An Overview of Outbreak Investigations

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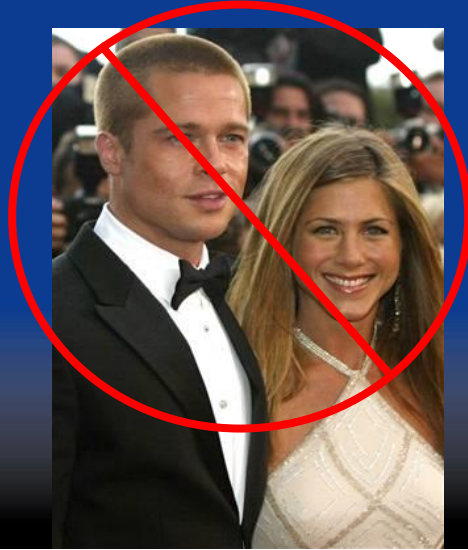

Is This the "Anatomy of an Outbreak"?

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More Like It!

Nosocomial Outbreaks in the United States
Magnitude of the Problem

- Extent of problem unknown
- Estimates
  - 2 million nosocomial infections annually
  - 5% of NI belong to clusters
  - Average cluster size: 6 patients/cluster
- Extrapolation
  - 16,700 clusters/year

What is an "outbreak"

- From Webster:
  - A sudden rise in the incidence of a disease
- From epidemiologists:
  - An increase in the incidence of a disease above what is normally expected

"Outbreaks" vs "Clusters"

- Sometimes small outbreaks are referred to as clusters.
- Functionally, there is no difference between the two since
  - They are both a problem
  - They both need to be investigated and controlled

Outbreak vs Pseudo-outbreak

- Outbreak generally refers to situations in which there is clinical disease or clinically relevant culture results.
- Pseudo-outbreak is generally used to refer to situations in which there is a rise in positive culture results but without evidence of disease in the patients.

Is it an outbreak?

- Given the definition, it's important to remember that one case can be an outbreak and may require investigation:
  - One case of healthcare associated *Legionella*
  - One case of post-operative group A streptococcus infection

How do you find outbreaks?

- Surveillance
  - Provides the ideal information since rates are tracked over time.
  - Only works for infections you do surveillance for!
- In the end, most outbreaks in healthcare are discovered by observant healthcare workers

How NOT to Discover an Outbreak at your facility

An Outbreak of *Burkholderia cepacia*

- An ICP and microbiologist noticed that there were 14 patients with cultures growing *B. cepacia* in the previous six months
  - Death in 8 patients
- In past years, there had not been more than 6 cases in an entire year.

When should you investigate?

- Some are easy:
  - Weird or important organisms
    - *Legionella*, Group A Strep, *Ralstonia, B. cepacia*
- Some are not:
  - 50% increase in SSIs for one quarter?
  - Doubling of MRSA BSI for one month?

Stages of an outbreak investigation

- Initial investigation
  - Literature review
  - Case definition
  - Case finding
  - Chart review and line list
  - Observations and review of patient care
  - Environmental sampling?
  - Implement interim control measures
- Follow-up investigation
  - Refine the case definition
  - On-going case finding/surveillance
  - Review of control measures
  - +/- Analytic studies (case-control, cohort etc.)

One thing to remember

- Outbreak investigations are neither linear nor orderly!
- Multiple steps happen simultaneously.
- Steps often have to be repeated several times.

Before you begin . . .

- Talk to the lab and ask them to save ALL isolates that might be part of the outbreak!

Literature review

- Is an important place to start.
- There are LOTS of published outbreak investigations more than 50,000.
- You will get good leads both on where and how to start your investigation.

Another great resource

outbre@k
WORLDWIDE DATABASE

GBC | Contact

Search Home   Outbreak Information   FAQ Help News

Welcome to Outbreak

Welcome to Outbreak, the first web-based register for nosocomial outbreaks. Outbreaks of nosocomial infections (NI) are dramatic for patients and they may damage the reputation of your hospital. However, by studying the reports of outbreaks, you can expand your knowledge about the spread of NI and apply this knowledge with the purpose of preventing further infection.

