Laboratory-Acquired Infections 1979-2013

- Karen Byers, RBP, CBSP
- Biosafety Officer
- Dana Farber Cancer Institute
- Boston, MA

5 Routes of LAI infection

20% 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

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

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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.

Harding and Byers: literature survey of LAIS 1979-2005. 1,141 LAI and 24 deaths.

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

Monitoring Select Agent Theft, Loss, and Release Reports in the United States–2004–2010

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

Applied Biosafety 2012 **17**(4) 171–180

LAIs with BSATs

Year	Agent	#cases	Entity type	Lab Type
2004	*Brucella melitensis*	1	Registered	BSL2
2004	*Coccidiodes* sp.	1	Registered	BSL3
2004	*Francisella tularensis**	3	Registered	BSL2
2007	*Brucella melitensis*	1	Registered	BSL3
2007	*Brucella melitensis*	1	Exempt	BSL2
2008	*Brucella melitensis*	1	Registered	BSL3
2009	*Francisella tularensis**	1	Registered	BSL3
2010	*Brucella suis*	1	Exempt	BSL2
2010	*Brucella suis*	1	Exempt	BSL2

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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. dificile* (1)

- Baron EJ, Miller JM.. 2008. Bacterial and fungal infections among diagnostic laboratory workers: evaluating the risks. Diagn Microbiol Infect Dis; 60 (3): 241-6.

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).

Baron EJ, Miller JM. 2008. Diagn Microbiol Infect Dis **60** (3): 241–6.

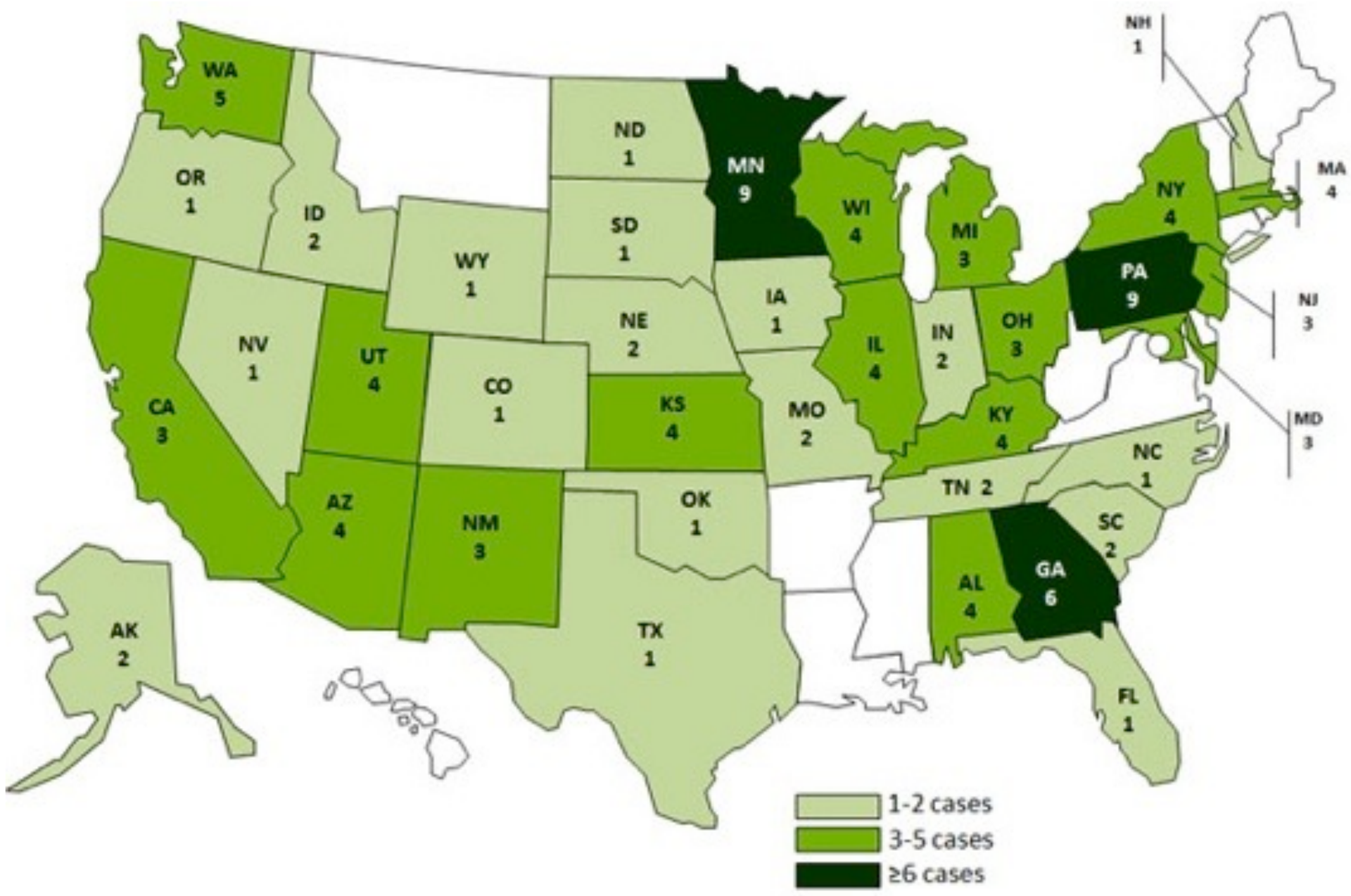
Student LAIs –Teaching Labs

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

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.

United States Department of Labor Office of Public Affairs. Region 9 news Release 13-270-SAN(SF-19). US Labor Department concludes fatality investigation at San Francisco Veterans Affairs Medical Center Research

LAIS attributed to Biosafety Cabinet Failure

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

- 1 took INH, 1 lost to followup, 1 developed endometrial tuberculosis and infertility). Shireman, *Arch. Pathol. Lab. Med.* **116:**521-523.

