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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

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Introduction

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. Despite these differences, practitioners in both professions must possess a basic understanding of infectious diseases to perform their jobs effectively. For example, a basic knowledge of the principles of disease transmission, disease prevention, risk assessment, risk management, disinfection and sterilization are a few of the key concepts common amongst the two professions. The recent outbreak of Ebola Virus Disease (EVD) in West Africa and the subsequent lessons learned from EVD patient care efforts both abroad and in the United States revealed gaps that highlighted the need for the sharing of skillsets between biosafety and infection prevention in order to work in concert to prevent occupational infections, especially during outbreaks of diseases of public health significance (Emery 2015). Since such global infectious disease threats will inevitability occur into the future, now is the time to gain a better understanding of how these professions can work together by identifying common competencies and highlighting differences. The codification of these similarities and differences can provide a roadmap to new professional development training initiatives for the enhancement of the biosafety profession in this new era.

Professional competencies

To ensure a high quality of professionalism (London 2005), professional disciplines establish standards for the knowledge, skills and abilities of a competent practitioner.

Competence can be defined “as the ability to do something well, or to do a job properly.” (Dreyfus 1980) “Competencies” are a set of defined knowledge and behaviors that provide a structured guide for enabling of the identification, evaluation and development of a competent individual, and “core competencies” are capabilities and/or technical expertise that are unique to a particular organization or profession (Dreyfus 1980). Similar to other professional organizations, the biosafety and infection prevention disciplines have utilized the collective wisdom of their organization’s practitioners to develop and establish competencies, as well as experience and educational attainment levels, necessary to be credentialed in the field. Credentialing within a professional organization is often considered as a tangible demonstration of the highest level of competency within one’s field.

Biological Safety

Professional competencies have been established for the biosafety profession by the American Biological Safety Association – International (ABSA), which are also embodied in the credentialing examination administered by the National Registry of Certified Microbiologists (NRCM). Applicants who meet the education and experience criteria set forth by ABSA and NRCM and who are successful in demonstrating competency by passing the exam, are afforded two certifications simultaneously – the Certified Biological Safety Professional (CBSP) and the Specialist Microbiologist in Biological Safety Microbiology (SM NRCM). There are 65 stated competencies that practitioners must master which fall into seven categories: (1) disinfection, decontamination, and sterilization, (2) safe work practices and procedures, (3) risk assessment and hazard identification, including infectious agents and recombinant or synthetic nucleic acid molecules, (4) regulatory aspects, standards and guidelines, (5) program management and development, (6) equipment operation and certification, and (7) facility design (NRCM 2016).[1]

Infection Prevention

The Certification Board of Infection Control and Epidemiology (CBIC) established 48 professional competencies for infection preventionists. These competencies fall within eight categories: (1) identification of infectious disease processes, (2) surveillance and epidemiologic investigations, (3) prevention/controlling the transmission of infectious agents, (4) employee/occupational health, (5) management and communication (including leadership), (6) education and research, (7) the environment of care and (8) cleaning, sterilization, disinfection and asepsis (CBIC 2016). Those who meet the education and experience requirements set forth by the Association for Professionals in Infection Control and Epidemiology (APIC), and pass the associated exam are afforded the credential called Certified in Infection Prevention and Control (CIC).

[1]Biosafety competencies are also described in documents such as the *Guidelines for Biosafety Laboratory Competency* (MMWR 2011) and *Competency Guidelines for Public Health Laboratory Professionals* (MMWR 2015) published by the Centers for Disease Control and Prevention (CDC) and the Association of Public Health Laboratories. While these references are written for individuals working in the laboratory with infectious agents, they should be recognized as a reference in parallel to the professional competencies.

Analysis

To identify commonalties and differences between these two professional disciplines, we compared and contrasted the professional competency lists for each and then developed a summary comparison table (see Figure 1). The column on the left summarizes the competency categories that are primarily applicable or unique to the biosafety profession and would not typically be considered relevant to infection prevention practitioners. For example, working in the laboratory with recombinant or synthetic nucleic acid molecule technology or research animals is not typically relevant in the healthcare setting. The column on the far right summarizes infection prevention competencies categories that are considered primarily applicable or unique to the infection prevention profession. For example, biosafety professionals are typically not concerned with environment of care issues related to patient care activities. Coalesced in the center column are competency categories where similarities exist between biosafety and infection prevention, but often subtle and important differences between the professions exists. Improving the understanding of the different perspectives and approaches could serve as the basis for improved collaboration between the professions, as we believe there is sufficient overlap between these programs to serve both professions in a practical and meaningful way.

