Bioterrorism Capabilities in Rural Texas Hospitals and Laboratories

by

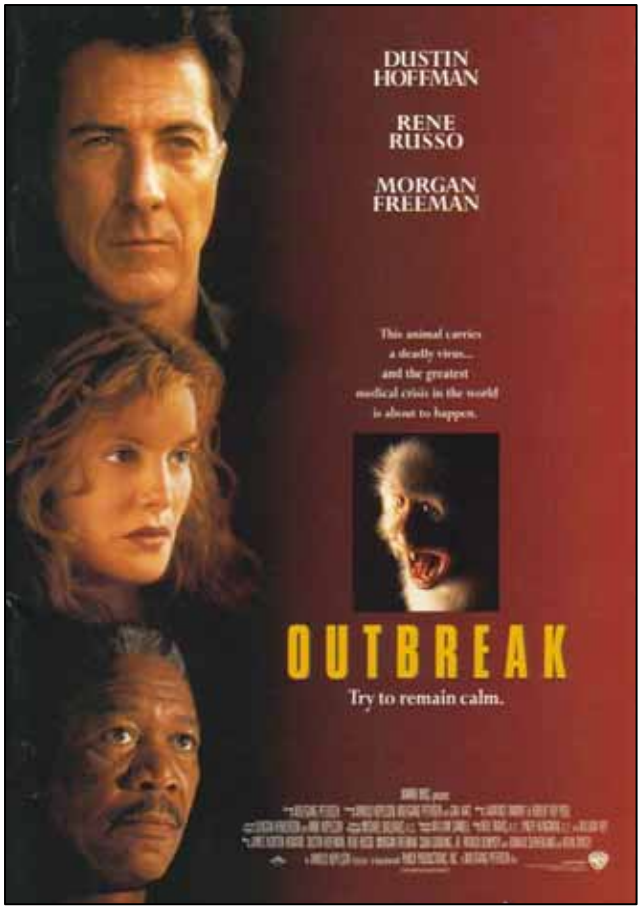
Taylor M. Johnson
Public Health Internship Program
School of Biological Sciences
The University of Texas at Austin

Mentor: Dr. Grace Kubin
Emergency Preparedness Branch
Texas Department of State Health Services

Bioterrorism:

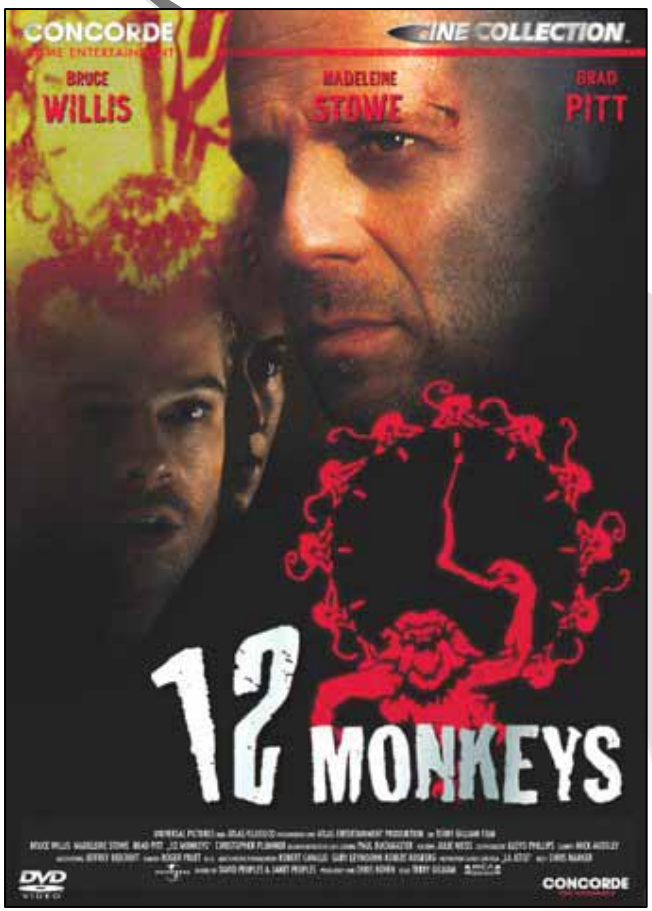
- The use of biologic agents to intentionally produce disease or intoxication in susceptible populations to meet terrorists' aims.
- The deliberate use of microorganisms or toxins from living organisms to induce death or disease.

Bioterrorism



Outbreak (1995)

12 Monkeys (1995)

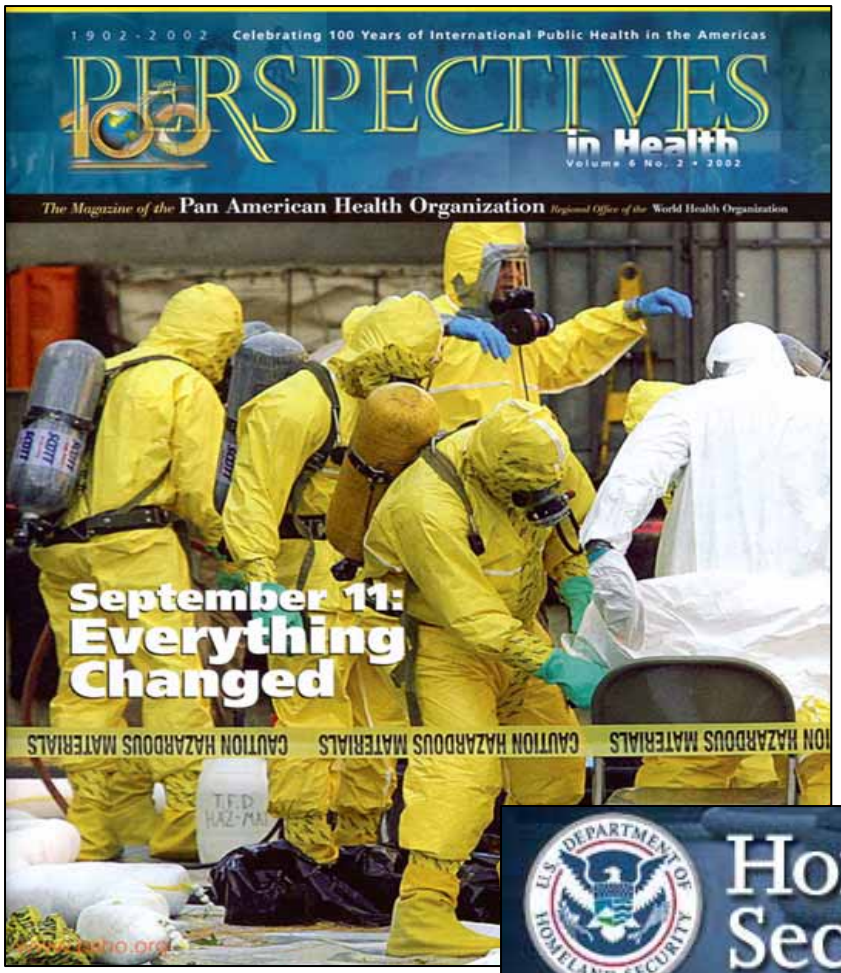


Brief History of Bioterrorism

- 5th century BC – Thucydides attributed the plague of Athens to the Ethiopians
- 1346 AD – Mongol army hurled plague-infected cadavers into the besieged Crimean city of Caffa
- 1519 AD – Hernando Cortes defeated the Aztec Empire with smallpox

September 11, 2001

Post 9/11
Response to Bioterrorism



Complacency is the enemy of preparedness !

www.cdc.gov

In 2001, President Bush signed a $2.9 billion Bioterrorism Appropriations Bill

Homeland Security

Categories of Bioagents

- Category A – most hazardous
- Category B
- Category C – least hazardous

Category A Bioagents

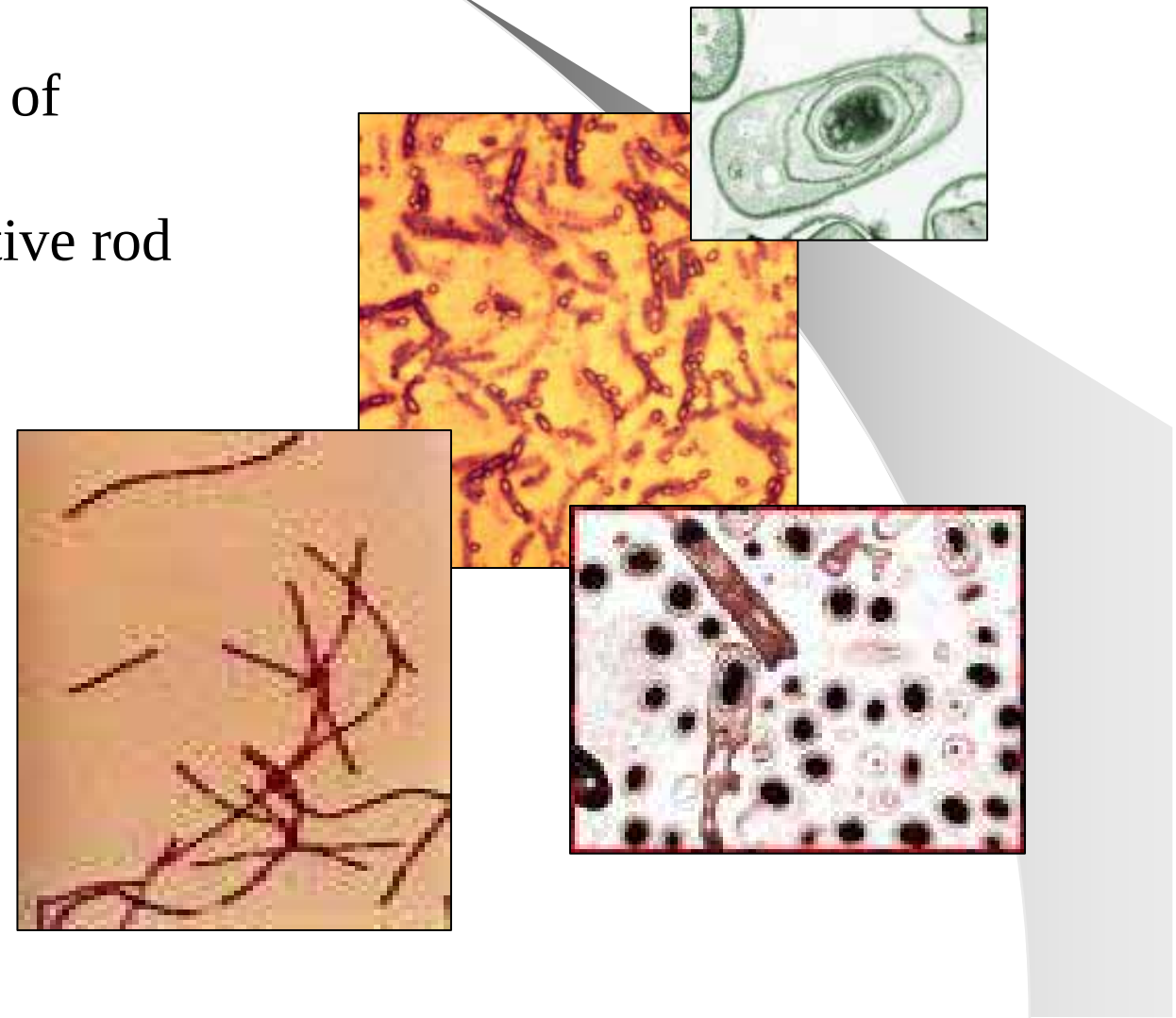
- Can easily be disseminated or transmitted
- Result in high mortality rates
- Possess the potential for a major impact on public health

