Translating Biosafety in the Clinical Realm

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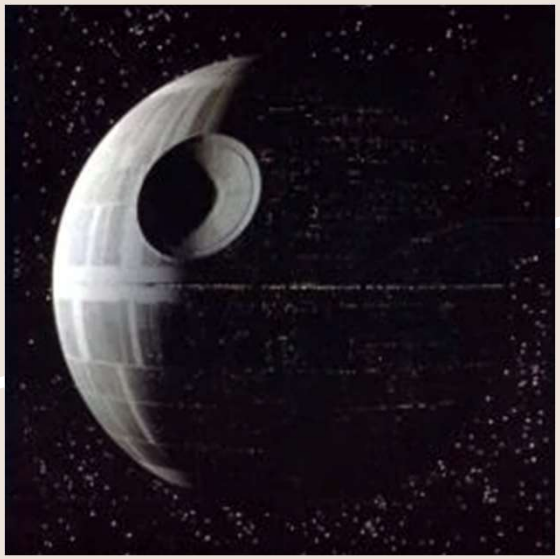
HMH Network Biosafety Officer

My Background

- Infectious disease researcher for many years as part of the New England Regional Center for Excellence.
- Biological Safety Officer for Harvard Medical School and Harvard School of Public Health.
- Biological Safety Officer at Tulane University serving the School of Medicine and the School of Public Health and Tropical Medicine.
- Alternate Responsible Official and Biological Safety Officer at Tulane National Primate Research Center.
- Academic background through and through…

2014 Ebola Outbreak



2014 Ebola Outbreak

- On September 30, 2014, CDC confirmed the first travel-associated case of Ebola diagnosed in the United States in a man who traveled from West Africa to Dallas, Texas.
    - The patient died on October 8, 2014. Two healthcare workers who cared for him in Dallas tested positive for EVD. Both recovered.
- On October 23, 2014, a medical aid worker who had volunteered in Guinea was hospitalized in New York City with suspected EVD. The diagnosis was confirmed by the CDC the next day. The patient recovered.
- Seven other people were cared for in the United States after they were exposed to the virus and became ill while in West Africa, the majority of whom were medical workers. They were transported by chartered aircraft from West Africa to hospitals in the United States. Six of these patients recovered, one died.

CDC.gov

2014 Ebola Outbreak

- Harvard had many academic ties to medical institutions at the time, and our expertise was called upon to assist in preparedness.
- Naive to the gaps between the academic environment and the clinical environment.
- Clinical staff training for Ebola preparedness quickly illuminated this problem.
    - Donning and doffing of PPE
    - Airflow requirements of potential patient areas
    - Sample handling procedures
    - Procurement overstep
- Quickly became evident that fundamental principles needed to be addressed to bridge the academic and the clinical environment.

Crisis averted, but how prepared are we?

Biological Safety and Infection Prevention

Biological Safety vs. Infection Prevention

“While both the biological safety and infection prevention professions exist to help individuals avoid contracting disease, there are distinct differences between the vocations. Biosafety professionals traditionally focus on the protection of laboratory workers from exposure to infectious biological agents by promoting safe microbiological practices, procedures, and the proper use of containment equipment and facilities. Infection preventionists primarily focus on patient safety using epidemiology and the clinical applications of microbiology to prevent the spread of disease in the healthcare setting.”

Rios et al. “Comparing the established competency categories of the biosafety and infection prevention professions: a possible roadmap for addressing professional development training needs for a new era” Applied Biosafety 2016

Biological Safety vs. Infection Prevention

Biosafety:

- Comprehensive Risk Assessment Process
  - Identify risks within a research project.
  - Review all risks within the process or procedure.
  - Put controls in place to mitigate risk.
  - Evaluate the ongoing effectiveness of those mitigation strategies.