As an example, consider “biohazardous and sharps waste management and disposal” a common competency category listed at the bottom of the center column in Fig 1. Now consider Ebola virus medical waste regulations that require robust handling, packaging and shipping procedures commonly implemented by biological safety professionals but that now must be implemented in less controlled patient care environments and with the capacity to process significant quantities of waste (Lowe 2014). Infection prevention does not specifically list biohazardous waste as a necessary competency, other than what can be inferred within the safe injection practices competency. But clearly infection prevention professionals were required to consider these waste management issues during this time.

Another example is the selection and use of personal protective equipment. Infection preventionists are likely to be familiar with basic protective equipment such as gloves, eye protection, gowns, lab coats, or isolation precaution ensembles routinely used in healthcare, but may not be familiar with options for higher levels of protection such as powered air purifying respirators or ensembles which are commonly used in high containment laboratories and can serve to protect healthcare workers in situations where patients may have a highly infectious disease.

Other competencies covered by biosafety such as decontamination, sterilization and disinfection, biohazard exposures to workers, proper handling of biological material, exposure control procedures, emergency response and biohazard waste management can be the backbone for establishing processes for infection prevention. Biological safety professionals have extensive practice in proper sample handling techniques, shipping infectious samples and handling personal protective equipment that may aid healthcare staff in an outbreak involving highly infectious but clinically rare diseases. A main focus of current biomedical research is using biological materials as novel therapeutics options, such as gene, cell, and plasma therapies. As this work evolves, the biological safety profession

will play a more significant role in review and monitoring of associated clinical trials to (1) ensure worker safety, (2) protect patients from the specific risks associated with the therapy, and (3) explain the hazards and controls that need to facilitate the infection prevention procedures.

Recent experiences highlighting the gaps

The value of an integrated approach to biosafety and infection prevention was exemplified in the experience of providing patient care for patients with EVD at the University of Nebraska Medical Center Biocontainment Unit (NBU) and other high level isolation patient care units in the United States. The experience at the NBU also highlights key areas that would benefit from cross training the two disciplines. In the case of Ebola care in the U.S. these two disciplines collaborated to enhance safety and reduce risk beyond what is provided by typical practices (Lowe 2015). The introduction of a Tier 1 Select Agent into clinical spaces presented unique challenges for utilization of complex medical devices, utilization and decontamination of clinical laboratory diagnostic devices, cleaning and disinfection of clinical spaces, and disposal of medical waste classified as Category A infectious substance (Jelden 2015, Lowe 2015).

Infection preventionists evaluated medical device integrity prior to use for EVD patient care. The infection prevention evaluation focused on potential for contamination and ability to withstand disinfection whereas biological safety practitioners developed strategies for disinfection and decontamination of medical devices prior to reuse. Devices evaluated for infection control integrity and disinfection included portable X-ray, ultrasound, ventilator, patient beds and mattresses.

As reflected in the professional competency analysis, it is common practice for infection preventionists to oversee biosafety with respect to clinical laboratories which represents a clear linkage between the biological safety and infection control disciplines (Luebbert 2001). In support of EVD treatment in the Nebraska Biocontainment Unit, a joint effort was carried out by both biological safety and infection prevention professionals to conduct a focused risk assessment for every individual piece of diagnostic equipment in the clinical laboratory as well as identify potential strategies to optimize the use of biological safety cabinets, thus enhancing the environment of the clinical laboratory to safely arrive at a diagnosis.

Environmental cleaning within the Nebraska Biocontainment Unit also required a partnership of disciplines demonstrating the value each profession adds to insuring greater safety. Environmental cleaning of patient care areas contaminated with Ebola virus involved robust protocols for manual disinfection, cleaning intervals and quality assurance. Biosafety professionals developed comprehensive cleaning protocols for the clinical environment to inactivate Ebola virus whereas infection prevention practitioners implemented those protocols into cleaning checklists for nurses and medical technicians that enabled systematic environmental cleaning at standard intervals that would not disrupt patient care. Similarly, terminal cleaning of the Nebraska Biocontainment Unit following conclusion of patient care

was managed by biosafety professionals and evaluated for quality assurance by infection prevention.

Management protocols for medical waste generated from care for patients with Ebola virus were developed by drawing expertise from biological safety and infection control disciplines. Procedures for disposal of Ebola contaminated medical waste requires packaging and shipping as Category A infectious substances or on site sterilization that is subsequently validated for adequate sterilization. Biological safety expertise was key to implementing necessary documentation and packaging protocols for large quantities of waste that met the Category A infectious substance requirements and infection prevention expertise was necessary to implement these strategies with healthcare workers in clinical spaces and in a manner that would enhance patient care.

