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ORIGINAL ARTICLE

Pivoting the Biosafety Program in Response to COVID-19: Recommendations of Key Services and Tasks to Consider for the Next Pandemic

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Abstract

Introduction: With the onset of the COVID-19 pandemic, a rapid adjustment of work tasks was necessary for many biosafety programs (and other safety programs) to address drastic shifts in workload demands amid pandemic-related shutdowns and subsequent needs for supporting COVID-19-related safe work protocols, diagnostic testing, research, vaccine development, and so forth. From a program management standpoint, evaluating and understanding these tasks were critically important to ensure that appropriate support and resources were in place, especially during such unprecedented times of rapid change and significant impact to normal life and routine.

Methods: Described here are examples of how the biosafety program at The University of Texas Health Science Center at Houston (UTHealth Houston) addressed these challenges.

Results: As part of this required pivot, key services and tasks emerged into three distinct categories: (1) those that were temporarily diminished, (2) those that had to continue despite COVID-19 and the associated shutdowns for safety or compliance purposes, and (3) those that dramatically increased in volume, frequency, and novelty.

Conclusion: Although the adjustments described were made in situ as the pandemic evolved, the cataloging of these tasks throughout the experience can serve as a template for biosafety programs to plan and prepare for the next pandemic, which will inevitably occur.

Keywords: biosafety professional, COVID-19, pandemic, biosafety services, biosafety program management

Introduction

With the onset of the COVID-19 pandemic in 2020, organizations were forced to make major adjustments both to protect people and to hopefully maintain operations.¹ This was made increasingly difficult because, as a novel viral disease outbreak, guidance from public health agencies rapidly changed as more was learned about the virus and its characteristics. This resulted in frequent confusion among the general public. Interpretation, under-

standing, and determination of appropriate protective actions based on this guidance was necessary on a nearly continuous basis due to the rapid change in information and guidelines. As such, health and safety professionals were called upon to assist in the development and implementation of workplace safety protocols, training, and frequent communications about the response to the pandemic.²

Given their expertise with infectious biological agents, disease transmission, workplace safety protocols such as

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the use of personal protective equipment (PPE), disinfection and decontamination, and containment, biological safety professionals often served in a support role, and in some cases a lead advisory role, for their organizations or clients during the pandemic.³ At the same time, although some research activities were temporarily paused, biological safety programs were expected to support normal research operations plus a massive influx of research related to the SARS-CoV-2. As a result, many health and safety programs, and specifically biological safety programs, were forced to make decisions about services and prioritize tasks throughout the pandemic.

Based on experience at The University of Texas Health Science Center at Houston (UTHealth Houston), key health and safety services and tasks were essentially divided into three categories: (1) those that were diminished; (2) those that had to continue despite the pandemic and the associated shutdowns and impacts as they were compulsory for safety, health, or compliance purposes; and (3) those that dramatically increased in volume, frequency, and novelty. Equally important to these adjustments was the cataloguing and displaying of the modifications to inform upper management and other stakeholders, in an easily comprehensible way, of the dramatic shift in operations that was occurring. This article showcases these impacts to our operations that we share in hope that others can learn from the experiences and lessons learned to prepare for future outbreaks and pandemics.

Program Description

The Biological Safety Program at UTHealth Houston resides within the Office of Safety, Health, Environment, and Risk Management (SHERM).⁴ Other programs within SHERM include radiation safety, chemical safety, occupational safety and fire prevention, hospital and clinic safety, environmental protection, risk management and insurance, and employee health. The SHERM office is responsible for the health and safety of ~14,000 students, faculty, and staff within various buildings that comprise ~465,000 square meters net assignable square feet of teaching, research, and clinical space.

The campus resides largely within the Texas Medical Center (the largest medical center in the world, and the eighth largest business district in the United States)⁵ and also hosts regional campuses across the State of Texas and an outpatient clinical enterprise with locations geographically situated in a footprint that spans an area approximately equivalent to the size of the State of Connecticut.⁶ The SHERM office consists of 32 full-time equivalent (FTE) employees in total. More specifically, the biological safety program consists of four FTE employees, plus SHERM leadership that includes two individuals with extensive biosafety experience.

