https://www.ochreealth.com.au

“Infinity War: Battling Emerging and Re-emerging Infectious Diseases”

ELIZABETH E. GALLARDO, MD, FPPS, FPIDSP

26th PIDSP Annual Convention
February 21, 2019

Emerging and Re-emerging Infectious Diseases

- Appearance of previously unrecognized or possibly heretofore nonexistent infections in humans
  - **Examples**: Hantavirus pulmonary disease, Acquired immunodeficiency syndrome (AIDS), Ebola virus infection

Feigin and Cherry's Textbook of Pediatric Infectious Diseases, 7th edition, Chapter 7 – Epidemiology of Infectious Diseases, pp 132-134

Emerging and Re-emerging Infectious Diseases

- Previously recognized human infections that exhibit **changes in epidemiologic behaviour** or **biologic characteristics** that enhance their transmission or virulence
  - Changes in host factors such as immune defenses
  - Changes due to external influences

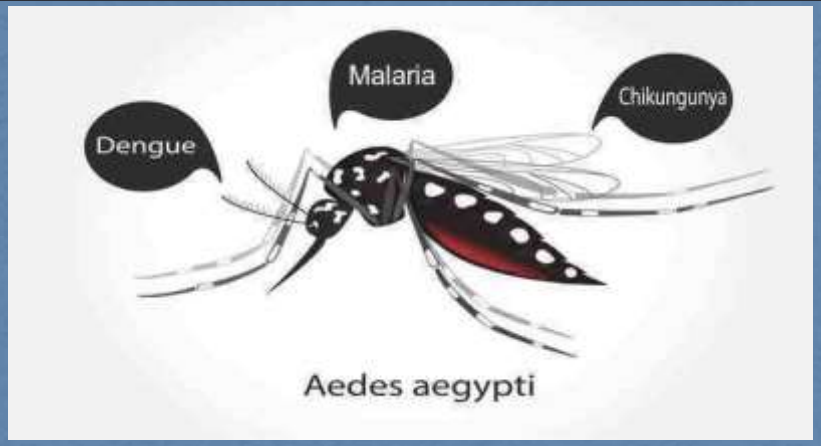
Feigin and Cherry's Textbook of Pediatric Infectious Diseases, 7th edition, Chapter 7 – Epidemiology of Infectious Diseases, pp 132-134

Emerging and Re-emerging Infections

- Examples of Old infections with New behaviour
  - Mutidrug-resistant tuberculosis
  - Community-acquired methicillin-resistant staphylococcal infections
  - H5N1 influenza (“bird flu”)
  - Infections fostered by immunosuppression or therapeutic measures such as antibiotics and catheters

Emerging and Re-emerging Infectious Diseases

- **Changes attributed to external factors - altered demographics**
  - Increasing population and rural-urban migration
  - International travel
  - New technology or technologic failure
  - Changes in land use
  - Adaptation of infecting organisms to various influences
  - **Inadequate or underused public health measures**



centegra.org

ENDEMICS and EPIDEMICS

ELIZABETH E. GALLARDO, MD, FPPS, FPIDSP

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Lecture Objectives

- Define what endemic and epidemic diseases are, describe their pattern and cite significant examples that have occurred globally or locally
- Describe the impact of epidemic and endemic disease events in the community and the healthcare sector

Definition of Terms

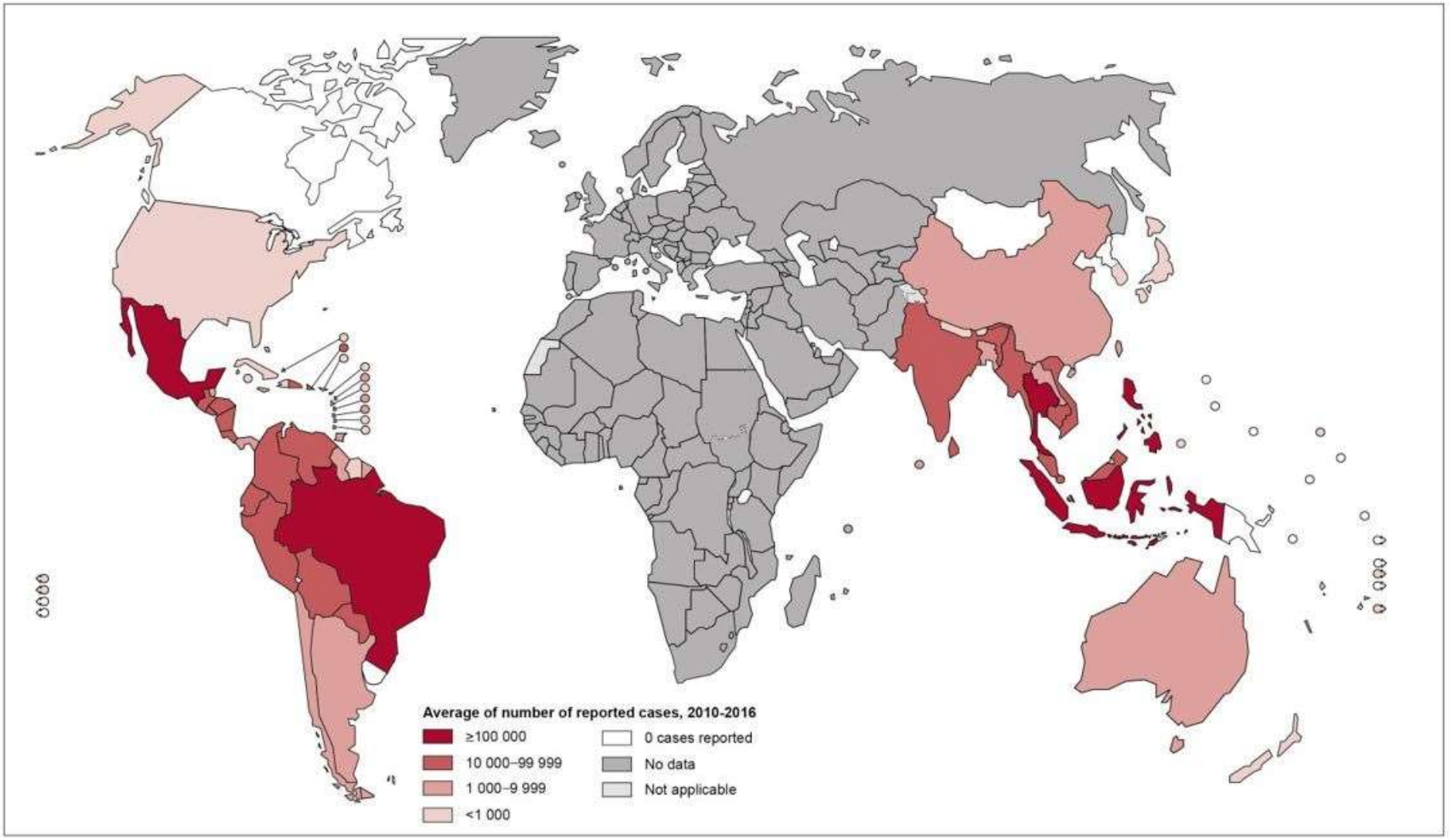
- **ENDEMIC**
  - Refers to the constant presence and/or usual prevalence of a disease or infectious agent in a population within a geographic area over a certain period of time
  - Baseline level of a particular disease in the community → the expected level of the disease

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Malaria-endemic countries in the Eastern Hemisphere

wwwnc.cdc.gov/travel/yellowbook/2018/infectious

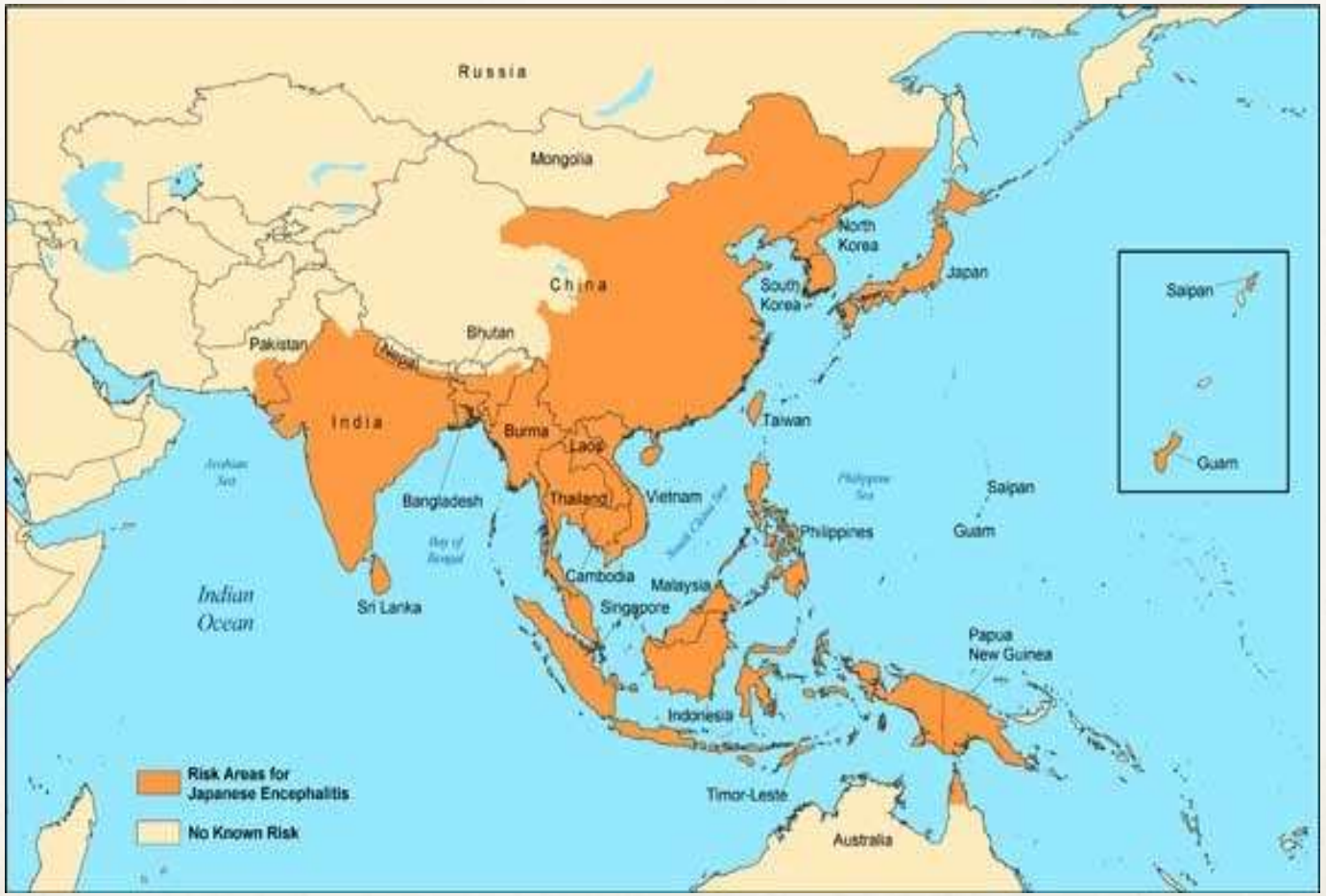
Distribution of dengue, worldwide, 2016



Data Source: World Health Organization
Map Production: Control of Neglected Tropical Diseases (NTD)
World Health Organization