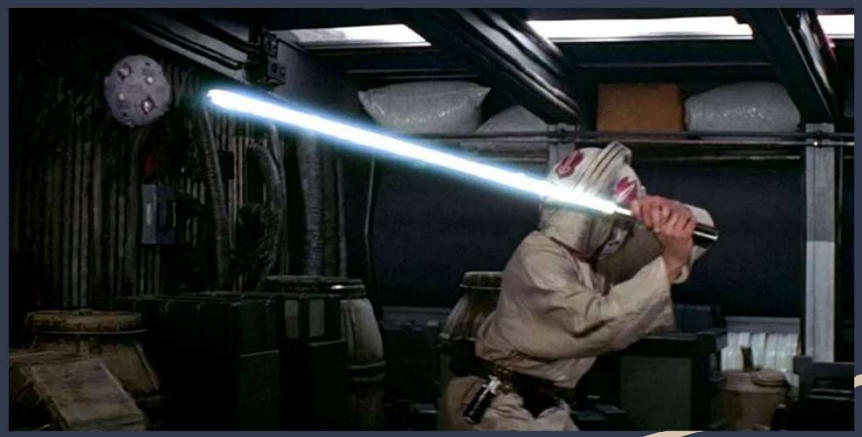
Infection Prevention:

- Standard Precautions are used for all patient care. They're based on a risk assessment and make use of common sense practices and personal protective equipment use that protect healthcare providers from infection and prevent the spread of infection from patient to patient.

Biological Safety vs. Infection Prevention

- While rooted in the same principles of risk assessment, Infection Prevention had a much stronger focus on the patient.
- Biosafety provided a focus on the materials being worked with and the procedures being performed.
- This created a fundamental bridge that needed to be crossed in the eyes of the clinical personnel.

Clinical Trials



- HMH is a primary, secondary, and tertiary site for numerous trials.
- Human gene transfer studies on the rise.
- With the intersection of IBC and these trials, in roads had to be made to bring biological safety to the clinic.
- A different world in risk assessing treatments vs. diseases.
- Regulatory need dictated an interactive environment that fostered the ability to begin to translate academic biological safety risk assessment into the clinical environment.

Clinical Trials

- Clinical researchers and staff were given awareness training on what the NIH guidelines were and how to identify human gene transfer research.
- As studies were proposed, a traditional biosafety process was implemented.
    - Studies were identified and the documents necessary for IBC review were collected.
    - Study materials were translated to a risk assessment identifying how to handle the research materials safety and effectively.
    - Site inspections occurred to ensure that areas proposed for the research were appropriately set up and fit for duty.
    - IBC review occurred and necessary updates were made to the risk assessment.
    - Training documents were generated and staff were trained on the projects to be implemented.

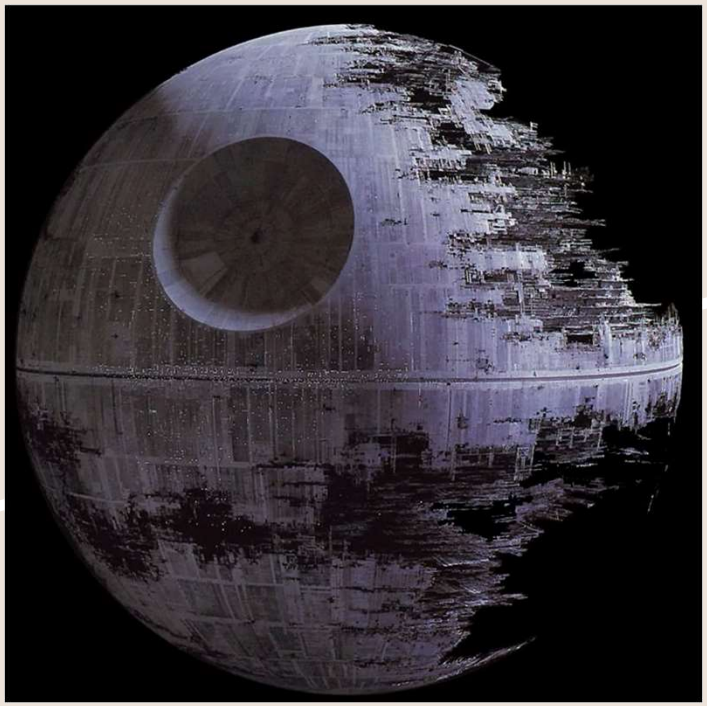
Clinical Trials

- Process took time to develop.
- Difficult to get all entities involved in the researcher together and identified.
- Documents had weeks to be fine tuned before training was delivered.
- A very deliberate and lengthy process.