Among these six biological safety professionals within the department, three are currently board certified as certified biological safety professionals (CBSPs) through ABSA International⁷ (including one individual that is uniquely credentialed as a CBSP and holds the certification in infection prevention and control,⁸ or CIC[®], offered by the Certification Board of Infection Control and Epidemiology). To be fully effective given the size and scope of the institution and the population served conducting dynamic teaching, research, and patient care activities, it is imperative that SHERM ensures all staff members are cross-trained on the basic aspects of health and safety related to goals and responsibilities of each program within the SHERM department.

For example, safety specialists within the radiation safety and chemical safety programs are cross-trained on the basics of biosafety so they have the core knowledge and understanding to be able to evaluate risk within Biosafety Level 1 and Biosafety Level 2 laboratory settings on our campus. This cross-training expectation is a component of each staff member's job description and allows additional safety staff members to be able to assist with laboratory inspections, basic training and guidance, spill response, and other health and safety functions to support our research laboratories. This cross-training approach and expectation, fortunately, have proved to be invaluable at the onset and throughout the duration of the pandemic situation.

Summary of Modified Services and Tasks

Table 1 provides a summary of the SHERM-modified services and tasks experienced during the COVID-19 pandemic. In some cases, the entries reflect terminology unique to UTHealth Houston, but these entries were preserved as originally entered to maintain the authenticity of the document. Explanations are provided where necessary.

Column 1 on the left reflects the services and tasks that were deemed eligible to be diminished while finite resources were redirected to address preparation and response priorities for the pandemic, or out of sheer necessity due to pandemic-related shutdowns at the onset of the pandemic. Column 2 in the middle contains those services and tasks that were deemed necessary to complete despite the ongoing pandemic due to immediate health and safety concerns or for required regulatory compliance purposes. Column 3 on the right lists the significant volume of added services and tasks that arose throughout the duration of the pandemic.

The formatting of the table was specifically designed to display this crucial information to department management and the organization's senior leadership regarding the amount of added work that was experienced by the entire SHERM department. SHERM staff members also benefitted from the visualization of these modified services and tasks within our department through

Table 1. Summary of UHealth Houston Office of Safety, Health, Environment, and Risk Management-modified services and tasks due to COVID-19