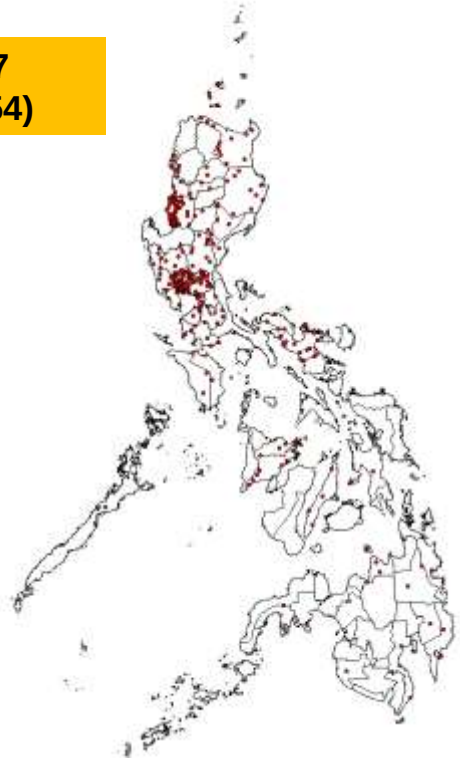
World Health Organization

Geographic Distribution of Japanese Encephalitis

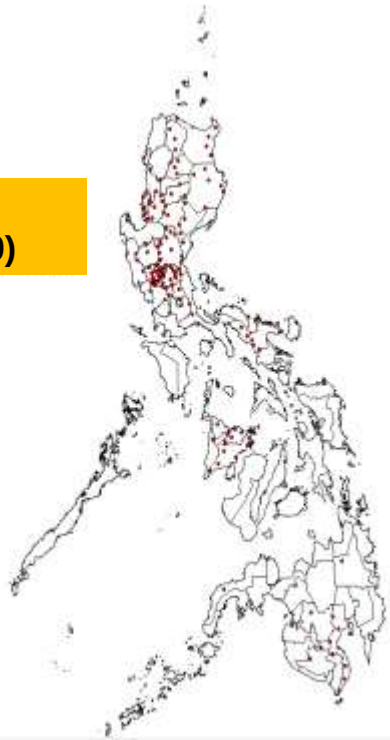


Confirmed JE cases by Province
2017 vs. 2018*, Philippines

2017
(N=354)



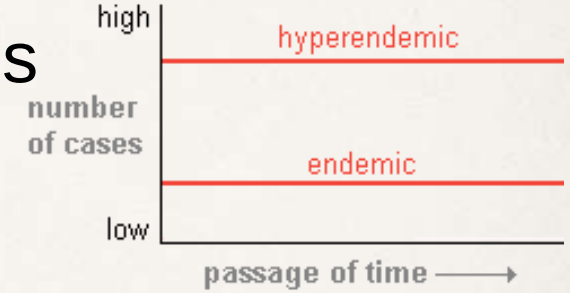
2018*
(N=180)



**Data from January 1 to October 20, 2018*

Definition of Terms

- **HYPERENDEMIC**
  - Refers to persistent, high levels of disease occurrence



- **SPORADIC**
  - Refers to a disease that occurs infrequently and irregularly

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Definition of Terms

- **EPIDEMIC**
  - Refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area
  - Disease affects a large number of people and/or is spread to many different places in a sudden, massive surge within a population that is largely without immune protection

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Definition of Terms

- **OUTBREAK**
  - Often used for a more limited geographic area
  - Spread of disease among a smaller number of people in a single community or limited location

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

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MEASLES OUTBREAK | SOUTH CHINA SEA | PHILSTAR VIDEOS | NEWS COMMENTARIES

Measles outbreak declared in Metro Manila, Central Luzon

1.6K SHARES

Sheila Crisostomo (The Philippine Star) - February 7, 2019 - 12:00am

MANILA, Philippines — The Department of Health (DOH) yesterday declared an outbreak of highly contagious measles in the National Capital Region (NCR) and Central Luzon.

"We are declaring an outbreak as cases have increased in the past weeks and to strengthen surveillance of new cases and alert mothers and caregivers to be more vigilant," Health Secretary Francisco Duque III said.

In an interview, Duque reiterated his agency's call for parents to submit their children to anti-measles vaccination to contain the spread of the disease.

the Department of Health (DOH) to educate school children from kindergarten to Grade 12 about the ill effects of taking illegal drugs.

21 hours ago

DEPARTMENT OF EDUCATION
DEPARTMENT OF HEALTH
PREVENTIVE DRUG EDUCATION

Mandatory immunization ordered

Republic of the Philippines
Department of Health
Kagawaran ng Kalusugan
ISO 9001:2015 CERTIFIED

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DOH EXPANDS MEASLES OUTBREAK DECLARATION TO OTHER REGIONS

Republic of the Philippines
Department of Health
Kagawaran ng Kalusugan

Epidemiology Bureau
Public Health Surveillance Division

Measles-Rubella Morbidity Week 52

January 1 – December 31, 2018

Table 3. Confirmed Measles Cases by Region
Jan. 1 – Dec. 31, 2018 vs. Jan. 1 – Dec. 31, 2017

Region	2018		2017		Cases % Change
	Cases	Deaths	Cases	Deaths	
PHL	5,120	59	791	17	↑ 547
I	79	2	3	0	↑ 2,533
II	9	0	0	0	↑
III	282	5	49	2	↑ 476
IVA	621	6	13	0	↑ 4,677
MIMAROPA	8	0	0	0	↑
V	170	4	0	0	↑
VI	264	0	1	0	↑ 26,300
VII	176	0	4	0	↑ 4,300
VIII	23	1	0	0	↑
IX	331	1	360	4	↓8
X	297	1	6	0	↑ 4,850
XI	458	11	171	5	↑ 168
XII	476	4	21	1	↑ 2,167
ARMM	645	4	150	4	↑ 330
CAR	103	0	0	0	↑
CARAGA	84	1	4	0	↑ 2,000
NCR	1,094	19	9	1	↑ 12,056

Republic of the Philippines
Department of Health
Kagawaran ng Kalusugan

Epidemiology Bureau
Public Health Surveillance Division

Measles - Rubella Surveillance Report

as of February 10, 2019

Table 4. Measles Cases by Region, Philippines, 2018 vs 2019

Region	2018			2019			% Change
	Cases	Deaths	%CFR	Cases	Deaths	%CFR	
PHL	1935	18	1	4302	70	2	↑ 122
01	43	0	0	103	4	4	↑ 140
02	5	0	0	14	0	0	↑ 180
03	42	2	5	481	6	1	↑ 1045
04A	36	0	0	1086	25	2	↑ 2917
04B	4	0	0	131	1	1	↑ 3175
05	2	0	0	44	1	2	↑ 2100
06	21	0	0	212	3	1	↑ 910
07	4	0	0	109	2	2	↑ 2625
08	3	0	0	166	7	4	↑ 5433
09	345	0	0	30	0	0	↓ 91
10	124	0	0	189	2	1	↑ 52
11	357	9	3	87	1	1	↓ 76
12	141	1	1	113	0	0	↓ 20
ARMM	718	4	1	110	0	0	↓ 85
CAR	8	0	0	78	0	0	↑ 875
CARAGA	11	1	9	53	0	0	↑ 382
NCR	71	1	1	1296	18	1	↑ 1725

Definition of Terms

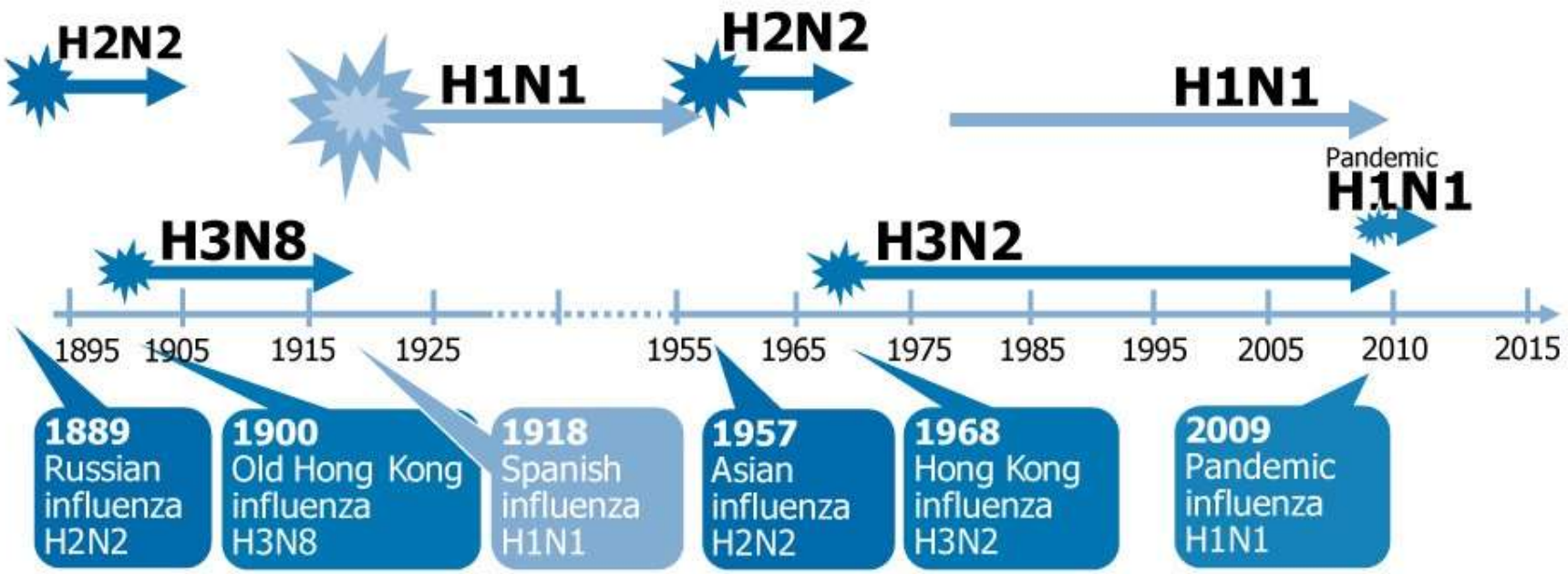
- **CLUSTER**
  - Refers to an aggregation of cases grouped in place and time that are suspected to be greater than the number expected
- **PANDEMIC**
  - Refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Human Pandemic Influenzas

FIGURE

Recorded human pandemic influenzas since 1885 (early sub-types inferred)



