Outbreaks and Unusual Infection Occurrences

Shasta IP Seminar, Sept. 26-27, 2024
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Center for Health Care Quality
California Department of Public Health

Objectives

- Define outbreaks and unusual disease occurrences
- Review the steps in an outbreak investigation
- Describe reporting requirements to public health
- Provide examples of outbreaks

Definitions

California regulatory definitions from Titles 17 and 22

- **Outbreak**
  - Occurrence of cases **above the expected** or baseline level
  - **Number of cases** indicating an outbreak will **vary**
  - "Outbreak" designation is **relative to the usual frequency of the disease**
  - **A single case** of a communicable disease long absent from a population or the first invasion by a disease not previously recognized requires **immediate reporting** and epidemiologic investigation

CDPH All Facilities Letter (AFL) 23-08(PDF)

(https://www.cdph.ca.gov/Programs/CHCQ/LCP/Pages/AFL-23-08.aspx)

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Definitions (continued)

- **Unusual Disease**
  - A **rare disease** or a newly apparent or **emerging disease**
  - **Syndrome of uncertain etiology** which a health care provider has reason to believe could possibly be caused by a transmissible infectious agent or microbial toxin
- **Unusual Occurrences**
  - Occurrences such as epidemic outbreaks, poisonings, fires, major accidents, death from unnatural causes or other catastrophes
  - Unusual occurrences which **threaten the welfare, safety or health** of patients, personnel or visitors

OUTBREAK INVESTIGATION

Recognizing an Outbreak

Greater number of infections than usual are found during routine surveillance

Example: Resistant Acinetobacter in sputum in several ICU patients

An unusual pathogen or infection is identified

Example: Botulism, Anthrax, Carbapenem resistant

Reports of a "cluster" of patients or employees with same symptoms during same time period

Example: sudden onset of GI symptoms or diarrhea

Practice Question

What are some sources you could use to identify a potential outbreak?

- What are some sources YOU would use to identify potential outbreaks (be creative!)

Sources for Identifying Potential Outbreaks

- Microbiology lab
- Local physicians
- Public Health
- Nursing Units
- Emergency Department

Steps in a Hospital Outbreak Investigation

Step 1	Verify the diagnosis
Step 2	Confirm presence of an HAI outbreak
Step 3	Alert key partners
Step 4	Establish a case definition
Step 5	Identify and count cases
Step 6	Organize data according to person, place, time, and size
Step 7	Conduct targeted observations, review key concerns with HCP, and develop abstraction forms
Step 8	Formulate and test hypotheses
Step 9	Perform infection control assessment and implement control measures
Step 10	Follow-up, communicate findings, and notify patients

CDC Investigations in Healthcare Facilities

Step 1 – Verify the diagnosis

Early in the investigation, identify as accurately as possible the specific nature of the disease

- Ensure that the **diagnosis** is correct
- Evaluate for possible **laboratory error** as the basis for increased diagnoses
- Evaluate possible **changes in surveillance** and case definitions
- **Review** clinical findings and lab testing results

Recordkeeping for Outbreaks

- Start a file folder **immediately**
- Keep a **timeline**
- Make notes of
  - **Who** you spoke with
  - Daily activities and meetings
  - **Dates, times, attendees**
- Keep everything!
  - Your documentation will be needed

As you begin…

- **Save all isolates!**
- **Save potential reservoirs for possible culturing later**
  - **Multi-dose medications**
  - **Antiseptics**
  - **Equipment**
  - **Food**

Step 2 – Confirm presence of an HAI outbreak

Verify that a suspected outbreak is real

- Reporting might be **increased because of changes** in reporting procedures, case definitions, or diagnostic procedures or increased local or national awareness
- Increase in infections recognized in healthcare settings may be part of a **broader community outbreak**
- **Pseudo-outbreaks** are those caused by lab processing errors or contamination of clinical diagnostic equipment, such as bronchoscopes, without clinical illness

Practice Question

The charge nurse on your medical floor calls and asks you to investigate a “pneumonia outbreak” involving three patients:

- Ms. Ramirez has a CRE chest infection
- Mr. Patel is recovering from a post-COVID bacterial lung infection
- Mrs. Saunders was admitted with left lower lobe pneumonia

Is this an HAI Outbreak?

Step 3 – Alert key partners about the outbreak

After the outbreak is confirmed

- Ensure key **facility staff are informed;** includes administration, facility IP, medical and nursing leaders
- Ask the clinical laboratory to **save all isolates** that might be related to the outbreak
- Notify other local and state **public health officials**
- Alert other **hospitals and facilities that share patients** to identify additional cases or take necessary control actions.
- Notify **regulatory partners** (such as FDA or EPA) if investigation involves regulated medical devices or products
- Notify **professional oversight** organizations (such as pharmacy boards or clinician licensing boards)

Step 4 – Establish a case definition

- A case definition is used to identify persons who are (or might be) infected
- A case definition usually includes
  - **Clinical information** about the disease (lab test results, signs and symptoms)
  - **Demographics** of affected patients (age, race/ethnicity, sex)
  - **Location** of possible exposure or time of onset (ward and bed number)
  - **Defined time** during which exposure or onset occurred
- The initial case definition should be **broad** enough to include most if not all cases; can be refined as more is known

Step 4 – Establish case definition (continued)

- Case definition also should be based on the causative agent, if known, and can include infected and colonized patients
- A stratified case definition can be applied to account for the uncertainty of certain diagnoses
  - **Confirmed**: Must have laboratory verification
  - **Probable**: Has typical clinical features and an epidemiologic link to confirmed cases but lacks lab confirmation
  - **Possible**: Has fewer of the typical clinical features or weaker epidemiologic links to confirmed cases