Category A Bioagents

- ***Bacillus anthracis* – Anthrax**
- **Variola (Smallpox) virus – Smallpox**
- ***Francisella tularensis* – Tularemia**
- ***Yersinia pestis* – Plague**
- ***Brucella sp.* – Brucellosis**
- ***Clostridium botulinum* - Botulism**

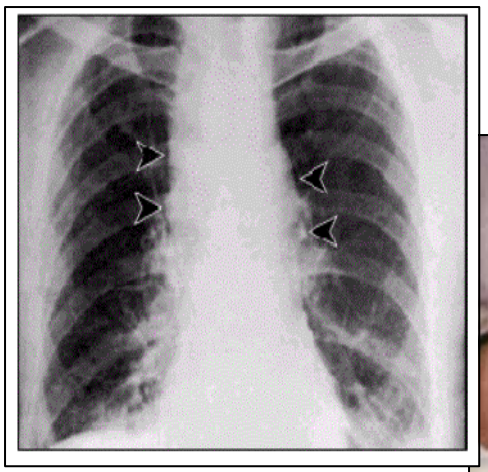
Bacillus anthracis

- Etiological agent of anthrax
- Large gram-positive rod
- Spore-forming
- Non-motile
- Aerobic



Clinical Diseases

- Cutaneous
- Gastrointestinal
- Inhalational

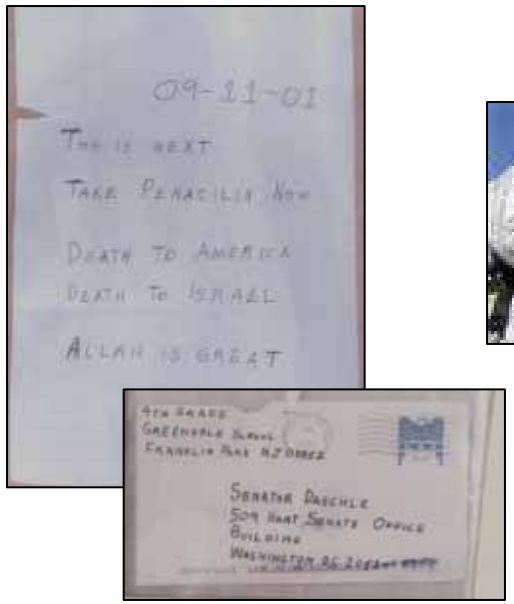


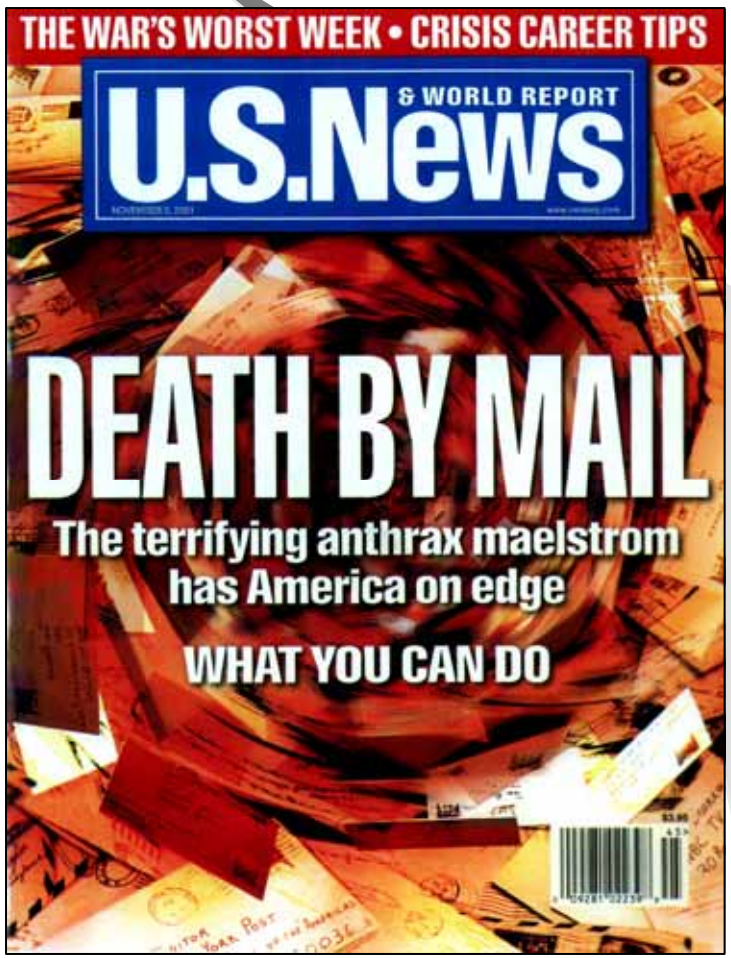
Anthrax Threat

- Spores can exist for decades
- Aerosol is odorless and invisible
- Can travel miles before dissipating

Anthrax Attacks of 2001

Only substance to be successfully used in a bioterrorist attack on modern day America





Variola (Smallpox) Virus

- Etiological agent of smallpox
- Double-stranded DNA virus
- Most complex type of animal virus

Clinical Diseases

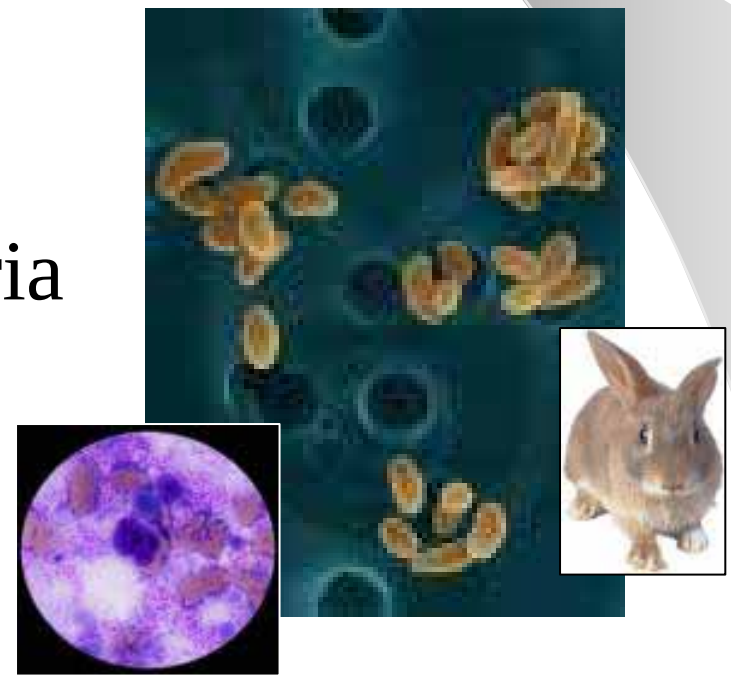
- Modified
- Flat
- Hemorrhagic
- Ordinary

Smallpox Threat

- Fatality rate of 30%
- Stable in environment
- Contagious until the last scab of an infected individual falls off
- Individuals under the age of 25 have not received vaccinations
- The former Soviet Union stockpiles may be in terrorists' hands

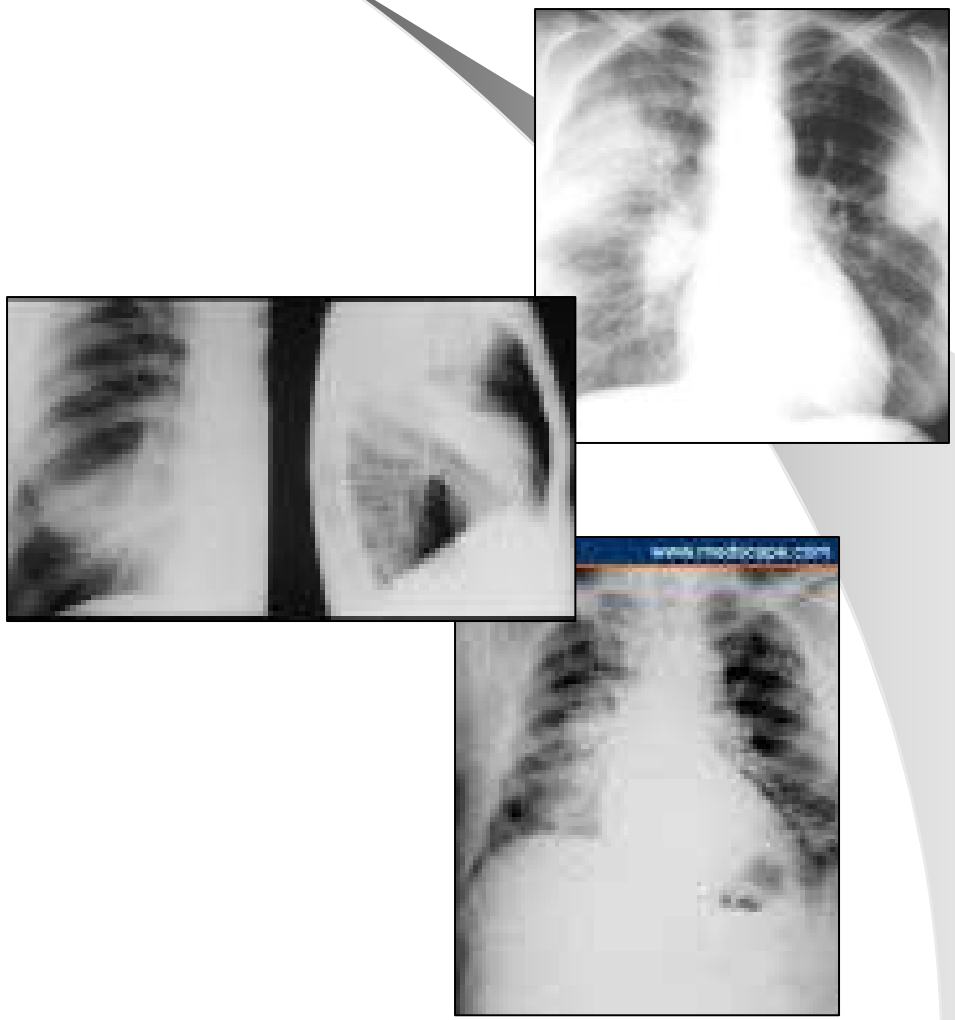
Francisella tularensis

- Etiological agent of the zoonotic disease, tularemia (rabbit fever)
- Naturally occurs in rabbits and rodents
- Gram-negative bacteria
- Small coccobacillus
- Aerobic



