



National Institute of
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Worker Training Program

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Ebola Biosafety and Infectious Disease Response Training

**Needs Assessment and Gap Analysis for
the NIEHS Worker Training Program**



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Ebola Biosafety and Infectious Disease Response Training

Needs Assessment and Gap Analysis for the NIEHS Worker Training Program



Introduction to the Ebola Virus Disease Outbreak

In the spring of 2014, international public health organizations received reports of an Ebola virus disease (EVD) outbreak in West Africa. Unlike previous EVD outbreaks, this one was larger and was occurring in urban areas as well as rural parts of the affected countries. More than 27,000 cases were identified, with over 11,000 deaths. U.S. concern was raised when U.S. medical volunteers serving in Africa became infected and were returned to the U.S. for treatment. National interest peaked when an infected traveler was treated in a Texas hospital and two of his medical providers became infected. This raised serious health and safety concerns for health care workers, as well as other workers with potential exposure through direct contact with infected travelers or contaminated environments or waste. These other professions were especially focused on the lack of guidance issued for their industries. Because Ebola virus is classified as a select agent under the Centers for Disease Control and Prevention (CDC)/U.S. Department of Agriculture Select Agent Program, EVD-contaminated materials are required to have very specific handling. This classification is based on a biological agent's potential to be exploited as a bioterrorism agent, and therefore tightly controlled transportation and destruction protocols are required for EVD-contaminated materials. All bodily fluids and medical waste, of which there was enormous quantities of both, from infected patients required sterilization or special (and expensive) containment prior to transport to an incinerator.

The U.S. response to the EVD outbreak revealed issues in preparedness for emerging infectious diseases. Public health interventions, hospital readiness, and worker safety and health were found to have weaknesses and gaps.¹ Congress appropriated supplemental funds to the U.S. Department of Health and Human Services (HHS) to enhance the public health and health care system's capability to respond to infectious diseases. Funds provided to the HHS Office of the Assistant Secretary for Preparedness and Response (ASPR) and CDC are intended to be distributed to the states through grants and cooperative agreements. More information on these programs can be found at:

<http://www.hhs.gov/news/press/2015pres/06/20150612b.html>

<http://www.cdc.gov/vhf/ebola/healthcare-us/preparing/assessment-hospitals.html>

CDC allotted a portion (\$10 million) of its funds to the National Institute of Environmental Health Sciences (NIEHS) Worker Training Program (WTP) to develop a worker safety and health training grant program. The WTP will issue a funding opportunity announcement (FOA) in August 2015 and award grants in 2016.

In an effort to best inform the FOA, the WTP has undertaken a training needs assessment and gap analysis of current training for Ebola and other emerging

¹ CDC (Centers for Disease Control and Prevention). 2015. Top 10 Ebola Response Planning Tips: Ebola Readiness Self-Assessment for State and Local Public Health Officials. Available: <http://www.cdc.gov/vhf/ebola/outbreaks/preparedness/planning-tips-top10.html> [accessed 3 August 2015].



“

The most consistent determinant of adopting safe work practices has been shown to be safety climate; that is, employees' perception of organizational commitment to safety.

”

Annalee Yassi, M.D., in the Canadian Journal of Infectious Diseases and Medical Microbiology, 2008

infectious diseases. The methodology for this assessment and analysis includes:

- A literature search for Ebola training
- A Web search for and review of existing Ebola training courses
- Meetings and interviews with stakeholders, including the [NIEHS WTP Ebola Biosafety Training Initiative Awardee Meeting](#)
- An online survey of stakeholders assessing their experience with Ebola training (Appendix A, Ebola Training Questionnaire)

Methods and Analysis

Literature Search

A literature search of PubMed and Web of Science was conducted to highlight the latest research and lessons learned related to Ebola and communicable disease outbreaks, occupational health, and biohazard training. Key search terms were broken into three areas (health and safety, training, and communicable disease) and included topics such as occupational health, teaching/methods, communication, health and safety, communicable diseases, Ebola, pandemic, severe acute respiratory syndrome (SARS), and influenza. A proximity search was conducted in Web of Science for specific diseases. Articles included from each category reflect only those that have undergone peer review, thus excluding opinion and editorials from the last year that do not present data or best practices. Due to the limited number of publications on Ebola proceeding 2014, peer-reviewed publications from the last 10 years were included. After creating

a bibliography from each search engine and reviewing all abstracts, articles focusing exclusively on the delivery of patient care or of relevance only to locations outside the U.S. were excluded. Additional articles specific to U.S. Department of Defense installations or deployments were further excluded. Thirty-eight articles met inclusion criteria and were reviewed. Abstracts and full text documents were accessed via the NIEHS Library system.

The majority of articles focused on outlining the need for training, how to evaluate training, or innovative training methodologies, such as simulations and interactive Web training. Few described curricula or competencies^{2,3,4} and two addressed resilience training.⁵ ⁶ Training components described mostly addressed the use of personal protective equipment (PPE) and infection control methodologies.

