Dominik Mertz, MD, MSc

Medical Director Infection Prevention and Control,
Hamilton Health Sciences

Assistant Professor, Department of Medicine, and Clinical Epidemiology and Biostatistics, McMaster University

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Inspiring Innovation and Discovery

Gathering Evidence...Solving the Case...

Tools to Identify, Contain and Prevent Outbreaks in Acute Care, Long-term Care and the Community...

CHEDOKE · CHILDREN'S · GENERAL · JURAVINSKI · McMASTER · ST. PETER'S

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Tools to revent

Outbre Care

In 30 minutes???

Objectives

1) What is an outbreak?
2) How to identify an outbreak?
3) Outbreak investigations
4) How to prevent outbreaks?

Objectives

1) **What is an outbreak?**
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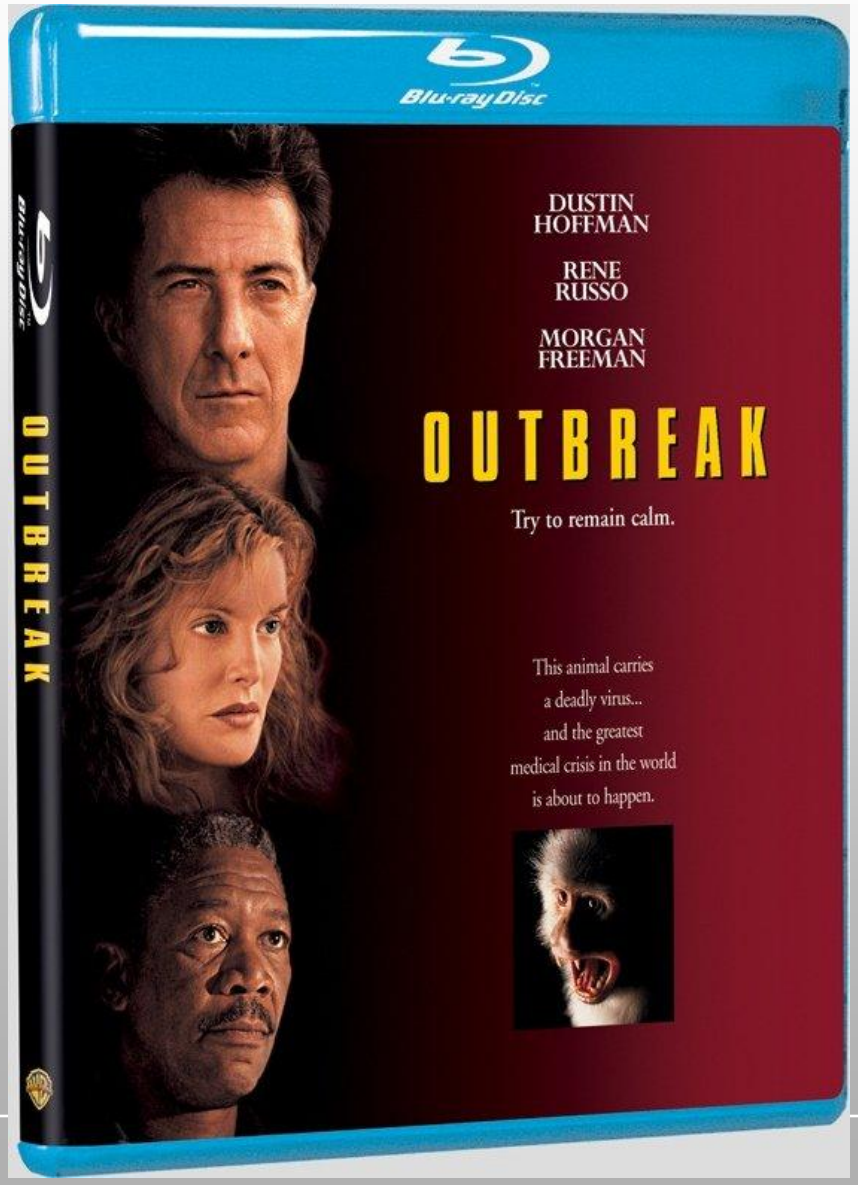
Outbreak definition



Outbreak definition

out·break
/ˈout ˌbrāk/

Noun
The sudden or violent start of something unwelcome, such as war, disease, etc.

Synonyms
outburst - explosion - eruption - burst

More info - Wikipedia - Dictionary.com - Answers.com - Merriam-Webster

Dr. Google

Outbreak

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From Wikipedia, the free encyclopedia

For other uses, see Outbreak (disambiguation).

Outbreak is a term used in epidemiology to describe an occurrence of disease greater than would otherwise be expected at a particular time and place. It may affect a small and localized group or impact upon thousands of people across an entire continent. Two linked cases of a rare infectious disease may be sufficient to constitute an outbreak. Outbreaks may also refer to epidemics, which affect a region in a country or a group of countries, or pandemics, which describe global disease outbreaks.

What is an outbreak?

According to the CDC, an "outbreak" is the occurrence of more cases of disease than normally expected within a specific place or group of people over a given period of time.

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A disease outbreak is the occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season. An outbreak may occur in a restricted geographical area, or may extend over several countries. It may last for a few days or weeks, or for several years.

A single case of a communicable disease long absent from a population, or caused by an agent (e.g. bacterium or virus) not previously recognized in that community or area, or the emergence of a previously unknown disease, may also constitute an outbreak and should be reported and investigated.

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- Current number of cases/incidence
- Baseline rate of disease
- Consistent case finding methods and definitions

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We need to know:

- Current number of cases/incidence
- Baseline rate of disease
- Consistent case finding methods and definitions

AND:

Is there a statistical significant excess above baseline?

GREATER

THAN EXPECTED

TIME/PLACE/POPULATION

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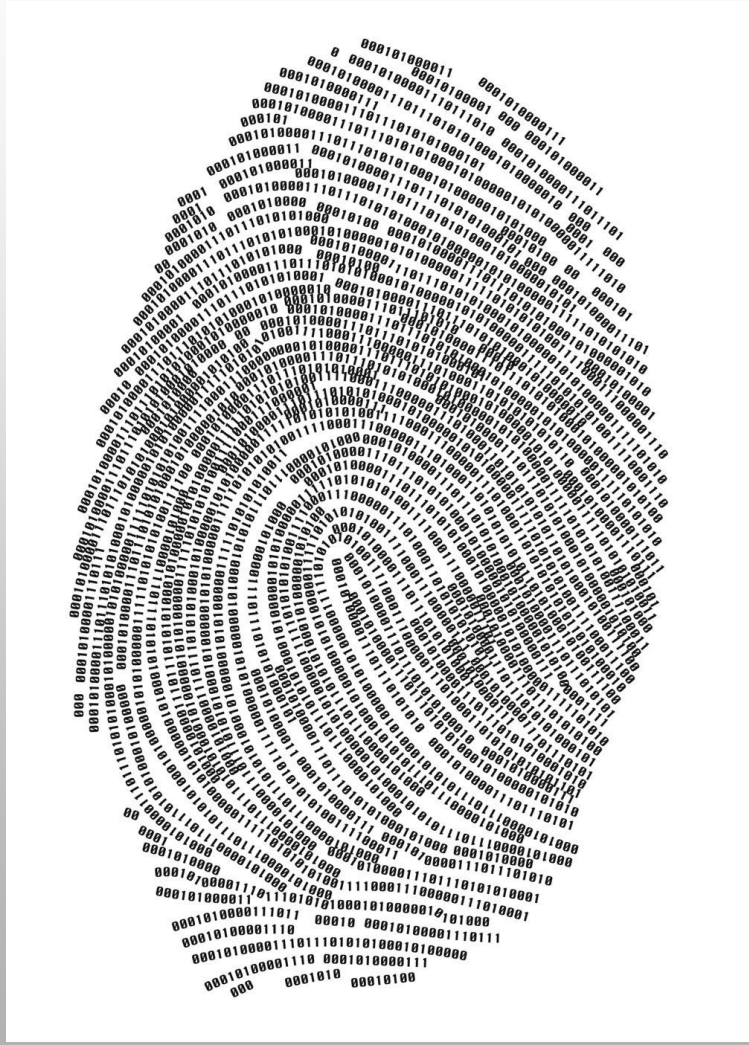
Tools

a) Epidemic curve

b) Control Charts

c) Formal statistical tests



Epidemic curve

a) **Epidemic curve**

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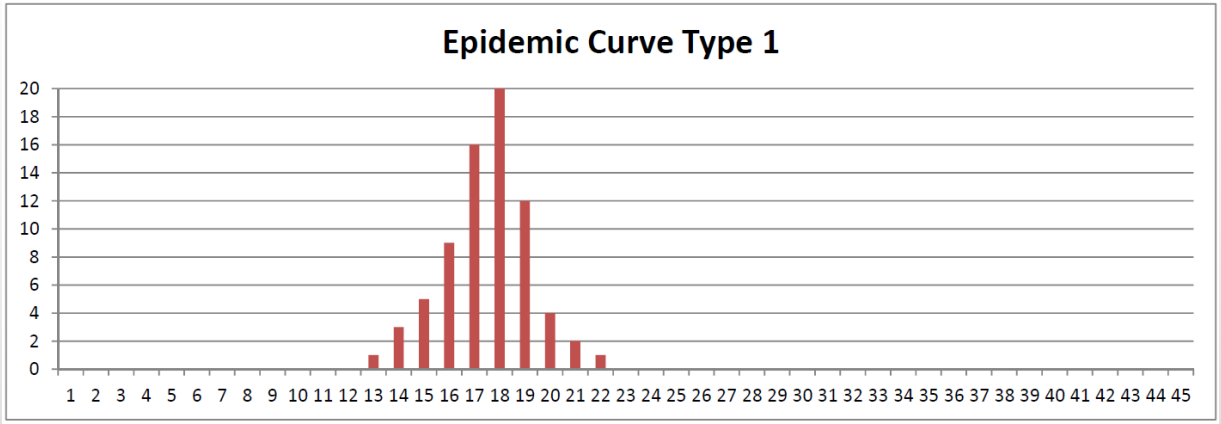

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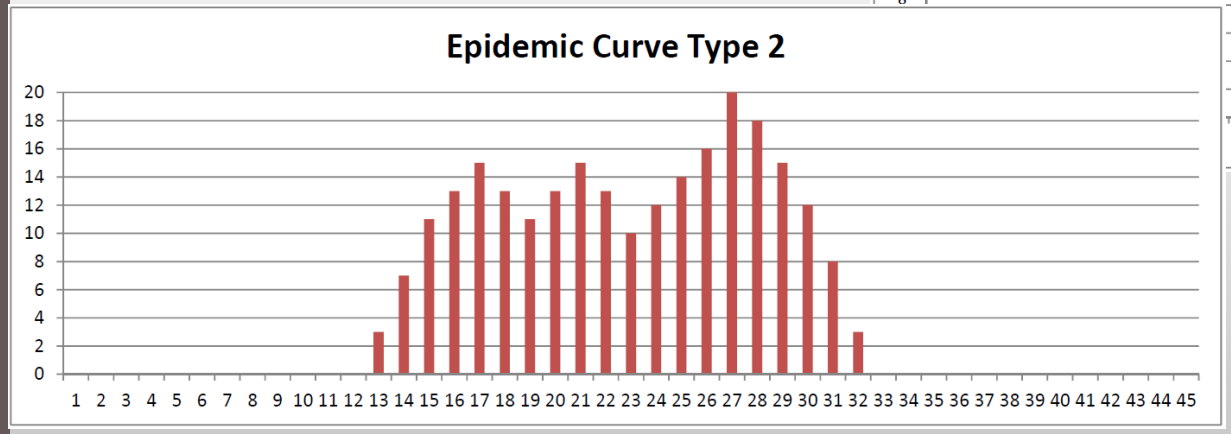

