Laboratory-Acquired Infections 1979–2013

- Karen Byers, RBP, CBSP
- Biosafety Officer
- Dana Farber Cancer Institute
- Boston, MA
5 Routes of LAI infection

- Parenteral inoculations with syringe needles or other contaminated sharps; spills and splashes onto skin and mucous membranes; ingestion or exposure through mouth pipetting or touching mouth or eyes with fingers or contaminated objects (20%)

- Infectious aerosols (and droplets) – directly or hand contamination. (80%)

\textit{MMWR Supplements 2012 / 61(01);1-101}
Role of aerosols/droplets
LAI Summaries

Pike and Sulkin: survey sent to 4,000 labs of various types: approximately 50% response. 4,079 LAI from 1935 to 1978. 14% clinical; 59% research.


Byers and Harding: working on update – 2033 LAI and 37 deaths... and counting..
What can we do with the data?

Limitations:

1) An literature search is not an epidemiological study.
2) Limited to English*publications (Sevilla–Reyes, 2009 ABSA conference–abstract listed 1, 179 laboratory, exposures in Spanish and Portugese journals.)

Is it useful? Case studies– reinforce training and program guidance.
LAI Data Analysis

- Settings
  - BSAT
  - Clinical
  - Teaching
- Research Laboratory
- Use of Animal models
- Equipment-related issues
- Practice breaches

10,000 individuals with access
11 LAI with BSAT
No fatalities
No secondary infections

*Applied Biosafety* 2012 17(4) 171–180
# LAIs with BSATs

<table>
<thead>
<tr>
<th>Year</th>
<th>Agent</th>
<th>#cases</th>
<th>Entity type</th>
<th>Lab Type</th>
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<tr>
<td>2004</td>
<td><em>Brucella melitensis</em></td>
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<td>Registered</td>
<td>BSL2</td>
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<td>Coccidiodes sp.</td>
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<td>BSL3</td>
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<tr>
<td>2010</td>
<td><em>Brucella suis</em></td>
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<td>Exempt</td>
<td>BSL2</td>
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</table>

*Applied Biosafety. 2012. 17(4) 171-180*
LAI in clinical labs...
2002–2004

- Clin Micro Net – an online survey of clinical lab directors.
- Reports from 88 hospital micro labs and 3 national reference labs.
Results of 2002–2004 online survey: 33% of labs reported at least 1 LAI.

Forty-one bacterial LAI were reported:

- *Shigella* (15),
- *Brucella* (7),
- *Salmonella* spp. (6),
- *Staphylococcus aureus* (6) with 5 of these being methicillin-resistant resistant,
- *N. meningitidis* (4),
- *E. coli* 0157:H7 (2) and *C. difficile* (1)

Incidence of infection for clinical lab staff vs. general population (aged 30–59)

Lower for clinical microbiologists than the general population for: *Salmonella*, *C. difficile*.

About the same for *Shigella* and *Coccidioides* species.

Higher for:
- *Brucella* (641 per 100,000 vs. 0.8)
- *N. meningitidis* (25.1 per 100,000 vs. 0.6)
- *E.coli* 0157H7 (83 versus 0.96).

Student LAIs – Teaching Labs

**China**: 27 students and teacher infected with Brucella in veterinary teaching lab (Lu Yanlu, 2011)

**Austria**: first case of *V. cholera* in 50 years, in student who cleaned up a spill in a shaker. (Huhulescu, 2010)
Multistate Outbreak of *typhimurium* infections associated with clinical and teaching labs.
August 20, 2010 - June 29, 2011

http://www.cdc.gov/salmonella/typhimurium-laboratory/011712/index.html
109 infections
4 of the LAI were
In children under 4

**Supervisor**
**Responsibilities listed:**
Advice to Laboratory Directors, Managers, and Faculty Involved with Clinical and Teaching Microbiology Laboratories

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**What You Work With Can Make You Sick**

Follow safe lab practices—and don’t bring germs home with you.