- 2 Baka A, Fusco FM, Puro V, Vetter N, Skinhoj P, Ott K, Siikamaki H, Brodt HR, Gottschalk R, Follin P, Bannister B, De Carli G, Nisii C, Heptonstall J, Ippolito G, European Network of Infectious Diseases. 2007. A curriculum for training healthcare workers in the management of highly infectious diseases. *Euro Surveill* 12(6):178–182.
- 3 Smith EL, Kerner RL Jr, Schindler JS, DeVoe B. 2015. Professional development implications of Ebola virus disease education: part II. *J Contin Educ Nurs* 46(2):56–58.
- 4 Alexander LK, Dail K, Horney JA, Davis MV, Wallace JW, Maillard JM, MacDonald P. 2008. Partnering to meet training needs: a communicable-disease continuing education course for public health nurses in North Carolina. *Public Health Rep* 123(Suppl 2):36–43.
- 5 Shaw K. 2006. The 2003 SARS outbreak and its impact on infection control practices. *Public Health* 120(1):8–14.
- 6 Aiello A, Khayeri MY, Raja S, Peladeau N, Romano D, Leszcz M, Maunder RG, Rose M, Adam MA, Pain C, Moore A, Savage D, Schulman RB. 2011. Resilience training for hospital workers in anticipation of an influenza pandemic. *J Contin Educ Health Prof* 31(1):15–20.

The primary focus of reviewed articles included:

- Biosafety
- Bioterror preparedness training
 - Biosafety laboratories
- Decontamination and cleaning of surfaces
- Ebola infection prevention
 - Preparation, PPE, infection control education,
- Influenza (H1N1 and others)
 - Training for nurses, health care facilities, transit workers
- Respiratory protection education and standards
- Occupational health training
 - Nurses, public health-based training, PPE
 - Computer-assisted training, simulation (with PPE), blended classroom learning
 - H1N1, highly infectious disease
- Pandemics
- SARS

The most detailed article on competencies was written by the European Network of Infectious Diseases (EUNID).⁷ It describes a core curriculum developed by surveying EUNID members working in high-level isolation units. Their suggested curriculum breaks down training into two components: theoretical knowledge and practical skills. Within each component is a series of lectures or skill stations related to that component. The breakdown is as follows:

Knowledge

- Disease-specific knowledge
- Public health
- Infection control
- PPE
- Disinfection/decontamination and waste management
- Biosafety issues such as risk assessment, transport, body handling
- High-level isolation units - design and construction

Skill Stations

- Use of respiratory protection
- Infection control and use of PPE
- High-level isolation unit
- Team working
- Country-specific skills

All trainees were assessed for mastery of the theoretical knowledge and competency in performing the various skills learned in the skill stations.

⁷ Baka A, Fusco FM, Puro V, Vetter N, Skinhoj P, Ott K, Siikamaki H, Brodt HR, Gottschalk R, Follin P, Bannister B, De Carli G, Nisii C, Heptonstall J, Ippolito G, European Network of Infectious Diseases. 2007. A curriculum for training healthcare workers in the management of highly infectious diseases. *Euro Surveill* 12(6):178–182.



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Needs Assessment and Gap Analysis for the NIEHS Worker Training Program

Review of Major Guidance

A gap analysis and review of major guidance related to worker protection was conducted early in the assessment process.

CDC Guidance

Guidance on Personal Protective Equipment To Be Used by Healthcare Workers During Management of Patients with Ebola Virus Disease in U.S. Hospitals, Including Procedures for Putting On (Donning) and Removing (Doffing)

Concerns

- Does not emphasize employer and employee rights and responsibilities under law
- Organizational responsibility to ensure the safe and effective delivery of EVD treatment is assigned solely to the site manager
- Does not state who has the responsibility of providing PPE and training
- Does not define healthcare workers covered by the guidelines
- Does not include other workers with potential exposure, outside of the healthcare industry
- Does not include the post exposure protocols required by the OSHA Bloodborne Pathogens standard
- Does not emphasize the training of trained observers
- Does not address actions to take when PPE is not available or is in short supply
- Assumes that healthcare workers understand the pathogen and routes

of transmission, incubation period, control methods, etc.

Interim Guidance for Environmental Infection Control in Hospitals for Ebola Virus

Concerns

- Assumes that the workers will understand the labels AND have access to the recommended disinfectants
 - Does not address issues of recommended PPE based on strength of disinfectant (e.g. Proper PPE for chemicals, etc.)
- No mention of the post exposure protocols required by OSHA's Bloodborne Pathogens Standard
- No mention of who will provide the PPE
- Assumes that all workers have clear understanding of the viruses they are cleaning up
- Assumes that this procedure will be clearly communicated to the workers
- Assumes that hospitals will clearly communicate the hazards to the workers

Interim Guidance for U.S. Residence Decontamination for Ebola and Removal of Contaminated Waste

Concerns

- Assumes that the user can read and understand the EPA disinfectant labels
 - Assumes user understands definitions of "enveloped" or "nonenveloped"
- Recommends the CDC Guidance on PPE to be used by Healthcare Workers guidance, but that guidance is mainly for healthcare workers,

which assumes that the cleanup worker has had a high level of training or understanding

- Assumes that the person with EVD who has only had a fever has not contaminated their environment
- Assumes that the contract company has received adequate training and follows OSHA standards
 - Does define the types of training or certification an organization should have

OSHA Standards

The standards listed below are some of the standards OSHA considers applicable in the event of possible worker exposure to the Ebola virus, depending on the specific work task, setting, and exposure to biological or chemical agents. The most notable gap pertaining to the OSHA standards is that many of the affected employers and workers are not aware of the OSHA requirements and therefore need training to advise them of their rights and responsibilities.