For a short introduction and more information about the use and the advantage of the Outbreak database see "Outbreak Information".

For search in the Database please press "Search"

http://www.outbreak-database.com/43.htm

They already did the hard work!

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WORLDWIDE DATABASE

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Search Home   Outbreak Information   FAQ Help News

matches out of 2015 from the outbreak rldwide database

e:1 /3   rch for: ralstonia

first <-prev 1 2 3 next-> last   new search   Report Type: ALL

Matchcode	Cases	#	fatality (infection)	Infection type	Source	Transmission	Measures
Burkholderia-2005-Mor-1765	Patients	3	2	Bloodstream infection/sepsis	Drug	Invasive technique	Modification of care/equ (Change) antibiotic ther
Matchcode	Cases	#	fatality (infection)	Infection type	Source	Transmission	Measures
Ralstonia-2005-Cen-1943	Patients	6	0		Medical equipment/device	Invasive technique	Disinfection/Sterilization
Matchcode	Cases	#	fatality (infection)	Infection type	Source	Transmission	Measures
Ralstonia-2005-Kim-2044	Patients	18	0	Bloodstream infection/sepsis	Drug	Invasive technique	Modification of care/equ Patient screening/surve (Change) antibiotic ther
Matchcode	Cases	#	fatality (infection)	Infection type	Source	Transmission	Measures
Ralstonia-2005-Mor-1764	Patients	14	0	Bloodstream infection/sepsis	Drug	Invasive technique	Modification of care/equ (Change) antibiotic ther
Matchcode	Cases	#	fatality	Infection type	Source	Transmission	Measures

Case definition

- Initial case definition should be narrow enough to focus efforts, but broad enough to catch all possible cases.
- How narrow to make it often depends on the pathogen.

For example

- Any hospitalized patient who had any culture that grew *B. cepacia* from June 2003- June 2004.
- Patients who developed an MRSA surgical site infection after undergoing cardiac surgery between January 1 and December 31.

How do you find cases?

- Microbiology data
- Infection control or surveillance records
- Discussions with clinicians

Case Finding Challenges

- Finding cases when you can't rely on microbiology is very tough and requires a lot more effort in chart review
- Requiring a micro link makes case finding easier and the definition tighter, BUT may miss cases ("is the juice worth the squeeze?).
- A lot depends on the pathogen, for example: influenza positive versus influenza like illness.

Case Finding Challenges

- In some instances, there may be cases with sub-clinical infections or cases that are only colonized with the organism of interest.
- Will surveillance cultures help find unknown cases?
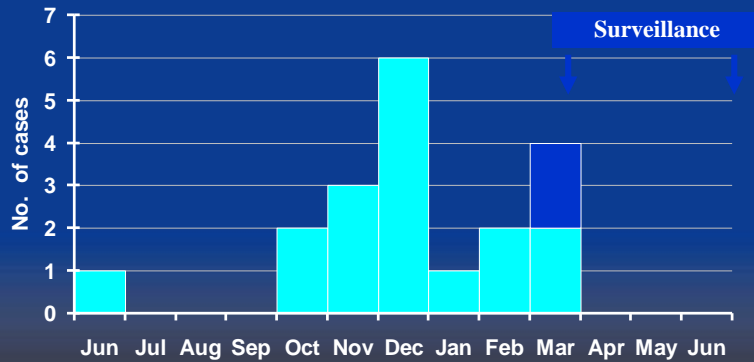- Is it worth the extra time and money?

How hard should I look?

- Remember, the goal of the investigation is to stop the outbreak, not to uncover every case.
- More exhaustive case findings efforts may not be needed up front, but might become important if you can't get things under control quickly.

Patients with *B. cepacia* Cultures, June 2003 to June 2004, Hospital A, MO

Total N = 19

It's all about the line list

- Arguably the single most important part of the investigation since it drives all investigative efforts.
- Could include information on:
  - Signs and symptoms- is this an outbreak?
  - Medications
  - Procedures
  - Consults
  - Location
  - Staff contact?
  - Host factors?