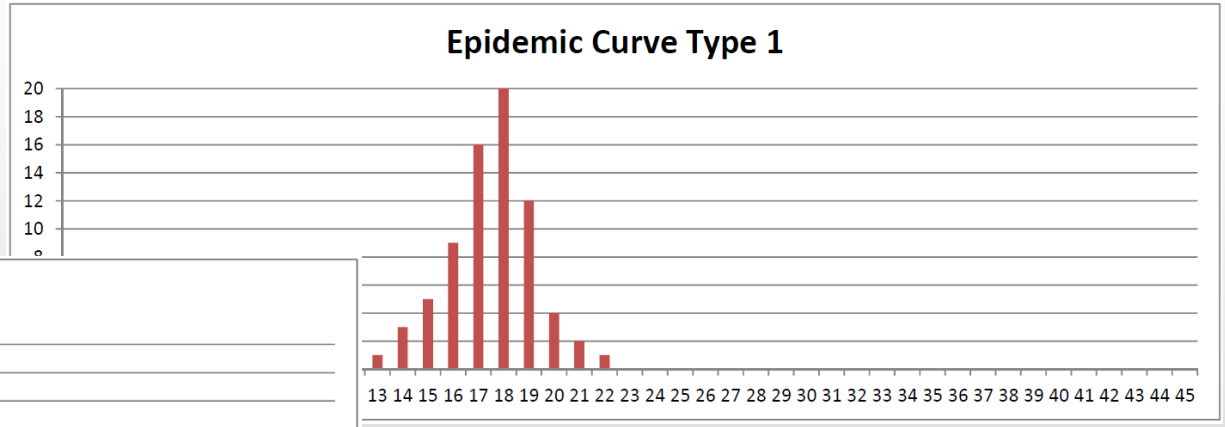

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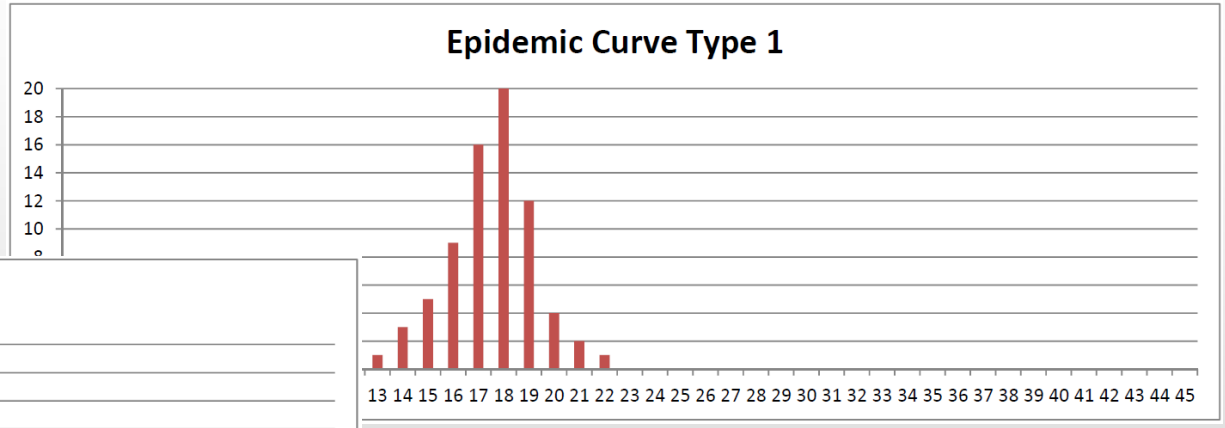
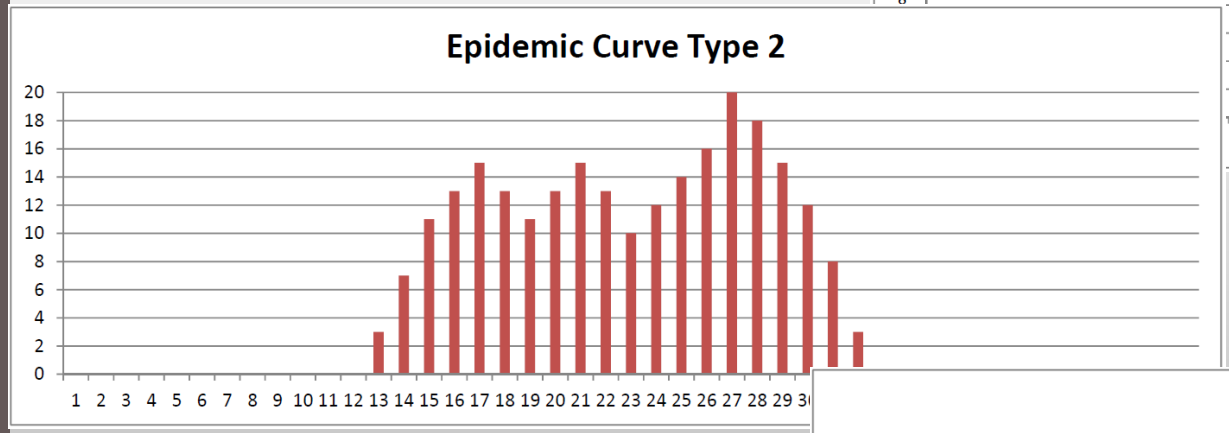
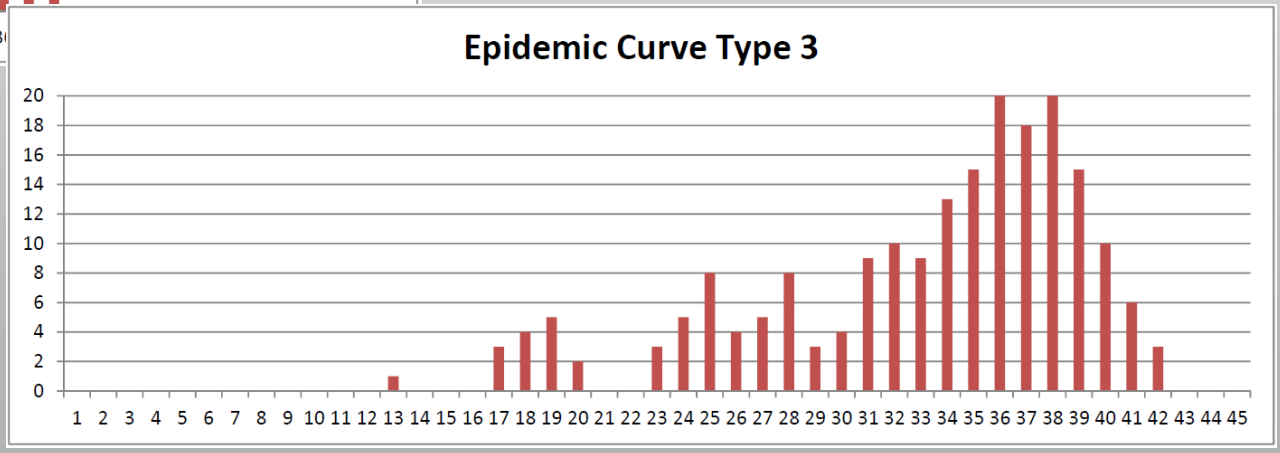
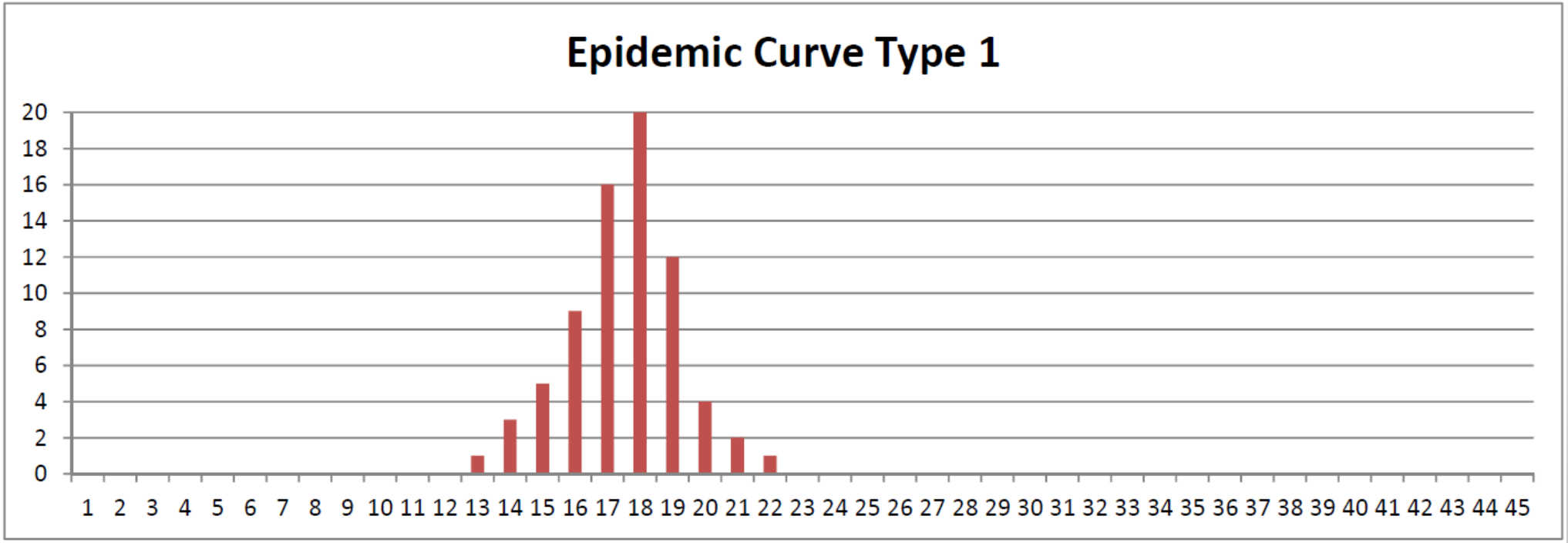






Type of outbreak



a) Continuous source type?

b) Point source type?

c) Propagated spread type?

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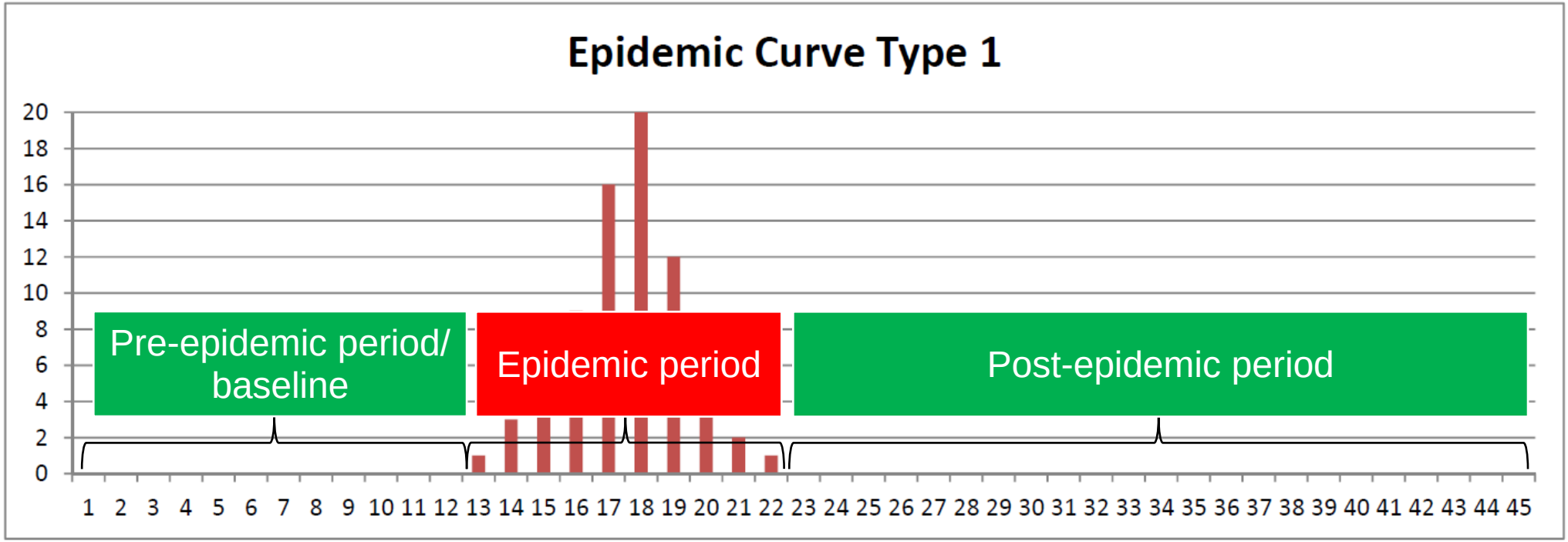

a) Continuous source type?

b) Point source type: single curve, peaks, vanishes quickly

c) Propagated spread type?