| 1. Diminished Services and Tasks Due to COVID-19 | 2. Continued Services and Tasks Despite COVID-19 | 3. Added Services and Tasks Due to COVID-19 |
|--|--|--|
| <i>Internal Department Services</i> | | |
| <p>Travel reservations, logistics, reimbursements</p> <p>Commute times to cover buildings across campus</p> | <p>EHS data collection and management</p> | <p>Transit time to various facilities</p> <p>Time spent getting screened for entry into various buildings, clinics, and hospitals</p> |
| <i>Services provided to the institution</i> | | |
| <p>Indoor air quality concerns and odor complaints</p> <p>Routine water testing program</p> <p>Monthly fire drills at various buildings closed due to pandemic shutdowns</p> <p>Corridor clearance oversight and efforts within buildings</p> <p>Temporary reduction in personnel radiation dosimetry</p> <p>Radioactive material package deliveries and check in</p> <p>Escorted access to security-sensitive irradiators</p> | <p>Environmental surveys of fuel tanks, generators, and grounds</p> <p>Oversight of ongoing renovations and new construction projects</p> <p>Required building fire drills at buildings remaining occupied</p> <p>Required building fire system testing and maintenance</p> <p>Biomedical equipment maintenance and oversight program</p> <p>Oversight of equipment/medications recalls</p> <p>Fire extinguisher checks, maintenance, and repair</p> <p>AED checks, maintenance, and repair</p> <p>Safety shower, eyewash station checks, maintenance, and repair</p> <p>Fleet management including reporting monthly mileage logs</p> <p>Hallway clearance program</p> <p>Incident response services: ventilation issues, leaks, spill cleanup, etc.</p> <p>Mold assessments</p> <p>Surplus equipment inspections/clearance</p> | <p>Work from home ergonomics consultations</p> <p>Site visits and post-approval monitoring for labs working with COVID-19 patient samples and SARS-CoV-2 pathogen</p> <p>Influx of requests for office, classroom, restroom, and clinic disinfections due to COVID-19–positive individuals in these spaces</p> <p>Processing of Supervisors First Report of Injury forms for workplace COVID-19 exposures and positive cases</p> <p>Increase in regulated medical (biohazardous) waste pick-ups from laboratories due to no personnel onsite to autoclave waste</p> <p>Provide sharp disposal containers and routine regulated medical (biohazardous) waste pick-ups at vaccine locations</p> <p>Regulated medical (biohazardous) waste volume, pick-up frequency, and cost at clinic locations and COVID-19 testing sites</p> |
| <p>Workplace ergonomic assessments and accommodations</p> | <p>Laboratory safety surveys</p> | <p>Work from home ergonomics consultations</p> <p>Site visits and post-approval monitoring for labs working with COVID-19 patient samples and SARS-CoV-2 pathogen</p> |
| <p>Monthly surveys by laboratory personnel if not using radioactive materials (verified semiannually by EHS)</p> | <p>Clinic surveys resumed once initial surge of modifications for COVID-19 situation was put into place</p> | <p>Influx of requests for office, classroom, restroom, and clinic disinfections due to COVID-19–positive individuals in these spaces</p> |
| <p>Clinic safety surveys initially put on hold due to COVID-19 interruptions</p> | <p>Processing and follow-up on insurance claims (property, cyber liability, etc.)</p> | <p>Processing of Supervisors First Report of Injury forms for workplace COVID-19 exposures and positive cases</p> |
| <p>Workplace injury investigations due to reduced frequency of accidents and injuries on campus</p> | <p>Hazardous waste pick-ups, processing, and management of final disposal</p> | <p>Increase in regulated medical (biohazardous) waste pick-ups from laboratories due to no personnel onsite to autoclave waste</p> |
| <p>Overall hazardous waste volumes, with the exception of regulated medical (biohazardous) wastes</p> | | <p>Provide sharp disposal containers and routine regulated medical (biohazardous) waste pick-ups at vaccine locations</p> <p>Regulated medical (biohazardous) waste volume, pick-up frequency, and cost at clinic locations and COVID-19 testing sites</p> |

(continued)

Table 1. (Continued)

| 1. Diminished Services and Tasks Due to COVID-19 | 2. Continued Services and Tasks Despite COVID-19 | 3. Added Services and Tasks Due to COVID-19 |
|--|---|--|
| New employee/student safety training (in person) Routine EHS technical staff in-person training EHS staff credential maintenance | Clinical-based new employee safety training (in person) Compliance activities including completion of one-time compliance documentation for dental clinics | New employee/student safety training (virtual online) EHS staff training on COVID-19 issues and UTHHealth Houston approach In-person and virtual BSL-2+/BSL-3 training for researchers Increase in COVID-19-specific submissions to the IBC, including HGT protocols and BSL-3 protocols, requiring risk assessment and review Conducting safety committee meetings virtually through Webex/Zoom Increased frequency of IBC meetings from monthly to twice per month Participation on “Research Task Force” to support reduction in laboratory activities during the COVID-19 pandemic Participation in The University of Texas system-wide meetings regarding COVID-19 preparedness and communication Coordinating, scheduling, and executing all campus-wide emergency operation center calls with emergency management leadership team Assistance in maintaining campus-wide emergency communication website regarding COVID-19 Deliberation of Clery Act compliance issues related to COVID-19 Communication and coordination with local regional advisory committee for hospitals Hospital bed reporting for local and state health departments Fulfillment of contingent requests or consultations for campus stakeholders, such as “my child went to a camp and now wants to return, what do I do to keep my family safe,” “my spouse or household member is positive, so what do I do,” etc. Participation in “return to campus” task force to assemble recommendations to campus president for decision making and communication across campus Monitoring case definition, case counts, positivity rates, geographic distribution of initial COVID-19 cases globally, nationally, and locally Screening protocol development for local hospitals and clinics, including manpower support to provide needed assistance at screening entry points Participation in development of clinical response algorithms for COVID-19-positive or suspected positive individuals |
| Reduced safety committee meeting frequency and overall protocol volume (except IBC) | Safety protocols submissions (e.g., chemical, radiological, biological) | |