Example Case Definitions

- Methicillin-resistant *Staphylococcus aureus* (MRSA) infection or colonization in Hospital A's neonatal intensive care unit during January 1–December 31
- Isolation of *Burkholderia cepacia* complex in a patient who received Medication A any time during January 1–June 30
- Fever (temperature >38.5ºC) and compatible symptoms in a patient who had been in an Ebola virus infection–affected country 21 days or fewer before symptom onset

Case Definition Practice

Create a case definition for this scenario:

- A.K is admitted from SNF A with pneumonia February 1, 2023
- J.M. is admitted from SNF A with respiratory symptoms January 6, 2023 and dies later that evening
- L.L. is admitted from SNF A March 12, 2023 with respiratory symptoms, and is later confirmed with legionella pneumonia

Step 5 – Identify and count cases

- Outbreaks are often first recognized and reported by **perceptive HCP** or identified during **surveillance** activities
- Additional cases can be identified through multiple types of data and records, including
  - Microbiology reports
  - Medical records
  - Symptom logs
  - Surveillance records
  - Interviews with HCP/physicians
  - Pharmacy records
  - Radiology records
  - Pathology records
  - Employee health records

Step 6 – Organize data according to person, place, time, and size

- **Create a line list**
  - Helps guide the outbreak investigation and permits rapid examination of exposures
- **Construct an epidemic curve**
  - Visually demonstrates the outbreak's magnitude and time course

Practice Question

- **Create a line list**
  - What are some items you would add to your line list?

Example Data to Obtain for the Line List

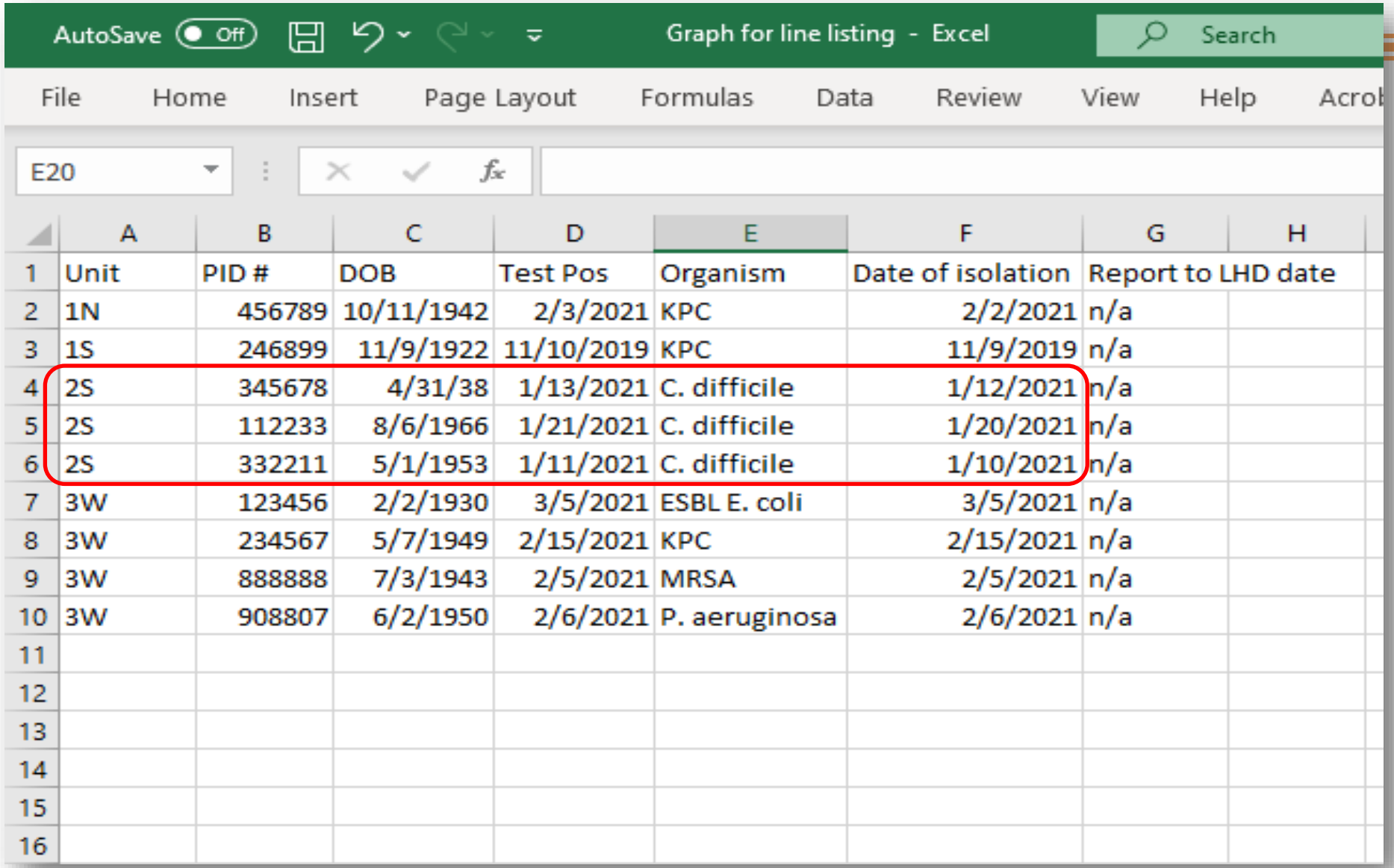
- Patient characteristics such as age, sex, comorbidities
- Date of admission
- Date of illness onset
- Date of discharge (if applicable)
- Facility location/unit, including room number, bed, and adjoining room numbers
- Medications
- Procedures
- Common staff: specific nurses, respiratory therapists, and physicians