While the Nebraska Biocontainment experiences may represent extreme examples, they provide a tangible representation of the value in combining and cross training two distinct but overlapping disciplines to enhance safety in a variety of environments where biological hazards exist.

Strategic direction

These experiences suggest that new professional development training initiatives should be developed based on the comparison of competencies performed, as well as lessons learned from EVD patient care and associated activities. The most pragmatic way to reach both biosafety and infection prevention professionals for cross-training is through their respective professional associations, ABSA and APIC. Offering pre-conference course content on the basics of infection prevention as it relates to biosafety professionals at the annual ABSA conference on biosafety is suggested, and this could be taught by practicing infection prevention professionals with an interest in this overlap. Vice versa, the biosafety basics for infection preventionists could be taught at the APIC conference by practicing biosafety professionals. Stand-alone courses or web-based learning offerings could also be effective for participants not able to attend annual conferences.

One group initiating efforts in this regard is the Biosafety and Infectious Disease Training Initiative (BIDTI), a multi-institutional collaboration funded in part by the National Institute of Environmental Health Sciences (NIEHS) under Award No. U45ES019360. The content being developed by this initiative represents a unique collaborative educational opportunity for both ABSA and APIC. Although the BIDTI is in its early stages, its experts successfully developed, delivered, evaluated and updated the day-long in-person course *Fundamentals of Infectious Diseases of Public Health Significance*. Moreover, the BIDTI has embarked on developing community-, awareness- and operations-level training courses using various teaching modalities (Emery 2015). Content being developed through BIDTI could be delivered in-person to both professions at the same time providing the benefit of learning from the experiences of others in each profession.

Summary

Leveraging and sharing the collective skills of both infection preventionists and biosafety professionals will enhance job performance and enable practitioners to respond to the next outbreak of infectious disease of public health significance.

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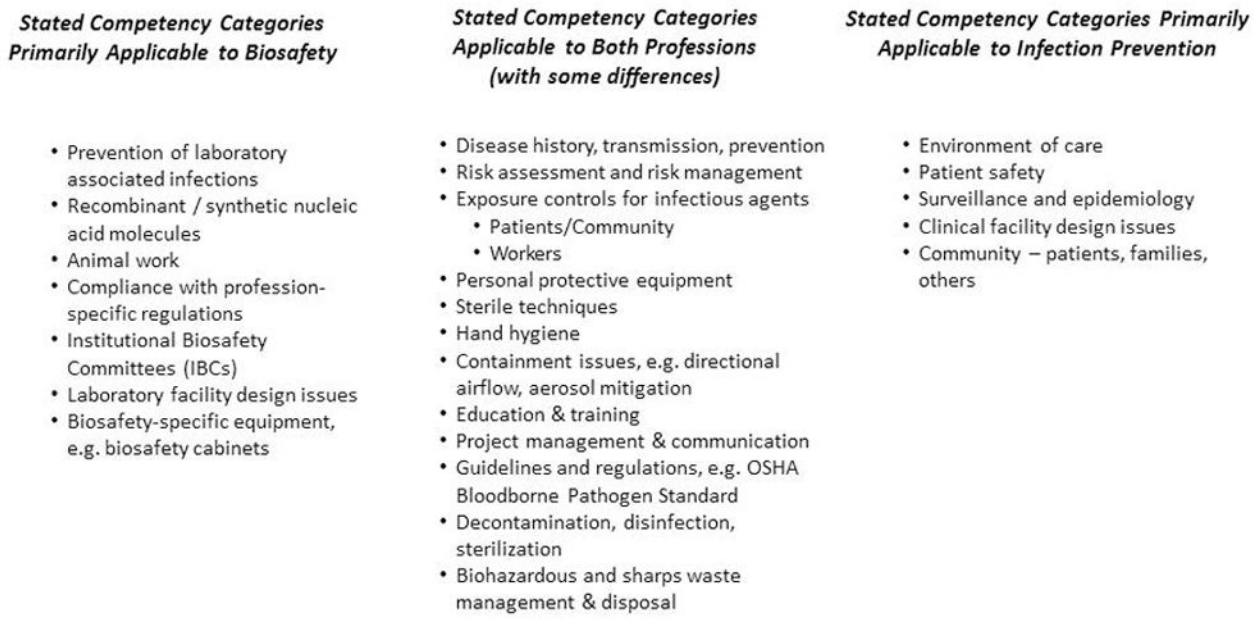

Fig. 1.

A comparison summary of stated competency categories for the biosafety and infection prevention professions