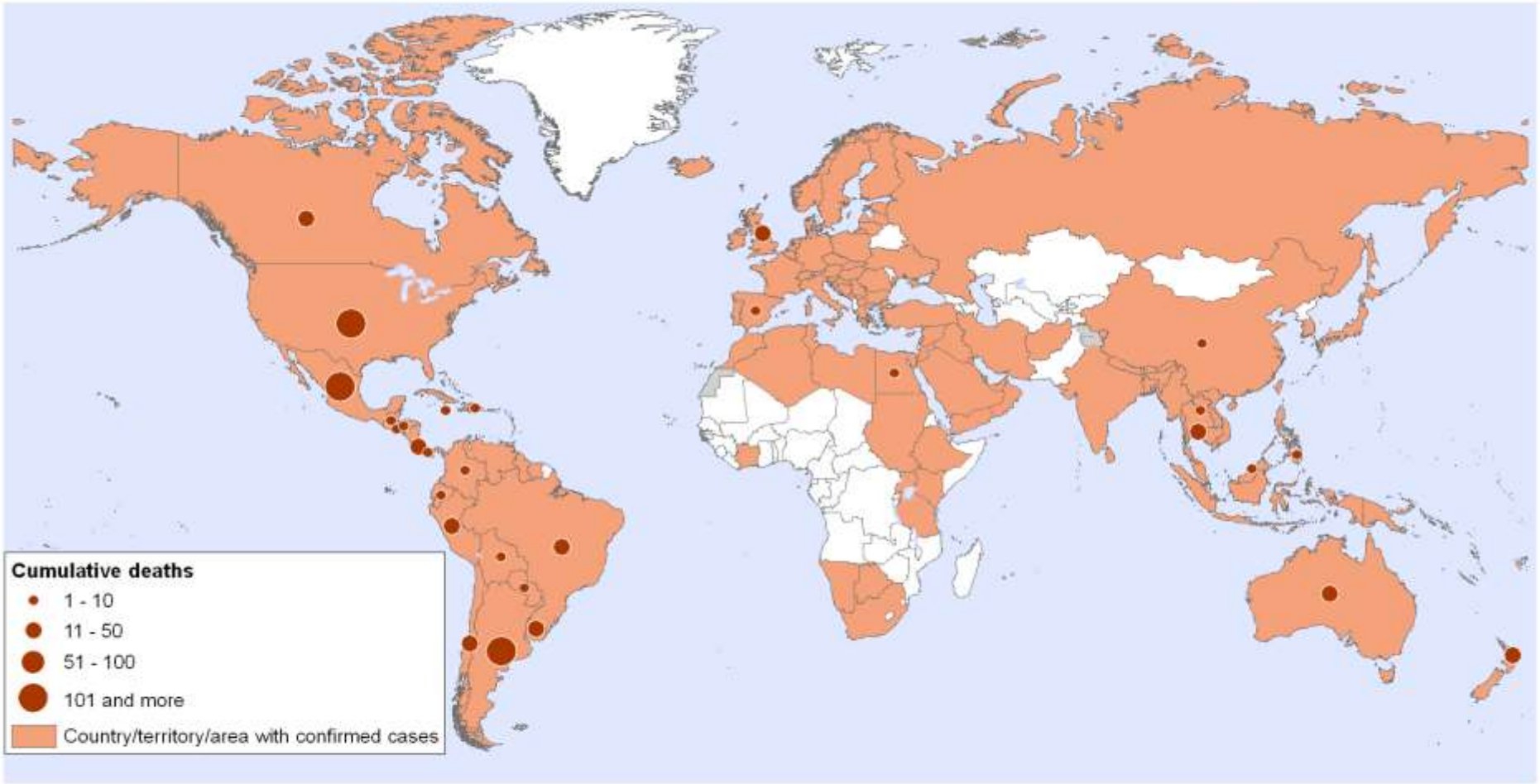
Source: European Centre for Disease Prevention and Control (ECDC) 2009

Reproduced and adapted (2009) with permission of Dr Masato Tashiro, Director, Center for Influenza Virus Research, National Institute of Infectious Diseases (NIID), Japan.

www.eurosurveillance.org

Pandemic (H1N1) 2009,
Countries, territories and areas with lab confirmed cases and number of deaths as reported to WHO

Status as of 22 July 2009



Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

World Health Organization

Map produced: 24 July 2009 10:00 GMT

Causes of Epidemics

- **A recent increase in amount or virulence of the agent**
  - *Meningococcal outbreak in Cordillera Administrative Region, Philippines (2004-2005)* → 98 cases (33% mortality)
  - Culprit of epidemic: hypervirulent strain of *Neisseria meningitidis serogroup A subtype A 1.9* sensitive to Penicillin

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Causes of Epidemics

- **The recent introduction of the agent into a setting where it has not been before**
  - e.g. In June 1981, the US CDC reports about cases of Pneumocystis carinii pneumonia in 5 young, white, previously healthy gay men in Los Angeles → marks the first official reporting of *AIDS epidemic caused by HIV-1*

https://www.hiv.gov/hiv-basics/overview/history/hiv-and-aids-timeline

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Causes of Epidemics

- **The recent introduction of the agent into a setting where it has not been before**
  - e.g. In November 2002, the first case of an atypical pneumonia is reported in the Guangdong province in Southern China.
  - In March 2003, Dr. Carlo Urbani reports an unusual outbreak of the illness in Hanoi, Vietnam to the WHO → issues a global alert of SARS

https://www.webmd.com/lung/news/20030411/sars-timeline-of-outbreak

Causes of Epidemics

- **An enhanced mode of transmission so that more susceptible persons are exposed**
  - e.g. West African epidemic of *Ebola virus* in 2014 → transmission through close and direct physical contact with infected bodily fluids (blood, feces, vomit); also detected in breast milk, urine and semen; indirect contact with previously contaminated surfaces and objects

https://www.who.int/mediacentre/news/ebola/06-october-2014/en/

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Causes of Epidemics

- **A change in the susceptibility of the host response to the agent**
  - e.g. H1N1 Influenza pandemic (2009) - human hosts had no pre-existing immunity to new virus
  - e.g. Measles outbreak in Philippines (2019) - low vaccination coverage → increased pool of susceptible individuals

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Republic of the Philippines
Department of Health
Kagawaran ng Kalusugan

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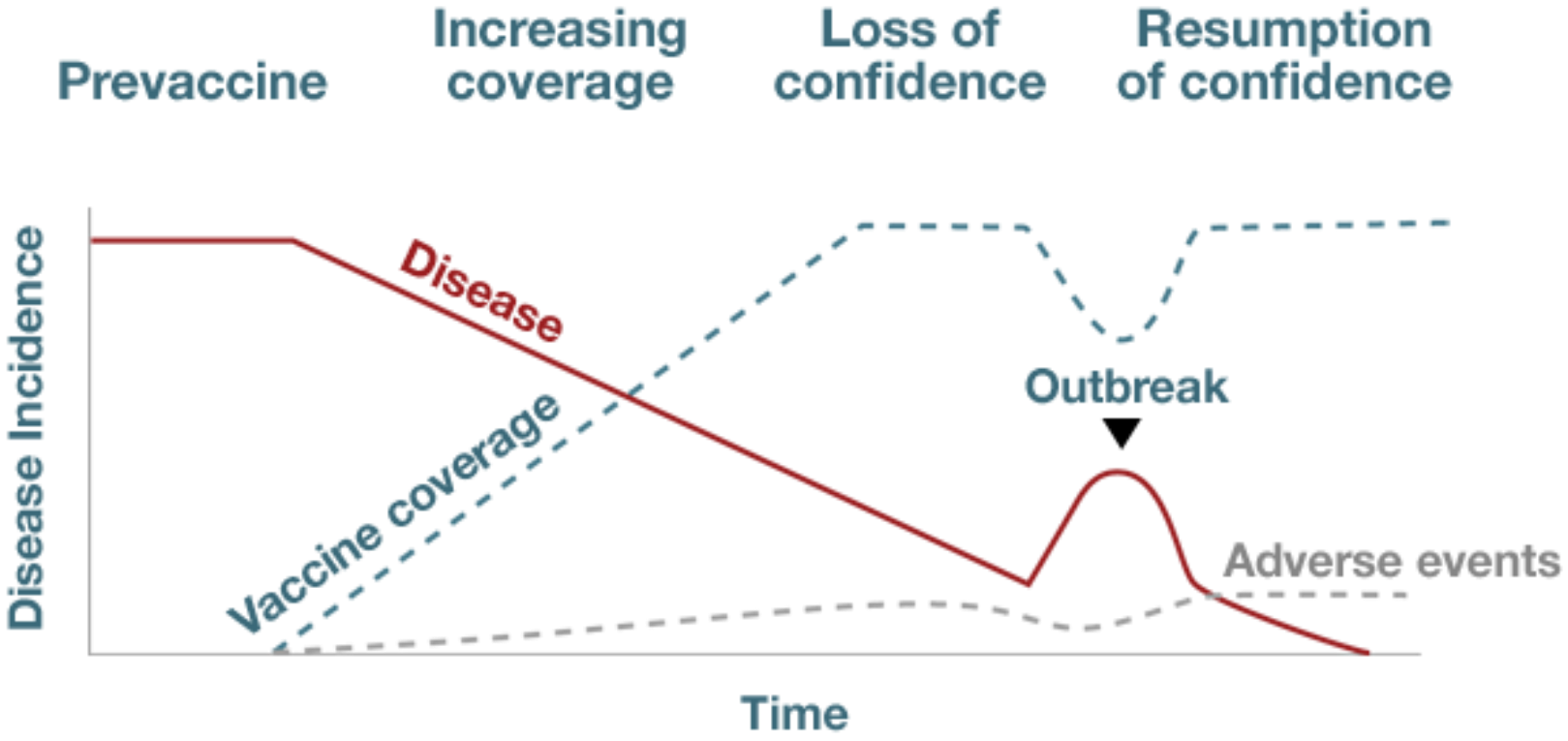
Measles - Rubella Surveillance Report

as of February 10, 2019

Profile of Measles Cases	n= 4,302	
Age: <1 mo to 76 yrs (median: 2 yrs)		
Most affected age group		
- 1-4 yrs.	1460	34%
- less than 9 mos.	1146	27%
Sex: Female	2011	47%
Male	2291	53%
Vaccination Status		
Not vaccinated	2859	66%
1 dose	105	2%
2 or more doses	26	1%
Unknown no. of doses	685	16%
Unknown vaccination status	627	15%
Outcome		
Alive	4232	98%
Died	70	2%

Profile of Measles Deaths	n = 70	
Age: <1 mo to 31 yrs (median: 1 yr)		
Most affected age group		
- 1-4 yrs.	34	49%
- less than 9 mos.	25	36%
Sex: Female	28	40%
Male	42	60%
Vaccination Status		
Not vaccinated	55	79%
1 dose	3	4%
2 or more doses	1	1%
Unknown no. of doses	3	4%
Unknown vaccination status	8	11%

Natural History of Vaccination Programs



Adapted from: Chen RT, et al. *Pediatr Ann*. 1998;277:445-455.