Clinical Diseases

- Oculoglandular
- Oropharyngeal
- Intestinal
- Pneumonic

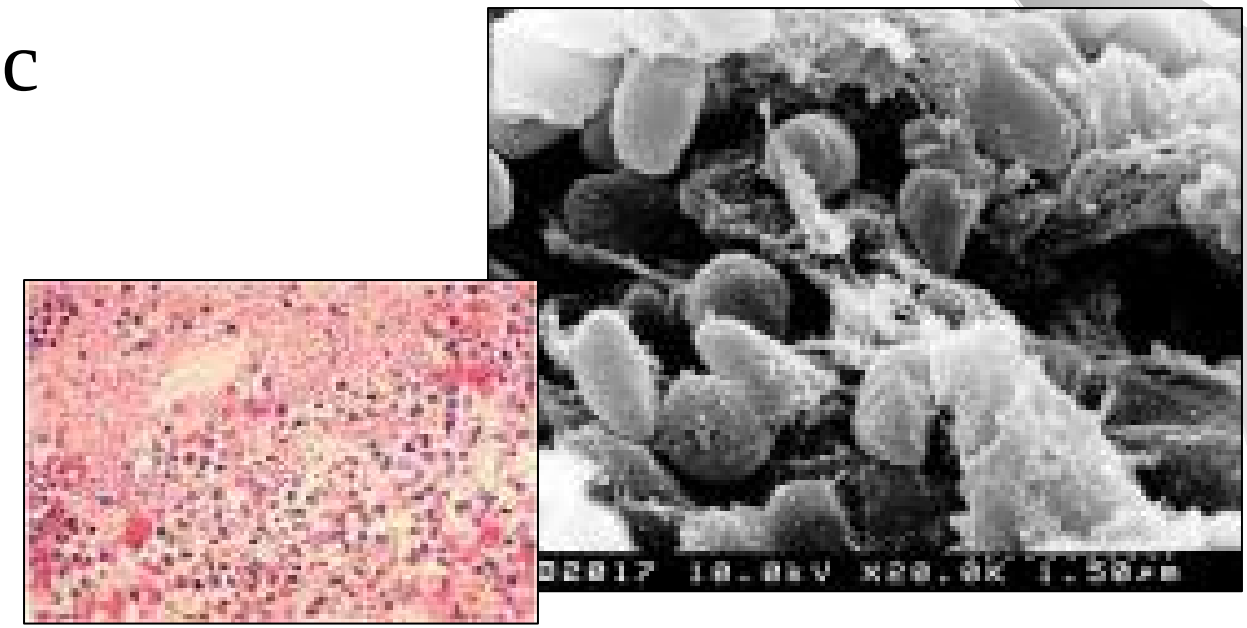


Tularemia Threat

- Highly virulent
- Small infectious dose
- WHO study – 50kg of *F. tularensis* exposed to a city of five million would sicken 250,000 and kill 19,000

Yersinia pestis

- Etiological agent of plague
- Small gram-negative rod
- Aerobic



Clinical Diseases

- Bubonic
- Systemic
- Pneumonic

Pneumonic Plague Threat

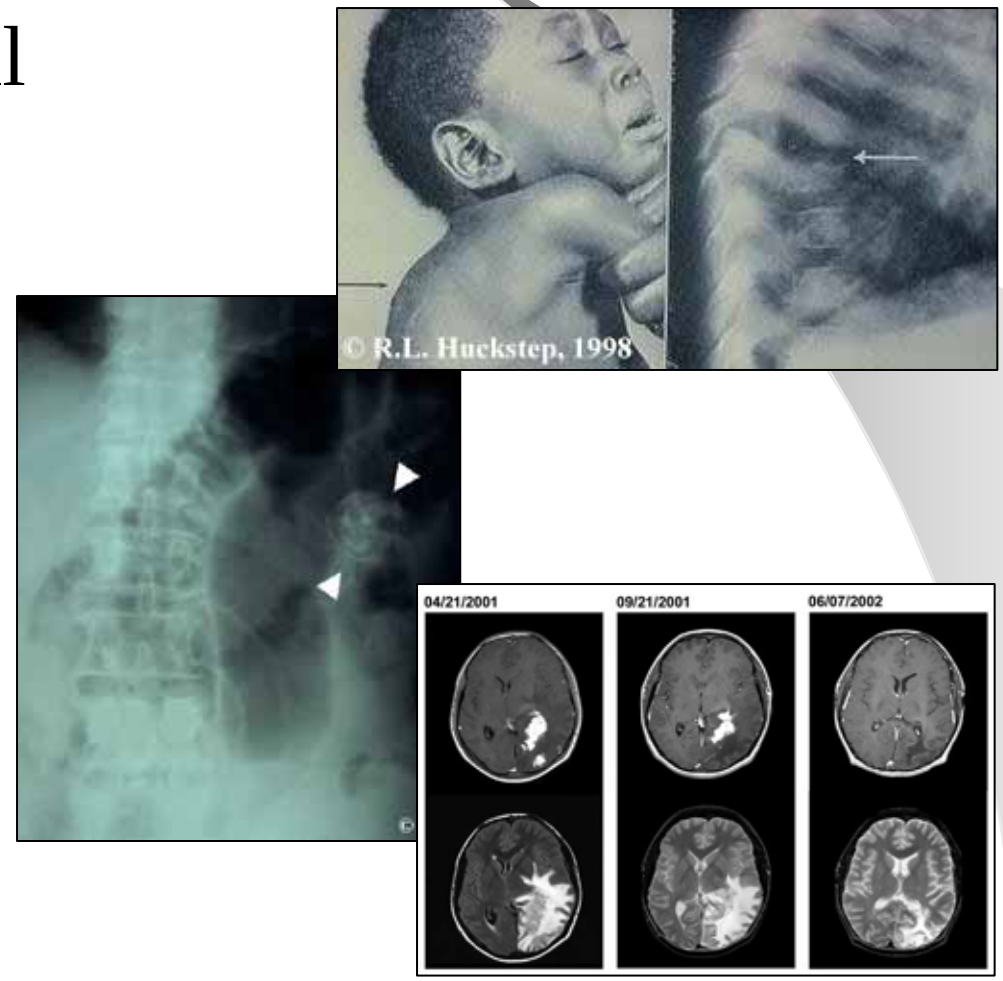
- Results in high fatality
- Spread person-to-person by respiratory droplet
- Symptoms do not present until several days after exposure

Brucella spp.

- Etiological agents of the zoonotic disease, brucellosis (undulant fever)
- Common species that cause disease in humans:
  - *B. abortus* (cattle)
  - *B. melitensis*
  - *B. ovis* (sheep)
  - *B. suis* (pigs)

Clinical Diseases

- Gastrointestinal
- Cutaneous
- Inhalational

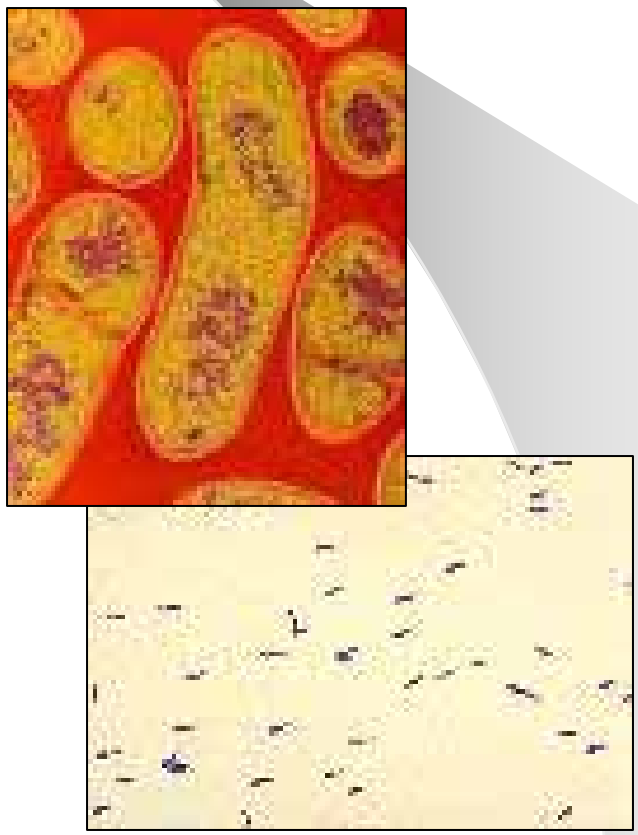


Brucellosis Threat

- Considered by some to be a Category B bioagent
- Person-to-person spread only found via the sexual and breast-feeding routes
- No successful use of the disease as a biological weapon

Clostridium botulinum

- Etiological agent of botulism
- Gram-positive
- Spore-forming
- Anaerobic
- Produces botulinum toxin



Clinical Diseases

- Cutaneous
- Infantile
- Food-borne

Botulism Threat

- Constraints in stabilizing the toxin for aerosol dissemination
- Failed to cause disease in recent releases by terrorists in Tokyo
- Heat greater than 85 degrees Celsius inactivates the toxin

Response to Bioterrorism

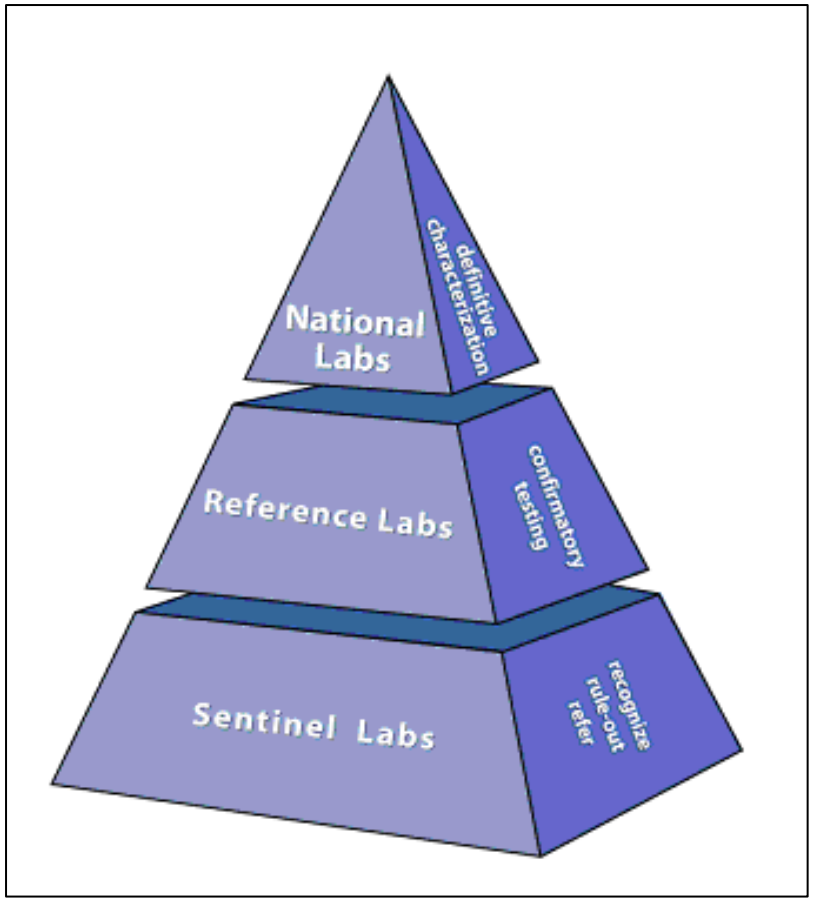
- Centers for Disease Control and Prevention (CDC) charged to protect the American public.
- The Laboratory Response Network (LRN) was established in 1999.

Laboratory Response Network

Mission:

To maintain an integrated national and international network of laboratories that are fully equipped to respond quickly to acts of chemical or biological terrorism, emerging infectious diseases, and other public health threats and emergencies. (www.bt.cdc.gov/lrn)

Laboratory Response Network



LRN structure for biological terrorism

← Level C Labs

← Level B Labs

← Level A Labs

Level A Labs

- Primarily non-public health clinical labs that serve hospitals and clinics
- Expected to detect diseases in cases of illness where bioterrorism is not yet expected

Level B Labs

- Reference laboratories are responsible for investigation of suspected bioterrorism specimens
- Responsible for training level A labs:

  -Level A lab training

  -Packaging and shipping

Level C Labs

- Primarily the CDC, along with other military research labs
- Responsible for specialized strain characterizations and the handling of highly infectious biological agents

Emergency Preparedness Branch of the TDSHS

Mission:

To protect both urban and rural areas in Texas from potential biological attacks, while functioning as a reference laboratory of the Laboratory Response Network

Potential Effect of a Biological Attack

Urban

and

Rural areas

affected!

