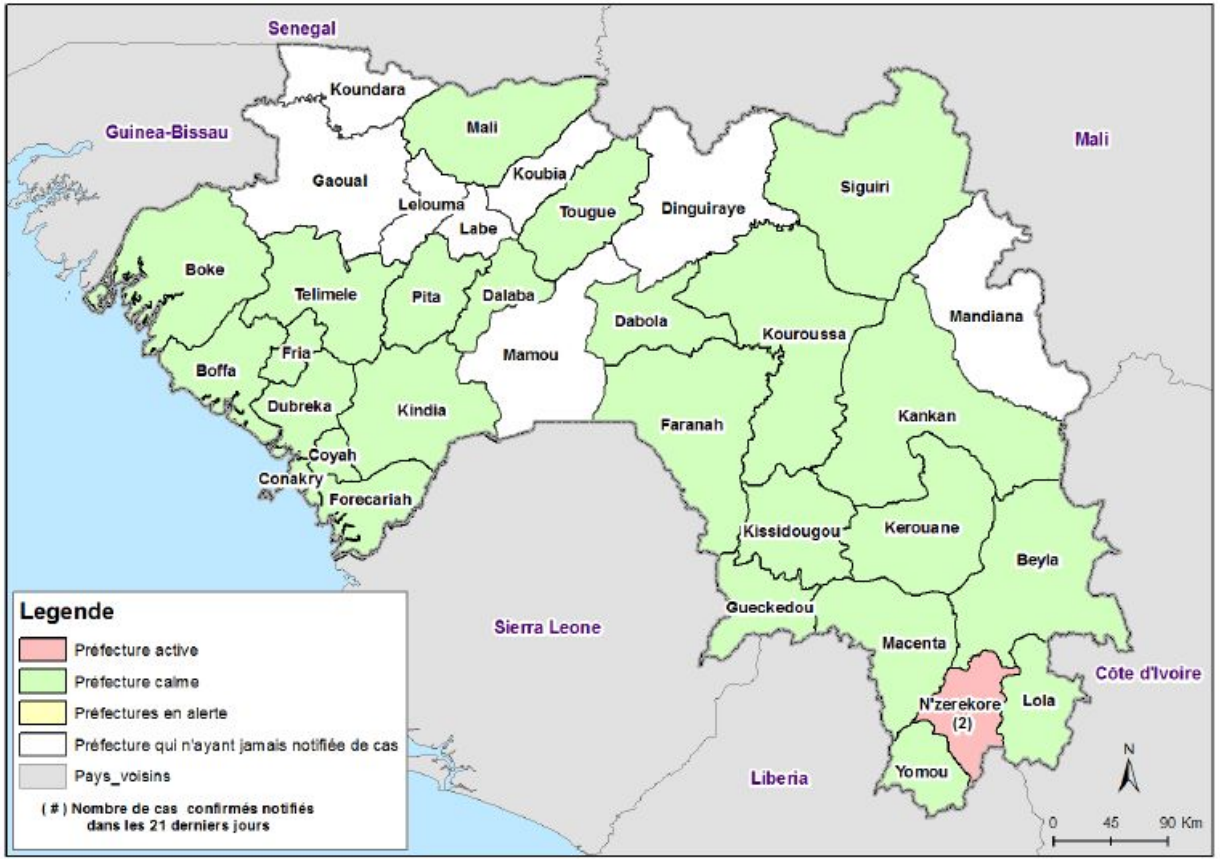
Charlotte Amino
Mother
Onset 8/5/99; Died 14/5/99
Confirmed

Nicole Arumbi
Grand-daughter
Onset 9/5/99; Died 15/5/99
Confirmed



Adapted with permission from Daniel Baush slides on outbreak investigation

Descriptive epidemiology: Construct map



Source: WHO, Rapport de la Situation Epidémiologique Maladie à Virus Ebola en Guinée, 17.3.16

5. Determine who is at risk: Epidemiological study survey

Epidemiological study of a disease of unknown aetiology									
Hypotheses		**Survey evidence**							
		Age / sex distribution				**Village Dist'n**	**Season**	**Sanitary ratings**	**Economics**
		< 1	**1 - 14**	**15- 50**	**> 50**				
Infections	Contact								
	Intestinal								
	Airborne								
	Arthropod-borne								
Hereditary									
Intoxication									
Other (specific)									