The devil really is in the details

- Gathering line list information is the most resource intensive part of the investigation.
- Sometimes, even a limited line list can be very helpful in focusing your initial investigation:
  - A *Pseudomonas* outbreak where all cases underwent bronchoscopy prior to infection.

Caveat emptor!

- The limited line list can also be misleading.
- Not every case might be exposed to the source.
- Many cases may be exposed to something that is only an associated factor.

Outbreak of *B. cepacia* - patient characteristics

	N	%
Admitted to ICU	17	(89)
On antimicrobials	19	(100)
On mechanical ventilation	13	(68)
On nebulized therapy	18	(95)
Received nasal spray	0	(0)

Observations

- Who and what to observe is generally driven by the line list.
- Initial observations and review of procedures can be very informative and can help with the creation of a standard observation tool, if needed.

What am I looking for?

- How does actual practice compare to written (or verbal) protocols?
- Do different people do the same thing in different ways?

A lesson from my sons

- Ask lots of questions of lots of people!
  - Do you always do it that way?
  - Have you seen other people do it differently?
  - What are the challenges with maintaining good techniques?
  - What do you think is causing the outbreak?
  - What procedures or medications might I be missing because they are not in the chart or done infrequently?

Back to our Example- Albuterol Administration

- Multi-dose vials for multiple patients
- Nebulizers not washed, rinsed and dried between treatments
- In-line nebulizers attached to ventilator circuit for 24 hrs
- Medication added to nebulizer reservoir without discarding residuals

Another outbreak of *Burkholderia cepacia*

- Discussions at a group meeting revealed that there was an on-going product evaluation of a sublingual CO_2 monitor.
- Use of the monitor was only for the 1st 24 hours of admission and not documented in the chart.
- The probe was packed in saline that was contaminated with *B. cepacia*.

Environmental sampling-
the good, the bad, the ugly

- Can be the most powerful and definitive aspect of an investigation.
- But can also be expensive, misleading and frustrating
  - Does a negative culture mean the bug was never there or just is not there right now?
  - Did we culture the right things?

Environmental Cultures-
Other Challenges

- Methodologies can be tricky and might not be the standard methods used in clinical labs.
  - Some environmental pathogens have adapted to low nutrition environments and need special media to grow
  - Some samples result in overgrowth of pathogens you're not looking for
  - Some samples require neutralization steps to get rid of disinfectants etc.

Environmental Cultures- Other Challenges

- Even using the best methods, the yield can still be low.
- For example with surface swab
  - ~25% yield in getting the bacteria off the surface onto the swab
  - ~25% yield getting the bacteria off the swab into the media

Environmental Cultures- Some Suggestions

- Culture AFTER you have data from the line list and observations.
- Talk with the lab about optimal methods. Culture only things that are likely routes of transmission (probably not walls and floors!).
- Culture what makes sense for the organism (*Ralstonia*- fluids, VRE- objects/surfaces)
- Remember- the environment is big, a swab is small.

Positive *B. cepacia* from environmental sampling collection

- Open albuterol multi-dose bottles from RT pocket
- Internal surface of vent circuit and suction cups
- In-line nebulizer

Implementing control measures

- Ultimately, the primary goal is to stop transmission, not necessarily find the source.
- It's OK to implement a variety of control measures targeting various possibilities based on the initial observations.

Follow-up or "definitive" investigation

- Refine the case definition based on the initial findings- make it as focused as possible to detect real cases.
- Continue surveillance efforts based on the refined case definition.
- Continue to review control measures:
  - Compliance
  - Do they need to be enhanced or loosened?

In our example

- Even before we knew exactly what was going on we recommended:
  - Reinforced best practices with respiratory therapy
  - Surveillance cultures for intubated patients
  - Contact precautions for all patients with *B. cepacia*

In the end

- Once we felt more comfortable with the explanation for the outbreak and were confident there were no more cases, they were able to stop surveillance cultures and contact precautions.