The Challenges Faced by Rural Hospitals and Labs

- Inadequate funding for laboratory equipment and supplies
- Lack of LRN trained personnel and laboratory space
- Geographic isolation

Increasing the Bioterrorism Preparedness of Rural Laboratories

1st Step – administer a survey to assess the capabilities of the rural labs in Texas to function as a level A lab

2nd Step – devise a plan to ensure biothreat laboratory preparedness in rural labs in Texas

Purpose

- Develop a survey tool for evaluating the capacities of laboratories in rural settings of Texas
- Identify needs and barriers preventing these laboratories from effectively performing as Level A laboratories

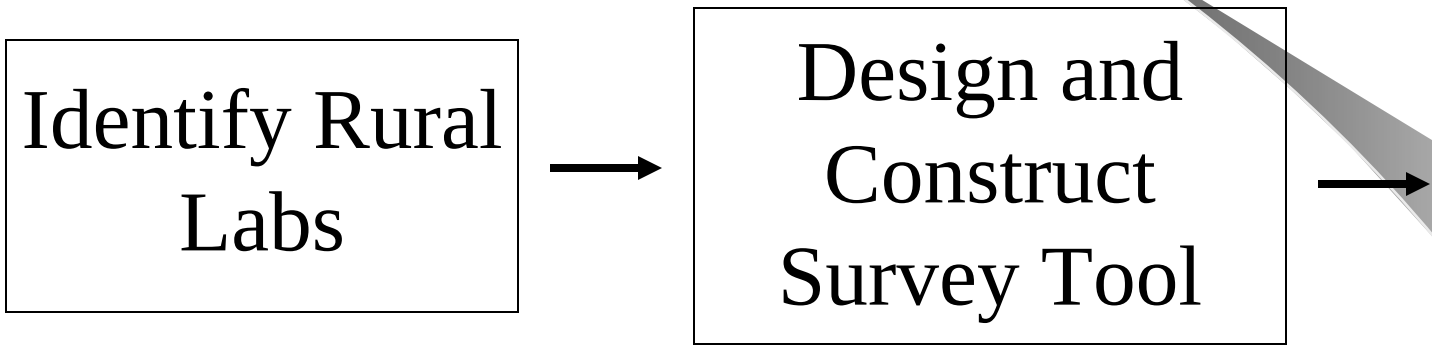
METHODS

Flowchart of Methods Process

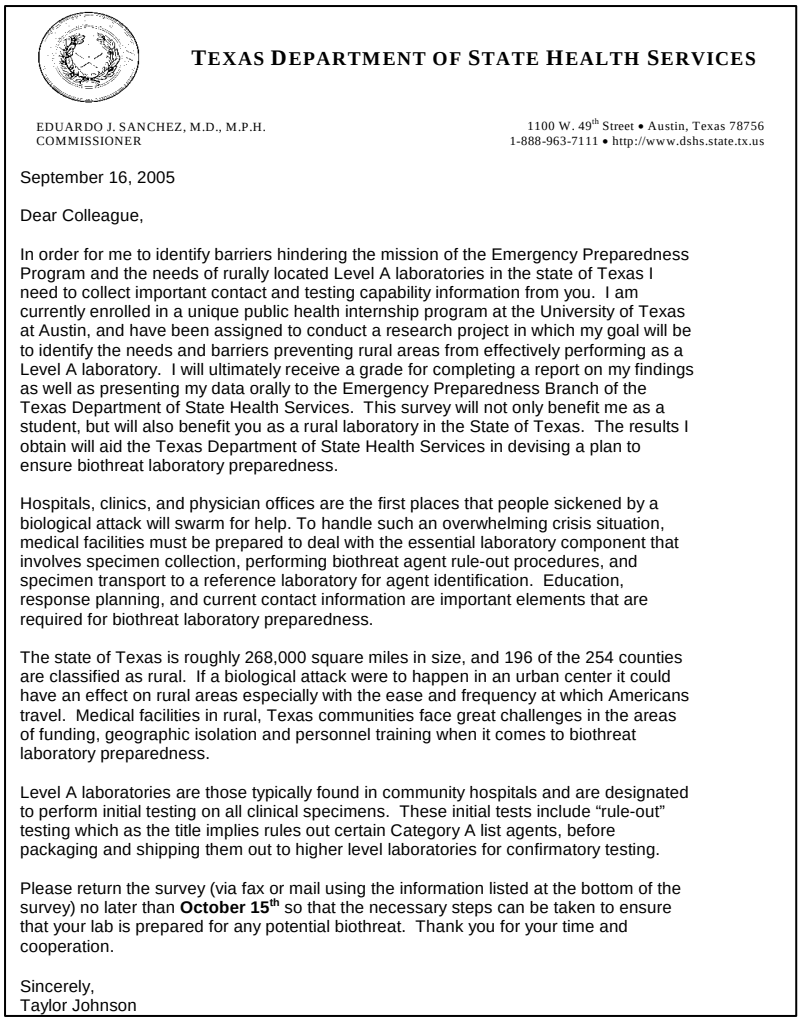
Definition of a Rural City

- A city with a population of less than six thousand residents is considered a “rural” city according to *city-data.com*
- 86 different hospitals and laboratories were identified in rural cities of Texas

Flowchart of Methods Process



Design and Construct a Survey Tool



TEXAS DEPARTMENT OF STATE HEALTH SERVICES

EDUARDO J. SANCHEZ, M.D., M.P.H.
COMMISSIONER

1100 W. 49th Street • Austin, Texas 78756
1-888-963-7111 • http://www.dshs.state.tx.us

September 16, 2005

Dear Colleague,

In order for me to identify barriers hindering the mission of the Emergency Preparedness Program and the needs of rurally located Level A laboratories in the state of Texas I need to collect important contact and testing capability information from you. I am currently enrolled in a unique public health internship program at the University of Texas at Austin, and have been assigned to conduct a research project in which my goal will be to identify the needs and barriers preventing rural areas from effectively performing as a Level A laboratory. I will ultimately receive a grade for completing a report on my findings as well as presenting my data orally to the Emergency Preparedness Branch of the Texas Department of State Health Services. This survey will not only benefit me as a student, but will also benefit you as a rural laboratory in the State of Texas. The results I obtain will aid the Texas Department of State Health Services in devising a plan to ensure biothreat laboratory preparedness.

Hospitals, clinics, and physician offices are the first places that people sickened by a biological attack will swarm for help. To handle such an overwhelming crisis situation, medical facilities must be prepared to deal with the essential laboratory component that involves specimen collection, performing biothreat agent rule-out procedures, and specimen transport to a reference laboratory for agent identification. Education, response planning, and current contact information are important elements that are required for biothreat laboratory preparedness.

The state of Texas is roughly 268,000 square miles in size, and 196 of the 254 counties are classified as rural. If a biological attack were to happen in an urban center it could have an effect on rural areas especially with the ease and frequency at which Americans travel. Medical facilities in rural, Texas communities face great challenges in the areas of funding, geographic isolation and personnel training when it comes to biothreat laboratory preparedness.

Level A laboratories are those typically found in community hospitals and are designated to perform initial testing on all clinical specimens. These initial tests include “rule-out” testing which as the title implies rules out certain Category A list agents, before packaging and shipping them out to higher level laboratories for confirmatory testing.

Please return the survey (via fax or mail using the information listed at the bottom of the survey) no later than **October 15th** so that the necessary steps can be taken to ensure that your lab is prepared for any potential biothreat. Thank you for your time and cooperation.

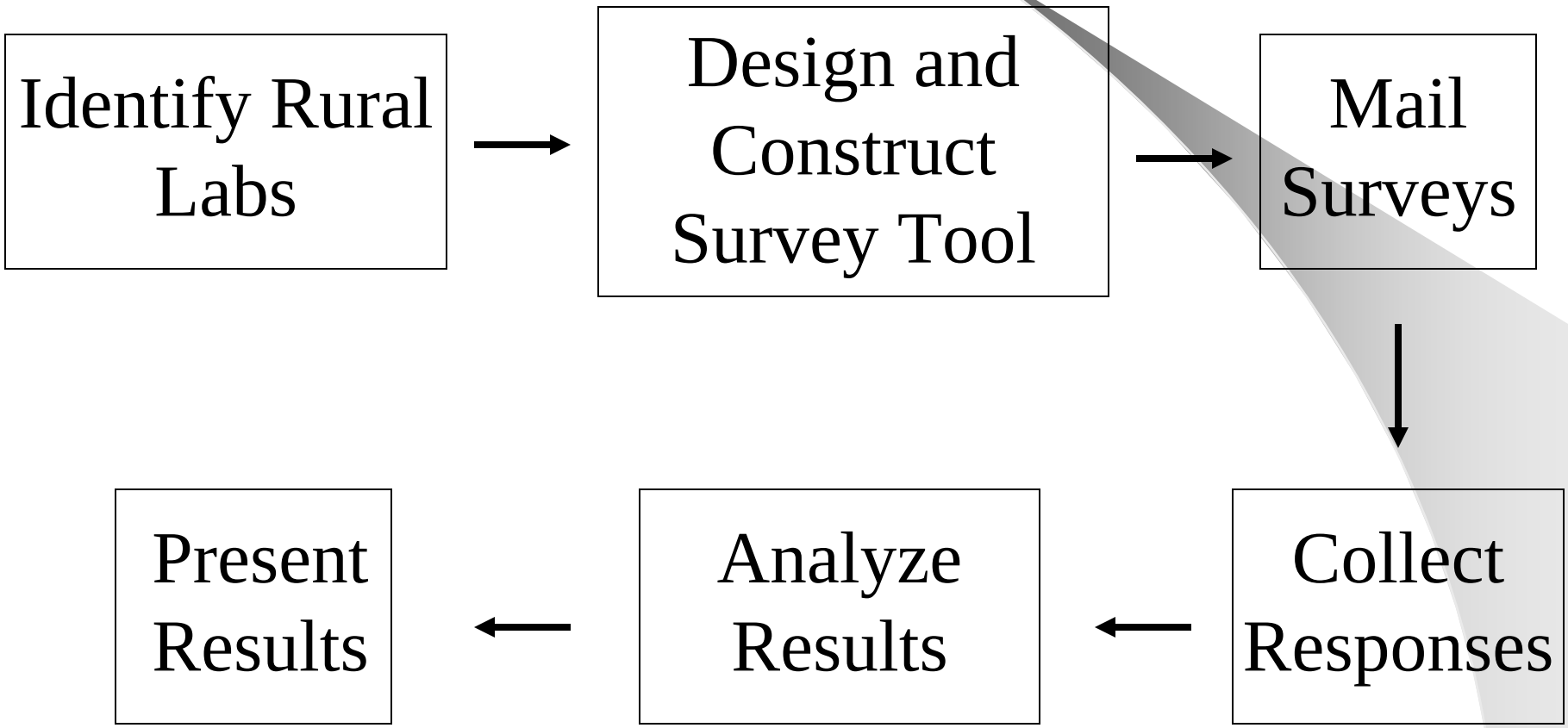
Sincerely,
Taylor Johnson

- **Divided into five sections**
- **Cover letter was also included**

Sections of Survey Tool

1. Current background information
2. Can your laboratory test for Level A Bioagents?
3. Has your laboratory received CDC endorsed training related to bioterrorism?
4. What tools does your laboratory possess to help implement the goals of the Bioterrorism Preparedness Program?
5. Is your laboratory capable of quickly shipping infectious specimens?