(continued)

Table 1. (Continued)

| 1. Diminished Services and Tasks Due to COVID-19 | 2. Continued Services and Tasks Despite COVID-19 | 3. Added Services and Tasks Due to COVID-19 |
|---|---|---|
| | | <p>Participation on newly created “Procurement Task Force” to address PPE and supply shortages</p> <p>Vendor/contractor management for UTHHealth Houston COVID-19 requirements</p> <p>Vetting of PPE solicitations from nontraditional vendors and donors</p> <p>General PPE evaluations and consultation</p> <p>Concierge PPE and supply delivery to clinics and laboratories in need</p> <p>Developing alternative PPE use protocols (e.g., half face elastomeric respirators)</p> <p>Protocol testing and evaluation of PPE decontamination strategies for reuse (e.g., N95s through vaporized hydrogen peroxide)</p> <p>Procurement of additional PPE and supplies necessary to support COVID-19 situation</p> <p>Massive increase in respiratory fit testing and training</p> <p>Processing of medical clearances for respiratory protection and fit testing records</p> <p>Requests for N95 respirator brand/model/size records for individuals</p> <p>Inquiries regarding N95 reprocessing, extended use, and limited reuse (plus additional unique scenarios such as double masking in clinics)</p> <p>Call volume and email correspondence regarding respiratory fit testing and training</p> <p>Providing guidance for disinfection and cleaning of affected building spaces</p> <p>Disinfection and cleaning of affected building spaces with short turnaround time by EHS staff using ionized HP</p> <p>Answering extremely high volume of general COVID-19 questions and concerns (received by phone, email, in person)</p> <p>Deployment of hand sanitizer stations across clinical and nonclinical buildings, in particular during the return to campus time period as these supplies were not readily available from most major vendors</p> <p>Participation in planning and execution of COVID-19 testing sites</p> <p>Assistance to aliquot test kits in biosafety cabinet to expand test kit capability during periods of extreme shortages</p> <p>Key decision maker and participant on COVID-19 vaccine task force for UTHHealth Houston</p> |

(continued)

Table 1. (Continued)

| 1. Diminished Services and Tasks Due to COVID-19 | 2. Continued Services and Tasks Despite COVID-19 | 3. Added Services and Tasks Due to COVID-19 |
|---|---|---|
| | | Liaison with state health department regarding eligibility to serve as a community COVID-19 vaccination hub COVID-19 vaccine receipt and storage at designated secured freezer location COVID-19 vaccine supplies receipt and transportation to vaccine hub locations |
| <i>Services provided outside of our institution</i> | | |
| | | Develop and deliver consultations for community-based businesses as Governor Greg Abbott reopens Texas Technical assistance to various city/county entities regarding COVID-19 safe work protocols Various outreach requests for community partners, Houston and Harris County health departments, etc. Training and fit testing for local UT System police department |

AED, automated external defibrillator; BSL-2, Biosafety Level 2; BSL-3, Biosafety Level 3; EHS, environmental health and safety; HGT, human gene transfer; HP, hydrogen peroxide; IBC, Institutional Biosafety Committee; PPE, personal protective equipment.

the understanding of the changes in our responsibilities and workload expectations. When printed onto one long sheet of paper (almost 0.3 square meters in total length), it became clearly apparent that the total number of entries in Column 3 was significantly larger than those in Columns 1 and 2.

Discussion

The onset of a global pandemic resulted in an “all hands-on deck” posturing within UTHealth Houston to prepare for and respond to the threat. The biological safety professionals within SHERM quickly found themselves involved in nontraditional biosafety tasks, identified by related professional competency categorization:

- Routinely monitoring for information on the disease outbreak status and communicating this information to the campus emergency management team (epidemiology; infection prevention and control)
- Assisting in the development of screening protocols for clinical and nonclinical building locations (infection prevention and control)
- Providing consultation regarding CDC recommendations for safe work protocols for settings across campus in addition to laboratory setting (occupational safety; infection prevention and control)
- Determining and advising on best practices for campus contact tracing investigations (epidemiology; infection prevention and control)