Causes of Epidemics

- **Factors that increase host exposure or involve introduction through new portals of entry**
  - e.g. Outbreak of serogroup W-135 meningococcal disease during the 2000 Hajj in Saudi Arabia

Serogroup W-135 Meningococcal Disease during the Hajj, 2000. Jairam R. Lingaooa, et al. Emerg Infec Dis, 2003 June; 9 (6): 665-671

Epidemic Patterns

- Classified according to their manner of spread through a population:

    1. Common-source
    2. Propagated
    3. Mixed
    4. Other

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Common-source Epidemic

- Occurs when a group of persons are all exposed to an infectious agent or a toxin from the same source
- Examples:
  - Cholera - traced to fecal contamination of food and water
  - Anthrax - traced to milk or meat from infected animals

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Common-source Epidemic

- Classified further into:
  - Point-source
  - Continuous
  - Intermittent

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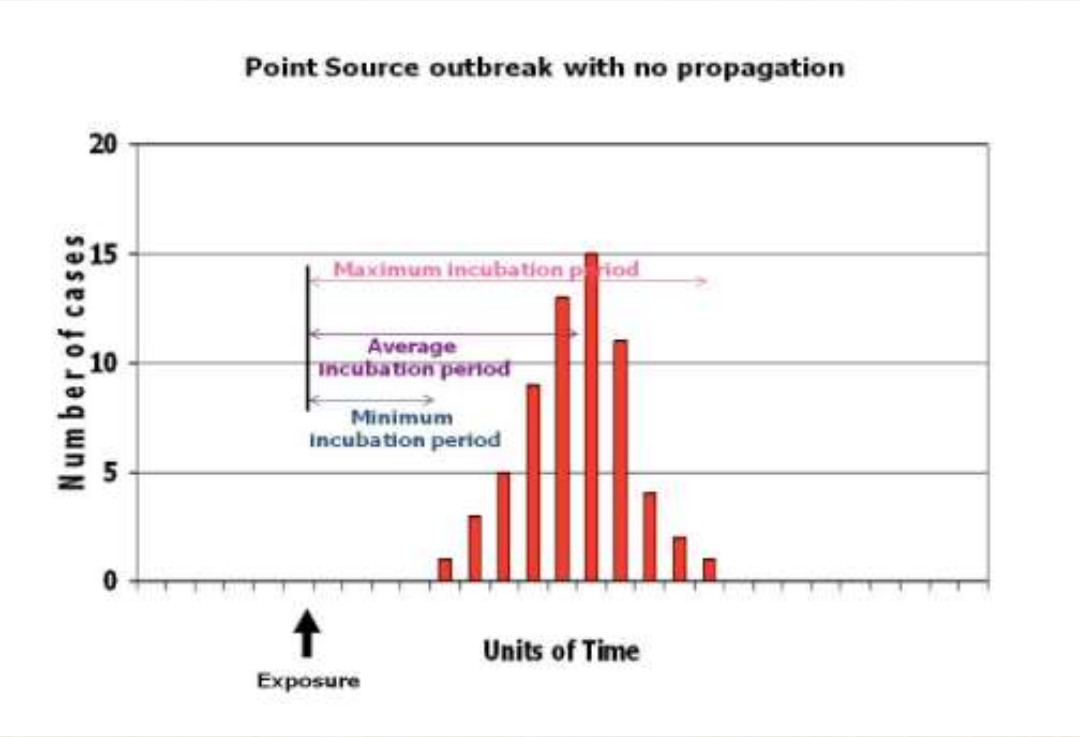
Point-source Outbreak

- Exposure of a group over a relatively brief period, so that everyone who becomes ill does so within one incubation period

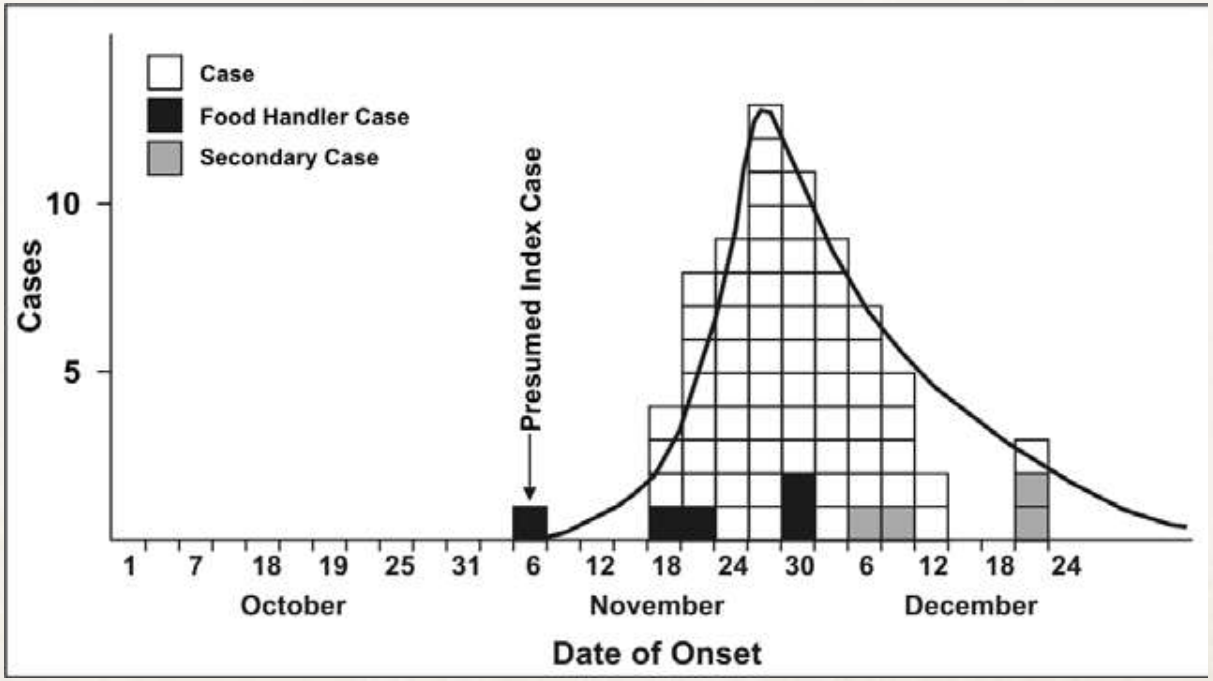


http://www.med.uottawa.ca/sim/data/Public_Health_Epidemic_Curves_e.htm

Point-source Outbreak

- Cases arise from a single, shared or “common” source, such as contaminated food or water supply

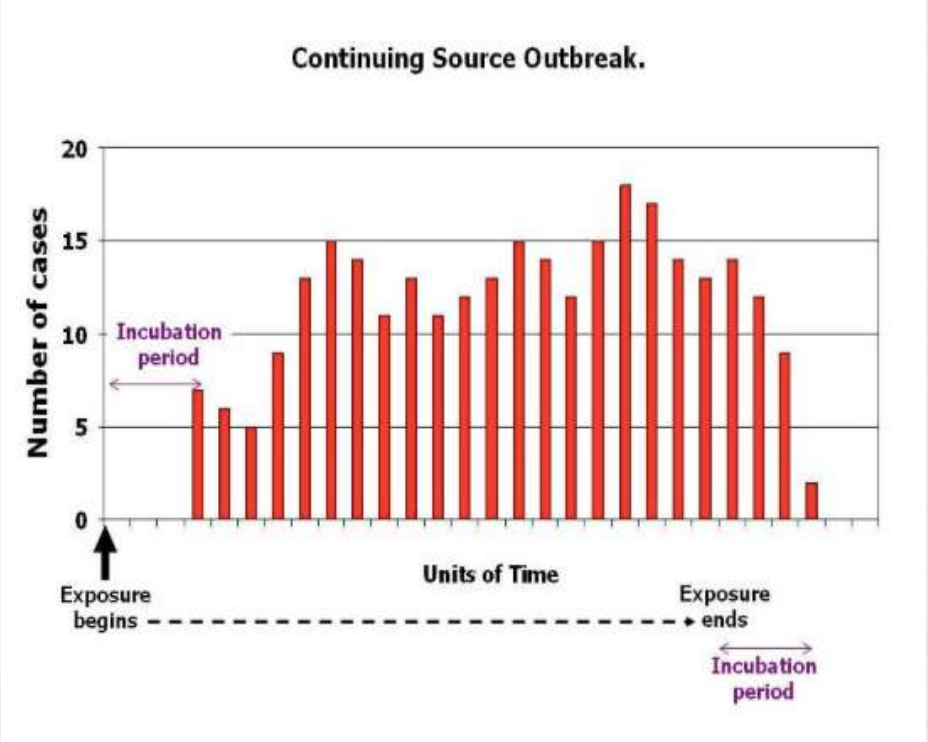
Hepatitis A Cases by Date of Onset, November–December, 1978



Source: Centers for Disease Control and Prevention. Unpublished data; 1979.

Continuous Common-source Outbreak

- Exposure of case-patients to a single noxious influence over a period of days, weeks, or longer
- Outbreak begins abruptly suggesting that many people were exposed simultaneously

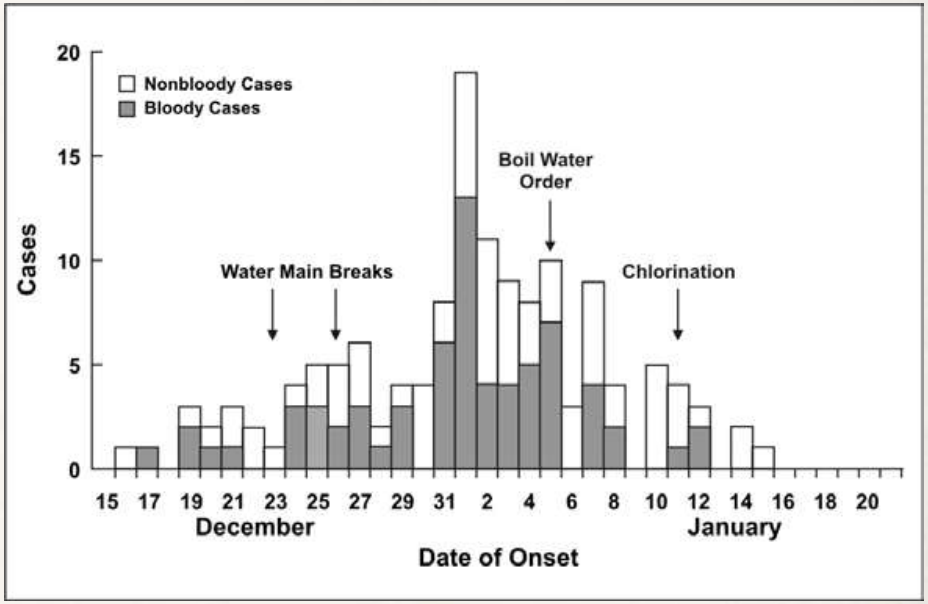


http://www.med.uottawa.ca/sim/data/Public_Health_Epidemic_Curves_e.htm

Continuous Common-source Outbreak

- The range of exposures and range of incubation periods tend to flatten and widen the peaks of the epidemic curve