- **Always wash your hands with soap and water...**
  - Right after working in the lab
  - Just before you leave the lab

- **Avoid contamination while in the lab.**
  - Don’t eat, drink, or put things in your mouth (such as gum)
  - Don’t touch your mouth or eyes
  - Don’t put on cosmetics (like lip balm) or handle your contact lenses

- **Leave lab supplies inside the lab.**
  - If you must take supplies out of the lab, keep them in a separate bag so you don’t contaminate anything else

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**Don’t carry dangerous germs from the laboratory home with you.**

- Leave personal items outside of the lab so you don’t contaminate them: cell phone, car keys, tablet or laptop, MP3 player
- Keep work items off of bench areas where you do experiments: backpacks, notebooks, pencils, pens

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**Leave your experiment inside the lab so you can stay healthy outside the lab.**

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*Monday, October 21, 2013*
Analysis of teaching labs with and without *Salmonella* LAI

Essentially same facilities, safety policies, procedures in labs that had LAIs and those that did NOT.

Monitoring and enforcing NO handheld electronics is difficult.

Lesson Learned: Labs without LAI included **symptoms** in their training, and their students were more familiar with biosafety materials.

http://www.cdc.gov/salmonella/outbreaks.html
Training – emphasis

Non-compliance with training requirements (as well as use of PPE) in review of fatal LAI caused by *pgm-Y.pestis*. *MMWR 2011 60*(07);201-205.

US Department of Labor cited the need to emphasize symptoms in training when investigating fatal LAI due to *N. meningitidis* serotype B.

LAIS attributed to Biosafety Cabinet Failure

3 Positive PPD tests in one clinical lab. hard-ducted bsc; no exhaust.


1 case of *Neisseria meningitidis; “defective bsc”* (Omer, 2011. *PLoS ONE* 6(2) e17145. doi: 10.1371/journal.pone.0017145)
Lab staff are...human...

Serum droplets when opening Vacutainer tube went in eye. Staff just blinked; did not use eyewash. Had been trained on using eyewash 6 months prior. Seroconversion to HIV 6 weeks later.


Researcher touched filter culture of cells growing *Helicobacter pylori*; put fingers in mouth. Developed ulcer.

Use of animals in research...

1979–2004: zoonotics – 171 overt infections; 2 fatalities


NHP infections 1979–2004

- 10 primary LAI, 1 secondary, 1 fatality due to *Macathine herpesvirus*, formerly CHV–1, B virus
- 41 asymptomatic Ebola–related Filovirus
- 1 Ebola, new strain from chimpanzee autopsy in field
- 2 Simian Type D
- 2 Simian Immunodeficiency Virus
- 18 Spumavirus or Simian Foamy
New simian adenovirus, TMAAdv-C, infected 9 baboons in NHP facility. Two baboons died. Anecdotal - staff had flu-like illness.


New adenovirus, TMAAdv, killed most of the titi monkeys in a colony. Staff member ill, family member - respiratory infections. Confirmed with antibodies.

Laboratory Practice: Inactivation methods

Samples removed for analysis at Biosafety Level 2-inactivation conditions not verified.

http://www.wpro.who.int/sars/docs/update/
Exposures due to cross-contamination of stocks

3 *F. tularensis* cases due to cross-contamination of stock.

Cell line provided for growth of West Nile virus stock contaminated with SARS.
Secondary transport container

Polystyrene tube containing *B. abortus* broke during transport from 1 lab to another.

Wearing mask, gloves, applied disinfectant. Lab evacuated w/in 45 mins. Cleaned up after 60 mins.

6 weeks post event: 3 staff diagnosed w/ Brucellosis.

Serologic study began: 9 more staff (incl. 1 office worker) seropositive--treated prior to development of clinical illness.

http://jcm.asm.org/cgi/content/full/38/5/2005
1st: isolation of Zika in US

2 scientists collected mosquitoes in Senegal.

6–9 days after return to Colorado, became ill. Also wife of 1 scientist.

Diagnosis: Zika virus. Found in Africa and Asia, Flavivirus related to yellow fever, West Nile, Japanese Encephalitis virus. Recovered from viral illness (pain, photobia, rash, conjunctivitis) but lingering wrist or thumb problem.

Evidence-based biosafety: a review of the principles and effectiveness of microbiological containment measures

- “Data on the containment effectiveness of equipment and laboratories are scarce and fragmented.
- Laboratory–acquired infections (LAIs) are therefore important for evaluating the effectiveness of biosafety.”