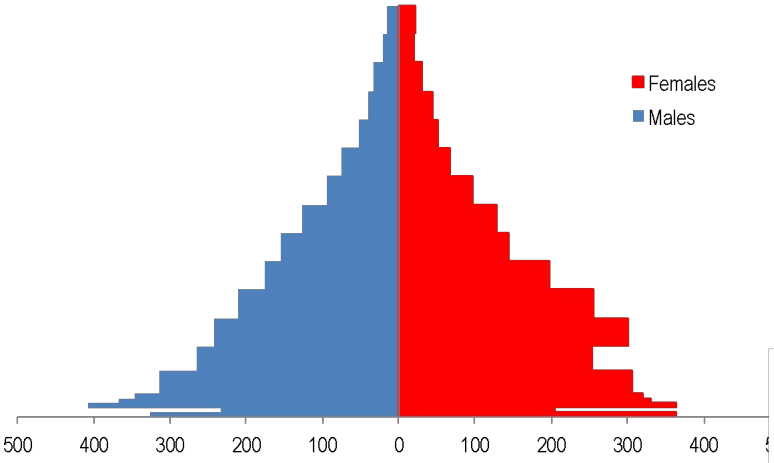
Source: ECCD course, LSHTM

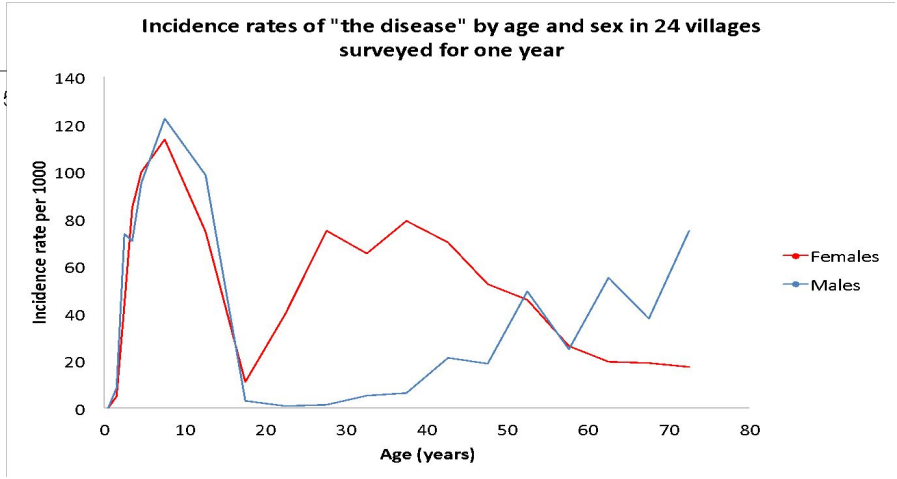
Determine who is at risk: Table 1

Age group	Males			Females		
	Population*	Cases	Rate per 1,000	Population*	Cases	Rate per 1,000
Under 1	327	0	-	365	0	-
1	233	2	8.6	205	1	4.9
2	408	30	73.5	365	16	43.8
3	368	26	70.7	331	28	84.6
4	348	33	94.8	321	32	99.7
5-9	1,574	193	122.6	1,531	174	113.7
10-14	1,329	131	98.6	1,276	95	74.5
15-19	1,212	4	3.3	1,510	17	11.3
20-24	1,055	1	0.9	1,280	51	39.8
25-29	882	1	1.1	997	75	75.2
30-34	779	4	5.1	720	47	65.3
35-39	639	4	6.3	646	51	78.9
40-44	469	10	21.3	485	34	70.1
45-49	372	7	18.8	343	18	52.5
50-54	263	13	49.4	263	12	45.6
55-59	200	5	25.0	228	6	26.3
60-64	164	9	53.6	153	3	19.6
65-69	106	4	37.7	105	2	19.1
70 and over	80	6	75.0	114	2	17.5
TOTAL	**10,808**	**483**	**44.7**	**11,238**	**664**	**59.1**

Source: ECCD course, LSHTM

Age and Sex: Deeper dive





Source: ECCD course, LSHTM

Determine who is at risk

- Absence of cases < 1 - ; could be consistent with
  - passive immunity??
  - babies not exposed
  - breast milk nutrition
- High risks among older children and adolescents
  - Consistent with contact infections e.g. measles / chickenpox etc … especially ubiquitous infections which lead to immunity
- Female excess in years 15 - 50
  - Childbearing age for females: Close contact with young children – parents commonly contract infections from their young children.
  - Metabolic demands of pregnancy - consistent with nutritional hypotheses
- Male excess at older ages > 50
  - May be difficult to explain, without sociological information (e.g. old women cook and thus have access to food - old retired men are left out).

Adapted from ECCD course, LSHTM

In practice: How do you report on a novel disease, where people are affected but we still have a lot to learn?

Behind the Conflicting Advice on Coronavirus Safety

New research is upending early public health advice. That's going to continue as researchers understand the virus better.

Source: The new republic

Coronavirus face masks Q&A: is the advice changing?