Flowchart of Methods Process

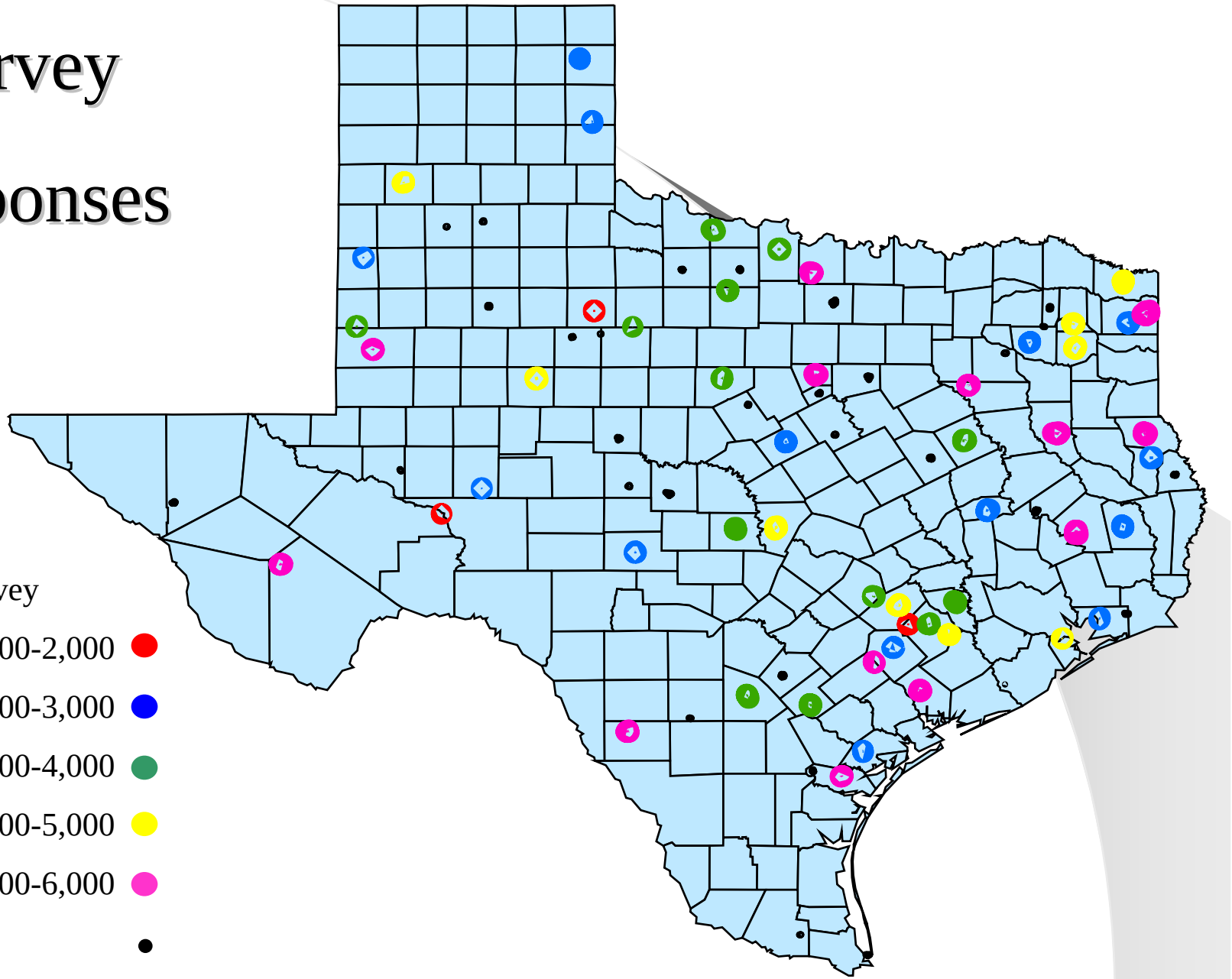


RESULTS

Survey Response

- Initial Response – 44% (38) received by October 15th
- After initial response remaining laboratories were individually called
- Final Response
  - 62% (53) received
  - 12% (10) no longer exist
  - 26% (23) no response

Survey Responses



Key

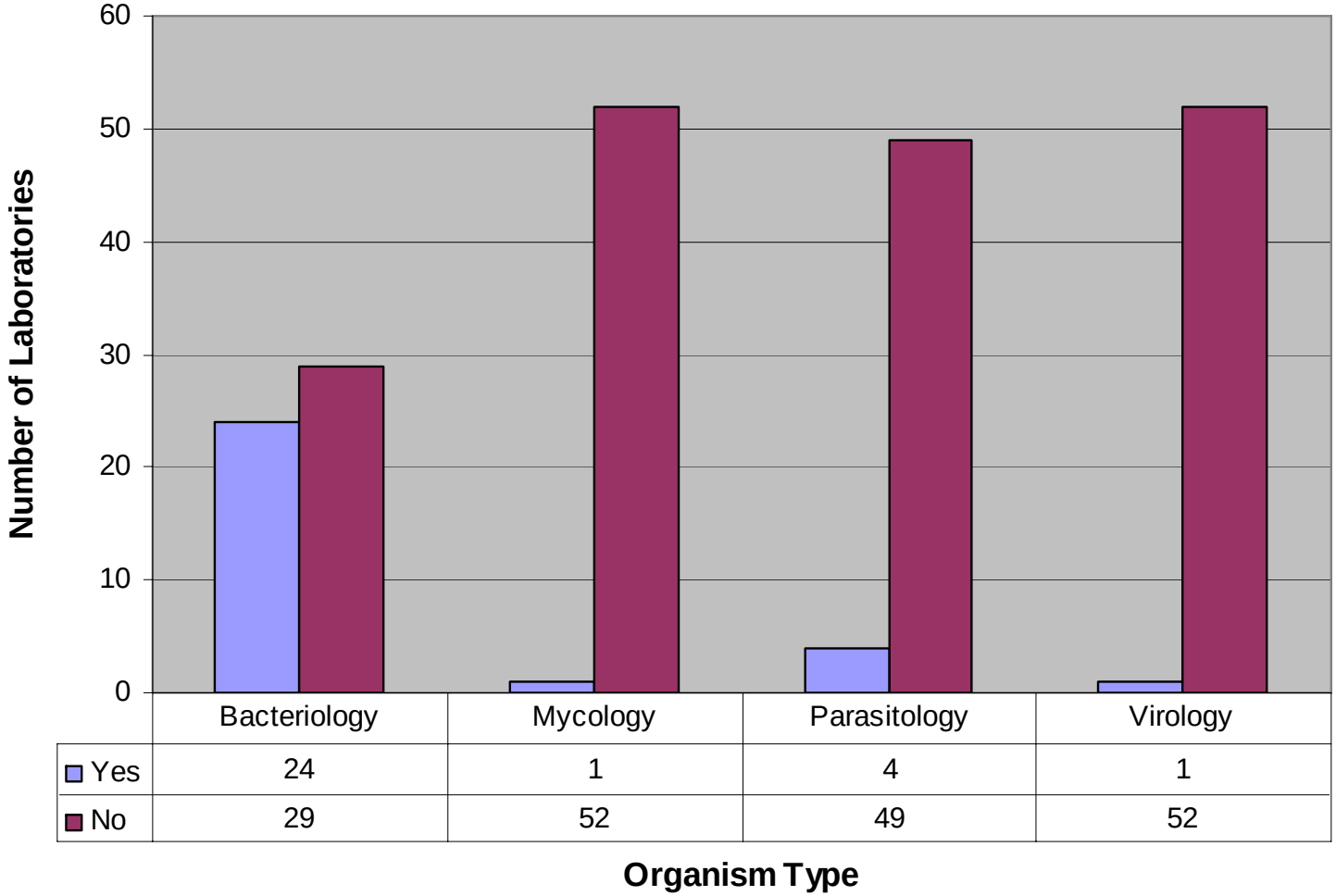
Received Survey

- Pop. 1,000-2,000
- Pop. 2,000-3,000
- Pop. 3,000-4,000
- Pop. 4,000-5,000
- Pop. 5,000-6,000

No Response

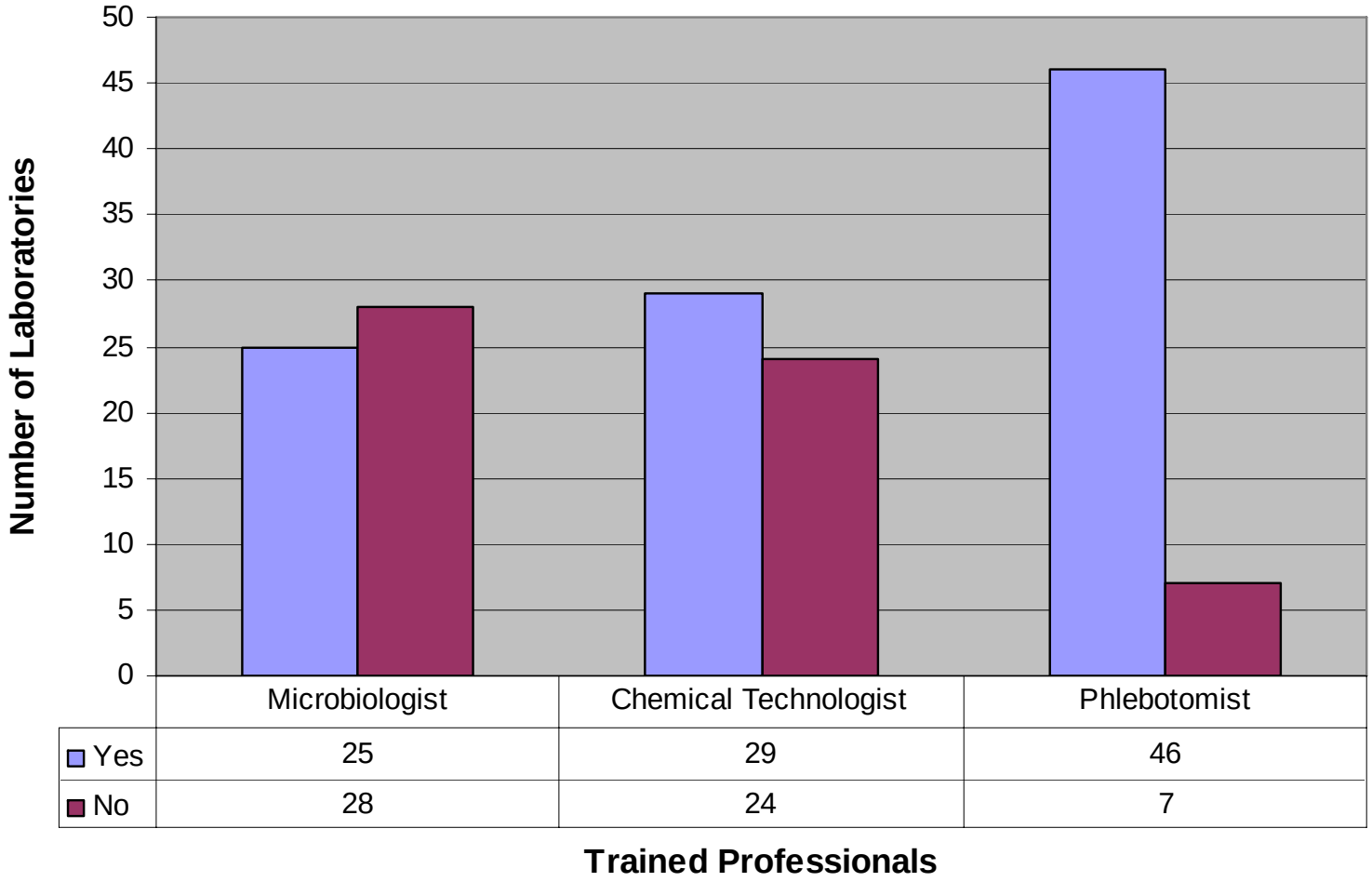
Can Your Laboratory Test for Level A Bioagents?