Creating the Line List

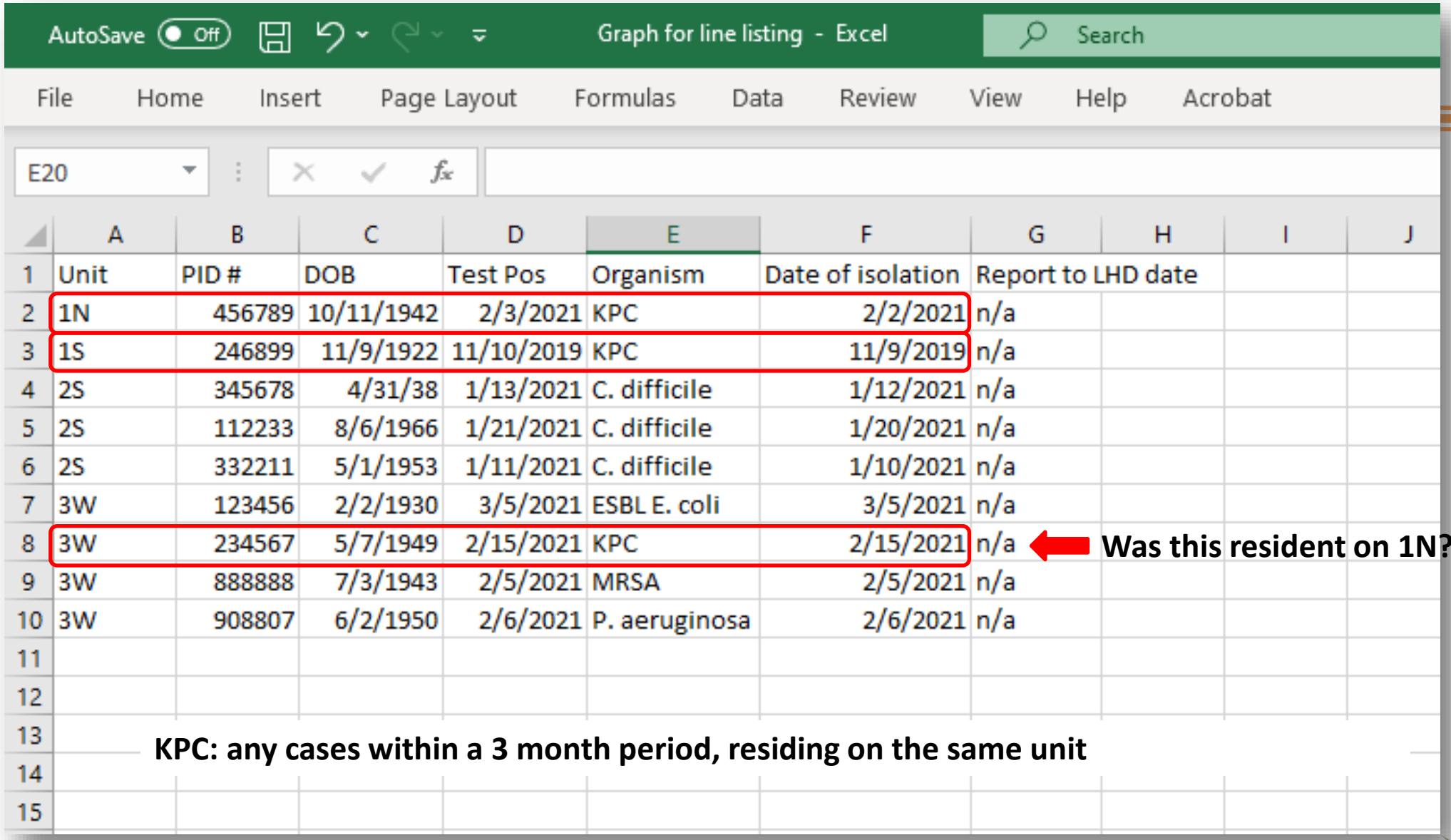
- Collect the information on a standard case-report form, questionnaire, or data abstraction form
- Build a table where each row represents a case and each column represents a variable
- Add new cases as they are identified

This simple format allows the investigator to scan key information on every case and to update it easily

Identify your cases



	A	B	C	D	E	F	G	H
1	Unit	PID #	DOB	Test Pos	Organism	Date of isolation	Report to LHD date	
2	1N	456789	10/11/1942	2/3/2021	KPC	2/2/2021	n/a	
3	1S	246899	11/9/1922	11/10/2019	KPC	11/9/2019	n/a	
4	2S	345678	4/31/38	1/13/2021	C. difficile	1/12/2021	n/a	
5	2S	112233	8/6/1966	1/21/2021	C. difficile	1/20/2021	n/a	
6	2S	332211	5/1/1953	1/11/2021	C. difficile	1/10/2021	n/a	
7	3W	123456	2/2/1930	3/5/2021	ESBL E. coli	3/5/2021	n/a	
8	3W	234567	5/7/1949	2/15/2021	KPC	2/15/2021	n/a	
9	3W	888888	7/3/1943	2/5/2021	MRSA	2/5/2021	n/a	
10	3W	908807	6/2/1950	2/6/2021	P. aeruginosa	2/6/2021	n/a	
11								
12								
13								
14								
15								
16								



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10	3W	908807	6/2/1950	2/6/2021	P. aeruginosa	2/6/2021	n/a			
11										
12										
13										
14										
15										

Was this resident on 1N?