Diarrheal Illness in City Residents by Date of Onset and Character of Stool, December 1989–January 1990

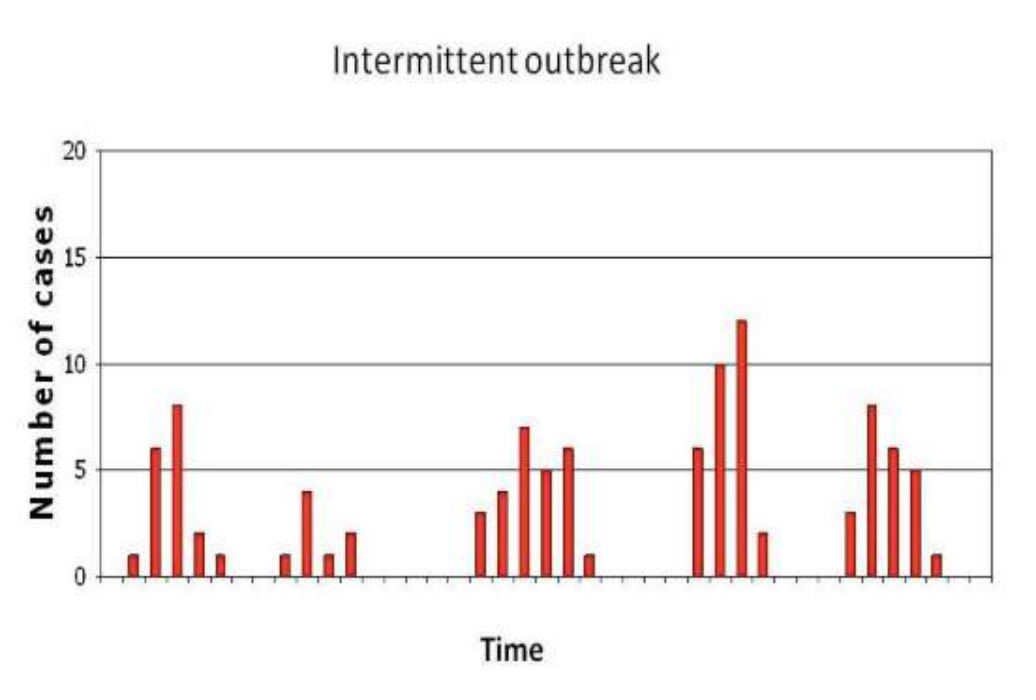


Source: Centers for Disease Control and Prevention. Unpublished data; 1990.

Intermittent Common-source Outbreak

- Epidemic curve has a pattern reflecting the intermittent nature of the exposure

- Outbreaks could be seasonal or due to a common source being emitted at intervals



http://www.med.uottawa.ca/sim/data/Public_Health_Epidemic_Curves_e.htm

Propagated Epidemic

- Results from transmission from one person to another usually by direct person-to-person contact
- May also be vehicle-borne (e.g. Hepatitis B or HIV transmission by sharing needles), or vector-borne transmission (transmission of yellow fever by mosquitoes)

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

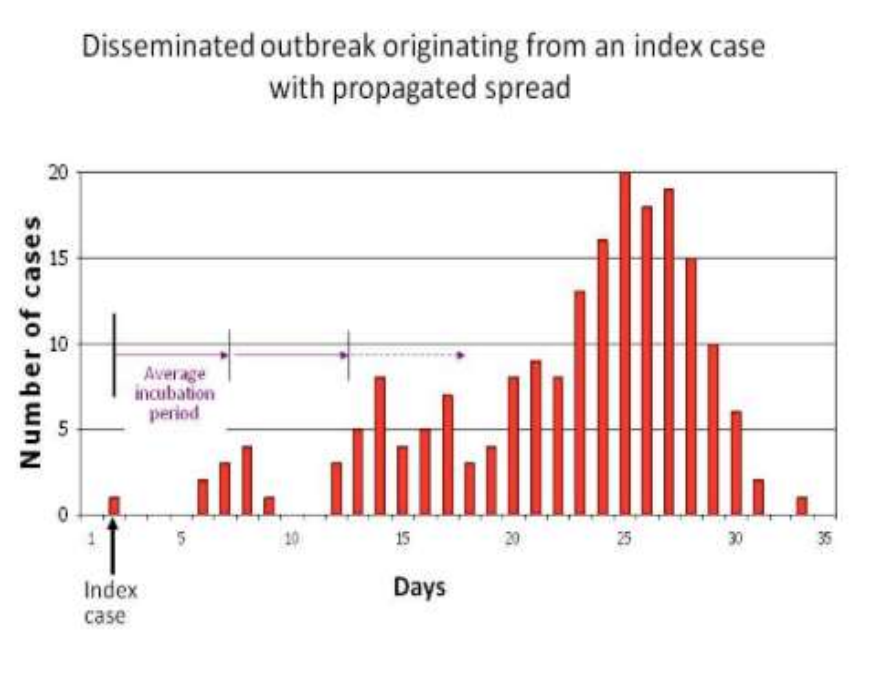
Propagated Epidemic

- Begins like an infection from an index case but then develops into a full-blown epidemic with secondary cases infecting new people who, in turn, serve as sources for yet other cases
- Cases occur over more than one incubation period

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

Propagated Epidemic

- The epidemic continues until the remaining numbers of susceptible individuals declines or until intervention measures take effect



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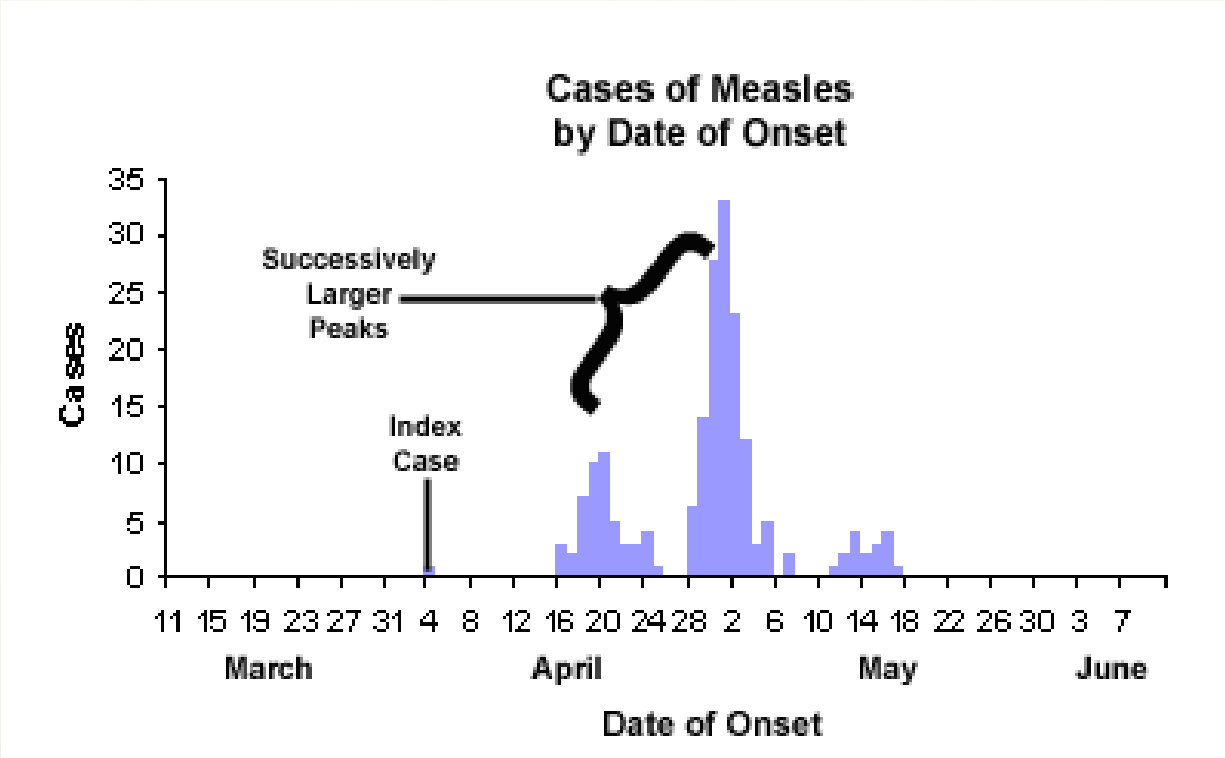
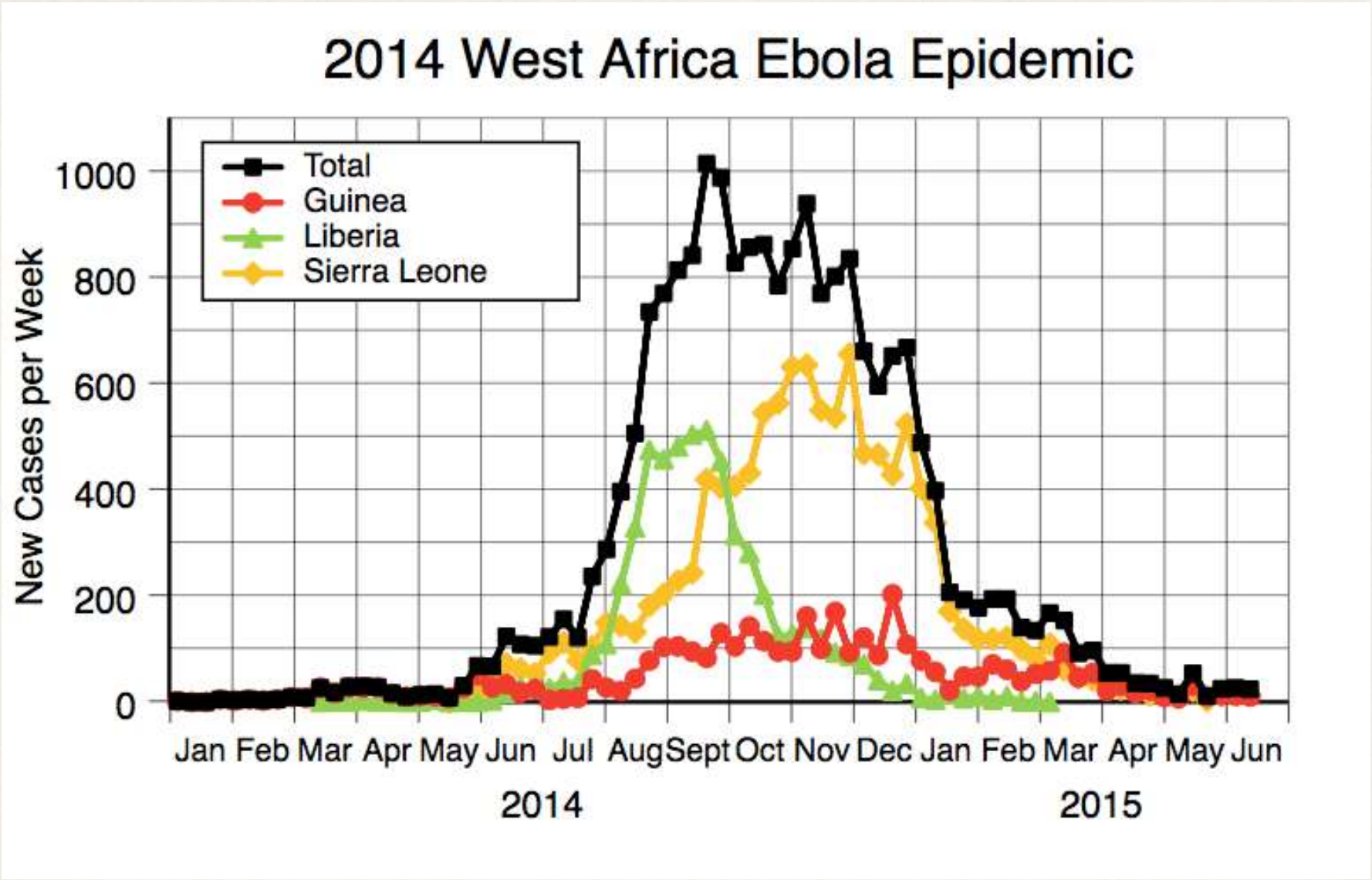
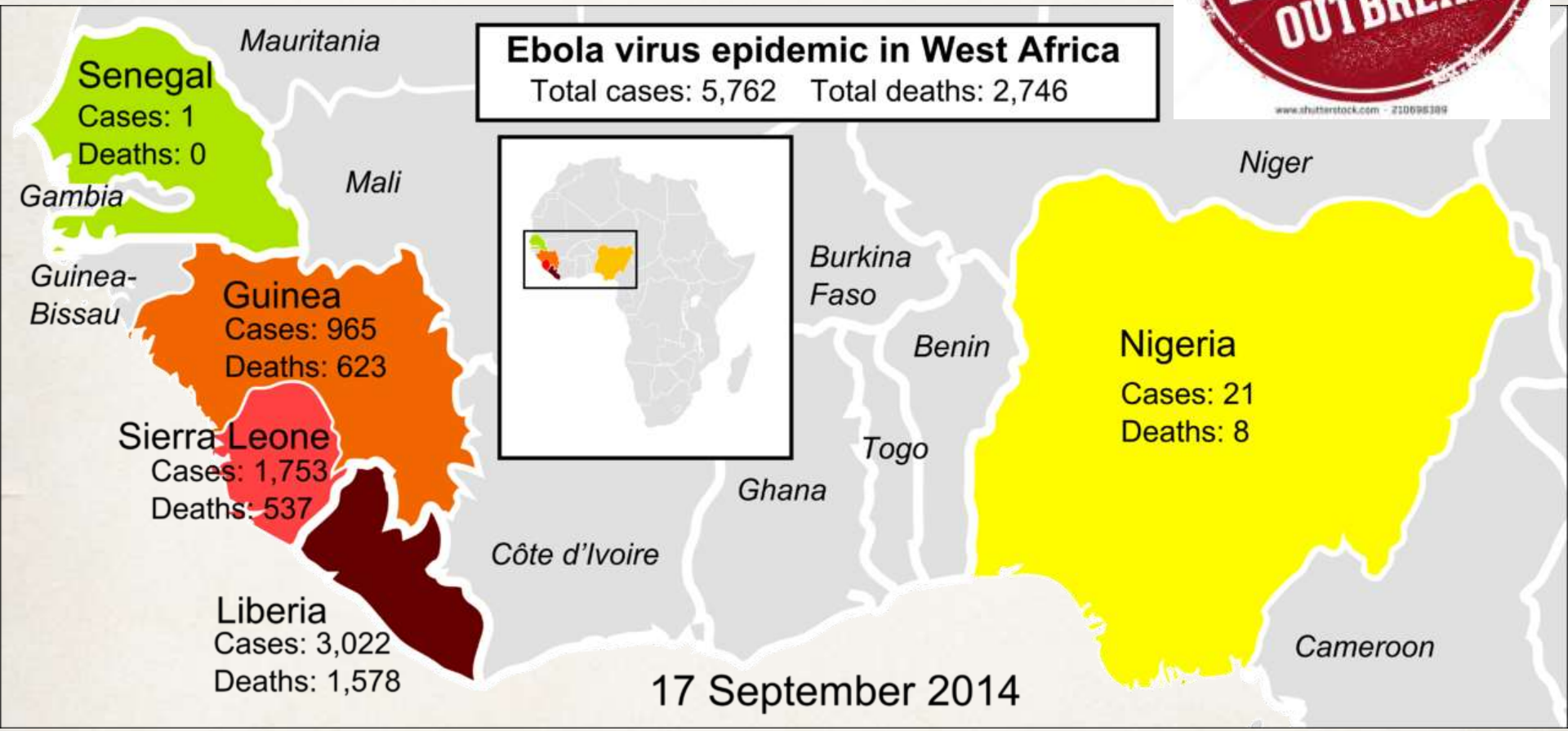
Propagated Epidemic