- General Duty Clause (Section 5(a)(1) of the OSHAct)
- Bloodborne Pathogens (1910.1030) standard
- Hazard Communication (29 CFR 1910.1200) standard
- Personal Protective Equipment (PPE) (29 CFR 1910.132) standard
- Respiratory Protection (1910.134) standard

In addition, OSHA's HAZWOPER (1910.120) standard applies to infectious materials.

Web Search for Ebola Training

Over several days, a search of the Internet looked for existing Ebola training courses that met the following criteria:

- Sponsored by an academic, response, professional, government, or other credible organization
- Created within the past 15 years
- Content has specific learning goals and objectives
- Focus on biosafety or infectious diseases

Courses were categorized by level of training (awareness, hands-on, operations, comprehensive), audience, delivery methods, duration, and cost. Seventy-one training courses met the inclusion criteria.

The majority of courses provided information about Ebola and how to protect one's self from EVD, but these courses are not a substitute for hands-on training with protective equipment. Hands-on training provided a step up from awareness training but it was difficult to determine whether these courses taught a systems approach to worker safety. Hands-on courses were PPE-intensive with a focus on donning and doffing. Environmental service workers were rarely a targeted audience. Most courses were directed at health care workers and used the University of Nebraska or the Emory University model as the basis of their curriculum. Most courses were offered on a one-time basis and are not being offered as ongoing training.

- **Awareness level:** Training that provides an overview of disease, situation, and precautions with the goal of enhancing knowledge. May involve online learning and video demonstrations or be taught in person.
- **Hands-on:** Training that allows trainees to practice an individual skill or portion of a skill. Only one skill set is practiced (e.g., don/doff) and the course may offer limited additional information.
- **Operations level:** Training designed to build skills and awareness of disease, precautions, and includes hands-on applications of skills. Elements of operations courses may be online/digital, but hands-on training must involve practicing with actual equipment and offer an opportunity for discussion. Operations-level courses focus on building a few specific skills.
- **Comprehensive:** Training developed to include background, awareness, biological basis, and global perspective education in addition to detailed hands-on practice to build multiple, different skills. Thorough training after which a person could safely come into contact with Ebola or contaminated materials and need no further training beyond a refresher.
- **Clinical Care:** Training that is primarily focused educating participants on best practices for the care of patients; including unique procedures and pharmaceutical therapy, discussion of procedures to avoid, general PPE and equipment considerations may be included.

Course Profiles

Of the 71 courses included, 52 were classified as awareness-level, nine as operations-level, six as comprehensive, one as clinical care, and three as train-the-trainer. The vast majority of primary audiences were clinical care providers and other health care providers. The course duration is broken down as follows:

	Average Duration	Shortest	Longest
Awareness	3.28 hours	15 minutes	40 hours (Web series)
Operations	15.9 hours	4 hours	32 hours
Comprehensive	28 hours	24 hours	40 hours
Train-the-Trainer	8 hours	8 hours	16 hours
Clinical Care	5.5 hours	NA	NA

The most common form of delivery was web-based for awareness-level courses, and classroom and hands-on for operations-level courses. Most courses are no longer being offered.

	Most Common Mode of Delivery		
Awareness	Web-based (31)	Classroom (15)	Hands-on (8)
Operations	Hands-on (9)	Classroom (9)	Lab-based (1)
Comprehensive	Hands-on (all)	Classroom (all)	

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Stakeholder Input

Meetings and Interviews

The WTP conducted four stakeholder meetings where participants were asked to provide input into their training requirements, best practices, challenges, barriers, and gaps. These sessions lasted between two and three hours. Participants were provided an agenda and a list of potential questions to be answered during the sessions. They were also provided with a link to a questionnaire about their training experiences that they could complete. The termination date for completing the questionnaire was open-ended. Participants represented labor unions, academic centers, government, private industry, professional organizations, and advocacy groups (see Appendix B for a list of organizations that were invited to participate). The locations for the meetings were New York City; Washington D.C. (two meetings); and Oakland, California. Detailed notes were taken at each meeting and the sessions were recorded to aid in the completion of the meeting notes. All recordings were deleted after notes were transcribed.

Stakeholders who were unable to attend any of the four meetings were afforded the opportunity to participate in individual interviews to discuss the same issues as discussed in the larger stakeholder meetings. Notes were taken during the calls, but not recorded.