KPC: any cases within a 3 month period, residing on the same unit

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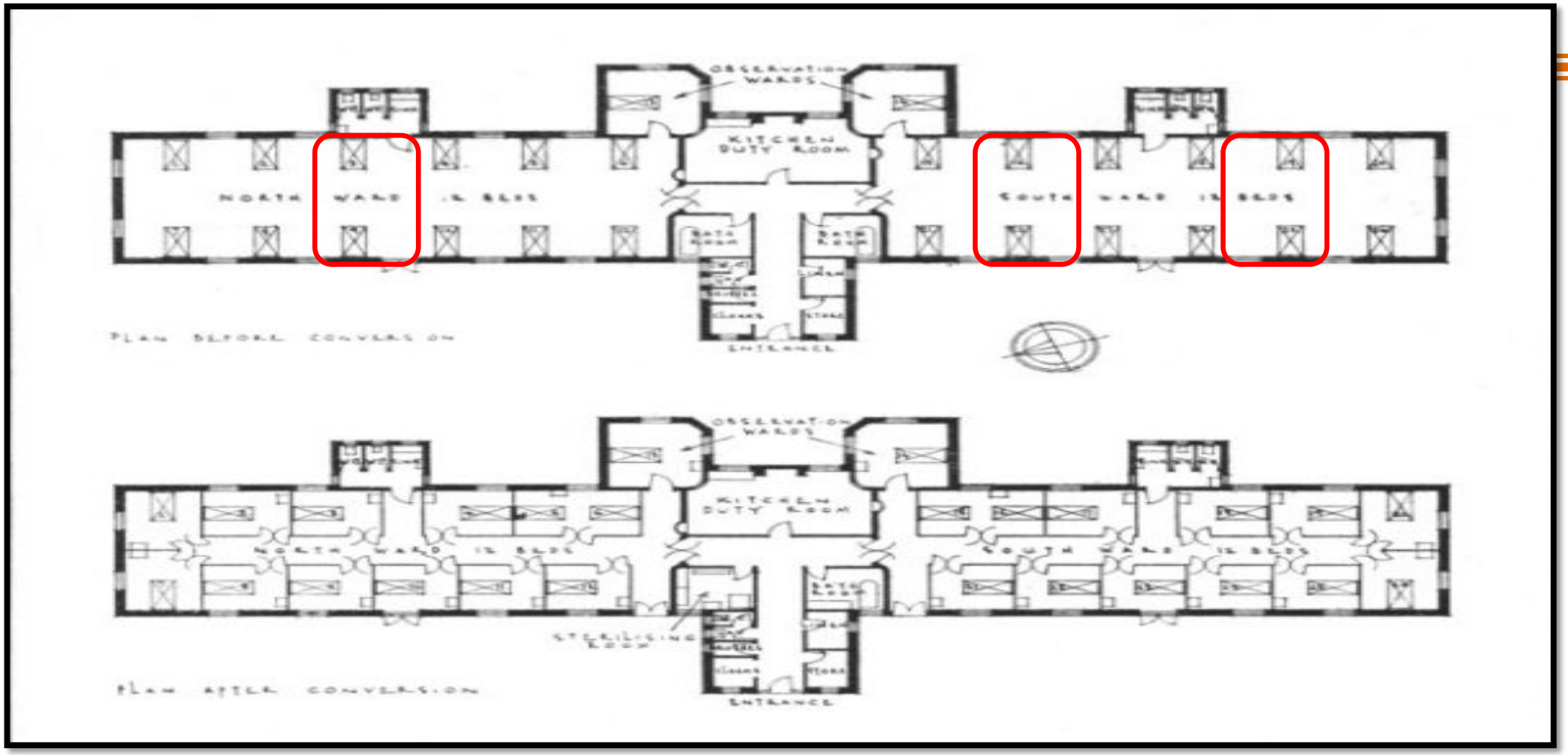
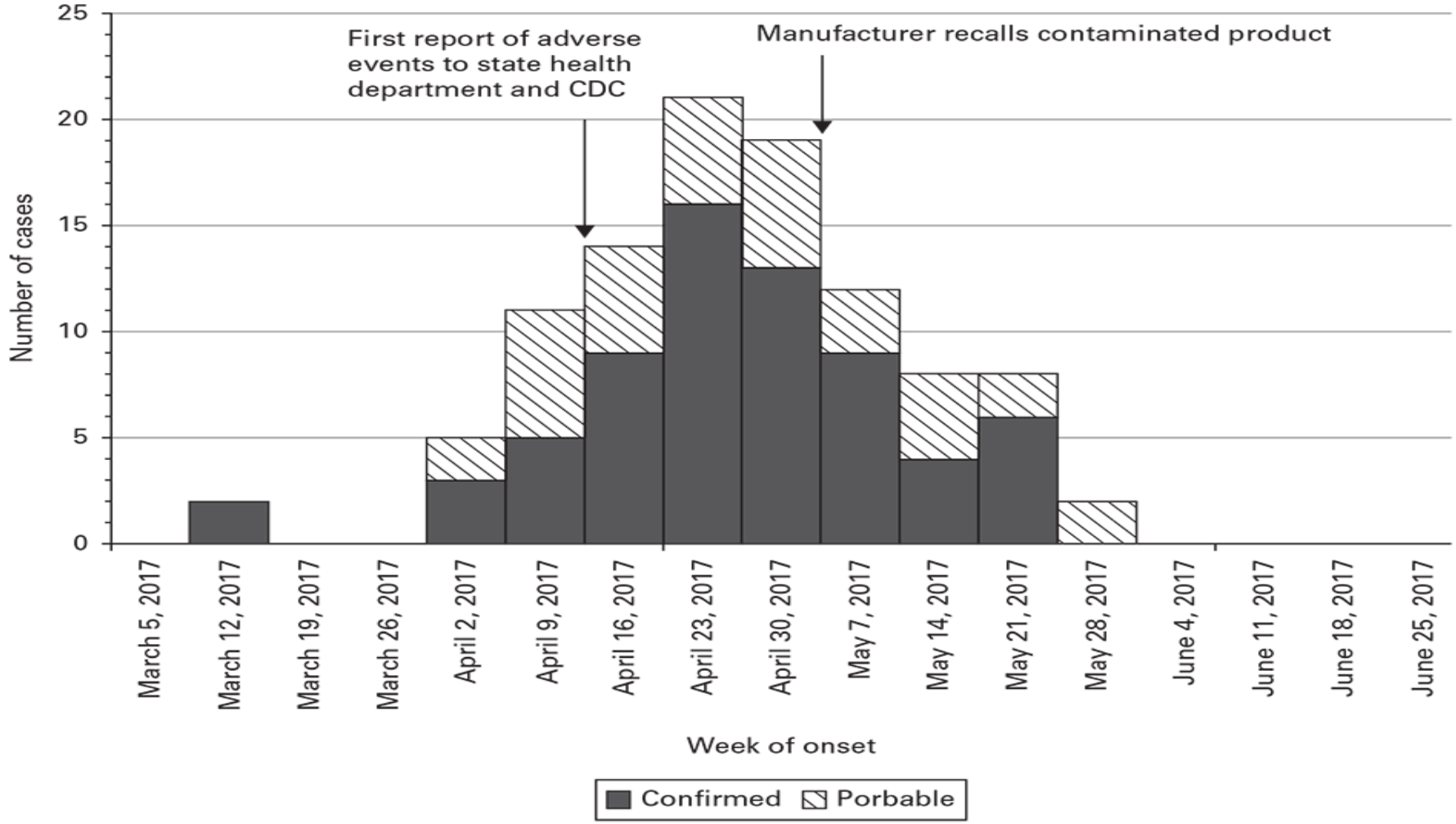