Source: Centers for Disease Control and Prevention. Measles outbreak—Aberdeen, S.D.



http://www.certifiedmedicaleducators.com/wp-content/uploads/2014/09/2014_Ebola_virus_epidemic_in_West_Africa.png

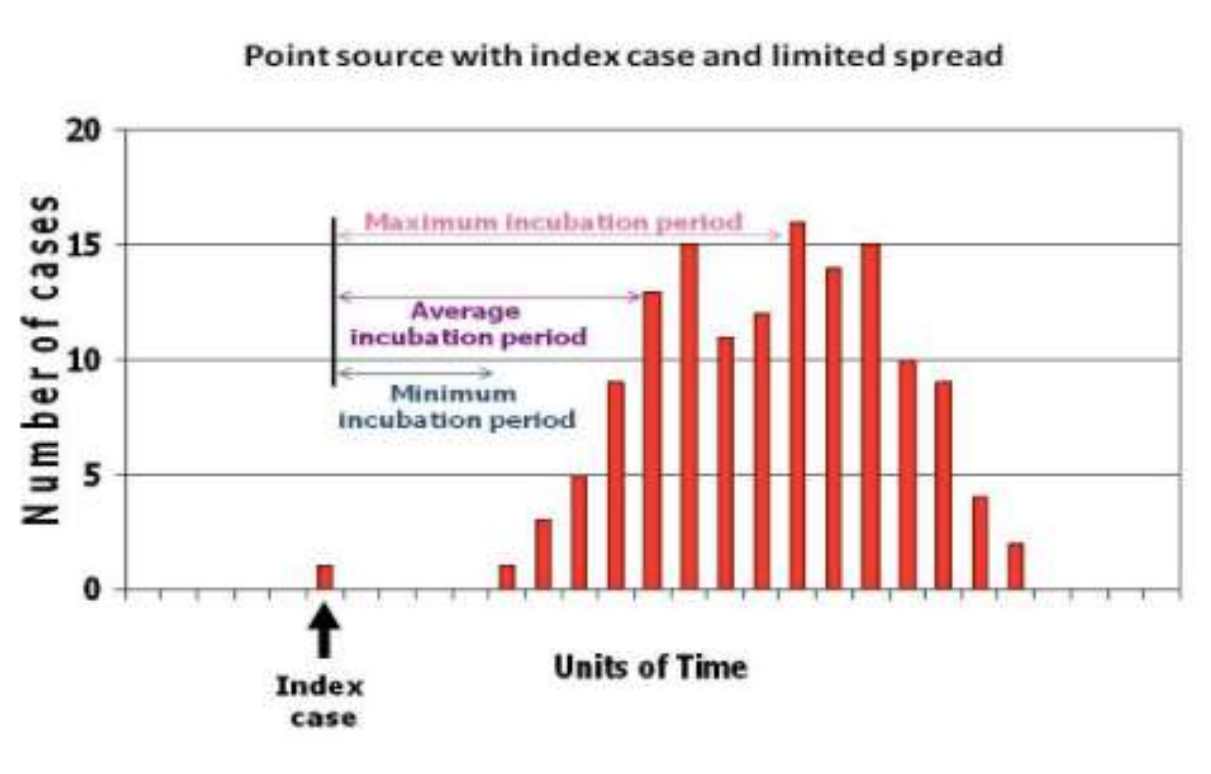


http://www.certifiedmedicaleducators.com/wp-content/uploads/2014/09/2014_Ebola_virus_epidemic_in_West_Africa.png

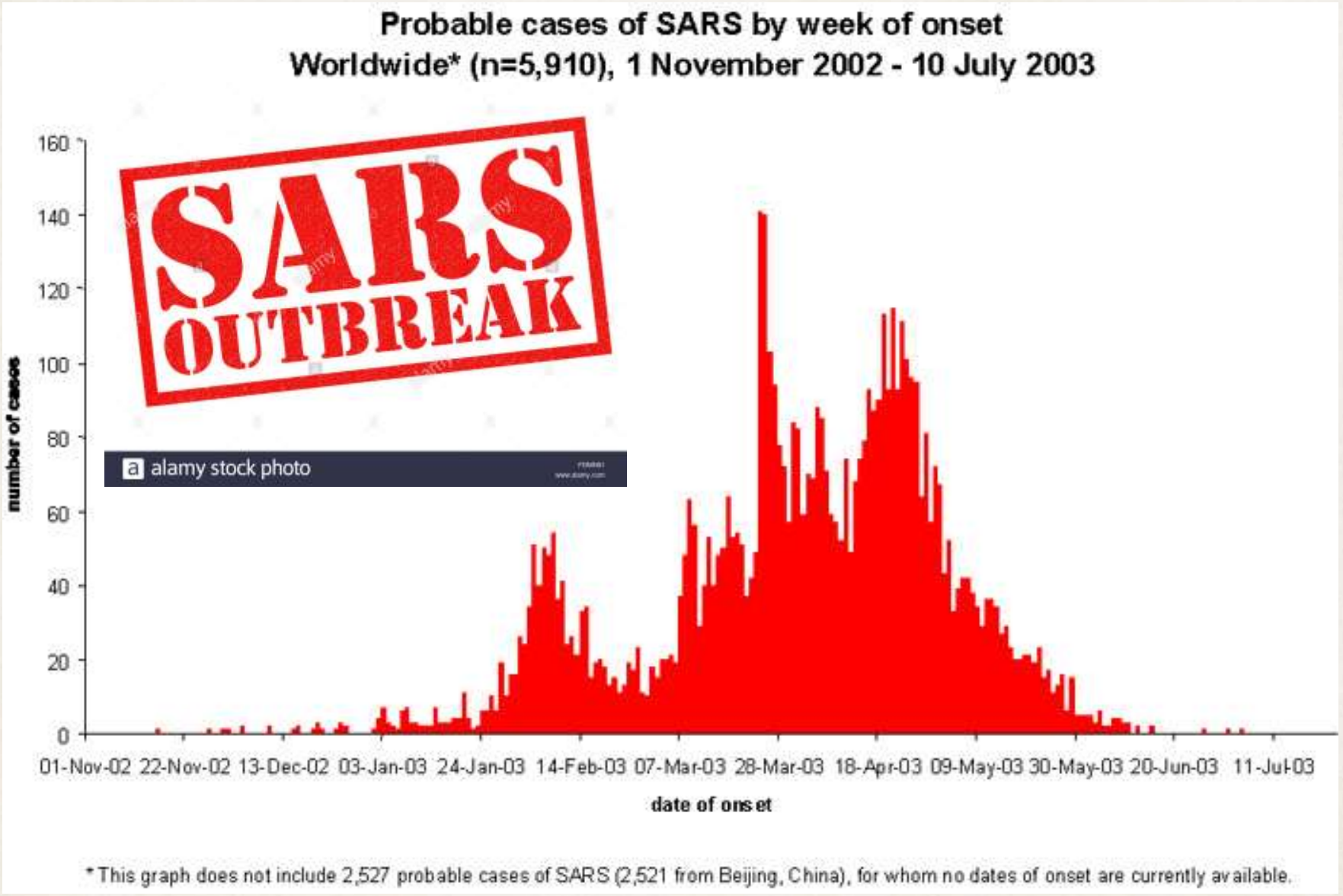
Mixed Epidemic

- Epidemics with patterns of a common-source outbreak followed by secondary person-to-person spread
- A single “index” case (e.g. a returning traveller) infects other people, and cases arise after an incubation period