Capabilities of Laboratories to Perform Microbiological Testing by Organism Type



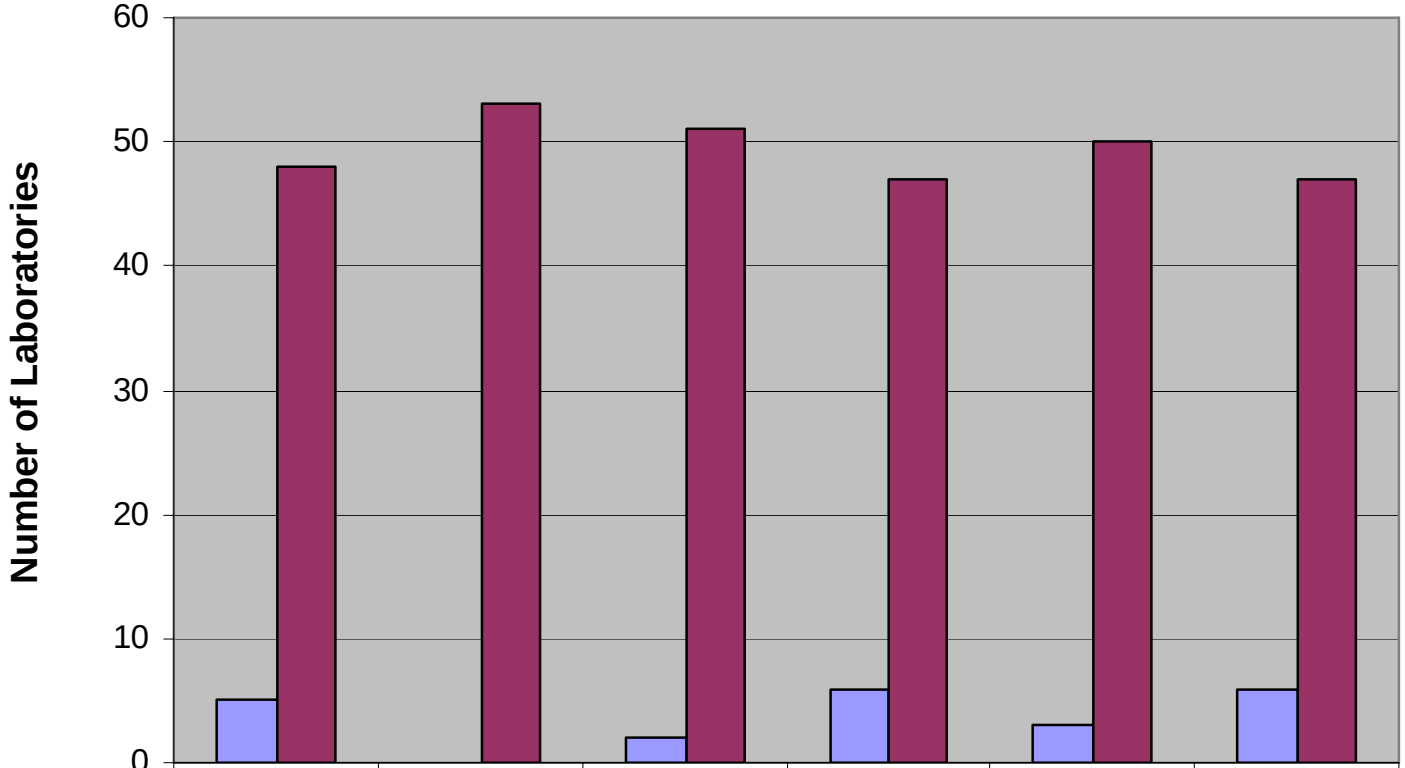
	Bacteriology	Mycology	Parasitology	Virology
Yes	24	1	4	1
No	29	52	49	52

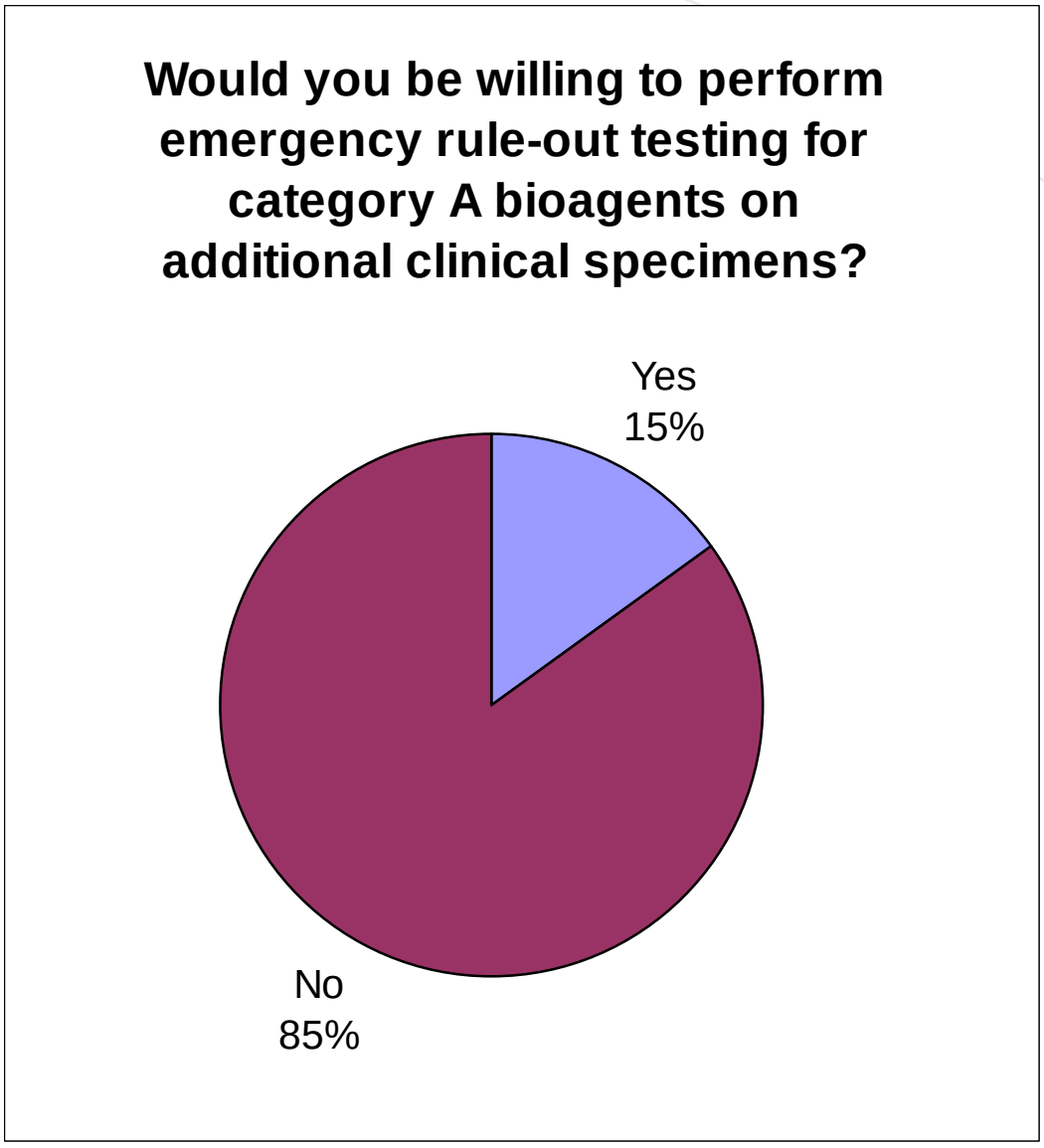
Employment of Trained Professionals by Rural Hospitals and Laboratories



	Microbiologist	Chemical Technologist	Phlebotomist
Yes	25	29	46
No	28	24	7

Capability of the Laboratories to Perform Rule-Out Testing for Bioagents

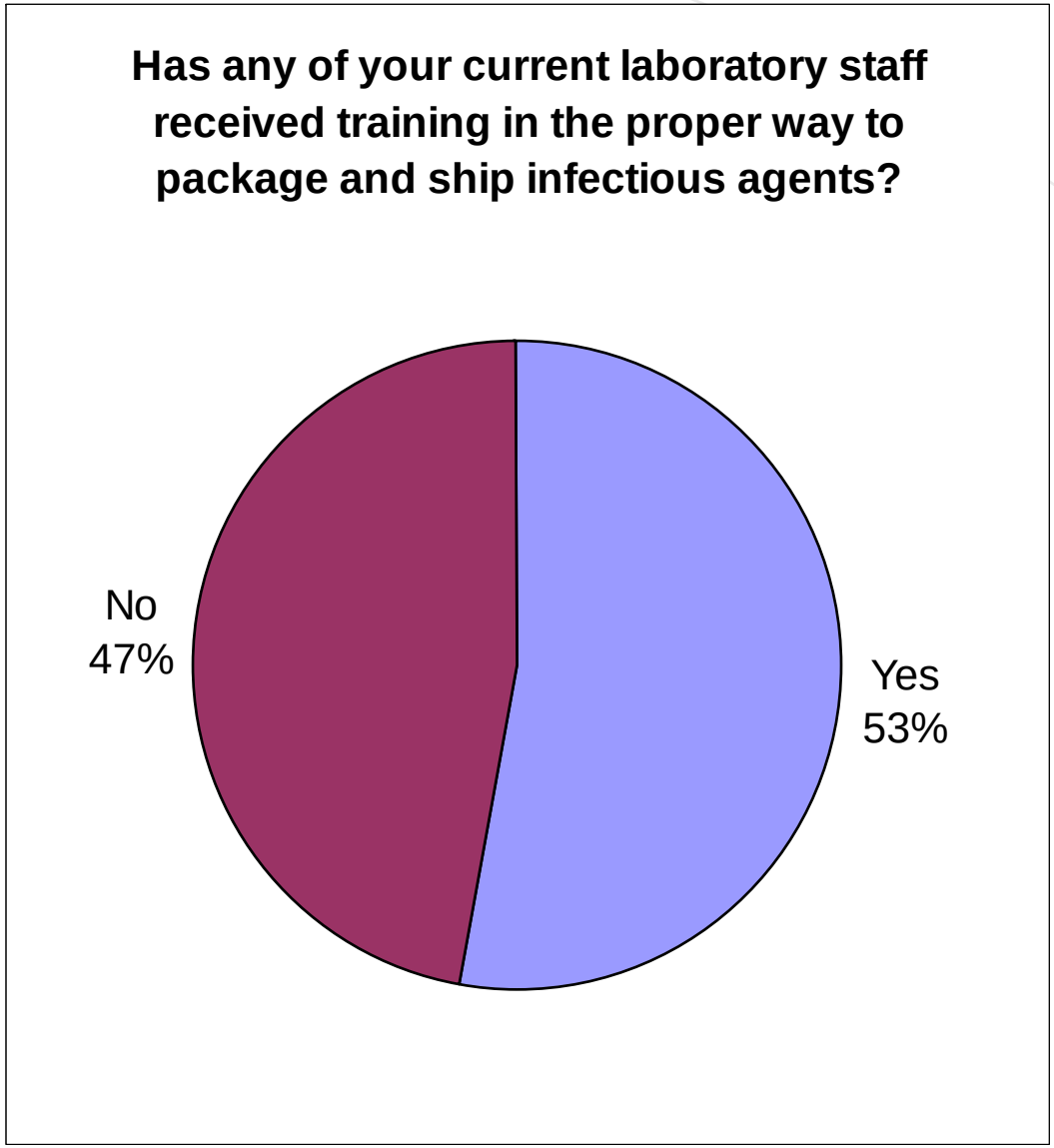




If not, what factors prevent you from participating in this procedure?