- Planning workflows for diagnostic testing and vaccine administration locations (logistics; infection prevention and control)
- Providing consultation on heat stress prevention for drive-through diagnostic testing and vaccine locations during the very hot and humid summer months (occupational safety)
- Vetting purchases of PPE and other supplies such as alcohol-based hand sanitizers and disinfectants, and cleaners (occupational safety; procurement)
- Developing decontamination protocols for necessary reuse of N95 respirators using vapor phased hydrogen peroxide and other approaches (highlights overlap of biosafety and infection prevention and control)
- Assisting in the performance of countless number of respiratory fit tests and training (biosafety; occupational safety; industrial hygiene); and many other tasks.

In addition, our biological safety professionals were tasked with establishing safe work protocols for laboratories investigating the SARS-CoV-2 pathogen, sometimes inclusive of animal work. The guidance for safe work practices in these settings with these activities was based on evolving guidance and scientific data, which required diligent monitoring for updated information from the CDC and other sources such as the SARS-CoV-2/COVID-19 Toolbox provided by ABSA International.^{9,10}

This included assistance to develop safe work protocols for our laboratories developing diagnostic testing and clinical trials for COVID-19 vaccine candidates. This included supporting institutional biosafety committee meetings more frequently (sometimes meeting twice per month as opposed to the normal frequency of once per month) to accommodate the high protocol review volume.

Similarly, the other safety professionals in our SHERM department outside of the biosafety program soon found themselves involved with biosafety-related tasks, such as the selection and use of PPE, providing guidance and training on safe work practices during the pandemic, performing respiratory fit testing and training, and disinfection and decontamination. All of our staff members were involved in novel tasks such as the reprocessing of respiratory protective equipment that was originally designed for single use—a temporary solution to severe global supply chain shortages. Our responsibility with reprocessing single-use PPE was to ensure we understood, operationalized, and followed CDC guidance on these processes and validating procedures.¹¹

SHERM's previous cross-training efforts for all staff members, augmented with just-in-time training for nonbiosafety staff, proved to be invaluable during this event. Cross-training is such a priority for SHERM that our educational materials have been codified for our staff as a stated job-related proficiency. This cross-training content has been extensively shared with other organizations, such as ABSA International through recurrent professional development courses (using a document known as the “50 questions every safety professional should be able to answer”). Interoperability is a key point of consideration for biosafety programs everywhere.

The value of all staff members being well equipped with knowledge and understanding of basic safety and health competencies outside of the boundaries of their “normal” biosafety duties was clearly exemplified during the pandemic. In short order, the biosafety program found itself addressing issues related to fire exit pathways and car exhausts while supporting mass testing and vaccination hubs. Other safety professionals joined in to support respiratory fit testing, PPE reprocessing, cleaning and disinfection, and biological waste disposal efforts. Table 1 provides a thorough catalog of the adjustments, modifications, and improvisations that all of our units made.

The ability to provide necessary just-in-time training was crucial to success, as was a true spirit of cooperation and flexibility. Our collective ability to pivot services to best fit the organization and its customers has proved to be invaluable. Equally important was the ability to capture and display the story of this collective effort in a manner that non biosafety professionals, such as executive leaders, could readily visualize and digest. Table 1 proved to be very effective in this regard.

Summary

The COVID-19 pandemic dramatically impacted operations and workload for health and safety professionals across many disciplines of the field. In particular, biosafety professionals have been called upon to serve their organizations and clients throughout the pandemic due to their understanding and expertise with infectious biological agents and disease transmission. Our staff members at UHealth Houston within the SHERM department have meritoriously served to help keep people healthy and safe during the COVID-19 pandemic.

Through aggressive cross-training efforts, and just-in-time training when circumstances changed due to the pandemic situation, the department was able to address the challenge. Inherent to this effort was the cataloging of the adjustments and added workload for services and tasks that was experienced. Equally important was the compelling display of this information in a way that department management, senior leadership, and other stakeholders could understand and appreciate. The listing of modified services and tasks captured here can serve as one means of preparing the next pandemic, which experts predict is inevitable.

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Authors' Contributions

Each author contributed equally to the creation, writing, and editing of this article.

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