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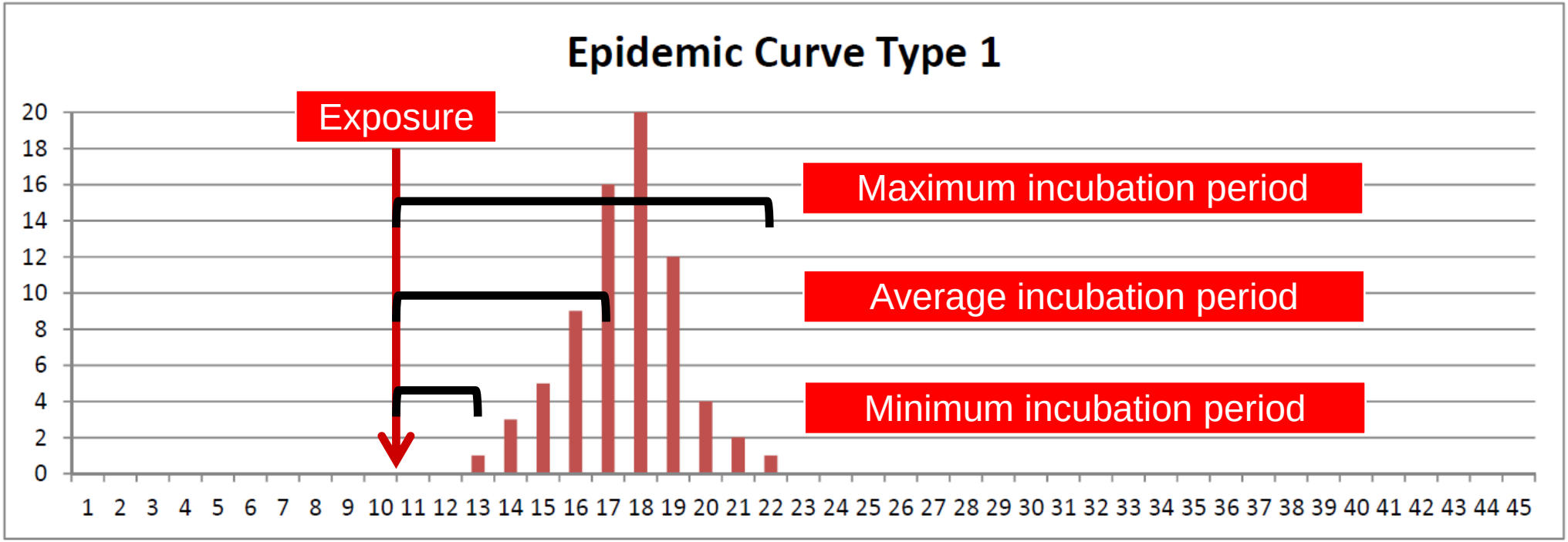

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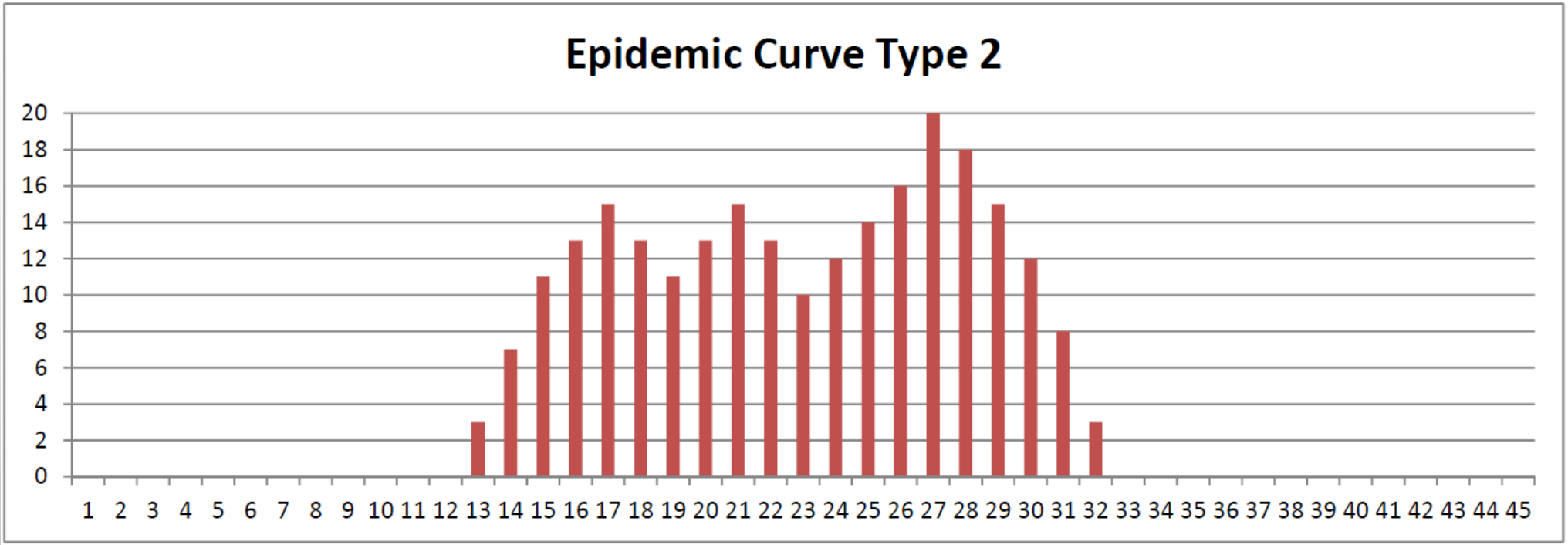

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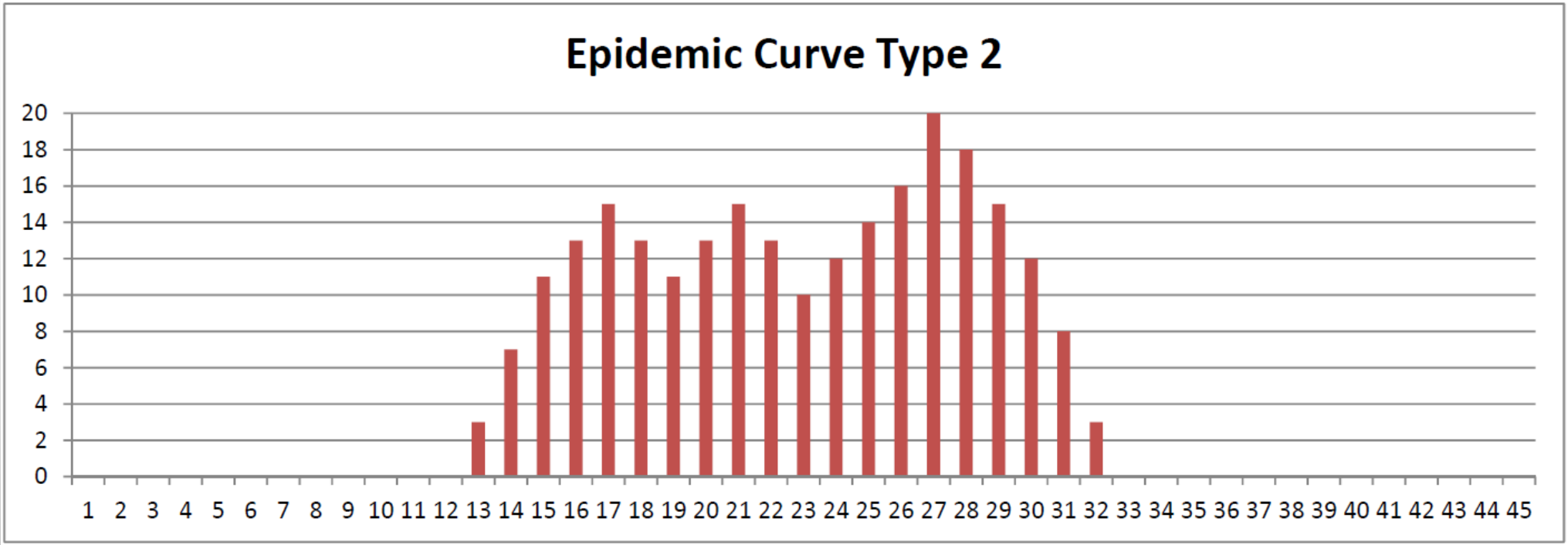
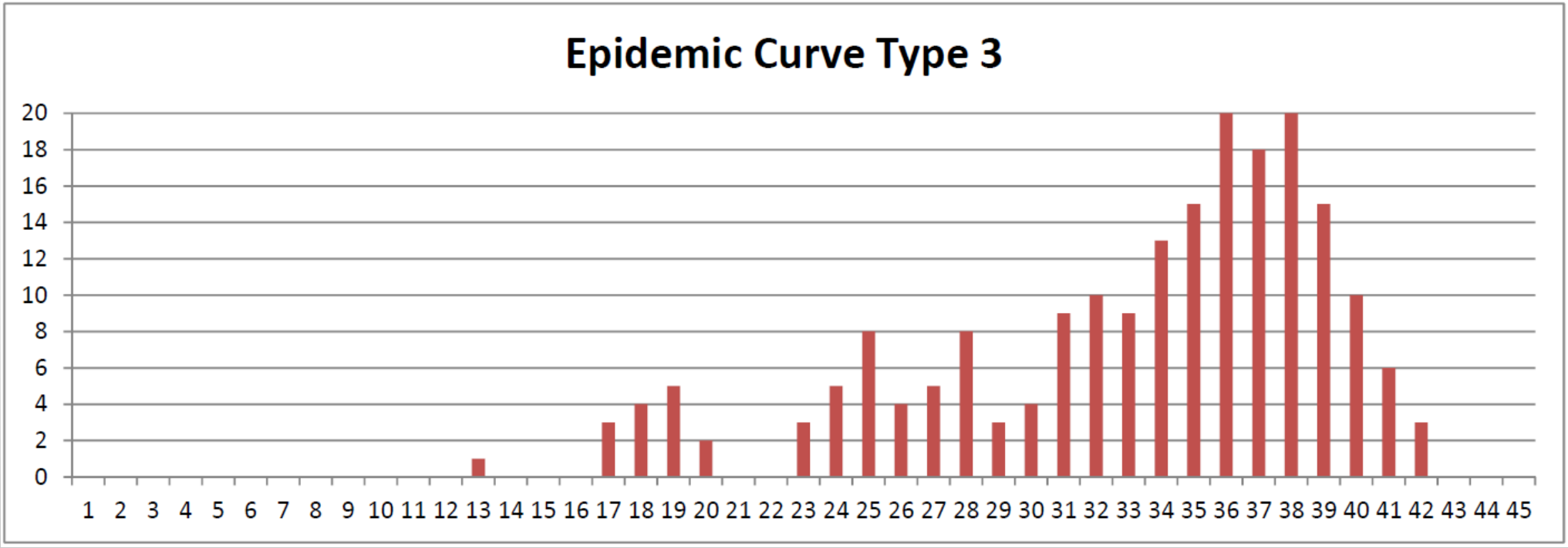


a) **Continuous source type**: long and flat curve

b) Point source type?

c) Propagated spread type?

Type of outbreak



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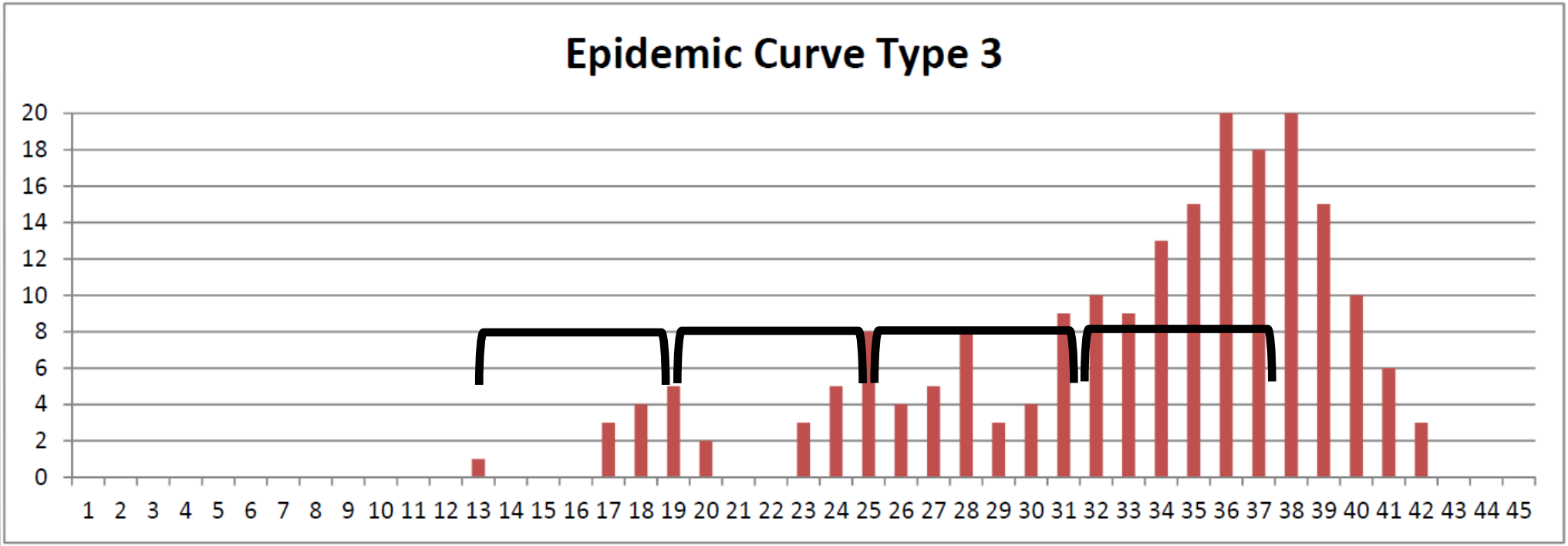


a) Continuous source type?

b) Point source type?