Results from the Meetings and Interviews

Participants enthusiastically and openly shared their perspectives regarding training requirements, barriers, challenges, and best practices or lessons learned. Over the course of the meetings, key themes were expressed. These included:

- Despite multiple recent infectious disease outbreaks of national significance, there is not a training atmosphere that endures past the incident.
 - Guidance issued by the federal health authorities continues to be disease-specific, rather than on generalized hazard assessment, generalized preparedness measures, and worker safety and health.
 - Guidance issued by the federal health and safety authorities was confusing, incomplete, and not practical for many end users outside the health care profession.
 - Initial guidance did not provide adequate protection and was not appropriate for many end users, particularly environmental service workers.
 - Guidance issued later did not include site-specific and job-specific assessment procedures and was not usable by all types of workers.
 - OSHA's PPE Selection Matrix for Occupational Exposure to Ebola Virus was very complex and difficult to use for some populations.
 - Current OSHA standards do not cover all possible scenarios. The California Aerosol Transmissible
- Diseases standard was held in high regard by the participants.
- Changing guidance from federal health authorities made training difficult to develop and sustain.
 - More emphasis needs to be placed on general worksite preparedness.
 - Workers need to be able to assess work site hazards, know who to report hazards to, and understand the health and safety plan used by their employers at the work site.
 - Back-to-basics training on understanding the spectrum of protective actions, from administrative controls to engineering controls, needs to be a major part of worker training for all infectious disease hazards.
 - Focus should be on more than just PPE.
 - Hospitals focus on infection control and not worker safety and health.
 - There needs to be more integration of these important hospital departments to better address protection of workers and patients during these kinds of events.
 - Programs that had the cooperative input from labor and management were felt to be the most successful.
 - Workers had input into training, selection of PPE, development of protocols, and prioritization of efforts by management.
 - Participants agreed that training should be competency-based but could not agree on which competencies to include in training.
 - Waste management and training for waste handlers is very important.
 - Engineering and administrative solutions are necessary to reduce risk of human contamination.

■ Training for laboratory workers is very important.

While some reported that labs were exceedingly well-prepared to deal with EVD, at least one state indicated that lack of well-trained lab staff was a hindrance in processing of specimens.

Stakeholder Surveys

To understand issues that individual organizations and facilities faced and the types of training developed, a questionnaire was created to allow anonymous responses by stakeholder meeting participants (see Appendix A). Results were used to generate location-specific conversations at each meeting. The online nature of the questions allowed for honest responses and included skip logic that customized questions based on the type of training (if any) created by a respondent and the population served. In total, 55 complete responses were received.

Respondents represented or worked with a wide variety of stakeholders and included representatives of professional associations and universities, in addition to the other categories listed (Figure 1).

Among respondents who did not develop training, most represented low- or no-risk occupations that played a role in the outbreak. A total of 38 trainings were reported to have been developed, with 45 percent reported as awareness level, 42 percent as operations level, and 13 percent as train-the-trainer courses. The majority of awareness-level courses (10) were reported to be less than two hours long. Operations-level courses ranged from two to 40 hours and train-the-trainer courses were