OBSERVATION WARDS
KITCHEN DUTY ROOM
NORTH WARD 12 BEDS
SOUTH WARD 12 BEDS
DATA ROOM
DATA ROOM
ENTRANCE
PLAN BEFORE CONVERSION
OBSERVATION WARDS
KITCHEN DUTY ROOM
NORTH WARD 12 BEDS
SOUTH WARD 12 BEDS
STERILISING ROOM
ENTRANCE
PLAN AFTER CONVERSION

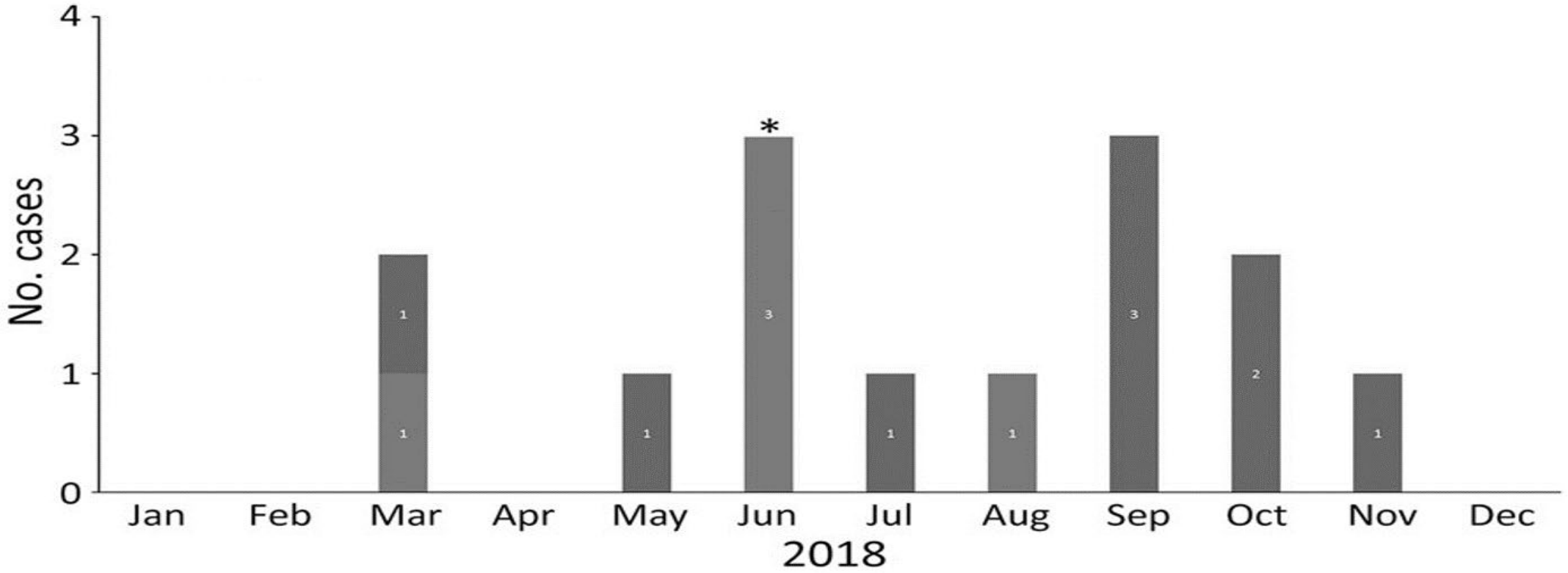
Construct an Epidemic Curve

- Local public health should assist the facility to construct
- The epidemic (epi) curve
  - Illustrates the course of the outbreak by day, week, or month
  - Might help estimate a probable exposure period (especially when an incubation period is known)
  - Might provide clues about the epidemic pattern (such as whether common source or person-to-person spread)
- Plot cases by illness onset date or time