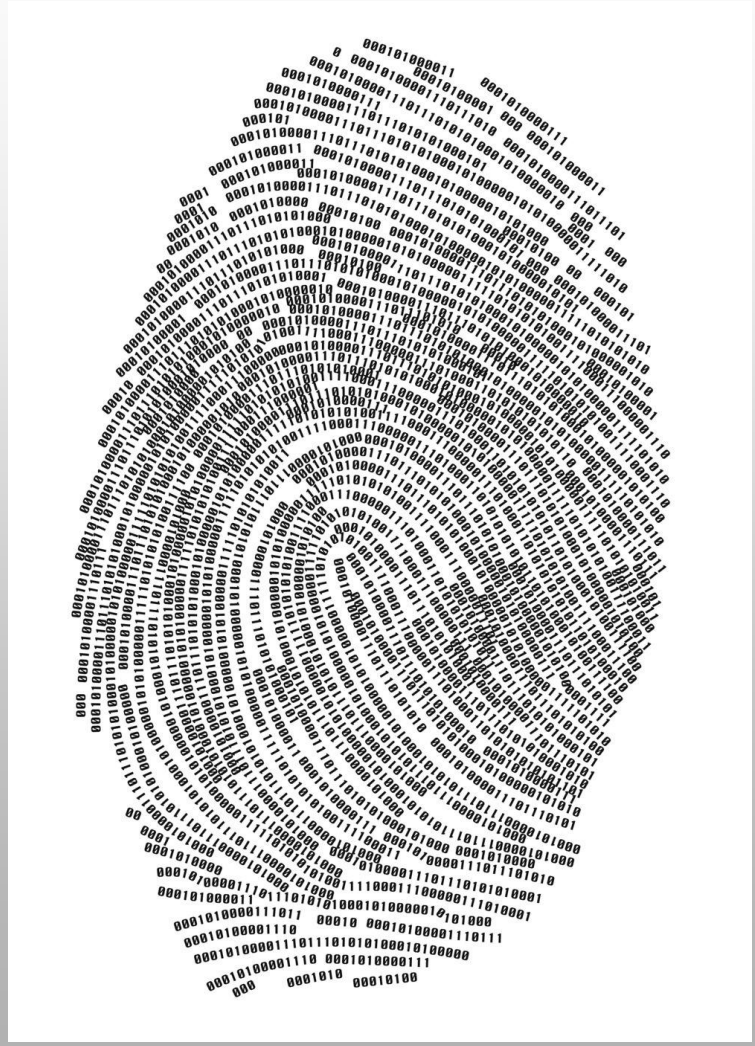
c) Propagated spread type: successive taller peaks after each incubation period

Tools

a) Epidemic curve

b) Control Charts

c) Formal statistical tests



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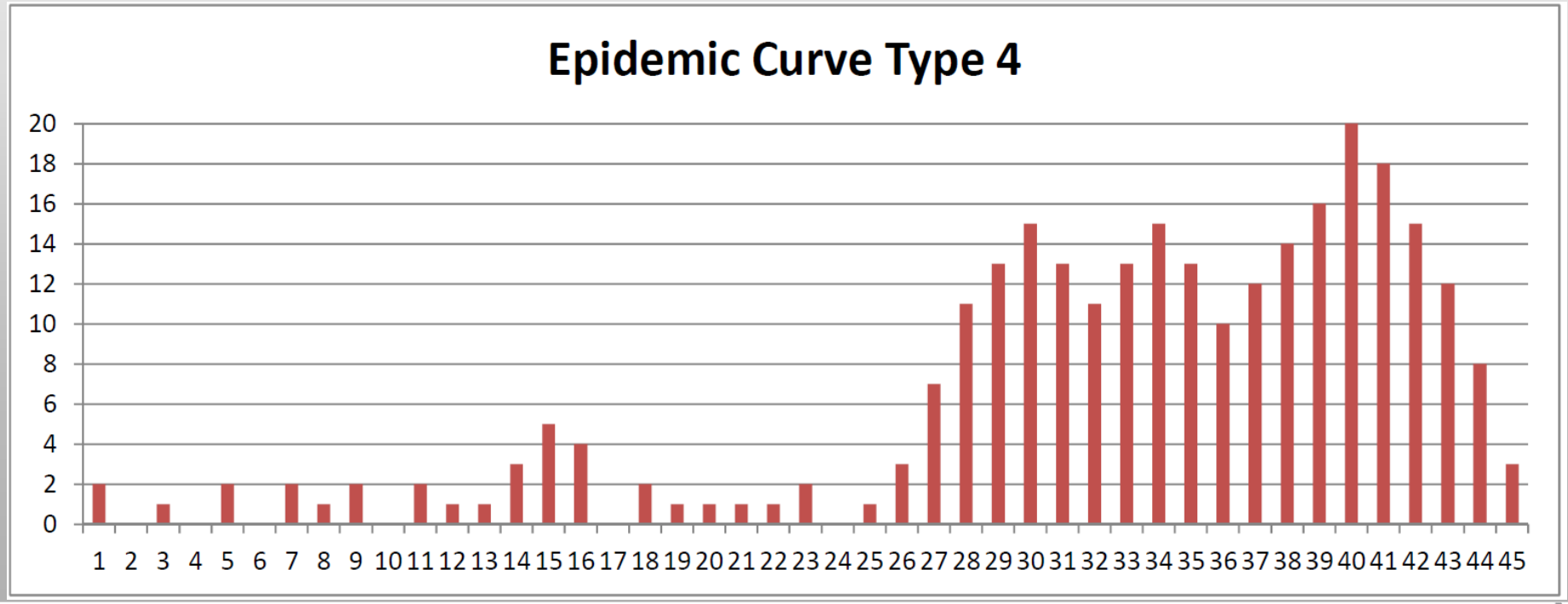

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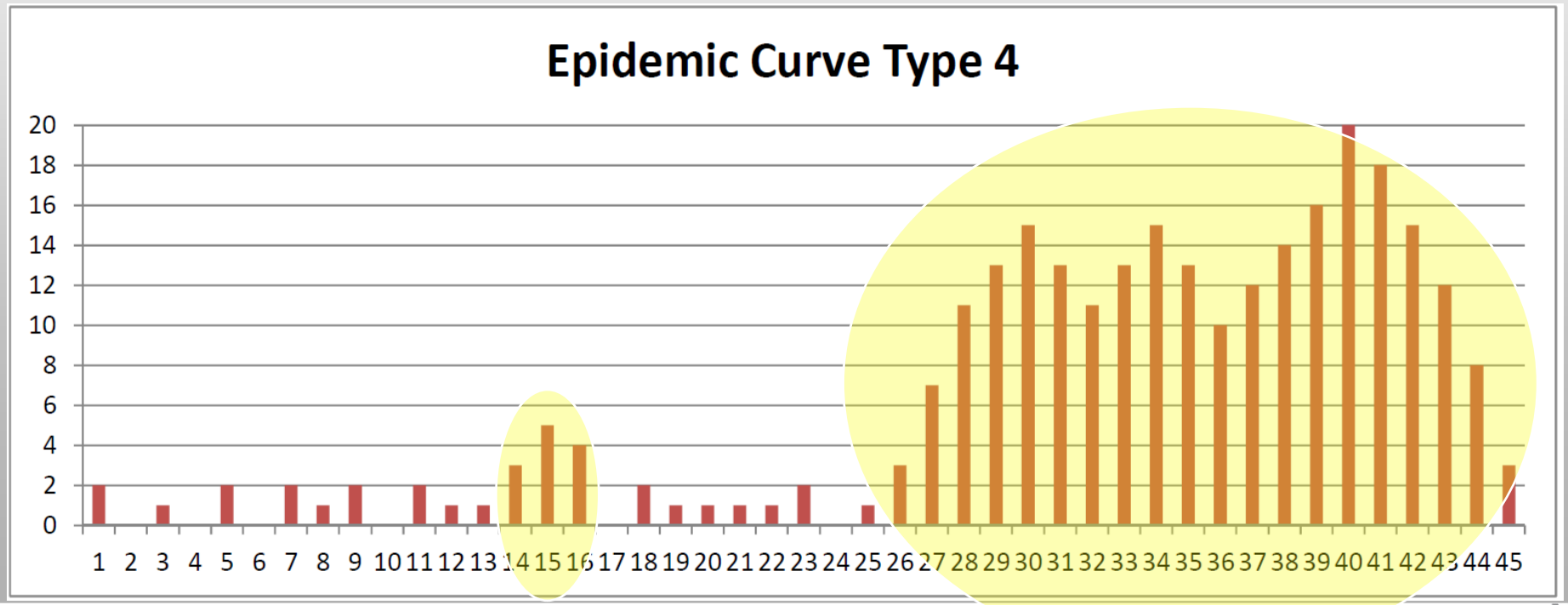