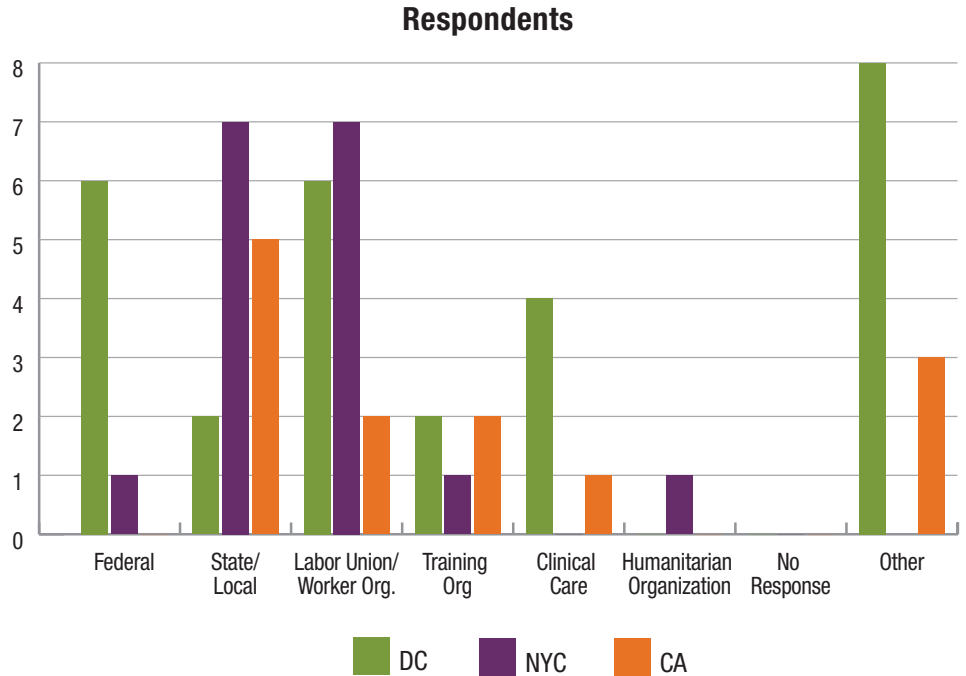


Figure 1: Organizations Represented by Questionnaire Respondents

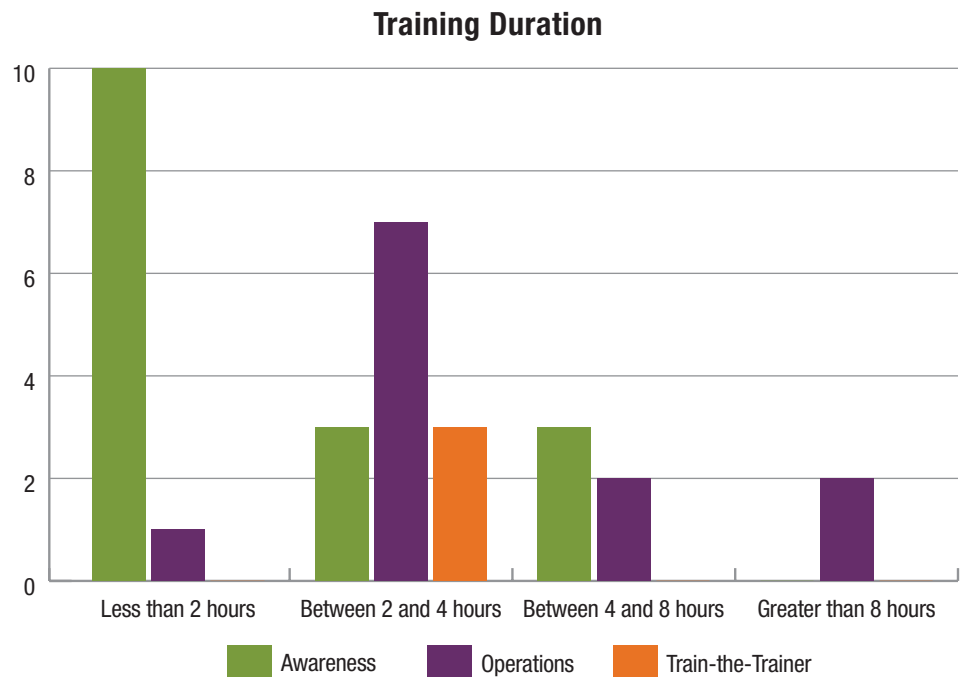


Figure 2: Training Duration

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reported as add-ons to operations-level courses that ran between two and four hours long (Figure 2).

Target training populations included health care workers (with or without potential contact with Ebola), environmental service staff, and lab workers in a health facility (Figure 3).

The most trainings (12) reported were created for “other” workers, including:

- Airport/aircraft cleaners
- Airport workers
- Compliance officers
- Environmental remediation workers
- Epidemiologists
- Maintenance staff
- Other staff potentially involved in response
- Public health responders
- Urban mass transit workers

Volunteers

Training content for awareness-level, hands-on, and operations-level courses focused heavily on PPE, decontamination, and respiratory protection (covered in more than 50 percent of all reported courses). Challenges identified by training developers and other respondents included finding time off for employees to attend training, logistics, including PPE to use in training, and funding (Figure 4).

Nearly 50 percent of reported trainings are not ongoing as of July 2015 and only 50 percent were reported as having been revised or updated since their creation. None of the reported trainings give continuing education credits.

Target Training Populations*

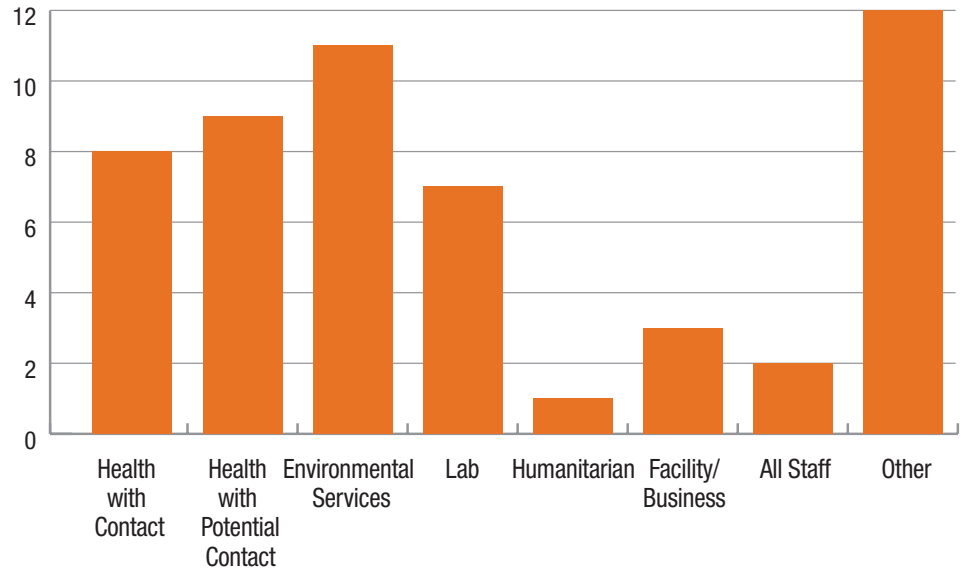


Figure 3: Target Training Populations *Note multiple populations may be reported for an individual training