Example: Epi curve of patient adverse reactions associated with a contaminated heparin



Example: Epi curve of a healthcare facility CRE outbreak



CDC KPC-3-Producing Serratia marcescens Outbreak between Acute and LTC Facilities

(wwwnc.cdc.gov/eid/article/26/11/20-2203_article)

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Step 7 – Conduct targeted observations, review key concerns with HCP, and develop data abstraction forms

Public health will guide the outbreak investigation. They will:

- Focus on whether actual practices deviate from recommended infection control practices and facility policies
  - Discrepancies are best identified through a combination of direct observation and HCP self-reported practices
- Review scientific literature to see if similar outbreaks in similar care settings have been reported previously
- Discuss with facility HCP to help generate hypotheses
- Develop or adopt standardized data abstraction forms or assessment tools

Step 8 – Formulate and test hypotheses

To determine the cause and extent of the outbreak

- Perform sampling and testing
  - A sampling strategy (who, where and what should be tested) must be guided by epidemiologic findings
- Consider testing of HCP
  - Only undertaken after careful consideration of how results will help control the outbreak
- Conduct analytic studies
  - Examine frequency of exposure to a risk factor among case-patients (persons with the HAI) compared with the frequency of exposure among controls (persons without the HAI)
  - **Analytic studies are not usually necessary to identify the likely source of outbreak and to institute control measures**

Step 9 – Perform infection control assessment and implement control measures

To control the outbreak

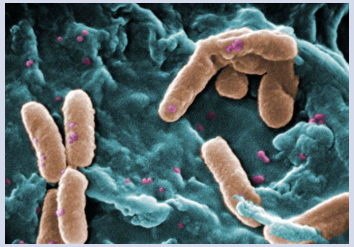
- Perform an infection control assessment
  - Crucial to determine which control measures need to be implemented
  - Use a standardized infection control assessment tool
  - Physical walkthrough should be targeted depending on the hypothesized source of transmission (such as care locations or areas suspected to be involved in the outbreak)
- Recommend and implement control measures
  - Should be implemented as soon as gaps are identified

Implement Outbreak Control Measures

What would you do?

Hepatitis C transmission in an outpatient clinic

Cluster of NICU MRSA infections



Patients with positive Legionella

Common Control Measures

- Isolation, room placement (cohorting), and Transmission-based precautions
- Closing a unit (or the facility) to new admissions until transmission has ceased
- Environmental control measures
- Adherence monitoring
- Post-exposure prophylaxis, as appropriate
- Visitor restriction, as appropriate
- Ensure affected patient status is communicated when transferred, or flagged internally

Common Control Measures

Type of transmission suspected	Suggested action
Cross-transmission (transmission between persons)	Patient isolation and Transmission-based precautions determined by infectious agent(s) Certain scenarios might require closure of locations to new admissions
Hand transmission	Improvements in hand hygiene and nonsterile glove use where needed
Airborne infections (tuberculosis or emerging viral pathogens)	Triage, detection, and patient isolation (transmission-based precautions) with recommended ventilation
Agent present in water, waterborne agent	Assessment of premise water system, liquid products, or medications; use of disposable devices where reusable equipment is suspected
Environmental reservoirs	Review and enhancement, as needed, of cleaning and disinfection processes to interrupt transmission from environment to patient

Step 10 – Follow-up, communicate findings, and notify patients

- **Complete follow-up stages of the outbreak investigation**
  - Refine the case definition, continue case finding and surveillance, and review control measures
- **Communication of findings**
  - Investigation report should include
    1. Outbreak characteristics
    2. Infection control problems that most likely contributed to outbreak
    3. Any interventions instituted and their effects
    4. Recommendations for preventing future outbreaks
- **Notification of patients**

Patient Notification

- Establishes transparency between HCP and residents/ patients
- Can help identify potentially exposed or infected patients who will derive a health benefit through follow-up testing or clinical evaluation
- May limit the spread of multidrug-resistant organisms or other pathogens of public health concern by identifying exposed patients and their contacts who should be managed under recommended precautions
- Improves case finding by informing patients and providers about the outbreak, associated exposures, and clinical signs and symptoms

When is it Over?

When transmission no longer occurs

- No additional cases identified
- All requested documents are received

- Investigation Closure
  - Email or Letter
    - Investigation summary
    - Final recommendations

HAI Outbreak Investigations Toolkit | HAIs | CDC
https://www.cdc.gov/healthcare-associated-infections/php/toolkit/outbreak-investigations-toolkit.html

Legal Considerations

- HAI outbreaks can result in litigation and have broad financial and public relations implications for affected facilities
- Pressure might be applied to investigate rapidly and implement necessary control strategies quickly
- Public health records of outbreak responses are frequently subject of Public Records Act requests
  - Keep records of all steps taken
  - Exercise care and discretion in how emails and other communications are used
  - Assume investigation records might become publicly available or used as part of litigation proceedings

Reporting Outbreaks and Unusual Occurrences

Health facilities licensed by CDPH Licensing and Certification (L&C) are required to report outbreaks and unusual infectious disease occurrences to