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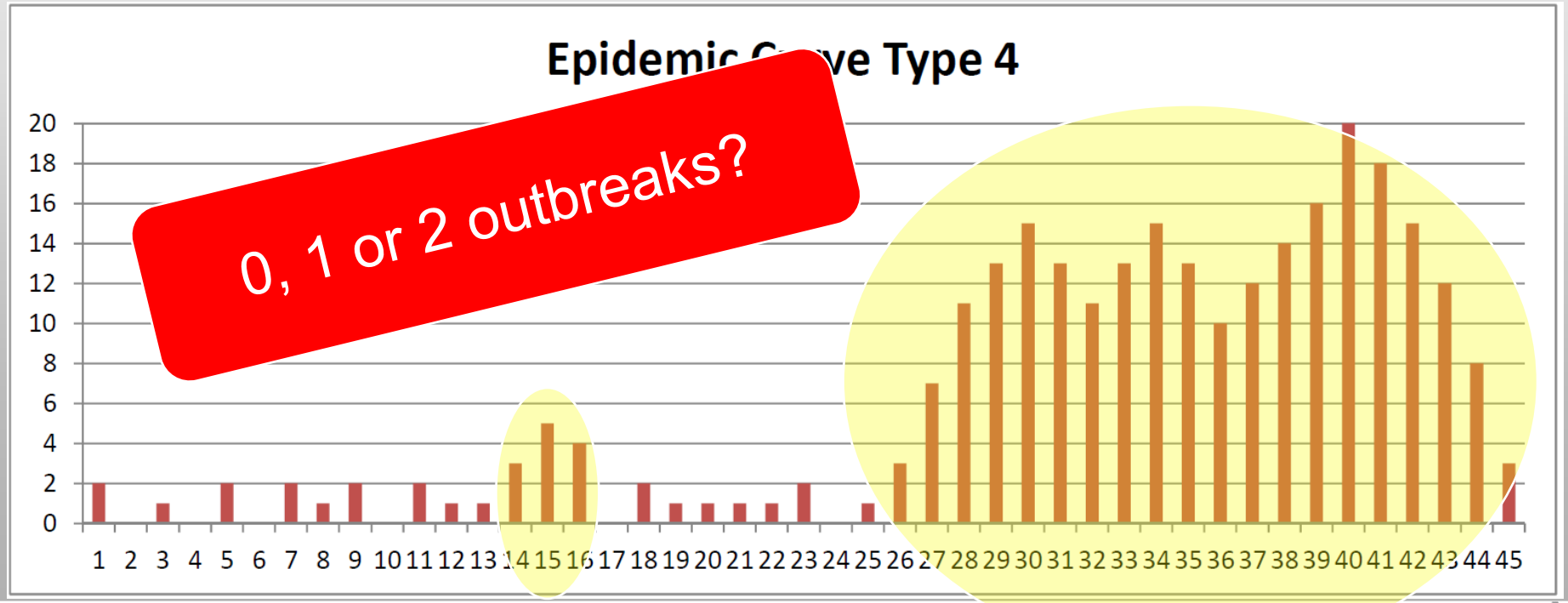
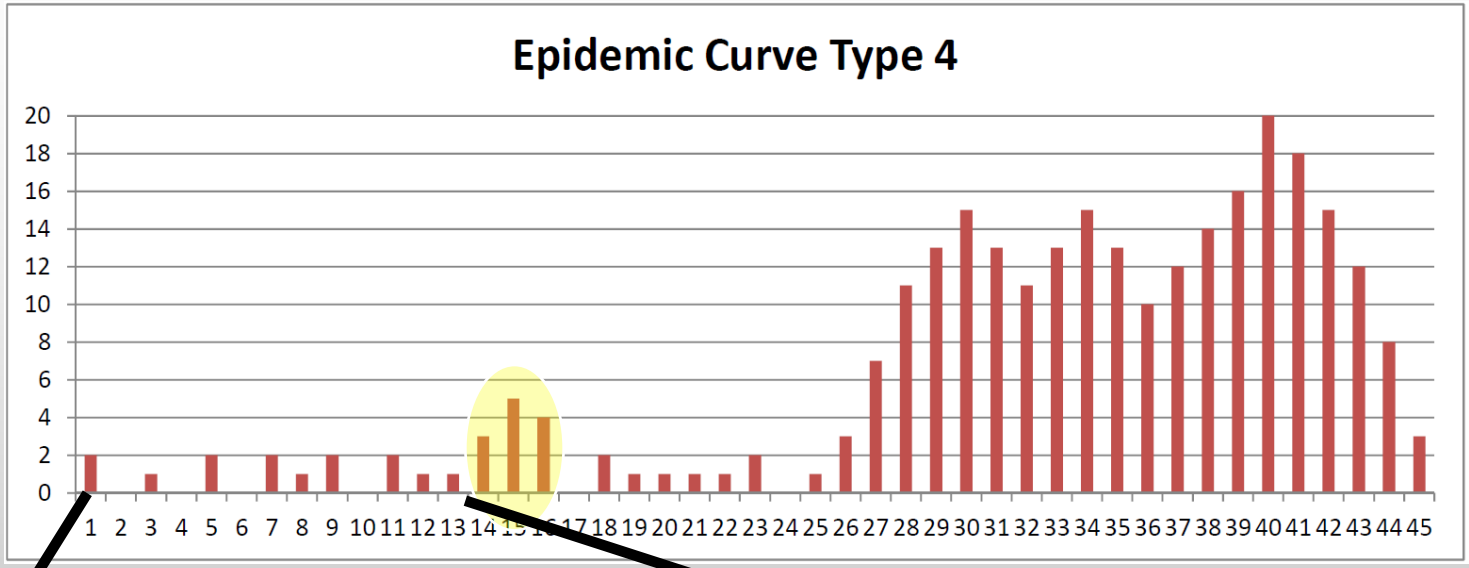
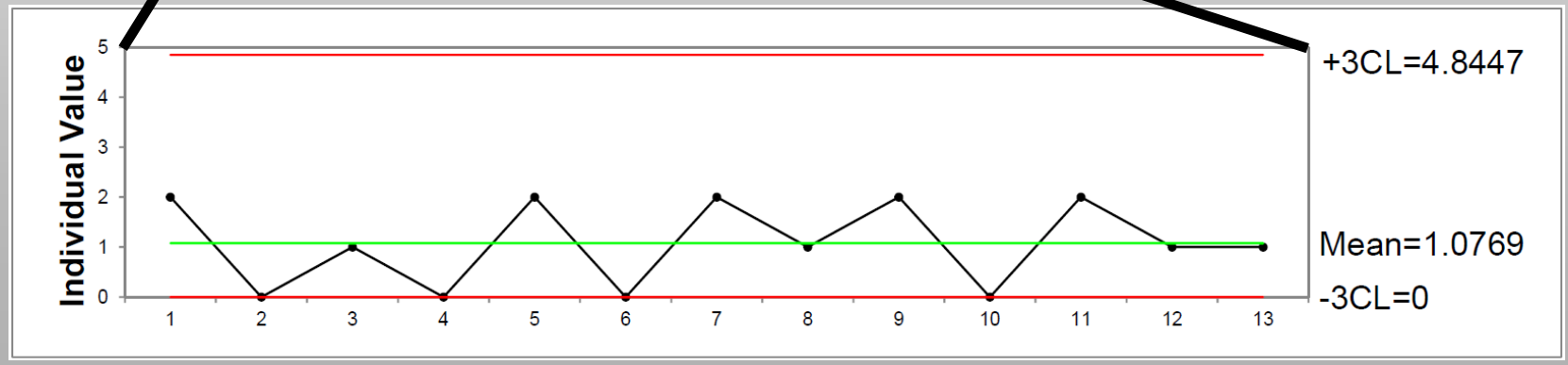


Control Charts

1. Baseline?



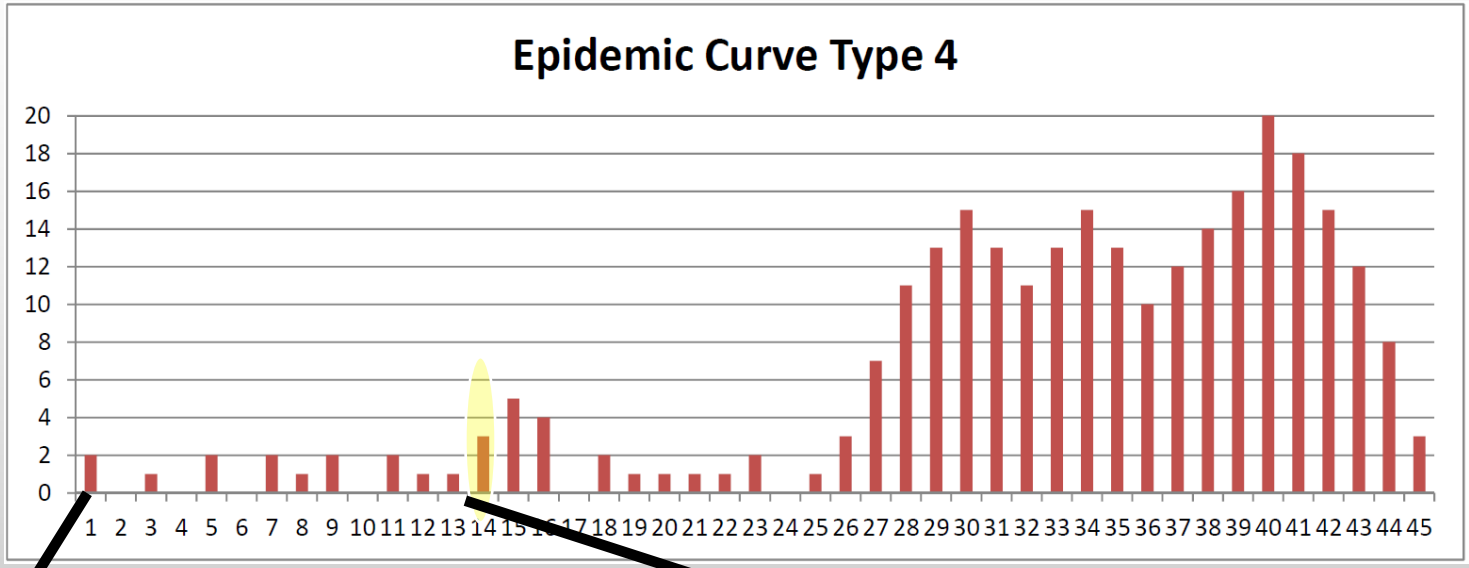


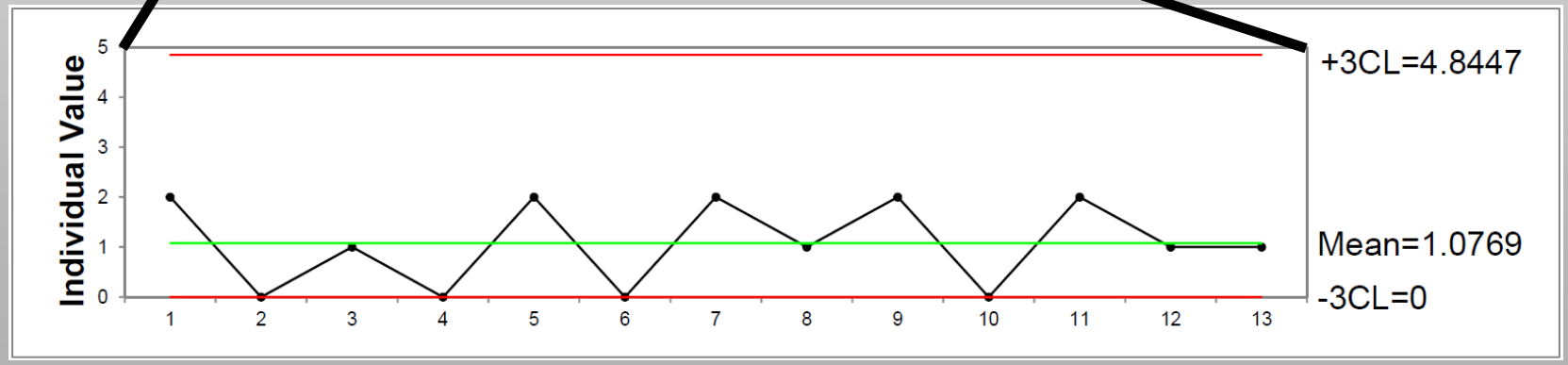
Control Charts

1. Baseline?

2. Point 14: n=3

Concerning?

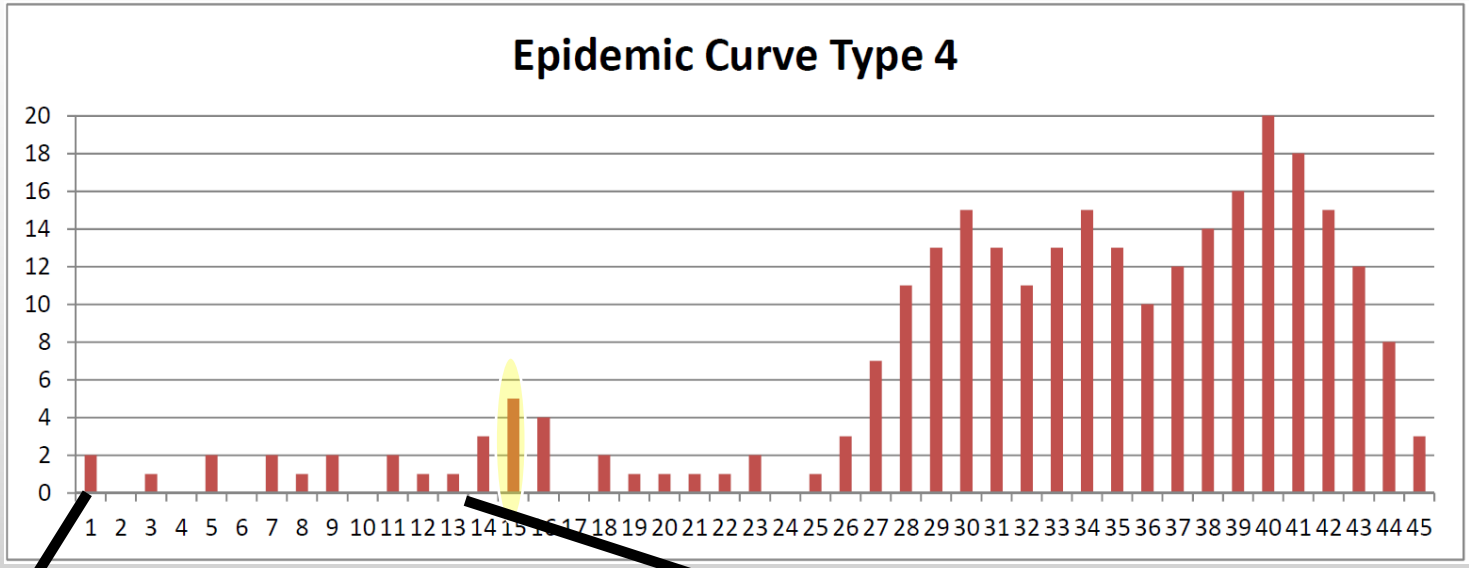


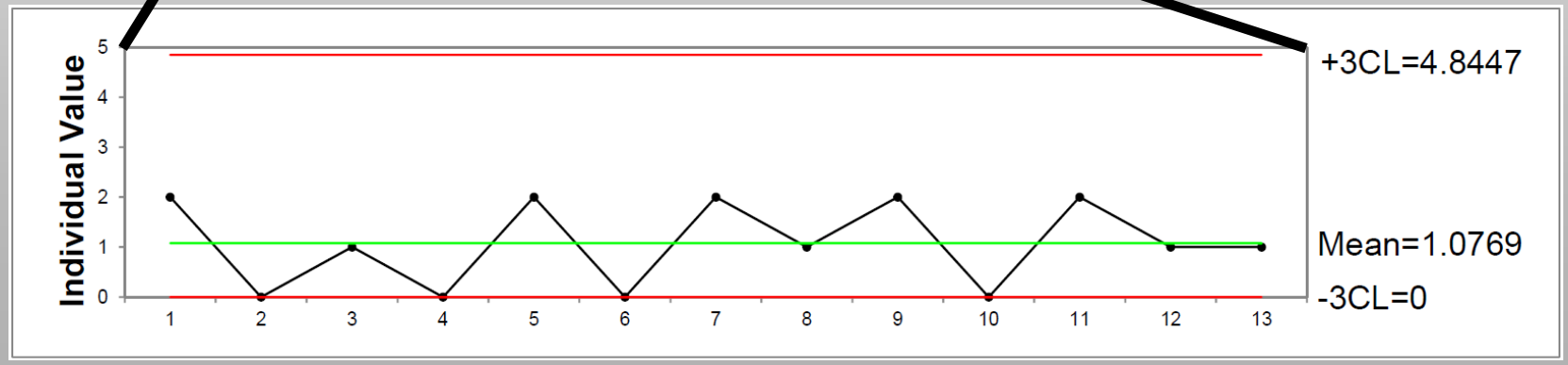


Control Charts

1. Baseline?
2. Point 14: n=3
3. Point 15: n=5

Concerning?