Infectious Disease Outbreak Planing

- Infectious disease playbook had been developed at HMH following the ebola outbreak.
- Developed by clinical personnel who handled preparedness response at the time.
- Had largely went untouched since.
- Edits were underway with inroads being made with input from the infectious disease clinicians and biological safety.
- Progress began…

SARS-CoV-2



First COVID patient in New Jersey

- March 4th 2020, The first presumptive positive case of coronavirus in New Jersey is announced. The patient, later identified as James Cai, 32, of Fort Lee, is hospitalized at Hackensack University Medical Center.
- This led to a massive mobilization of resources within the clinical environment as plans developed previously became implemented in hospitals across the country.
- The need for risk based education was a must.

HMH CDI PCR Verification of SARS-CoV-2

- HMH's response to case testing was challenged by the initial limitations of the SARS-CoV-2 reverse-transcription polymerase chain reaction (RT-PCR) test developed by the US Centers for Disease Control and Prevention (CDC) and extensive delays (7–10 days) in test results, highlighting the urgent need to establish an accurate and practical diagnostic method in local hospitals in the period of time when no commercial test was approved or available.
- CDI systematically evaluated both the CDC diagnostic panel and another real-time RT-PCR diagnostic panel developed by researchers in Germany. The latter had already been adopted by the WHO as their official molecular diagnostic panel for COVID-19 and has been widely used in many European laboratories.
- Based upon evaluation results, CDI built a hybrid diagnostic panel (CDI Enhanced COVID-19 Test) and quickly implemented the test in the molecular laboratory of Hackensack University Medical Center.

Hackensack University Medical Center

Hurdles Identified

Challenges of Implementing the Test at Hackensack University Medical Center

- The hospital presented a clinical environment that allows for the use of many rapid diagnostic platforms.
- This allows an ability to focus on many assays at once but also presents a lack of utilizing fundamental molecular techniques.
- A back to basics approach was needed to implement a diagnostic assay requiring extraction and non-automated RT PCR.
- Staff was reluctant and rusty within this environment and also had many fundamental fears surrounding SARS-CoV-2.
- A different approach was needed to not only train them in the assay safely but also to work through the fundamentals of biosafety and how that would play into the work they perform.

Challenges of Implementing the Test at Hackensack University Medical Center

- The idea of teaching the fundamentals of biosafety became evident.
- They had lived so long in a world of infection prevention, that basic risk assessment techniques focused on the hazards they were working on were lost.
- A new training tactic needed to be developed to work through an ability to penetrate the thought processes of the staff while at the same time ensuring that they were able to work safely and confidently in an ever changing environment.

Clinical Training Needs Identified

- After meeting with molecular and virology staff it became apparent that training deficits were present in many departments within the clinical area.
- Speaking with the pathology team, a need developed to present some for of risk based biosafety training to all of the departments within the clinical laboratory division that may process SARS-CoV-2 Infected biological materials.
- As word spread other clinical departments within the hospital wanted to get in on the action as well.
- A process and tactic needed to be developed to hit divergent areas in rapid succession.

Fundamental Issues

- Time and again the clinical environment sought a one size fits all approach.
    - This became a common theme traveling throughout different departments.
- A quick reference risk assessment process needed to be developed that would allow staff to quickly assess risks and put SOPs into place to ensure the safety of staff and personnel.
- Develop training checkpoints within programs to try and gradually introduce personnel to what is important and try and prevent folks from being “thrown into the deep end”.
- Identify and develop point people throughout the various environments to generate buy in and cultivate trained “trainers”.
- Involve Occupational Health wherever possible.

Barriers were in place that needed to be overcome

Goals to accomplish

- Develop appropriate training program and materials
- Implement training program
- Train key personnel throughout the hospital
- Roll out a comprehensive and usable risk assessment process for hospital workers