1 case of Q fever; leaking filter (Rusnak, 2004. J Environ. Med. **46**(8):801–811.)

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.

Eberle, J.,J. Habermann, and L. Gurtler. 2000. HIV-1 infection transmitted by serum droplets into the eye: a case report. *AIDS* **14**(2):206-209.

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

Matysiak-Budnick, T., F. Briet, M. Hegman, and F. Megraud. 1995. Laboratory-acquired *Helicobacter pylori* infection. *Lancet* **346:**1489-1490.

Use of animals in research..

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

1979-2004: experimentally infected animals - 11 symptomatic, no asymptomatic.

Harding and Byers, 2006. "Epidemiology of Laboratory-acquired Infections" *In* D.O. Fleming and D.L. Hunt, eds. *Biological Safety, Principles and Practices, 4th* ed. Washinton, DC:ASM Press.

NHP infections1979-2004

- 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

LAIs from NHP models-

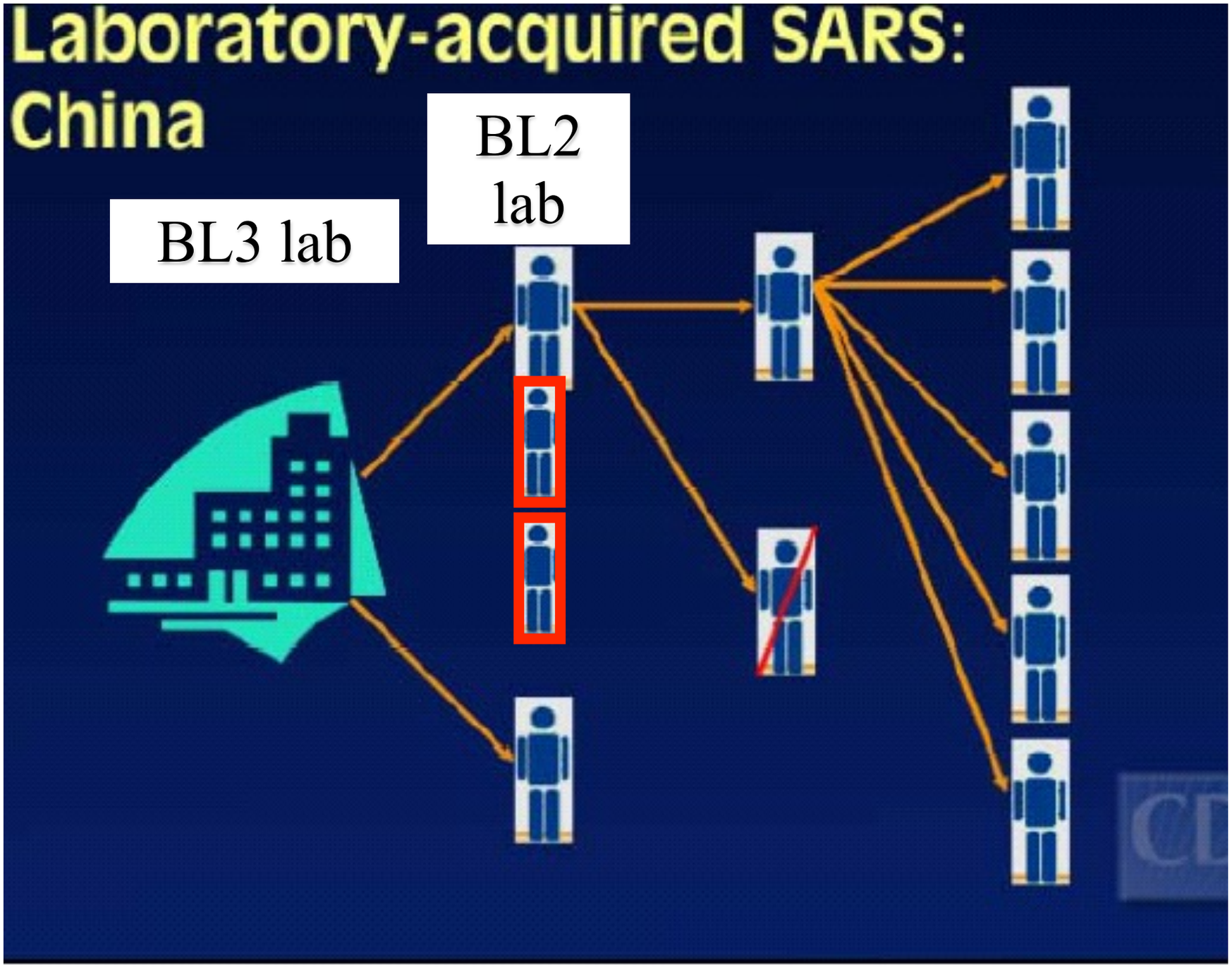
New simian adenovirus, TMAdV-C infected 9 baboons in NHP facility. Two baboons died. anecdotal - staff had flu-like illness.

Chen, 2011. PLoS Pathog **7**(7): e1002155. doi:10.1371/journal.ppat.1002155.

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

Chiu, 2013.*mBio* **4(2):**e00084-13.

Laboratory Practice: Inactivation methods



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

Modifed from 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.

Barry, 2005. http://www.bphc.org/reports/pdfs/report_202.pdf.

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

Heymann, 2005. *Lancet*. **363**:1566-1568.

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.

Foy 2011. *Emerg Infect Dis.* **17**(5): 880-882.

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."

- Kimman, TG. et al. 2008. Clin Microbiol Rev. 21(3):403-25.