Analytic study

- Do you need to do one?
- In many cases, a study is "icing on the cake", but not necessary to control the outbreak.
- They can be helpful in guiding more investigation when the source remains unclear.
- They can help support hypothesis when there is no "smoking gun".

Challenges

- Often (hopefully) the number of cases is small which limits the power.
- Control selection can be challenging.
- It can be tricky to isolate the real risk factors.
- They are a ton of work!

Outbreak of *B cepacia-* patient characteristics

	N	%
Median hospital stay (days, range)	9	(1- 50)
Admitted to ICU	17	(89)
On antimicrobials	19	(100)
On mechanical ventilation	13	(68)

Control selection

- Comparing these patients to an average admission, who was not intubated, not in the ICU for several days (and maybe not on antibiotics) will greatly overestimate all of these things as risk factors
- We already know that being on a ventilator in the ICU is a risk- we need the case-control study to look at more details.

Patients with *B. cepacia* Cultures, June 2003 to June 2004, Hospital A, MO

Total N = 19

More control selection challenges

- What if some patients selected as controls actually are unrecognized cases?
- You will end up underestimating the importance of some risk factors.
- This will reduce your already small power!

Control criteria-
An outbreak of *B. cepacia*

- Control selection:
  - Admitted for > 72 hours
  - At least one *B. cepacia*-negative sputum
- Matched case-control:
  - Age group ± 15 years
  - Ward or ICU

Risk Factors for *B. cepacia* Acquisition- What's the real problem?

Exposure since admission	Cases N=18 N (%)	Controls N=18 N (%)	OR	95% CI	P
Hospital > 6 days	13 (72)	7 (39)	4.1	1.0 – 17.4	0.04
ICU > 6 days	11 (73)	5 (33)	5.5	1.1 – 28.2	0.03
Ventilation	12 (67)	4 (22)	7	1.5 – 33.0	0.02
Albuterol > 3 days	15 (88)	6 (43)	10	1.6 – 79.1	0.01

Molecular Typing

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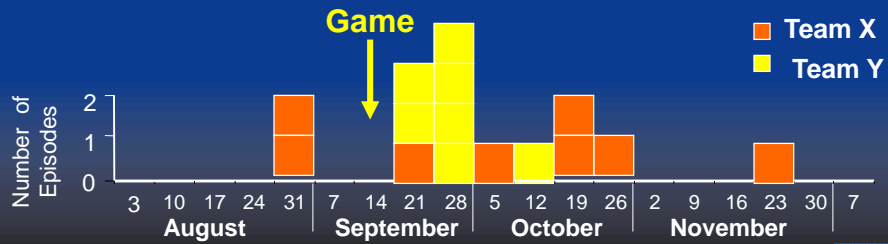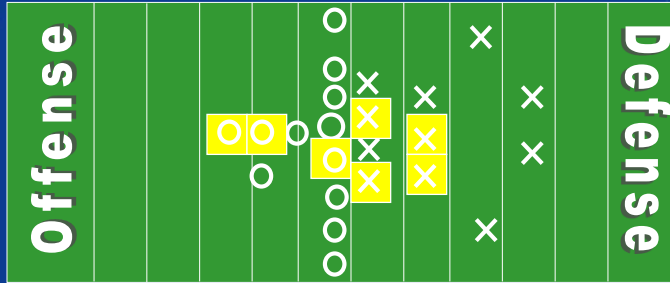
Molecular typing