Local Public Health
LPH

AND

CDPH Licensing & Certification District Office
L&C

Public Health Roles in Outbreaks

Facility

LHD

Epi investigation,
IC recs, onsite visit

L&C District Office

Regulatory, onsite survey,
approve plans of correction

CDPH HAI Program

Infection control expertise, guidance, coordination, onsite visit assistance (if needed), **NOT** regulatory

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Examples of Reportable Incidents

CDPH examples of outbreaks and occurrences that should be reported

- Single case of colonization or infection with a **novel MDRO** that was never previously or only rarely encountered such as
  - Candida auris
  - Vancomycin-resistant Staphylococcus aureus (VRSA)
  - pan-resistant MDRO
- Single case of **measles** in a patient not placed into airborne isolation precautions upon facility entry
- Single case of healthcare-associated **legionellosis**
- Single case of healthcare-associated invasive **group A beta hemolytic Streptococcus**

CDPH All Facilities Letter (AFL) 23-08(PDF)

(https://www.cdph.ca.gov/Programs/CHCQ/LCP/Pages/AFL-23-08.aspx)

More Examples of When to Report

- Infection Prevention suspects a cluster or unusual event and is conducting an investigation
- When laboratory testing to evaluate relatedness of isolates is pending or shows isolates are not closely related
- A consultant is hired to assist with the investigation
  - Legionellosis
  - Aspergillosis
- Death(s) are linked to an unusual pathogen or infectious disease

"outbreak"

CDPH HAI Program Outbreak Resources

Outbreak guidance for	Resource type
Candida auris	Quicksheet (PDF)
Carbapenem resistant Enterobacteriaceae (CRE)	Quicksheet (PDF), Slides (PDF), Webinar Recording
Clostridioides difficile infection (CDI)	Quicksheet (PDF), Slides (PDF), Webinar Recording
Healthcare-associated Acute Viral Hepatitis	Quicksheet (PDF), Slides (PDF), Webinar Recording
Healthcare-associated Legionnaires' Disease	Quicksheet (PDF), Slides, Webinar Recording
Influenza and Other Respiratory Illness Outbreak	Quicksheet (PDF) Skilled Nursing Facilities annual guidance (PDF)
All outbreak types	Outbreak Line List (EXCEL)

CDPH HAI Detecting and Controlling Outbreaks in SNF

(www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/SNF_DetectAndControlOutbreaks.aspx)

CDPH HAI Resources for LPH (See Outbreaks)

(www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/LHD_Resources_and_Trainings.aspx)

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Summary

- Healthcare facility IPs should be able to conduct investigations of unusual occurrences or outbreaks, and report them to their local health department
- HAI outbreak investigations involve a step-by-step process
- The cause of the outbreak may not be identified, and a facility may not know which control measure was most effective
- HAI Program medical epidemiologists and IPs, and your local health departments are available to assist with outbreak or unusual occurrence investigations

Additional Resources and References

- CDC HAI Outbreak Investigation Toolkit (www.cdc.gov/hai/outbreaks/outbreaktoolkit.html)
- CDC Outbreak Investigations in Healthcare Settings (www.cdc.gov/hai/outbreaks/index.html)
- Worldwide Database for Nosocomial Outbreaks (www.outbreak-database.com)

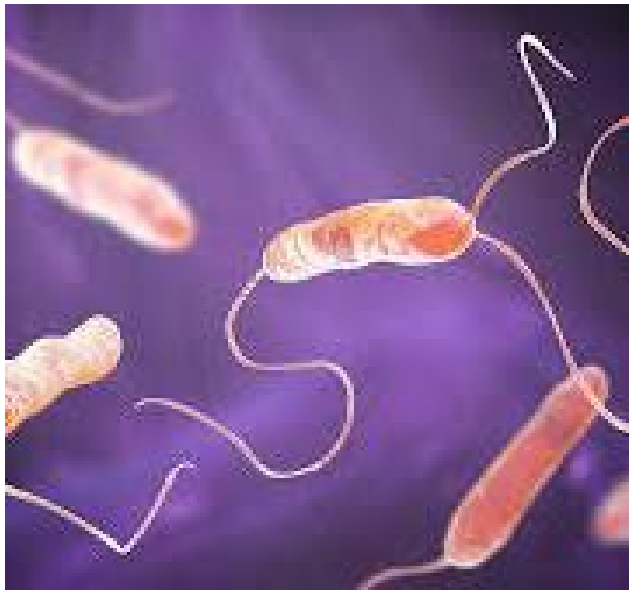
CASE STUDY-*Stenotrophomonas Maltophilia* Outbreak

OUTBREAK CALL

- When: September 2022-23
- Where: >300 Bed Acute Care Hospital
- Patients: ICU, Most ventilator dependent
- Status: 9 culture positive patients in 2022
  3 more in 2023
- Organism: *Stenotrophomonas Maltophilia*