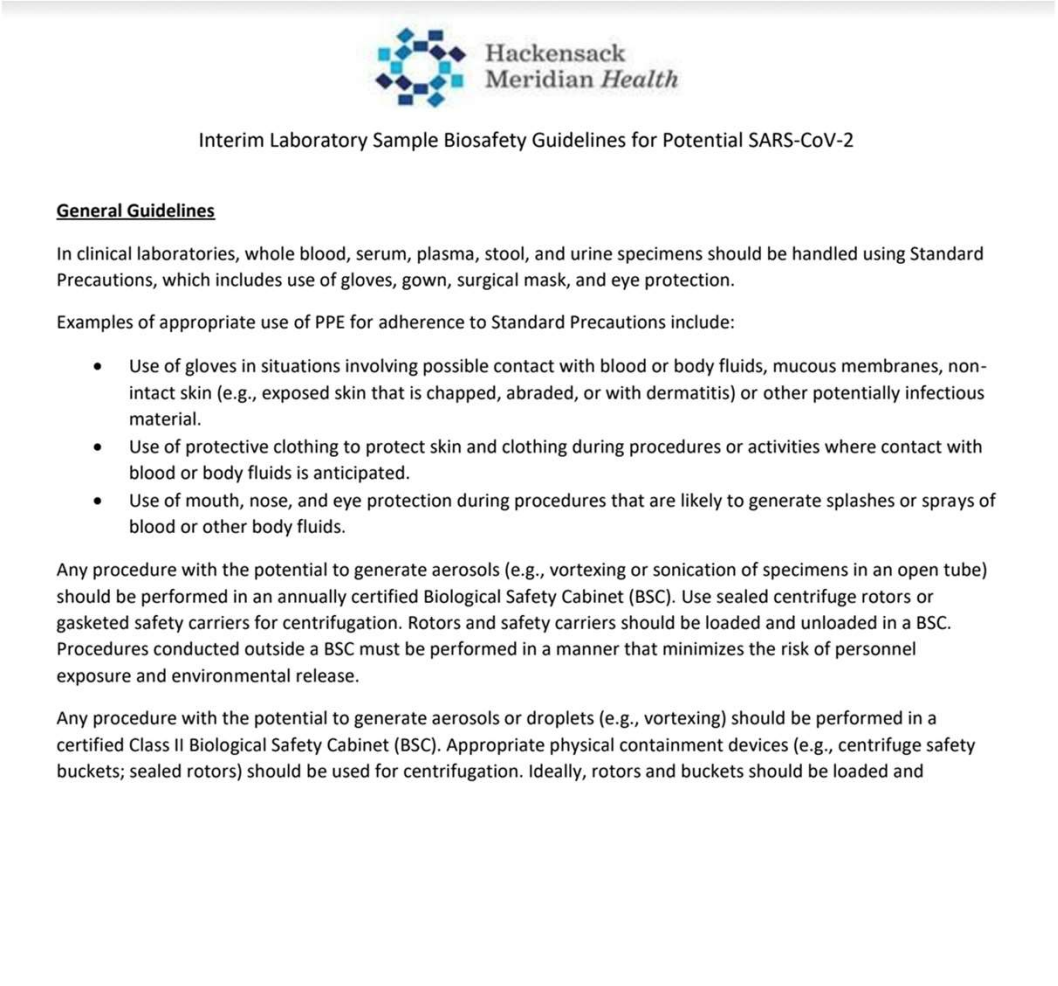
Clinical Training Tactics - Training Material

- Developed a fundamentals of biological safety training to be able to hit the high points in a 5 to 10 minute oral session.
- This put more of a focus on the principles of risk assessment.
    - The concept of what a risk assessment actually is needed to be delineated to the group.
- Staff had received bit and pieces in the past, but this needed to be in a digestible package for a broad audience.
- This allowed to focus in on specifics of both SARS-CoV-2 and Risk Assessment.
- The training material needed to be delivered in a quick, verbal lecture format, while also having materials to take away.

Clinical Training Tactics - Training Material

- Focused on topics core to the issues assessed in the areas at the time, as well as, general information.
  - General Guidelines
  - Emergency Response
  - Decontamination
  - Transportation and Shipping
- These were issued identified as needs but also issues that frequently generated questions from the clinical staff.
- The material was written and formatted in a concise and understandable way to try and create a valuable resource to the clinical environment.

Training Materials



Hackensack Meridian *Health*

Interim Laboratory Sample Biosafety Guidelines for Potential SARS-CoV-2

General Guidelines

In clinical laboratories, whole blood, serum, plasma, stool, and urine specimens should be handled using Standard Precautions, which includes use of gloves, gown, surgical mask, and eye protection.

Examples of appropriate use of PPE for adherence to Standard Precautions include:

- Use of gloves in situations involving possible contact with blood or body fluids, mucous membranes, non-intact skin (e.g., exposed skin that is chapped, abraded, or with dermatitis) or other potentially infectious material.
- Use of protective clothing to protect skin and clothing during procedures or activities where contact with blood or body fluids is anticipated.
- Use of mouth, nose, and eye protection during procedures that are likely to generate splashes or sprays of blood or other body fluids.