April 7, 2020 7.38pm AEST

Source: The Conversation

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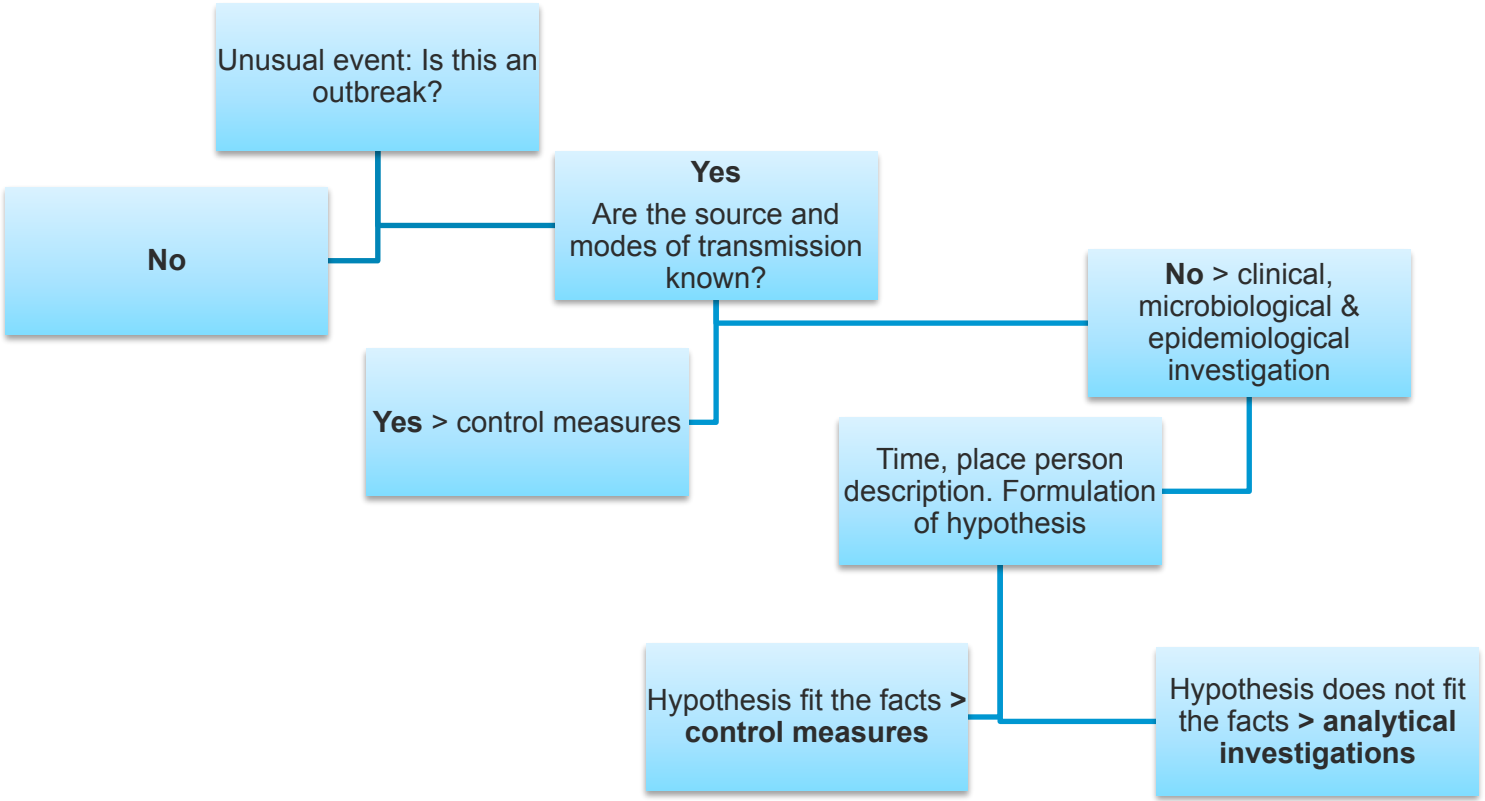
Should we implement control measures or do a study?



6. Implement methods of control and prevention

1. Eliminate/treat source – e.g. contact tracing and isolation
2. Prevent continued exposure – e.g. vaccination campaign, social distancing
3. Protect the population at risk – e.g. shielding of elderly

Norway's response three weeks from R_e=3.8 to R_e=0.6

Source: nationalgeographic.com

Implement methods of control and prevention: Contact tracing

Source WHO/N Erondu

7. Analytic epidemiology: develop a hypothesis and test it

Evaluate hypothesis epidemiologically

Use of studies

- Case-control
- Retrospective and prospective cohort
- Cross-sectional
- Molecular epidemiology

Use the (famous) 2x2 table to calculate:
Risk ratios (relative risks)
Attributable risks
Odd Ratios

8. Environmental and laboratory investigation

1. Obtain as early in the investigation as possible without compromising efforts to control human disease
2. Find out what specimen is needed and how to conserve it
3. Safe and legal shipping

When in doubt, take it and save it!