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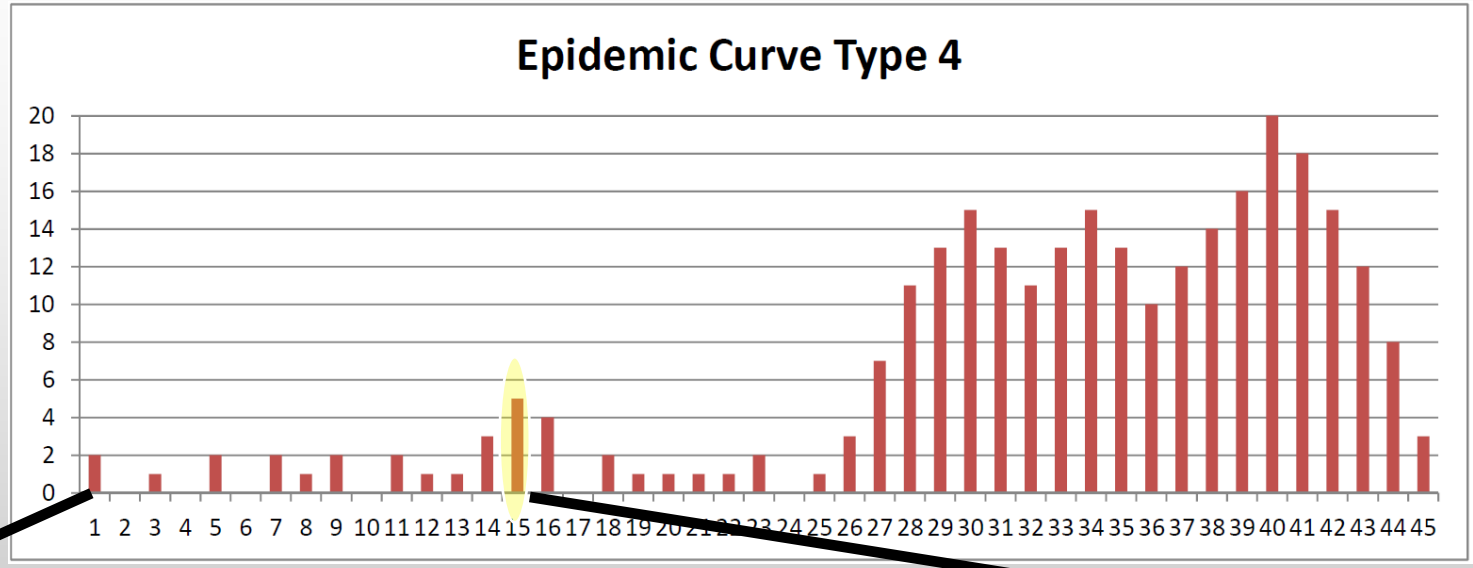
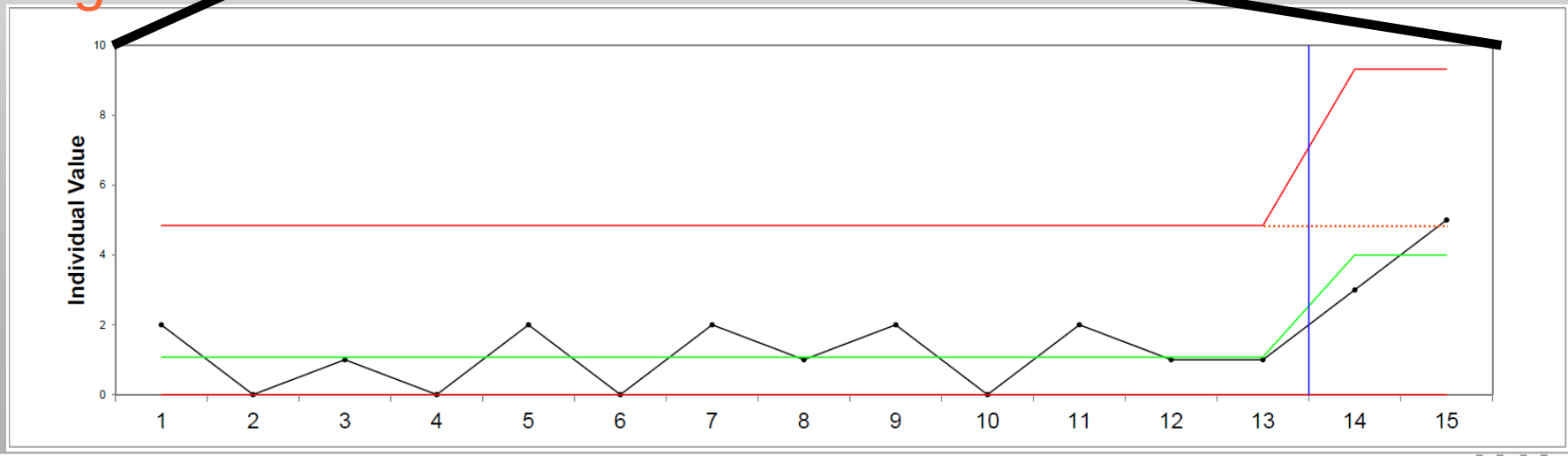
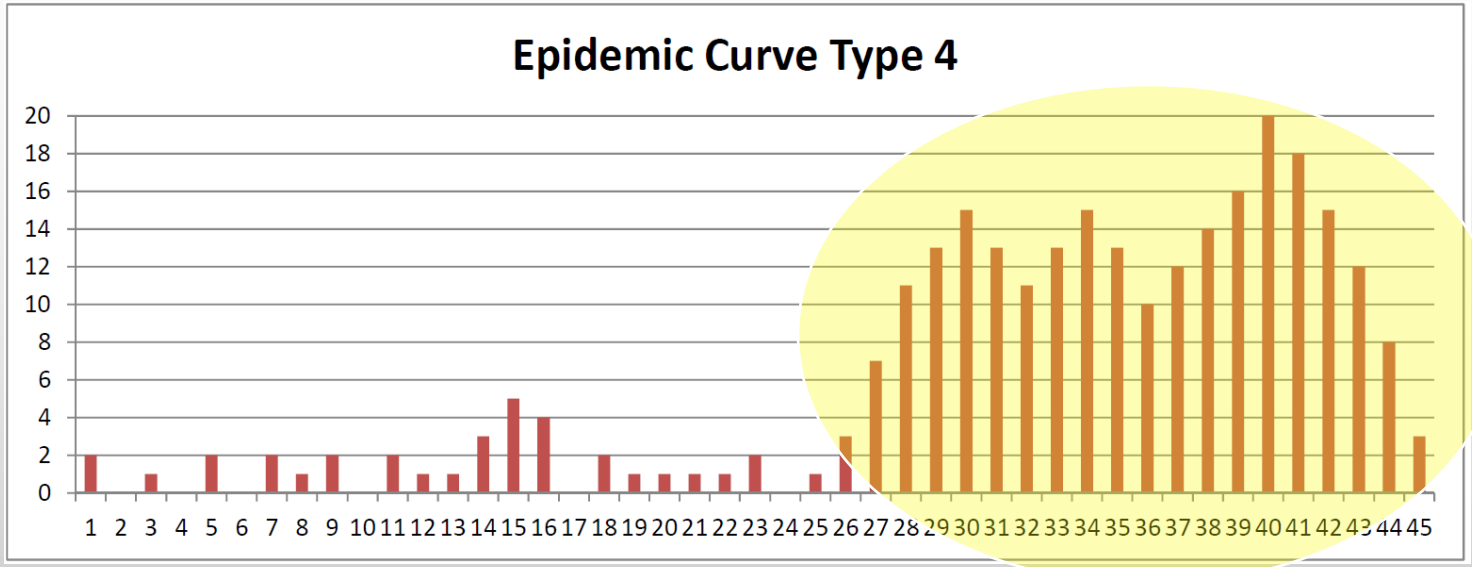




Control Charts

1. 2nd peak:

When do you start having concerns?



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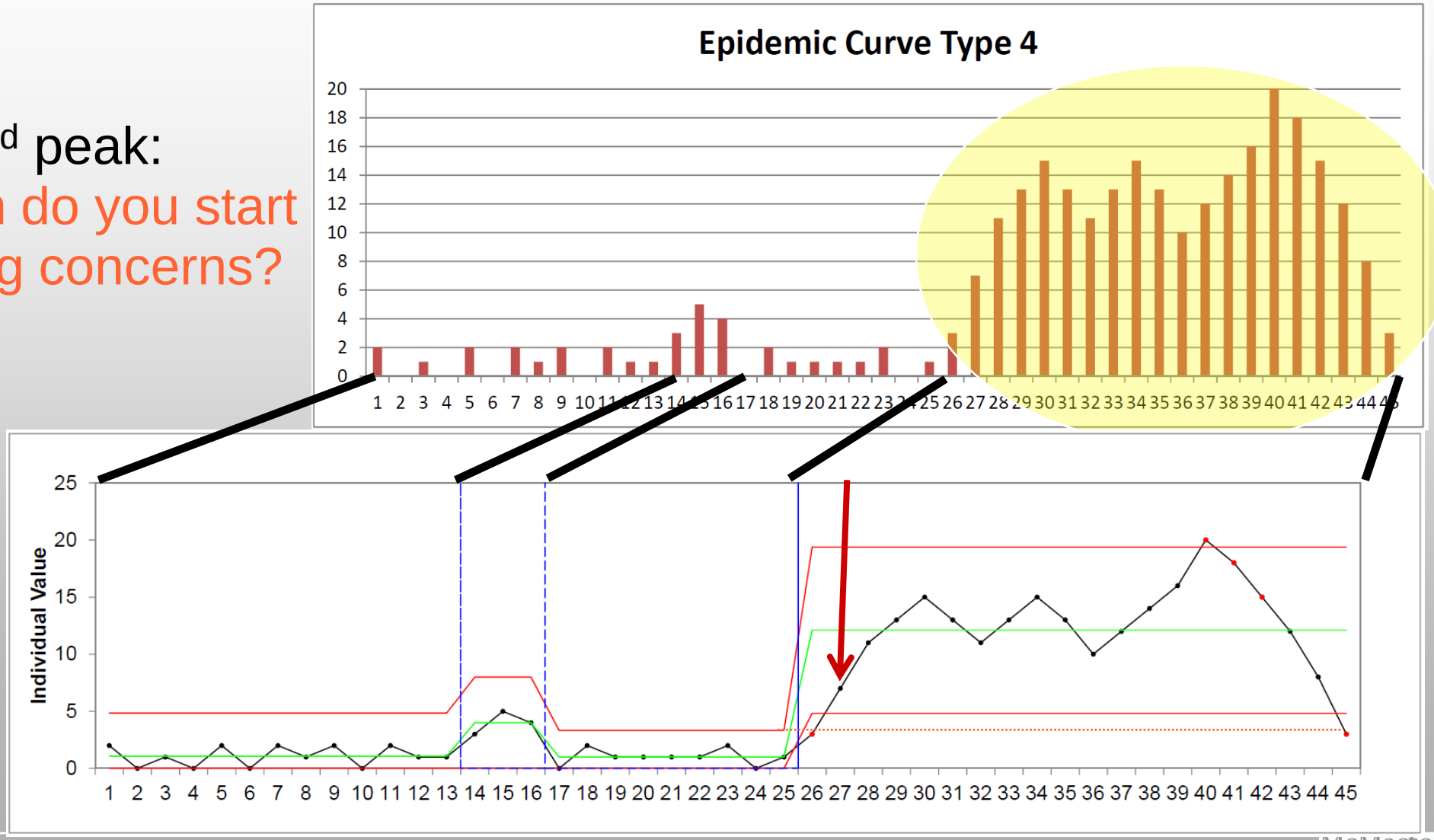