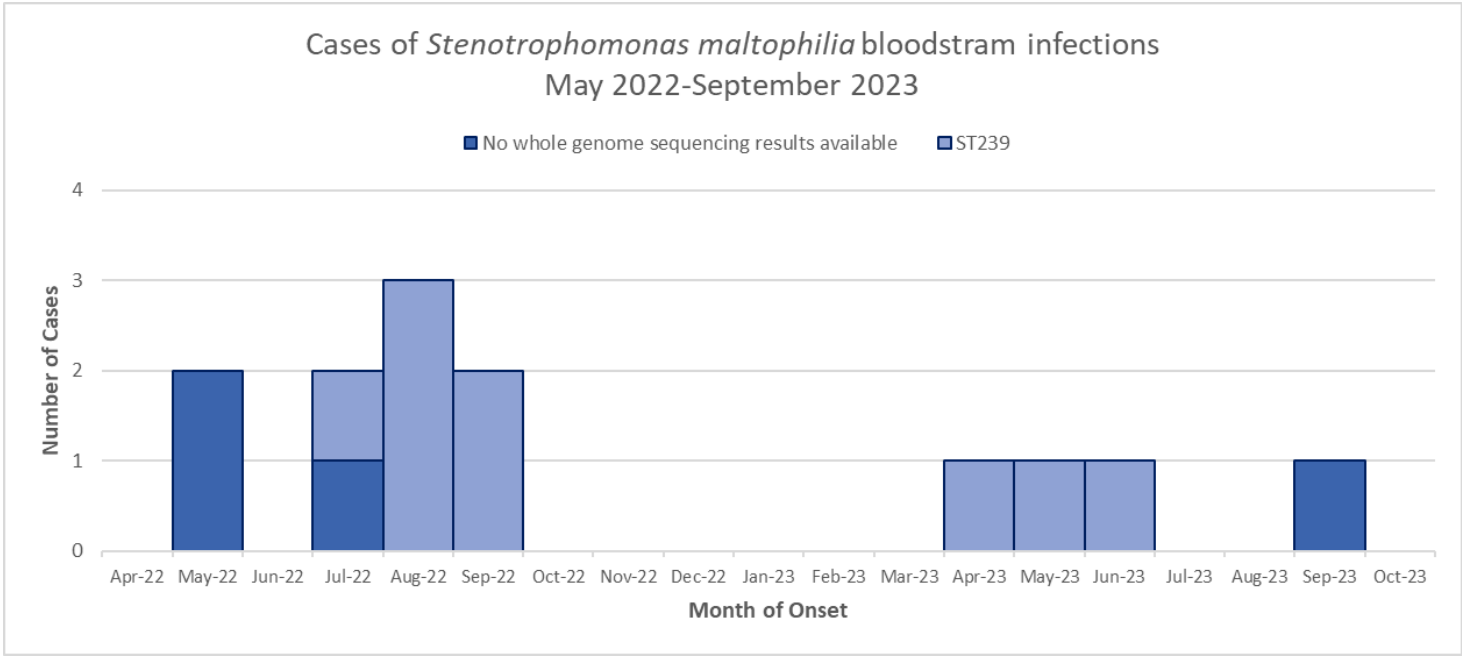
Stenotrophomonas maltophilia (SM)

- Newly emerging pathogen of concern
- Gram-negative MDRO
- Waterborne transmission
- Risk factors:
  - Chronic respiratory diseases
  - Long ICU stays
  - Mechanical ventilation
  - CVCs
  - Use of broad-spectrum antibiotic courses



CASE DEFINITION

- A patient in the ICU with fever, diagnosed and treated for HAI bloodstream infection (BSI)
- *S. maltophilia* isolated from a blood culture from May to Oct, 2022



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INITIAL PUBLIC HEALTH CONSULTATION

- Infection prevention and control (IPC) findings
  - Patient care supplies and medications stored within the splash zone of sinks
  - Sinks not dedicated for handwashing
  - Potential use of single-use intravenous medical products for multiple patients

- Interventions
  - Implementation of sink splash guards in CT suite and other patient care areas
  - Re-education of staff on sink hygiene practices throughout the hospital
  - Educated staff to not to use single-use intravenous products for multiple patients

CDC EPI-AID INVESTIGATION OBJECTIVES

- Determine **source, risk factors, and route of exposure** for *S. maltophilia* infection
- Aid with medical record abstraction, data management, and epidemiologic analysis including a **case-control** or cohort study
- Gather information via interviews and **direct observation**
- Determine the need for, planning of, and conduct **additional environmental sampling**
- Perform additional targeted **infection control assessments**
- Assist with **recommending infection prevention and control measures** to stop infections

CASE CONTROL STUDY

- Medical chart abstraction for case-control study
- 12 in-depth case patient medical chart abstractions
- 3 matched controls per case
    - Matching criteria: the patient **closest to case patient's admission date with greater than or equal to amount of time in the hospital**
- Medical chart abstraction on control patients
    - **Only** during the reference period for their matched case **(reference period: date of admission to date of positive culture collection)**

CASE CONTROL STUDY RESULTS

- Matched case-control study
  - Exposures of interest with high ORs:
    - Exposure to contrast
    - Arterial lines
    - Injectable medications
- Environmental sampling did not implicate a single point-source
- Continue to improve IPC practices in highlighted areas
  - Opportunity to address improvements in multiple areas

REDUCING RISK FROM WATER & ENVIRONMENTAL CLEANING

- Do not place patient care items within 3 feet of sinks
  - Splash guards may be helpful in areas with limited counter space
- Ensure ice machines undergo appropriate maintenance and leaks are fixed promptly
- Ensure medications, tube feeds, and other liquids are not disposed in sinks in patient care areas
- Ensure manufacturer's instruction for use are followed for cleaning components of the CT injections system
- Educate, train, and audit environmental services staff regarding PPE donning and doffing, sequence of cleaning, and contact time of disinfectant products

ENSURING SAFE USE OF INJECTABLE MEDICATIONS

- Review and audit the preparation, handling, storage, and administration of fentanyl and propofol
  - Give additional attention to practices associated with outbreaks involving propofol contamination, such as:
    - Reuse of syringes for multiple patients
    - Single use vial used for multiple patients
    - Improper storage or handling of opened vials
- Ensure that USP <797> standards are being appropriately followed
- Assess the potential for drug diversion in affected units

Questions?

For more information, contact the HAI Program at

HAIProgram@cdph.ca.gov

Thank you!