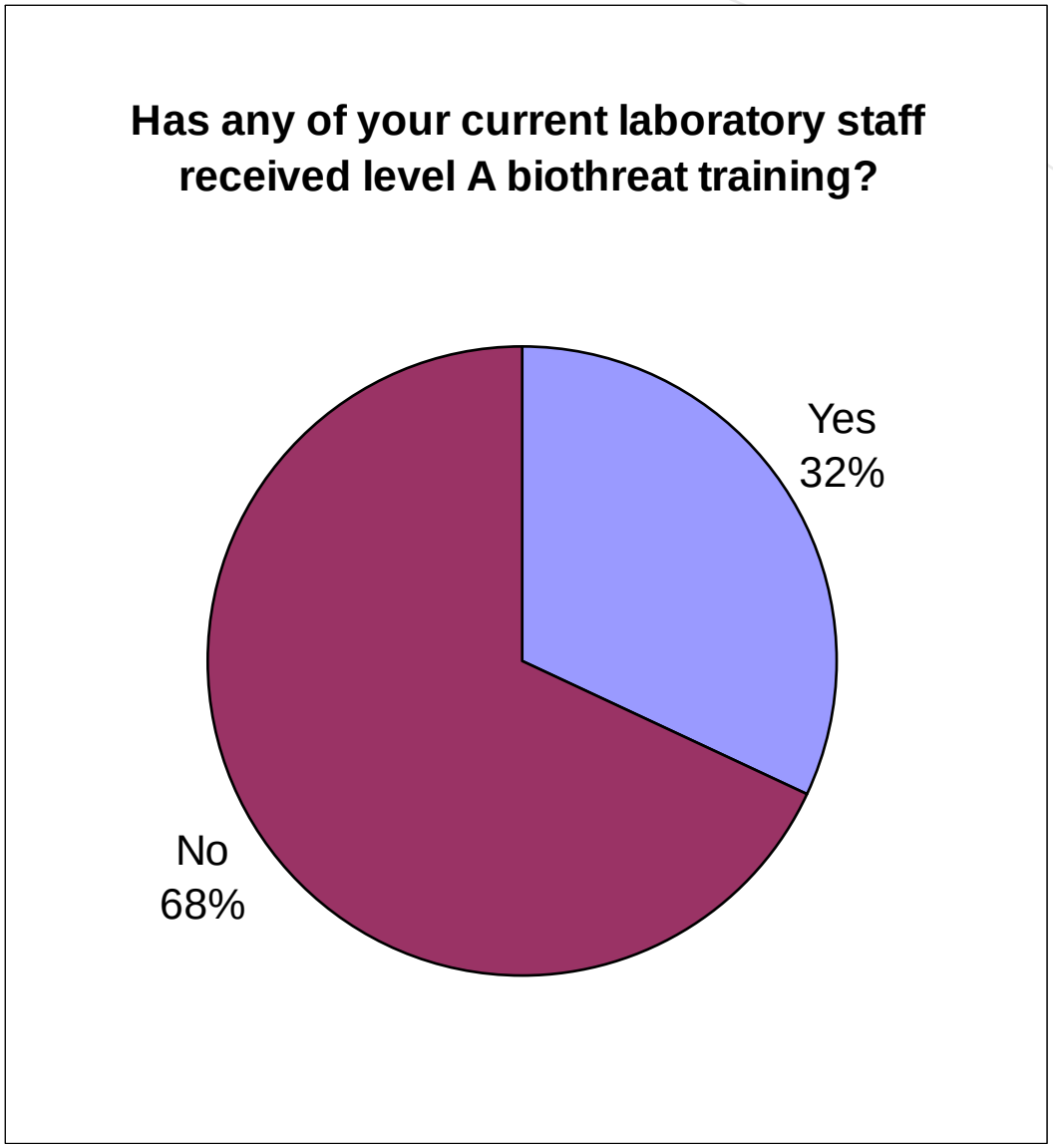
- Lack of equipment and supplies
- No bio-safety hood
- Lack of space
- No microbiology department
- Lack of trained personnel

Has your laboratory received CDC endorsed training related to bioterrorism?



If not, would you be willing to let staff receive proper training in the packaging and shipping of infectious agents?

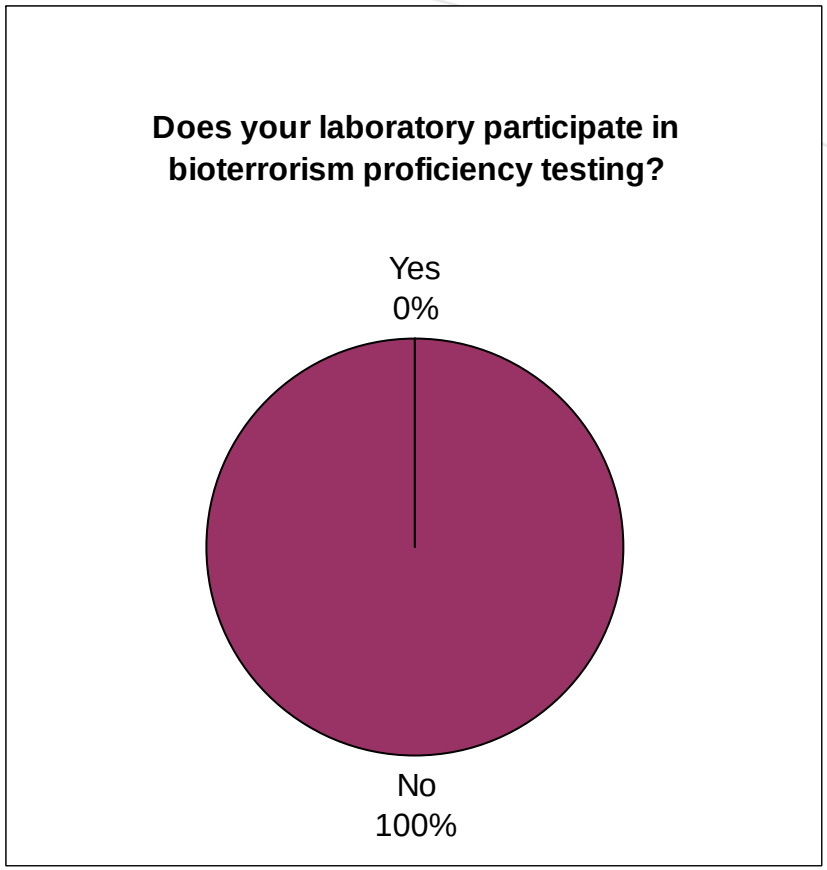
- 98% of labs who answered this question said that they would like to receive the training
- Laboratories who did not answer this question already possessed the training

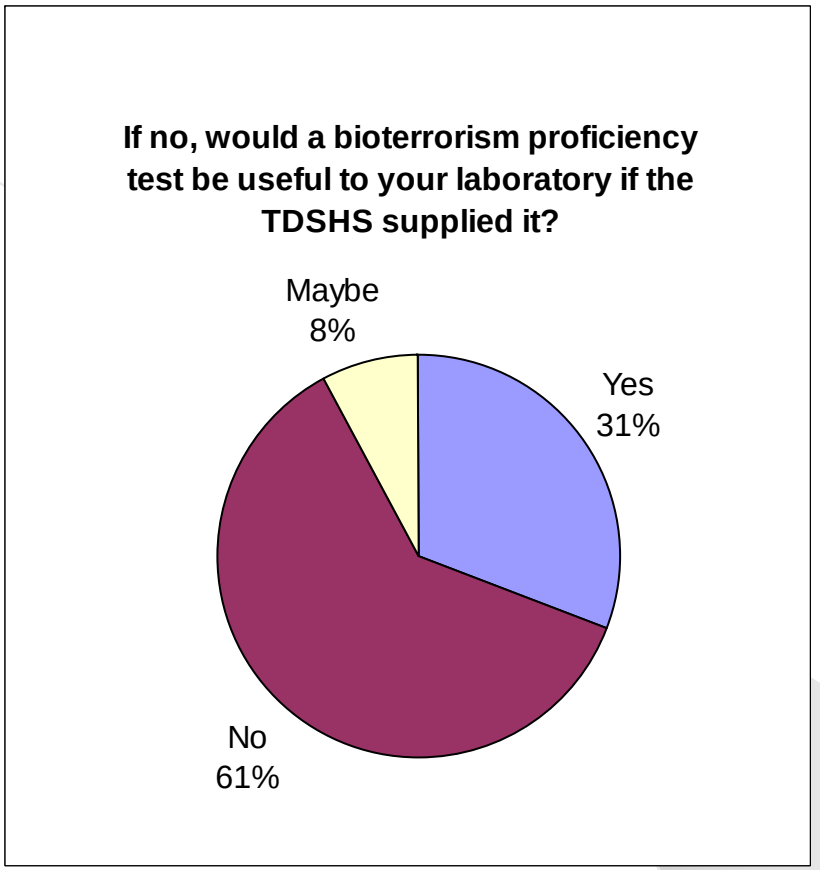


If, not what factors prevent you from participating in this procedure?