Source: Dan Bausch, LSHTM & PHE

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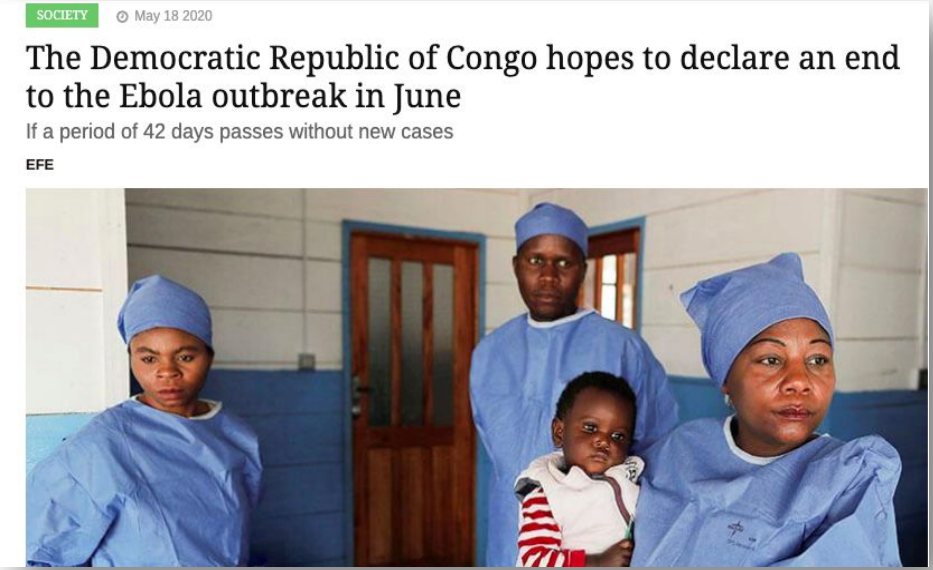
9. Implement surveillance system

1. Continue monitoring the situation to asses trends in cases and deaths
   - Communication network
   - Laboratory support
   - Training

2. In able to declaring the outbreak over: **No new cases during two incubation periods since onset of last case**
3. Requires careful case searching


SOCIETY May 18 2020

The Democratic Republic of Congo hopes to declare an end to the Ebola outbreak in June

If a period of 42 days passes without new cases

EFE

Source: https://atalayar.com/

10. Communicate Findings

- Written reports
- Meetings with local and national authorities
- Press interviews
- Scientific publications

In practice: How can the media prepare the public for necessary control and prevention measures?

Balancing privacy with public health: how well is South Africa doing?

June 25, 2020 2.49am AEST

Social Media Disinfo

Screenshot

Claim: WHO no longer recommends self-isolation and social distancing to prevent COVID-19 transmission.

Verdict: False

Read the full story at: Agence France-Presse

Source: The Conversation

The story of COVID19 in Africa is up to you!

CHATHAM HOUSE

ALJAZEERA News AJ Impact AJ Go Documentaries Shows

NEWS / AFRICA

How prepared is Africa for an outbreak of deadly coronavirus?

What The US Could Learn From Nigeria's Response To The COVID-19 Coronavirus Outbreak

Andrew Wight Contributor

Science

I am a journalist covering #GlobalSouthScience, tech and devel

FIRST OPINION

Learning about epidemic response from sub-Saharan African countries

COVID-19 vaccine trial in South Africa: everything you need to know

Global report: South Africa cases pass 200,000 as Kenya plans 'phased reopening'

Health News 14 May 2020

Tanzanian doctors sound alarm over hidden coronavirus cases

'Corona is considered a security issue, not a public health issue.'

Lack of Covid-19 testing undermines Africa's 'success'

COVID-19 Pandemic

African Scientists Step Up Role in Coronavirus Fight

Coronavirus: Zimbabwe arrests 100,000 for 'violations' of measures

19 July 2020 Share

PostEverything • Perspective

East Africa has weathered pandemics — and has a few things to teach the U.S.

A willingness to learn from history and science, take preventive measures and seek international cooperation has prepared the continent to fight covid-19

Resources

- Principles of Epidemiology in Public Health Practice, Third Edition, CDC (online textbook)
- Field Epidemiology, Michael B. Gregg
- Outbreak Investigations Around the World: Case Studies in Infectious Disease Field Epidemiology , Mark S. Dworkin