- Can provide the "slam-dunk" that we all crave in outbreak investigations.
- But, there are challenges:
  - You have to have the organisms
  - It's expensive and not available everywhere
  - It does not always answer the question!
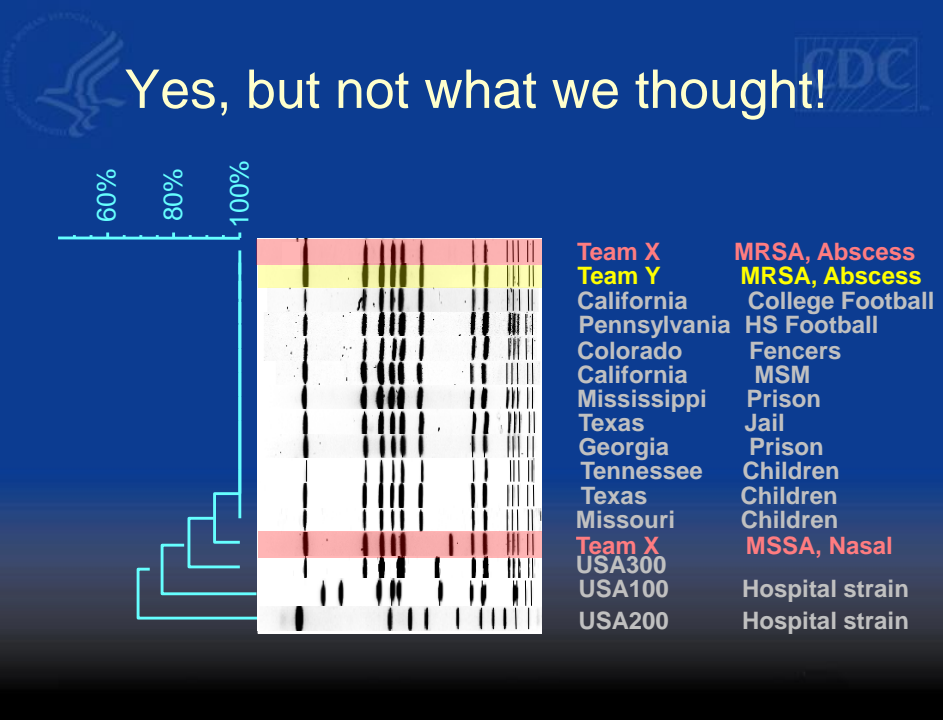
Results – Molecular Epidemiology Team X MRSA: USA 300

MRSA: Abscess
MRSA: Abscess

Results – Cases (Team Y and Team X)

A connection?
MRSA from teams X and Y

Team X MRSA Abscess
Team Y MRSA Abscess
Team Y MRSA Nasal

Yes, but not what we thought!

Team X	**MRSA, Abscess**
Team Y	**MRSA, Abscess**
California	**College Football**
Pennsylvania	**HS Football**
Colorado	**Fencers**
California	**MSM**
Mississippi	**Prison**
Texas	**Jail**
Georgia	**Prison**
Tennessee	**Children**
Texas	**Children**
Missouri	**Children**
Team X	**MSSA, Nasal**
USA300	
USA100	**Hospital strain**
USA200	**Hospital strain**

"Different" may not mean "The end"

- NICU outbreak with three-fold increase in *Pseudomonas* pneumonias.
- Typing showed several different strains.
- We still have a problem!

Molecular typing

- Strain typing data can provide useful data for outbreak investigations
- Typing data is NOT a substitute for a sound epidemiologic investigation
- The two data sets should be used together to provide complementary information

Other important issues in outbreaks

- Aside from the patients, there will be other "interested parties"
- Hospital administration
- Media
- Lawyers

Facility administration

- Will be keenly interested in all aspects of your work!
- Sometimes they have to be "educated" on the importance of doing the investigation in the 1st place.
- It's important to keep them updated- you want them on your side when you need to get things done.

The media

- Outbreaks are sensational, they make good stories and so reporters love them.
- Work with your public affairs/relations office.
- Designate a spokesperson so that there only 1 person doing all the talking.

Lawyers

- It is a reality that outbreaks can lead to lawsuits.
- Keep careful records of what you did.
- Keep a detailed timeline- one of the key questions you will get asked is "when did you do that?".
- Involved your risk managers at the start.

Conclusions

- Outbreaks remain a major detriment to patient care and patient safety.
- Devastating for healthcare workers.
- Can have massive financial and public relations impacts on healthcare facilities.

Conclusions

- Outbreaks are also sentinel events that help us understand and confront emerging challenges in healthcare.
- They can play an important role in making recommendations that improve overall patient care and provide important opportunities for education.

Thanks!

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