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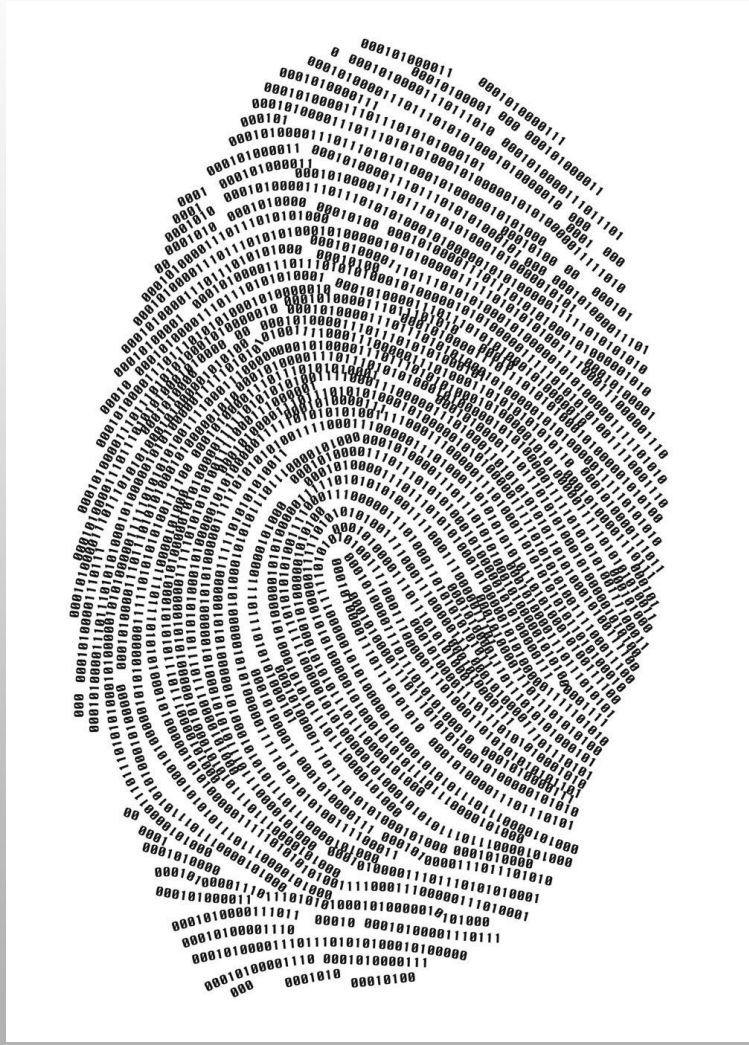

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- “Gold standard”

- Comparing incidence rates or cases at baseline to epidemic period using e.g. chi-square or t-tests

- Based on 2 standard deviations from the mean → when compared to control charts, more sensitive than 3 control limits and more specific than 2 control limits

Ontario Public Health and *C. difficile*

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

C. diff outbreak at Juravinski

Hamilton Health Sciences declared a C. difficile outbreak on Monday at the Juravinski General Hospital on the Mountain.

The outbreak comes three days after the hospital corporation declared an end to a three-week C. difficile outbreak at the Hamilton General Hospital.

HHS said the outbreak is on the E3 medical unit at the Concession Street facility. Four hospital-acquired cases of C. difficile have been diagnosed on the unit since Friday.

The potentially deadly bacterium causes mild to severe diarrhea.

HHS said Monday afternoon that E3 remains open. Enhanced infection prevention and control measures have been implemented to prevent the spread of the disease.

The Hamilton Spectator

Hamilton Health Sciences (HHS) has declared a C. difficile outbreak at the Juravinski General Hospital on the Mountain.

Cathie Coward/The Hamilton Spectator

McMaster University HEALTH SCIENCES

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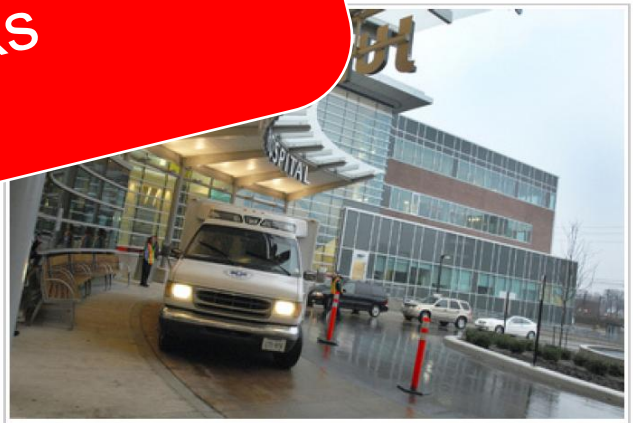
Santé publique Ontario
PARTENAIRES

Baseline not considered to define notification thresholds for *C. difficile* cases for unit specific outbreaks

...ced infection prevention and control
...the spread of the disease.



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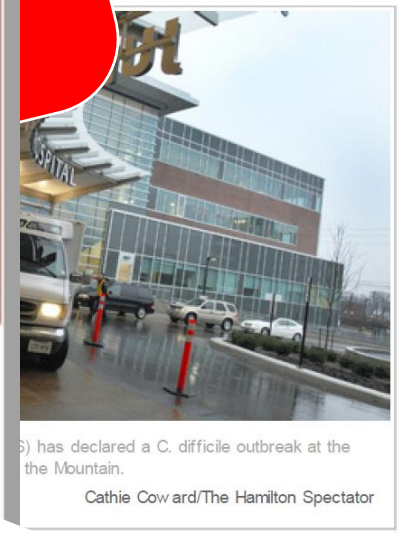
Public Health Ontario

PARTNERS FOR HEALTH

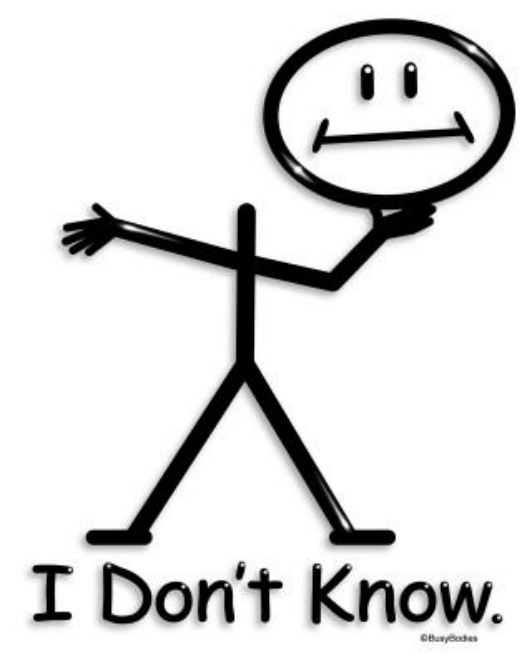


McMaster University HEALTH SCIENCES

C. difficile outbreaks…

- Public Health notification thresholds based on cases per time period, e.g. 5 cases / 28 days or 3 cases / 7 days

DOES BASELINE REALLY MATTER?



C. difficile outbreaks…

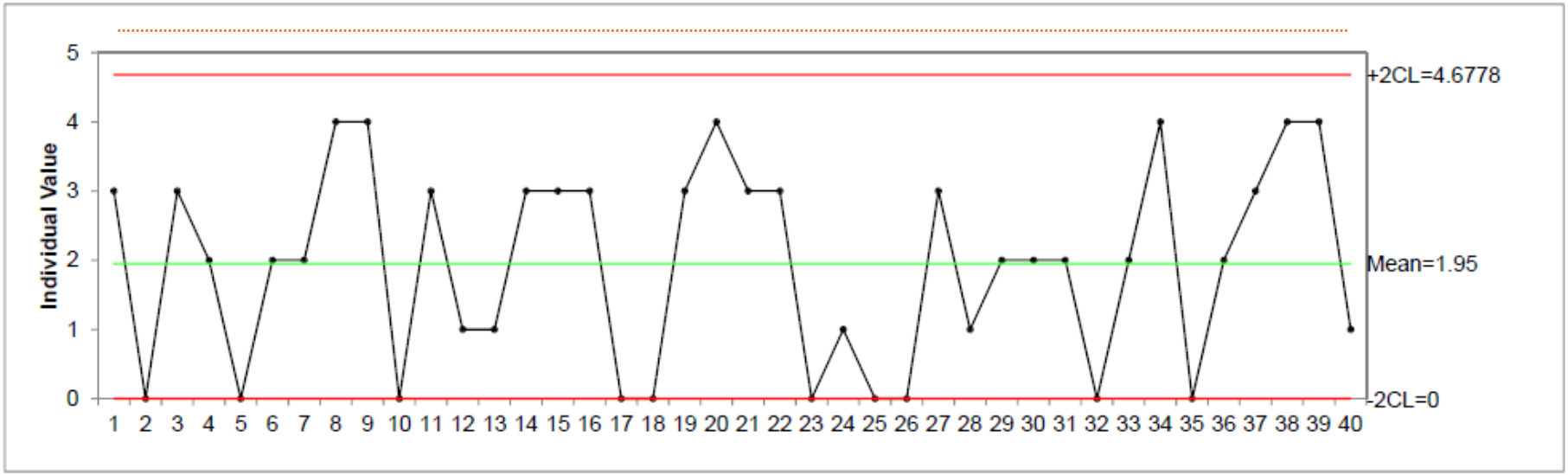
- Public Health notification thresholds based on cases per time period, e.g. 5 cases / 28 days or 3 cases / 7 days

DOES BASELINE REALLY MATTER?

Two hospital wards with 25 beds
and
5 cases of *C. difficile* in 28 days

Baseline rates….

1



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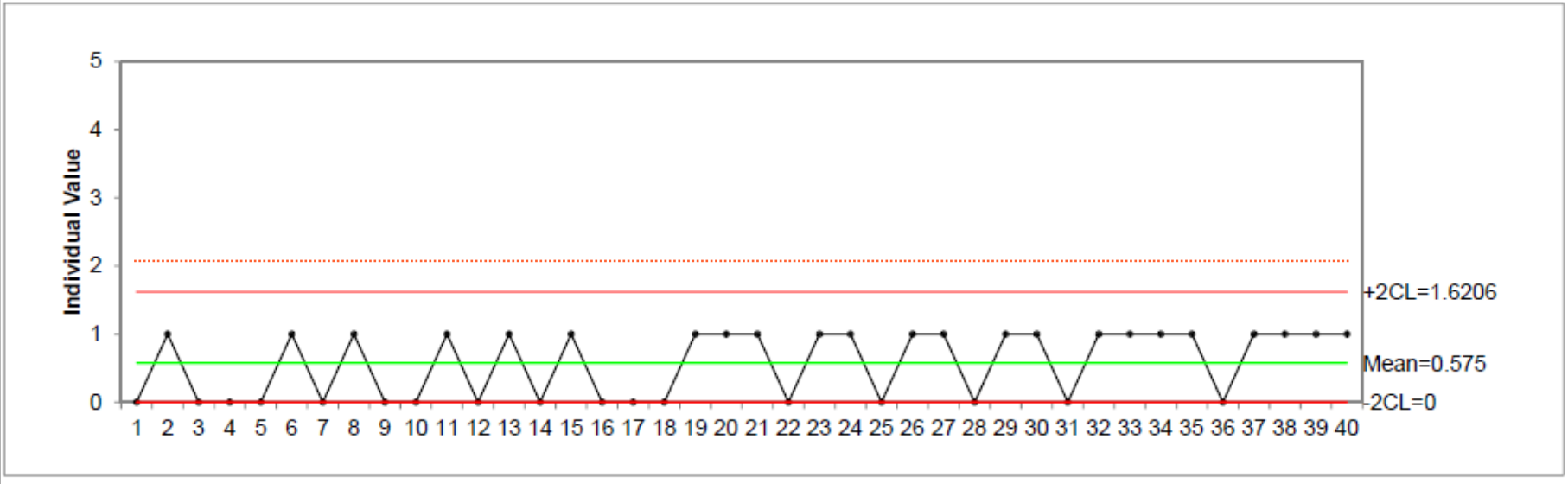

C. difficile outbreaks…

BASELINE REALLY MATTERS!