- Outbreak wanes when the infected people no longer transmit the infection to other susceptible people, because of successful control measures (isolation or quarantine)

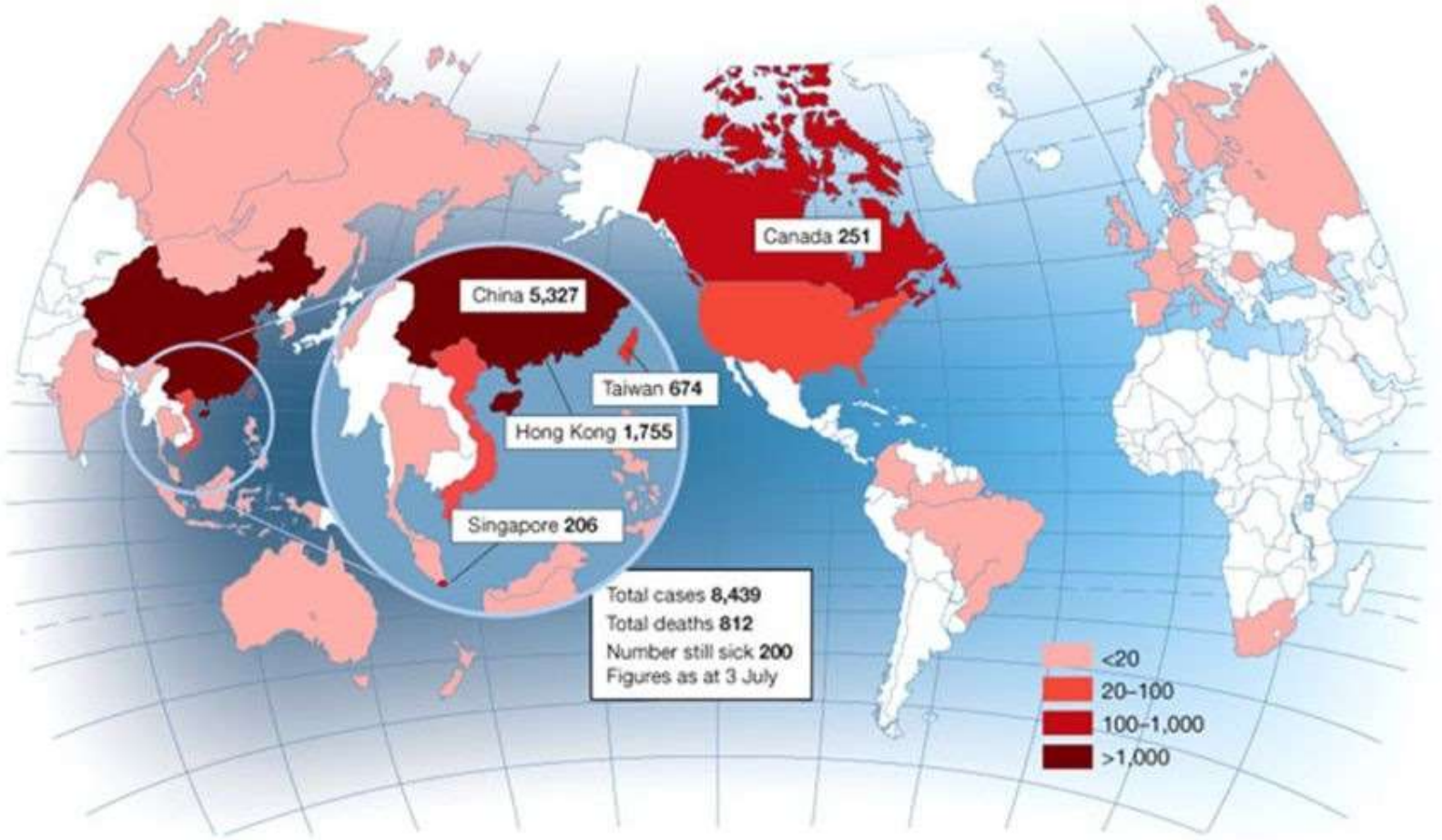


http://www.med.uottawa.ca/sim/data/Public_Health_Epidemic_Curves_e.htm



https://www.who.int/csr/sars/epicurve/epiindex/en/index6.html

SARS Worldwide



Pattern of an Epidemic [Map]. **Retrieved:** June 13, 2012, **from:** http://www.nature.com/nature/focus/sars/images/outbreak.jpg

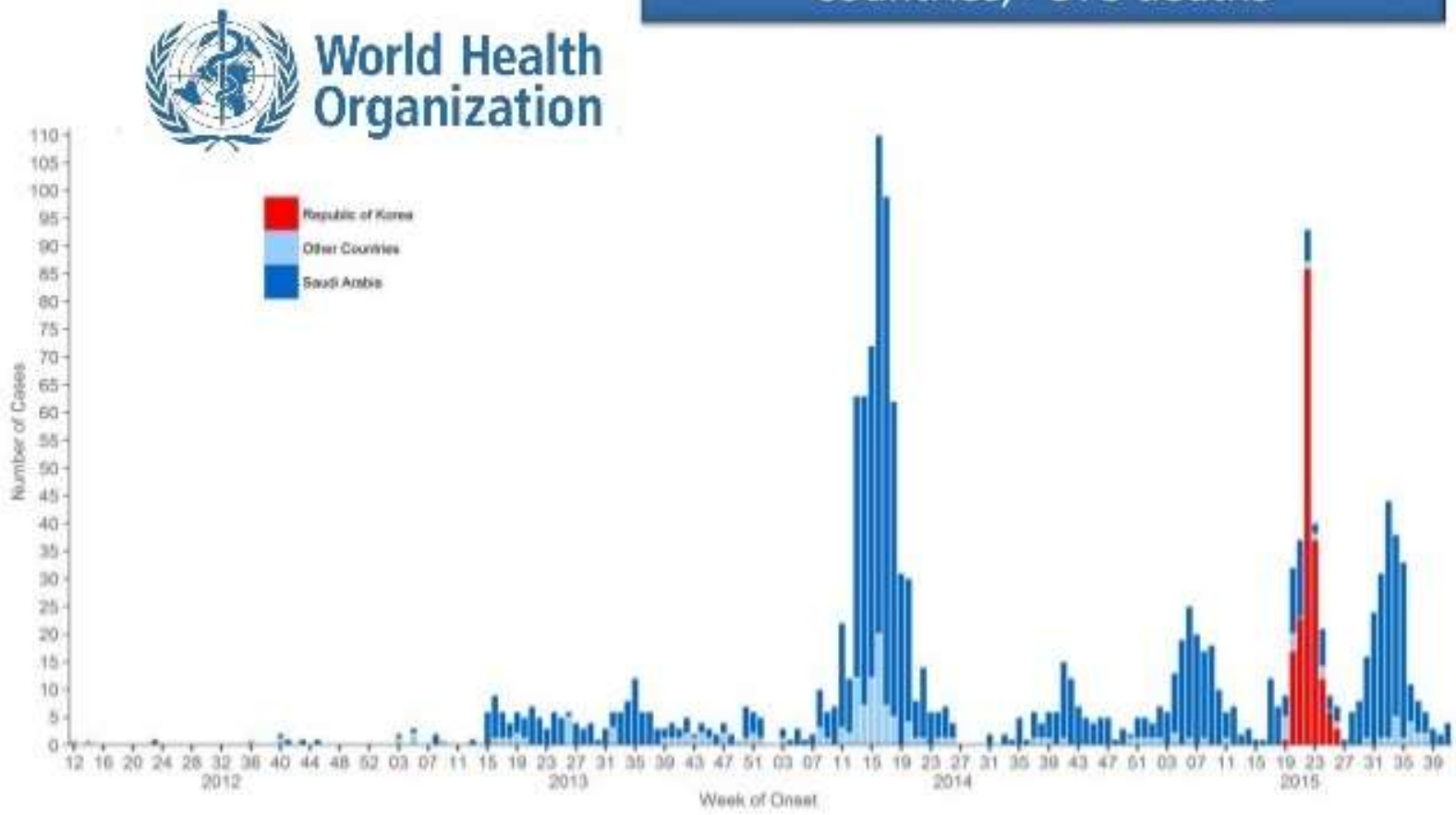
Other Epidemic Patterns

- Epidemics that are neither common-source in its usual sense nor propagated from person-to-person
- Outbreaks of zoonotic or vector-borne disease resulting from sufficient prevalence of infection in host species, sufficient presence of vectors, and sufficient human-vector interaction