Any procedure with the potential to generate aerosols (e.g., vortexing or sonication of specimens in an open tube) should be performed in an annually certified Biological Safety Cabinet (BSC). Use sealed centrifuge rotors or gasketed safety carriers for centrifugation. Rotors and safety carriers should be loaded and unloaded in a BSC. Procedures conducted outside a BSC must be performed in a manner that minimizes the risk of personnel exposure and environmental release.

Any procedure with the potential to generate aerosols or droplets (e.g., vortexing) should be performed in a certified Class II Biological Safety Cabinet (BSC). Appropriate physical containment devices (e.g., centrifuge safety buckets; sealed rotors) should be used for centrifugation. Ideally, rotors and buckets should be loaded and

Clinical Training Tactics - Training Implementation

- Training had to be deployed across many departments, at many times, at a very rapid pass.
- This meant giving pop up lectures where people worked.
  - Nurses stations
  - Lab benches
  - Offices
  - Unused patient areas
- Hospitals being 24/7 operations, three shifts had to be trained where possible.
  - Identifying second and third shift supervisors in the important areas became vitally important.
  - Due to shifting changes of the pandemic, this involved identifying folks and arriving at off hours ready to deploy the quick hitting training materials.
  - This also involved having the flexibility in place at those disparate times to answer questions and perform timely risk assessments.

Clinical training Tactics - Train the Trainer

- Became apparent that one person would not be able to sustain a culture of biological safety across this ever changing environment.
- Identified individuals to help spread awareness and information.
    - People with an interest in what was being discussed.
    - People with supervisory capacity.
    - Lastly, folks that were volunteered for this by their superiors.
- These individuals became important advocates for the process.
- They helped develop a culture of biological safety and active risk assessment.

Clinical Training Tactics - Risk Assessment Process

- Risk assessments needed to be documented.
- They also needed to be in a digestible package for quick reference in an ever changing situation.
- They had to comprehensively cover what was needed by the clinicians while at the same time be easy to use and understand.

Risk Assessment Documentation

Hackensack Meridian *Health*

Clinical Laboratory Procedure Risk Assessment

	SARS-CoV-2 Detection utilizing the ID NOW platform	**Virology Laboratory Director: Gary Munk, Ph.D.**

BSO: Fitzgerald, Biosafety Officer and Chair of the Institutional Biological Safety Committee.

Summary: This risk assessment pertains to the clinical laboratory use of the ID NOW platform for rapid SARS-CoV-2 Testing for potential COVID-19 patients. The platform uses isothermal nucleic acid amplification to provide qualitative detection. Patient swabs are collected and transported in approved transport media to the virology laboratory. The ID NOW machine is prepped following manufacturer's instructions. During this process, the swab from the patient is removed from the sample tube and placed in the sample receiver in the ID NOW device. The swab is then discarded and the process can begin. Alternatively, 200 µl of sample transport media can be added to the receiver in lieu of the swabbed, following the same process. Following the test, the test cartridges can be removed following manufacturer's guidelines and disposed of.

All manipulations related to the use of the ID NOW for COVID-19 patient testing should follow strict standard precautions and BSL-2 practices and procedures. Special attention must be paid to the swab removal from the transport media and the insertion into the sample container. This presents a splash risk that will need to be mitigated by utilization of a splash guard worn on the face or placed on the laboratory bench between the ID NOW and the laboratorian.

Agent (source and gene insert, if applicable)	BSL	RG	Stipulations	NIH Citation	Precedent
SARS-CoV-2 clinical specimens	2	N/A	• BSL-2 practices and procedures must be followed at all times. • Aerosol-proof rotors or centrifuge buckets with safety caps will be used during centrifugation of biological materials. • Face shield or splash shield between the laboratorian and the ID NOW during any sample loading and handling activities. • Lab personnel must be trained on the health hazards associated with the material handled in the laboratory.	N/A	N/A