- Decision to declare an outbreak depends on baseline rates
- But: 5 cases is a reasonable trigger in most instances
- Sufficiently specific for most hospital wards to be used as an outbreak threshold (at least as long as the baseline is not significantly higher than 2 cases/28 days)
- Sensitivity to detect an outbreak too low for units with lower incidence rates

Take home message:

- Hospitals need to consider an outbreak even with less than 5 cases / 28 days in low incidence hospital units
- Challenge: Need to know baseline for each pathogen of interest for all hospital units and track continuously in real-time

Objectives

1) What is an outbreak?
2) How to identify an outbreak?
3) **Outbreak investigations**
4) How to prevent outbreaks?

Outbreak investigation

IT IS VERY EASY, SIMPLY:

- Identify the etiologic agents
- Identify the reservoir
- Identify the mode of transmission
- Eliminate the reservoir and transmission
- Prevent future outbreaks

Outbreak investigation

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- Prevent future outbreaks

- May be known (e.g. CDI, AROs)
- Easy to detect (e.g. gastroenteritis)
- Sometimes unspecific symptoms or delay to diagnosis

Outbreak investigation

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- Prevent future outbreaks

- IPAC: Patients, environment, HCW
- Public Health: much more challenging

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- Known once pathogen identified
- Challenging with emerging pathogens or if pathogen not yet identified

k investigation

OUTBREAK MANAGEMENT CHECKLIST

Outbreak-
Affected Units- ☐A2 ☐A3 ☐C1E ☐C1W ☐C2E ☐C2W ☐C3E ☐C3W ☐D ☐E1 ☐E2
Date declared-
Date declared over-

	ACTION TO DO:	Individual(s) responsible	Date control measures discontinued
	INFECTION CONTROL PRACTITIONER (ICP)	I	
☐	Notify Medical Director	ICP/A	
☐	Public Health Contact	ICP/D	
☐	Notify Administrator	ICP/D	
☐	Notify Department heads	ICP/D	
☐	Notify Pharmacy—Alert pharmacy when collecting NP swabs.	ICP/D	
☐	Inform pharmacy of NP swab results when received	ICP/D	
☐	Notify MOHLTC- Complete CIS "Critical incident" e-form	ICP/D	
☐	Outbreak Communication-Lodge wide-Notify all staff send mail-all	ICP/D	
☐	Arrange Outbreak Team meeting	ICP/A	
☐	Complete MOHTC "LTC Closure/Outbreak Tracking" form	ICP/A Coord	
☐	Request OB closure letter from Public Health Dept.	ICP/A	
	NURSING	Nursi	
☐	Inform all Nursing staff	DON/	
☐	Add Outbreak message on PCC Home page	DON/	
☐	Post signs at main entrances (front and back)	Nurse	
☐	Close affected unit doors and post signs	Nurse	
☐	In the event of a suspected/confirmed Enteric Outbreak (vomiting/diarrhea), change disinfectant product to the Accelerated Hydrogen Peroxide-based disinfectant on the affected unit. If more then one unit affected, implement product lodge-wide.	DON/	
☐	Collect resident specimens (NP swabs/ enteric specimens)	Unit F	
☐	Ensure ill residents isolated in bedspace	Unit F	
☐	Ensure proper isolation precautions and PPE used (isolation station with precaution sign hung on ill resident door; staff wearing proper PPE etc.)	Unit F	
☐	If unable to provide meal tray service segregate ill from well residents at meals	Unit F	
☐	Notify ill resident POA for care	Unit F	
☐	Provide OB update to all residents on unit (informal communication done at meal times)	Unit F	
☐	Discourage resident mingling in common areas	Unit F	
☐	Discourage OB unit residents from participating in off unit programming. Ensure no ill residents participate.	Unit F	
☐	Notify Coroner of any death in the facility during a declared OB	Unit F	
☐	Attempt to provide extra staff on OB unit (suggestion-1100-1900 hrs)	Supe	
☐	Attempt to cohort staff (assign staff to either work with well or ill residents). If not possible, provide care to well residents before moving to care for ill residents.	Supe	
☐	Supervisors/Staffing clerks to ensure ongoing tracking of staff illness and exclude ill staff from working	Supe N:/Loo	
☐	(Respiratory/Gastrointestinal illness on line)	OUTBREAK/staff illness tracking log	
☐	**Admissions** Admissions *may* be considered on a case-by-case basis. If admitting during an outbreak new resident/POA of care and their physician must be aware of potential risk	Admissions Coordinator	
☐	Complete "bed holding due to Outbreak" form if admissions postponed	Admissions Coordinator	
	For INLUENZA CONFIRMED OB:		
	Initiate Tamiflu protocol for all residents: • Pharmacy to upload batch Tamiflu 'draft' orders on eMAR and will dispense medication • RN/RPN will then accept draft order, process order and deliver medication	Nursing Lead Team/RNs/R	
	• Notify all unvaccinated staff that they must take the antiviral medication (Tamiflu) in order to work in the facility for the duration of the OB. • Track antiviral medication use for unvaccinated staff	Directors/Su Clerk	
	• Ensure all units are segregated as much as possible. No group programs off units.	Nursing Lead Team/RNs/R	
	BUILDING SERVICES	Director of E Services	
☐	Inform all Building Services staff	Director of Bu	
☐	In the event of a suspected/confirmed Enteric Outbreak (vomiting/diarrhea), change disinfectant product to the Accelerated Hydrogen Peroxide-based disinfectant on the affected unit. If more then one unit affected, implement product lodge-wide.	Director of Bu	
☐	Initiate enhanced housekeeping	Director of Bu	
☐	Supervisors/Staffing clerks to ensure ongoing tracking of staff illness and exclude ill staff from working (Respiratory/Gastrointestinal illness on line)	Supervisors/ N:/Lodges/Maca OUTBREAK/sta	
	For INLUENZA CONFIRMED OB:		
	• Notify all unvaccinated staff that they must take the antiviral medication (Tamiflu) in order to work in the facility for the duration of the OB. • Track antiviral medication use for unvaccinated staff	Directors/Su Clerk	
	DIETARY SERVICES	Director of F	
☐	Inform all Food Services staff	Director of Fo	
☐	In the event of a suspected/confirmed Enteric Outbreak (vomiting/diarrhea), change disinfectant product to the Accelerated Hydrogen Peroxide-based disinfectant on the affected unit. If more then one unit affected, implement product lodge-wide.	Director of Fo	
☐	If alternate dining space is used implement cleaning and disinfection of this area and ensure high contact surfaces in dining areas are cleaned and disinfected after each meal	Director of Fo	
☐	Notify Meals-on-Wheels if necessary	Director of Fo	
☐	Supervisors/Staffing clerks to ensure ongoing tracking of staff illness and exclude ill staff from working	Supervisors/ N:/Lodges/Maca OUTBREAK/sta	
	For INLUENZA CONFIRMED OB:		
	• Notify all unvaccinated staff that they must take the antiviral medication (Tamiflu) in order to work in the facility for the duration of the OB.	Directors/Su Clerk	
	• Track antiviral medication use for unvaccinated staff		
	ADULT DAY PROGRAM (ADP)	**Supervisor of Resident Services**	
☐	Inform all Recreation and Social staff	Supervisor of Resident Services	
☐	Stop ADP visits into the Lodge	Supervisor of Resident Services	
☐	Notify Volunteers	Supervisor of Resident Services/ Volunteer Co-ordinator	
☐	Supervisors/Staffing clerks to ensure ongoing tracking of staff illness (Respiratory/Gastrointestinal illness on line)	Supervisors/Staffing clerk N:/Lodges/Macassa/ OUTBREAK/staff illness tracking log	
	RECREATION, SOCIAL AND SUPPORT SERVICES	**Supervisor of Resident Services/designate**	
☐	Check for outside bookings (auditorium etc.)	Supervisor of Resident Services	
☐	Possible restriction of Lodge wide or off unit group programming	Supervisor of Resident Services	
☐	Provide programs that the limit use of shared equipment	Recreationist	
☐	Notify OT and Physio	Supervisor of Resident Services	
☐	Notify Hairdresser and Barber	Supervisor of Resident Services	
	For INLUENZA CONFIRMED OB:		
	• Notify all unvaccinated staff that they must take the antiviral medication (Tamiflu) in order to work in the facility for the duration of the OB. • Track antiviral medication use for unvaccinated staff	Directors/Supervisors/Staffing clerks	
	BUSINESS OFFICE	**Business Office Supervisor**	
☐	Inform all Business office staff	Business Office Supervisor	
☐	Change voice message on answering machine if necessary	Business Office Supervisor	
☐	Add Outbreak message to 'TV Tour'	Business Office Supervisor/QI Co-ordinator	
☐	Notify IT if necessary	Business Office Supervisor	
☐	Supervisors/Staffing clerks to ensure ongoing tracking of staff illness (Respiratory/Gastrointestinal illness on line)	Supervisors/Staffing clerk N:/Lodges/Macassa/ OUTBREAK/staff illness tracking log	
	For INLUENZA CONFIRMED OB:		
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McMaster University HEALTH SCIENCES

Outbreak investigation

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EVERY OUTBREAK IS DIFFERENT!

- Isolation/cohorting (if indicated)
- Active surveillance (case definition!)
- Promote hand hygiene and cleaning
- Posting / information for patients and visitors
- Consider closure to admissions

Outbreak investigation

IT IS VERY EASY, SIMPLY:

- Iden
- Iden
- Iden
- Elim
  tran
- Prev

Once outbreak identified, involve all key stakeholders (can include everyone from C-suite to front line staff)

E.g. hospital unit with *C. difficile* outbreak:

- Public Health
- (Executive) VPs Medical and Professional Affairs
- Physician and Surgeon-in-Chief
- Director, manager, and chief physician of affected unit
- (Stewardship) pharmacists
- Environmental cleaning
- Public relations

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- Last minute of my presentation…

Outbreak investigation with n=1?

Outbreak investigation indicated with n=1, e.g.:

- Single case of healthcare associated Legionnaire's disease?
- Single case of post-operative group A streptococcus infection?
- Single case of fungal meningitis?
- Single case with hospital associated carbapenemase resistant enterobacteriaceae?

Outbreak investigation with n=1?

Exserophilum rostratum

Outbreak investigation with n=1?

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Sep 18: Tennesse DOH email from physician treating aspergillus meningitis who had recent epidural steroid injection

Lancet Neurol. 2013,12(5):429

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COMMON LINKS/RESERVOIR:

SURGERY CENTER?
METHYLPREDNISOLONE ACETATE (MPA)?
PVP-IODINE?
LIDOCAINE?
SPINAL NEEDLES?
EPIDURAL TRAY KITS?

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Day +8: NECC recalls 3 lots of MPA voluntarily and provides list of 76 facilities in 23 states with MPA from these 3 lots

Case definition shared with all involved states

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Day +10: Exposure and pathogen still not identified (only index). All patients exposed to these 3 lots notified

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Day +10: Exposure and pathogen still not identified (only index). 14,000 patients exposed to these 3 lots to notify

Day +16: FDA identified fungus in unopened vials

Aftermath

- 733 infections in 20 states, 53 deaths
- Exserophilum rostratum predominant fungus identified in patients, also detect in unopened vials
- Largest healthcare associated infection outbreak in US
- Joint effort by:
  - Clinical community (hospitals, physician notifying of n=1)
  - Local and state public health departments
  - CDC
  - FDA
  - and many, many more…

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YES!

IF EXPECTED NUMBER OF CASES (BASELINE) IS ZERO

Objectives

1) What is an outbreak?
2) How to identify an outbreak?
3) Outbreak investigations
4) **How to prevent outbreaks?**

Prevention: Hospital outbreaks

Prevention: Hospital outbreaks

Prevention: Hospital outbreaks

Prevention: Hospital outbreaks

Take home messages

- Outbreak is an excess of cases as compared to baseline
- Tools to identify excess include epidemic curve, control charts, and formal statistical test
- *C. difficile* notification threshold specific but not very sensitive
- Outbreak investigation include identification of agent, reservoir, mode of transmission, and elimination of reservoir and transmission, and involvement off all key stakeholders
- Collaboration between individuals, clinics/hospitals, public health, federal agencies key to control outbreaks with a common reservoir
- Prevention of hospital outbreaks… come back next year


Thank You!