CDC Principles of Epidemiology in Public Health Practice, 3rd ed., May 2012

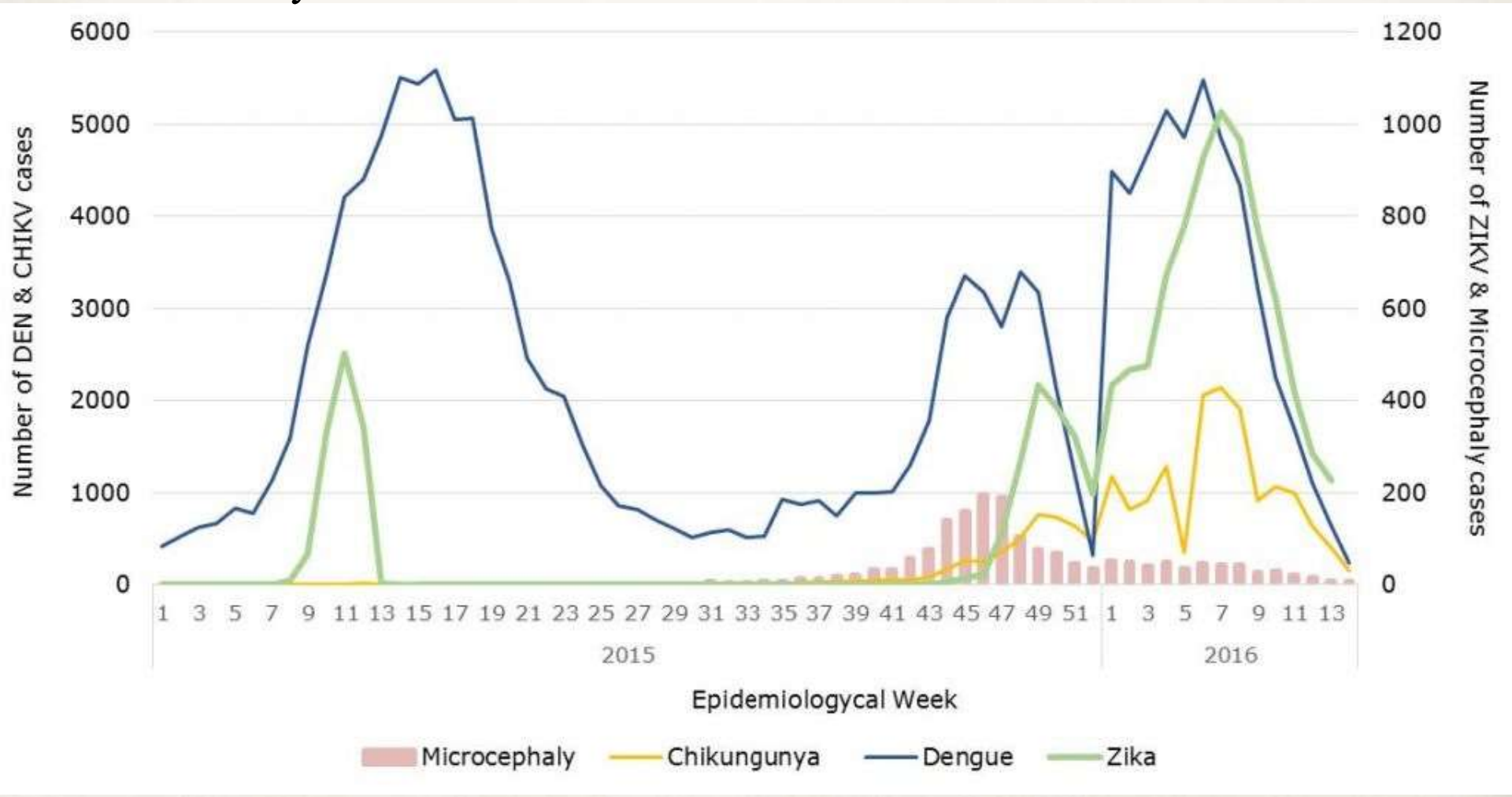
MERS-CoV: What we know

>1611 cases reported from 26 countries, >575 deaths



https://image.slidesharecdn.com/plenaryevankerkhovemers-covescaide2015-151204144146-lva1-app6891/95/merscov-extent-of-infection-in-and-transmission-to-humans-dr-maria-van-kerkhove-2-638.jpg?cb=1449240863

Weekly reported cases of Zika virus (green), dengue virus (blue), chikungunya virus (yellow) and microcephaly pick) in Pernambuco State, Brazil from 2015-2016. Chart by the Pan American Health Organization; data by Pernambuco State Secretary of Health



https://www.pbs.org/newshour/science/how-many-zika-infected-infants-will-develop-microcephaly-and-other-faqs

Impact of Epidemics and Endemic Diseases

Direct Effects

- Death
- Disabilities and human suffering
- Disease carriers who may cause resurgence and spread of disease

Deadliest Epidemics of 21st Century

- **2016 Yellow Fever Outbreak in Angola** (Dec 2015-January 2016) - hundreds of deaths reported in Angola and Congo
- **2013 West African Ebola Virus Epidemic** (2013-2016) in Liberia, Sierra Leone and Guinea - about 3,000 deaths (CFR > 70%) and major socioeconomic losses

www.worldatlas.com/articles/the-deadliest epidemics of the 21st century so far

Deadliest Epidemics of 21st Century

- **2009 H1N1 Influenza Pandemic -** spread from Mexico to the US, parts of Asia and Africa resulting to about 18,000 deaths (global estimates: 151,700 - 575,400), 80% of whom were younger than 65 years of age

- **2010 Haitian Cholera Outbreak** - possible source was contamination resulting from infected Nepalese UN peacekeepers deployed in Haiti resulting to 9985 deaths by March 2017

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Deadliest Epidemics of 21st Century

- **2002 SARS Outbreak -** started in China resulting to 8,439 cases (between November 2002 and July 2003) with 812 deaths in 37 countries
- **2011 Dengue Fever Outbreak in Pakistan** - more than 21,204 people infected and over 300 deaths

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Deadliest Epidemics of 21st Century

- **2009 West African Meningitis Outbreak -** occurred in Nigeria, Niger, Burkina Faso and Mali; 13,516 individuals infected and 931 deaths

- **2016 Yemen Cholera Outbreak** - as of July 2017, 269,608 cases reported with 1,614 recorded deaths; the war situation is one of the biggest factors responsible for disease outbreak

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Deadliest Epidemics of 21st Century

- **2012 Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Outbreak -** first reported in Saudi Arabia then spread to 26 countries with > 1611 cases and > 575 deaths

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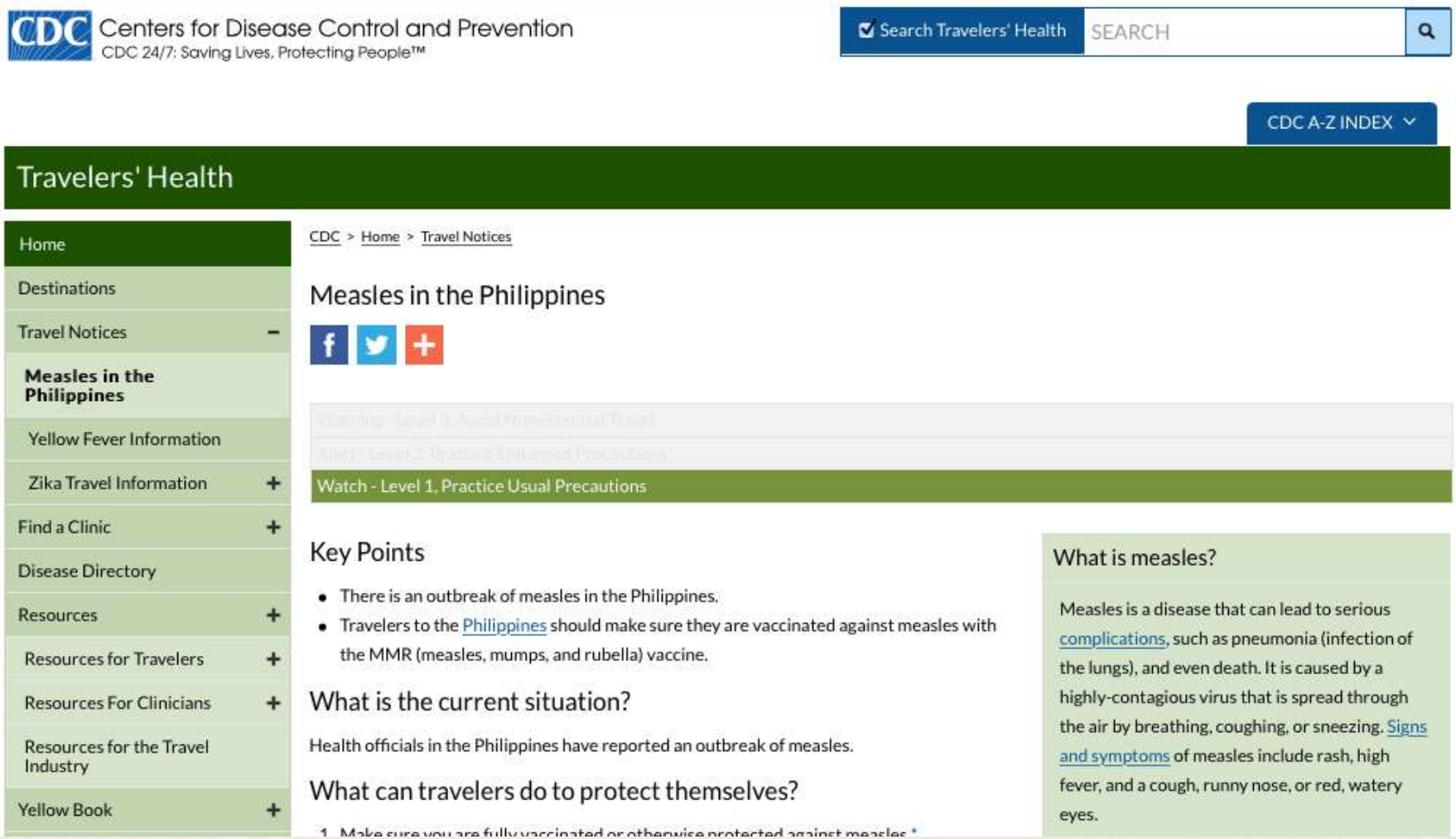
Indirect Effects

- **Psychological effects on population**
  - Fear, panic, anxiety, depression
- **Social and political disruption**
  - Disrupt social and economic structures
  - Impede development in affected communities

Indirect Effects

- **Economic loss**
  - Loss of income
    - MERS-CoV epidemic in 2015 cost South Korea 10 billion dollars
  - Travel restrictions/Adverse effects on tourism
    - Cholera outbreak in Peru in 1991 - loss of US$ 770 million due to food trade embargoes and impact on tourism

CDC Advisory for Travel to the Philippines



Measles **anywhere** is a threat **everywhere.**

Since measles is still common in many countries, **unvaccinated travelers** will continue to **bring the disease into the U.S.**, and it can spread to other people.

Get Vaccinated: Prevent and Stop Measles Outbreaks

Make sure you and your family members are up to date on your **measles-mumps-rubella (MMR) vaccine**, including before traveling internationally. Ask your doctor if everyone has received all recommended doses of MMR for best protection against measles.

www.cdc.gov/Features/MeaslesInternationalTravel/

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Indirect Effects

- Scarcity of clean food and water leading to malnutrition and starvation
- Worsening of already poor sanitary conditions resulting in aggravation of epidemics

Indirect Effects

- Worsening of the already overburdened health services, as the available resources have to be diverted for control and management of epidemics
  - Bill Gates: *"Preparing to respond to a global pandemic would cost $3.4 billion a year. The potential cost of one if the world is unprepared could be $570 billion".*

SUMMARY

- Outbreaks of emerging and re-emerging infectious diseases continue to occur globally and locally
- Endemic and epidemic diseases have significant direct and indirect effects on the individual and the community
- In order to win this “infinity war”, we need to draw on lessons learned and experiences gained in battling past epidemics

“What is my role?”