- Lack of money
- Distance from site of training
- Lack of space
- No time
- Lack of trained personnel

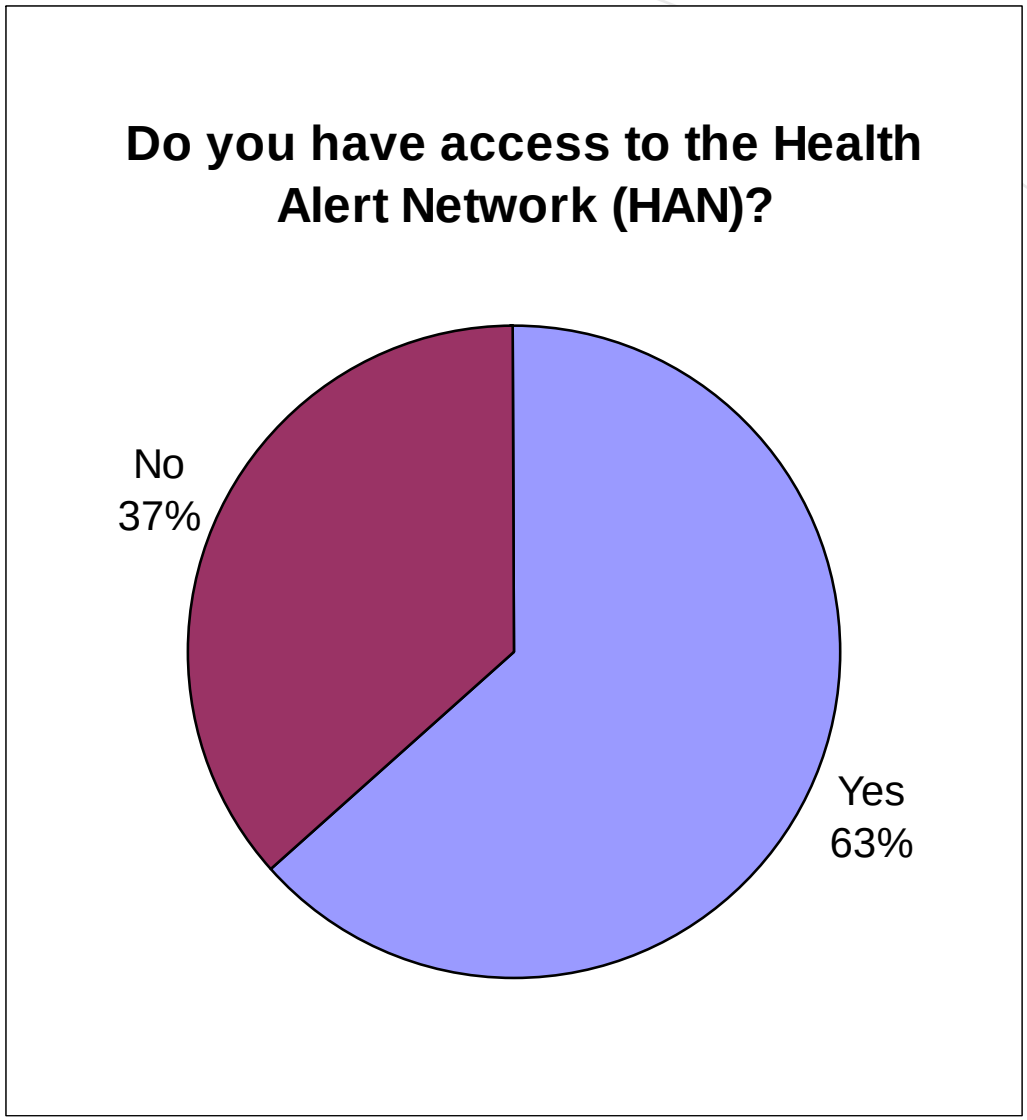
What tools does your laboratory possess to help implement the goals of the Bioterrorism Preparedness Program?





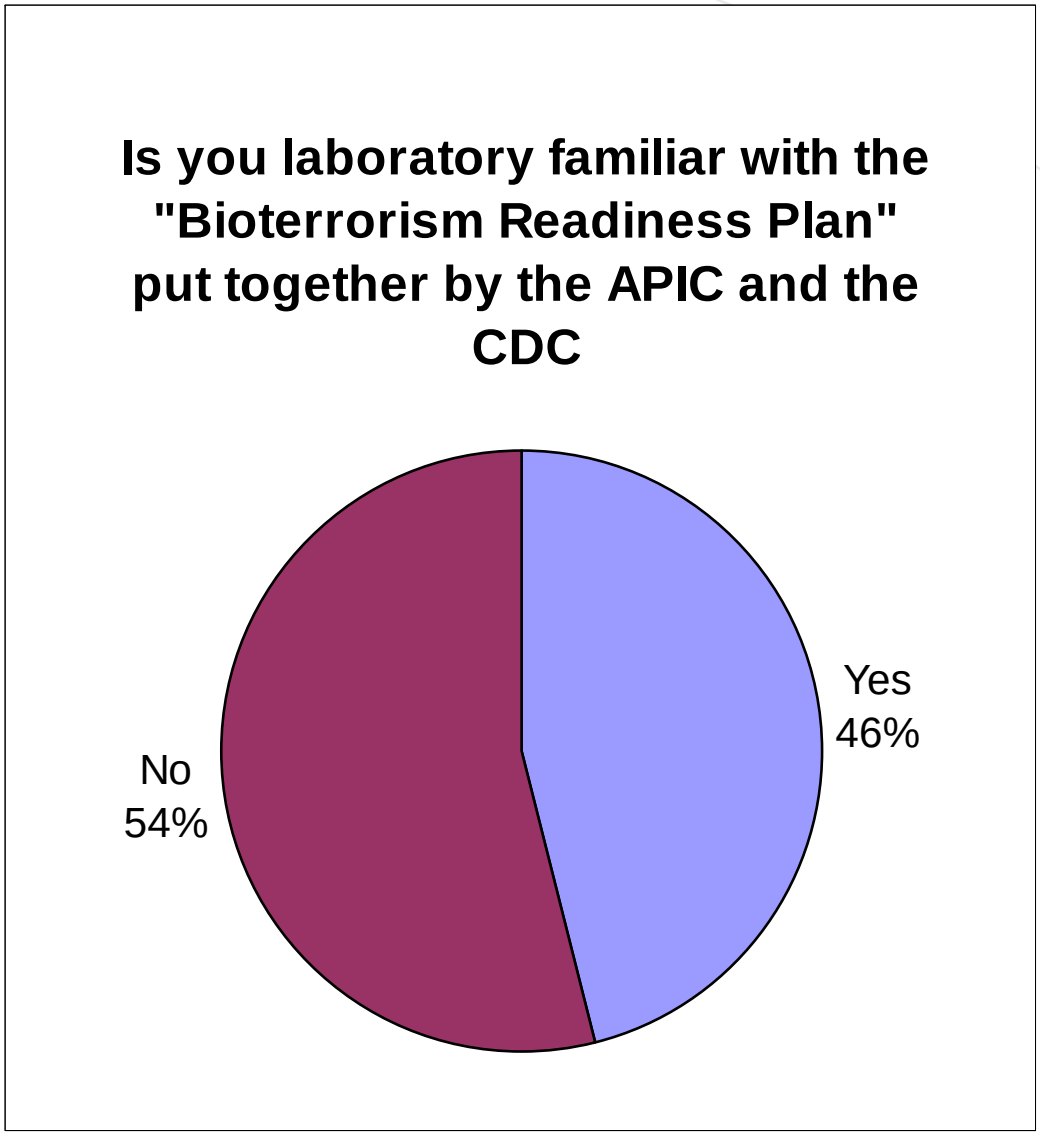
What factors prevent you from participating in this procedure?

- Need appropriate facility
- No microbiology department
- No knowledge of testing
- Expense of supplies



If not, what factors prevent you from participating in this procedure?

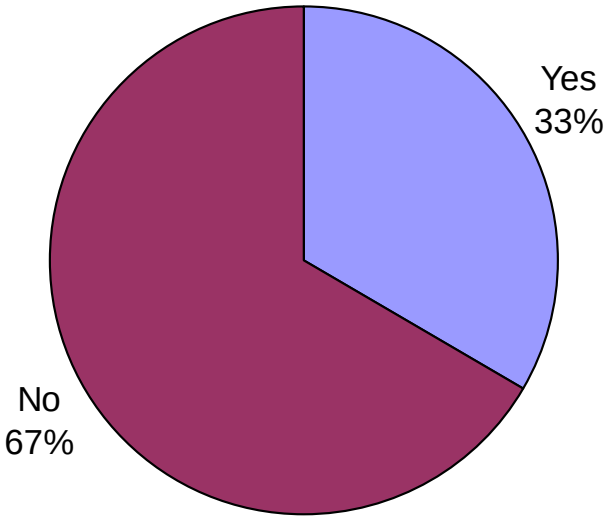
- Don’t have any knowledge of it
- Don’t know how to receive access



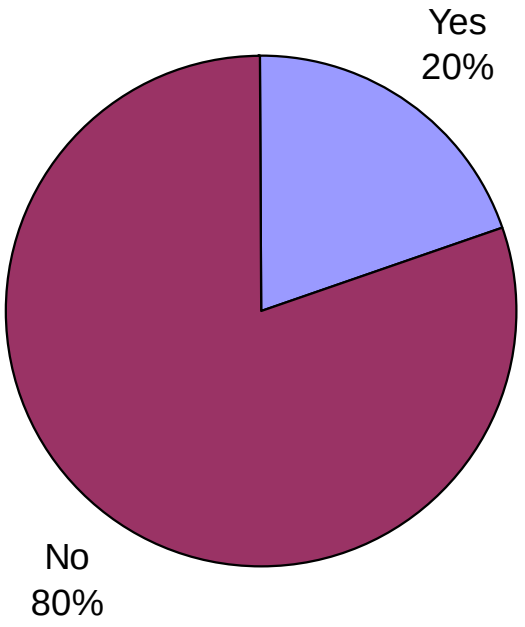
Created in order to introduce laboratories to bioterrorism.

Is your laboratory capable of quickly shipping infectious specimens?

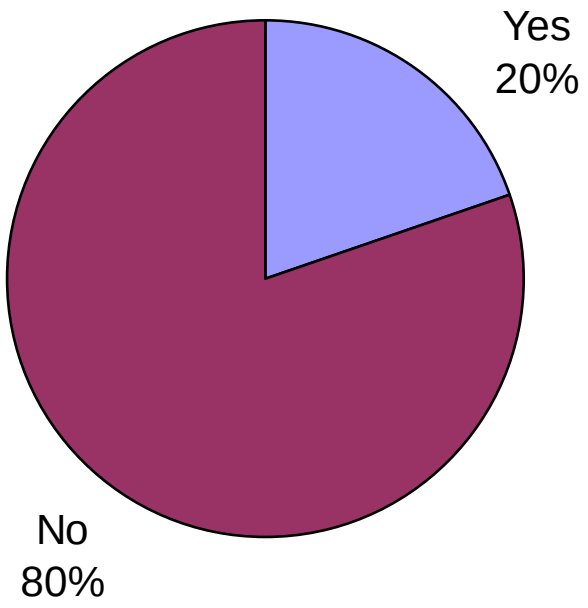
Send clinical specimens, which may involve an infectious biological agent, to a reference laboratory within 60 minutes of collection?



Send environmental samples, when the incident requires biological or chemical characterization, to a reference laboratory within 60 minutes of collection?



Send potentially contaminated food samples to a reference laboratory or coordinate with the FERN, when the incident might involve food contaminated with a biological or chemical agent within 60 minutes of collection?



If not, what factors prevent you from participating in this procedure?

- No courier service
- Need training
- Distance to nearest reference lab is farther than 60 min.
- No proper collection materials
- Don’t know where to send them
- No policy or procedure in place

Conclusions

- Rural laboratories are not prepared for a bioterrorist attack
- Majority of labs do not possess the training, equipment, or facilities to effectively respond to a potential attack

Needs of Rural Laboratories

- Need more training
- More personnel and space
- Bio-safety hood
- Selective media for rule-out testing
- Equipment and supplies to safely package and ship infectious agents
- **MONEY!!!**

Recommendations

- Introduce HAN and “Bioterrorism Readiness Plan” to labs
- Increase availability of trainings
- Inform labs of proficiency testing
- Stay in contact with labs
- Allot any unused funds to buying necessary equipment and supplies

Acknowledgements

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- Mrs. Marianne Garcia
- Dr. Leanne Field

Special Thanks

- The Texas Health Foundation
- The Centers for Disease Control and Prevention's Epidemiology and Laboratory Capacity for Infectious Diseases Program