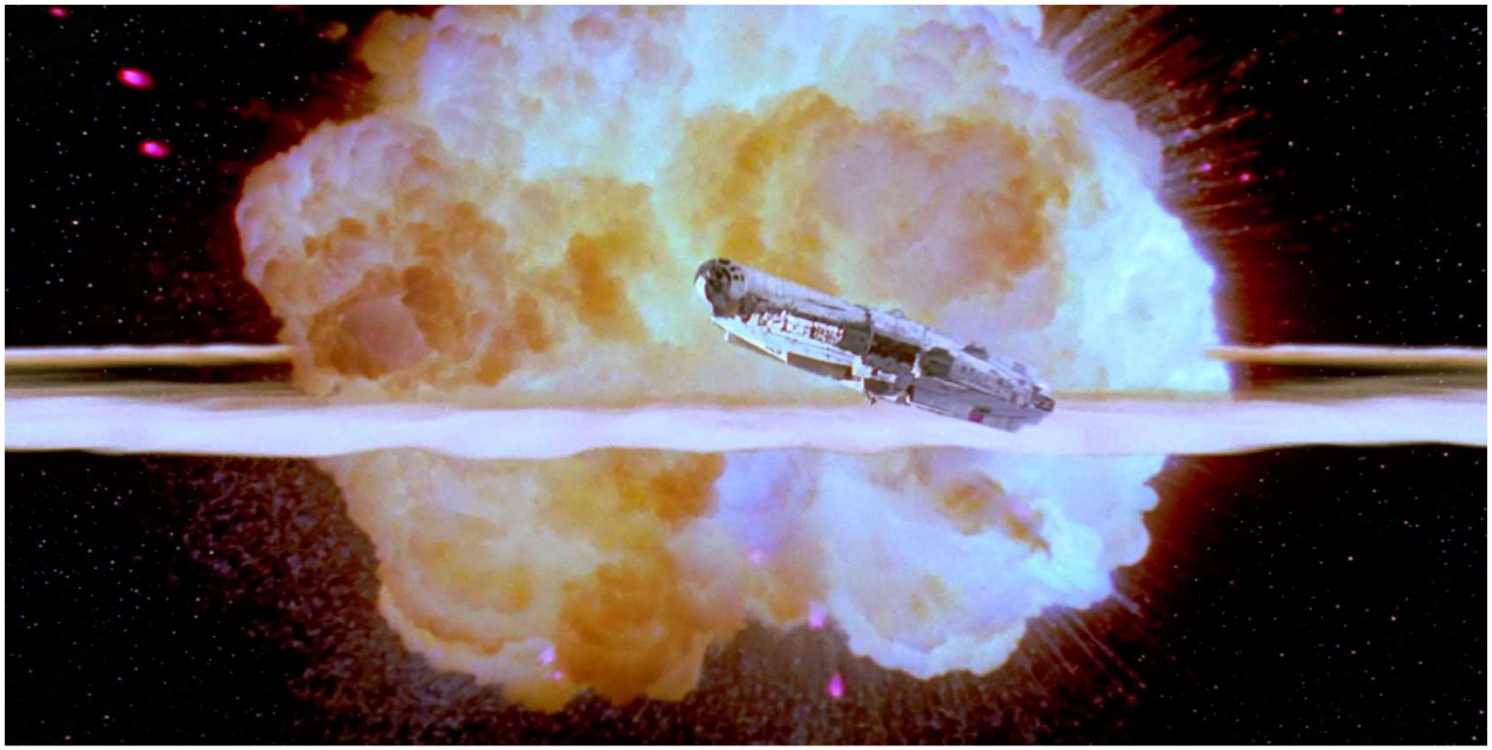
Risk Assessment Documentation

Hackensack Meridian *Health*

Clinical Laboratory Procedure Risk Assessment

			• Liquid infectious cultures and waste must be treated with an appropriate disinfectant, such as bleach, prior to sink disposal. Other waste that cannot be disinfected in this fashion must be handled by a commercial vendor. • Avoid using sharps if possible. Follow sharps precautions if there are no alternatives to the use of sharps. Contaminated sharps must be discarded into sharps containers immediately after use. • Personnel exposure related to the project must be reported to employee health as soon as possible.		
Risk Assessment: This work may occur at BSL-2 following standard precautions.					
Other personnel:					
Alternate Contact:					

Success….for now



Lessons Learned

- The traditional laboratory risk process needed to be adapted in a way that was easy for the medical masses.
- Training material needed to be accessible and comprehensible.
- Training deployed where and when needed.
- Process needs to be fluid and dynamic.
- Buy in must be earned.
- Great things can be accomplished when bringing traditional laboratory biological safety to the clinical environment.

Questions?