Training Challenges Identified

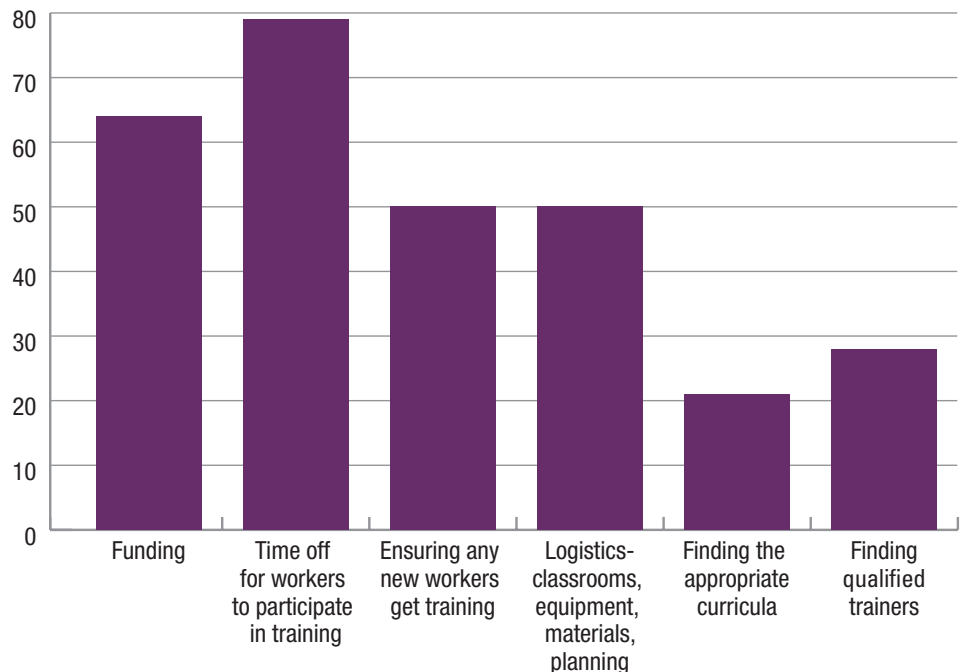


Figure 4: Training Challenges Identified



The majority of courses (68 percent) were reported as being delivered in a classroom or being delivered in both a classroom and a hands-on environment, with the remaining 32 percent being online or computer-based.

All respondents were offered the opportunity to share lessons learned and identify challenges they faced during the Ebola response. Specific training challenges included updating training to reflect changing guidance, lack of time or PPE for training, and confusion on the appropriate PPE for non-health care staff and for those who did not have access to CDC-recommended PPE (powered air purifying respirator, etc). Additional survey items were discussed in detail at stakeholder meetings and are outlined in meeting discussions.

Best Practices Noted from Meetings and Surveys

Effective Training Programs Require Labor and Management Cooperation and Coordination

Training requires end-user input and support of management to schedule paid training and ensure backfill. Management policy for paid sick leave, precautionary leave, proper equipment, and adequate supplies are necessary. Labor needs to identify job functions, assist with hazard identification, and identify contractual changes necessary. Organizations with joint labor/management councils were put forward as models.

- Refresher training needs to be performed to keep workers' competencies intact.
 - Smaller teams need to be trained regularly, with additional surge staff trained as required by events.
- Training should be risk-based and site-specific.

- Hazardous Waste Operations and Emergency Response (HAZWOPER)-based training is a good foundation for preparing workers who may encounter infectious diseases – First receiver is a good concept to use.
- Collaboration among infection control, employee health/occupational health and safety, and emergency management resulted in broad policies and protocols that addressed worker safety, patient safety, and integration into the response community in ways that went beyond the walls of the hospital.
- Employees should be paid for their time in training.

Challenges Noted from Meetings and Surveys

- Now that the outbreak has passed, interest in training has waned significantly. We have seen this with SARS, pandemic influenza, anthrax and other infectious disease outbreaks.
- Sustainability is an issue associated with cost and interest in preparedness for infectious diseases.

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Perfect performance with imperfect equipment is preferable to an imperfect process with perfect equipment.

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Stakeholder comment

- The lack of consistent guidance that has relevance to the end users of all professions has hampered preparedness and made training more difficult.
- Risk assessment can be difficult. While OSHA's PPE matrix was a good start, a simplified version of it would be more easily used.
- Management /employers should use a risk exposure matrix.
- Determining site hazards, training for specific audiences.

Barriers to Training Noted from Meetings and Surveys

- Paid time off for training
- Funding for training
- PPE for training
- Federal agencies didn't seem to be coordinating
- Training fatigue
- Political interventions
- Infection control culture in hospitals





Overall Gap Analysis

Throughout the process of assessing training requirements, content, and structure of the current training, two major themes emerged related to existing gaps in biological pathogen safety training: integration of efforts and complacency. Other themes could be logically categorized into these two fundamental gaps in training a workforce that is knowledgeable, healthy, and protected. As has been pointed out by many of the stakeholder meeting participants, these gaps preceded the EVD outbreak and are likely to remain as legacy issues for future biotreats. In this section of the report, we delve into each of the themes to better understand the perspectives of the participants and to discuss pertinent literature related to these themes.



Theme 1:

There is no current mechanism to integrate public health, medical, occupational health, and worker safety activities in a comprehensive and all-encompassing approach that incorporates the perspectives of key stakeholders and delivers concise, easy to understand, risk-based protective guidance that informs the full spectrum of workers.

Gap 1 A: There is a disconnect between infection control, occupational health, worker safety, and emergency management at the health care level.

Throughout the meetings, we heard from participants that infection control efforts are directed toward the patient and worker safety is directed toward workers. We also heard that worker safety was a secondary priority for hospitals and that



infection control was a main priority due to issues of patient safety, quality of care, and liability. Participants noted that where worker safety and infection control were integrated, training was better accepted, more effective, and more applicable to the end users. Further linking infection control and worker safety to hospital emergency managers was suggested as a means of helping workers understand the response structure (hospital incident command).

This observation was evident in the literature search, as many of the articles referred to infection control method and few spoke about worker safety and incident command.

Gap 1B: End users do not have a mechanism by which they can provide input into local practice and policy and into guidance issued by federal authorities.

Participants noted that when a team approach was used, where local procedures and practices had the input of end users, results were more comprehensive and better accepted. Oftentimes, it was reported that procedures were top-down driven, which resulted in procedures and protocols which were difficult to implement by the end users.

Several criticisms were noted regarding protective guidance issued throughout the outbreak by federal agencies. Participants noted that guidance was often not practical, was too complex to be easily implemented, and did not reflect current understanding of the disease or worker safety. Many

felt there was too much focus on PPE and not enough focus on hazard assessment and basic individual and organizational preparedness.

There was also a lack of training programs that were given in languages other than English, although many of the environmental service workers represent a large group of non-English speaking workers.

Participants felt that when new information and practices were identified, there was no way to inform CDC and OSHA about it. They also felt that the guidance being issued would have benefited from end users' input into its development. They noted that successful models at the local level were those where employees and management collaborated on protocols, procedures, and other guidance.

Gap 1C: Guidance issued by federal authorities was inconsistent and left out key items that adversely affected worker safety and health.

The model promoted by most participants was the California Aerosol Transmissible Disease standard. Participants felt that it provided more worker protection. OSHA's Bloodborne Pathogens standard, Respiratory Protection standard, or the General Duty Clause were useful but individually or collectively, did not provide complete protection for EVD and many in the impacted industries are not aware of the responsibilities and rights under these individual OSHA standards. CDC guidances issued were often late in their

release and initially focused on health care providers. Over time, waste workers, emergency medical services, mortuary workers, and others received guidance from CDC. Additionally, it was hard for the people targeted by the guidance to keep up with the many versions that CDC issued.

The OSHA PPE Selection Matrix was felt to be overly complicated and difficult to apply to end users.

Many participants felt that checklists and pathogen safety data sheets would be useful for workers who need decision support aids to assess workplace safety plans and rapid access to information about biohazard threats, respectively. These would be similar to those produced by the Public Health Agency of Canada, but using plain language focused on worker protection.

Gap 1 D: Resources on infectious diseases from trusted sources is sometimes conflicting or lacking in enough specificity to be immediately helpful.

In doing an exercise that looks at various aspects of a specific infectious disease, three resources provided great variability in their information. We looked at the Public Health Agency of Canada website, the World Health Organization website, and the American Public Health Association's Control of Communicable Diseases Manual. We looked at routes of exposure, symptoms, incubation period before symptoms develop, and treatment. Each resource provided different information and in some cases not enough information to be immediately helpful.

Gap 1 E: In most cases, there was no incentive for labor and management to work collaboratively on policies, protocols, and practices in the workplace.

Hospital administrators felt pressure to provide training to employees but were faced with costs of training, paying salaries for personnel attending training, paying for backfill employees, and covering the cost of training equipment such as PPE. Employees felt pressure to balance EVD training with other training, as well as take time from work, some without pay. As such, training time was kept to a minimum. Most training was four to eight hours in duration and not ongoing.

Most felt that protocols and procedures that were issued came from a top-down process that largely excluded the end users in their development. Training for such programs was described as "checkbox" training, i.e., done at a level only

to satisfy a requirement and not really sufficient to increase skills or knowledge. Few examples were put forward as best practices where workers and management collaborated on procedures and processes. In those cases, programs were felt to be more integrated and comprehensive in nature. Training was also felt to be more effective because of the combined perspectives of the workers and management.

Gap 1F: Resiliency training was rarely offered in any training.

Almost all participants noted the importance of mental health resiliency as being included in training, yet only a few noted its inclusion in their training programs. Worker stress is exacerbated while working in the exposed environment due to multiple factors: physical stress of working in PPE, potential exposure to highly pathogenic biological agents, fear of exposing others, stigma associated with working with biological agents, and overall uncertainty of working with potentially deadly agents. Stress recognition and management were acknowledged as topics that should be key modules in all training programs; few stakeholders found time in the curriculum to address resiliency.

Theme 2:

Sustaining a high level of readiness is difficult due to a number of factors, including complacency, inadequate funding, and a loss of interest as the outbreak resolves. Pathogen-specific training and emphasis on technical aspects of PPE which are not employed in daily use or ongoing training make it difficult for workers to maintain the high level of competency necessary to perform one's job duties safely.

Gap 2A: Timely and consistent guidelines based on worker risk are essential to developing effective training programs.

Participants expressed frustration over the issuance of guidance that was not timely and was inconsistent with other guidance issued by federal organizations. Many felt that the existing standards (OSHA PPE standard, Respiratory Protection standard, General Duty Clause; CDC guidance for PPE) were not adequate for EVD, based on perceived uncertainties regarding the transmission of EVD. The OSHA PPE Selection Matrix was felt to be too complex and difficult to apply to all jobs where exposure was a risk. As noted above in the section comparing the different standards,

gaps have been noted. The California Airborne Transmissible Diseases standard and the CALOSHA guidelines on EVD protections in hospitals were touted by many as the model for protective standards. It too has its gaps, but was cited as a link to unifying protective standards for workers. The HAZWOPER training program was also noted for its emphasis on tiered levels of protection that can be adjusted to the specific hazard and the potential level of exposure, and because it teaches workers to recognize risks.

Gap 2B: Complacency and funding interfere with sustainment of existing programs and development of new programs.

Many of the training courses offered were one-time only opportunities. We heard many reasons for this. As voiced in the stakeholder meetings and questionnaire results, the expense of training was frequently noted. Employers have to pay for the training development, pay for employees to take training, pay for any equipment used in training, such as PPE, and pay for backfill employees. Because of the personnel costs, training was kept as short as possible and limited to one-time only. Funding from the federal government was generally lacking until the very late stages of the outbreak. Additionally, PPE for training was difficult to procure because of the high demand on manufacturers for PPE at the peak of the EVD concern. Many also noted that plans for additional EVD training will be done for much smaller populations of workers, i.e., strike teams that require less equipment and time away from their daily responsibilities.

Training fatigue was also described as a factor in getting workers trained. As a highly regulated industry, health care workers are required to take other mandatory training that impact their daily job responsibilities. As they prioritize their training time, EVD training is not considered to be among the highest priorities and therefore is not taken.

Waning interest in EVD training was also mentioned by many stakeholders. As the number of EVD cases drops in the U.S., concerns become less, and interest in training subsides. This is especially true for those parts of the training that are EVD-specific or require highly technical training. As has been noted in other disasters, unless preparedness and response activities can be incorporated into daily activities, those skills and competencies perish quickly. Those that remain fresh are the skills and competencies that have the opportunity to be put to use in everyday work.

Incentives like continuing education credits were discussed

by participants but virtually no organization offered them. Reinforcing the day-to-day application of PPE to more common diseases (Clostridium difficile or C. diff, tuberculosis) was noted as a way to encourage continued training and comfort with PPE.

Gap 2C: Workers need basic preparedness training to enhance generalized worker safety and health.

Many participants of the stakeholder meetings, especially those representing workers, expressed the need for workers to be able to demonstrate basic workplace preparedness and safety skills in their workplace. It was felt that workers cannot or are not empowered to identify workplace hazards, they did not know who to report hazards to, and they were unable to assess the effectiveness of their employer's preparedness plans. These skills were felt to be basic skills that crosscut hazards and empower employees to assess workplace preparedness. While much of the training delivered was EVD-specific, stakeholders felt these basic skills were more vital to day-to-day safety and would be carried forward without decline over time. Many felt that workers needed checklists for their specific jobs and work sites that helped them assess safety. Others suggested the need for pathogen safety data sheets to assist them with understanding the details of specific infectious disease agents to which they might be exposed. Most agreed that readily available, easy-to-understand, and factual information that was needed for workers to obtain basic information on potential hazards was lacking.

Additionally, stakeholders related that preparedness training should commence in professional schools. Most professional schools were not focused on basic preparedness training that provided hazard identification, preparedness/response plan assessment, or protective actions. This type of training would lead newly hired health care professionals to start their employment asking for things such as a hospital's preparedness plan and infectious disease control plan. This would help drive the hospitals to ensure these plans not only exist but are exercised, bringing a significant improvement to the safety culture in the health care industry.

Gap 2D: No clearly defined and agreed-upon core competencies for worker safety and biothreats.

Most participants agreed that training should be competency-based. When a group was presented with a comprehensive list of core competencies, there was not general agreement as to which comprise the core and which do not. However, most

agreed that training should not be EVD-specific, but needs to address those competencies that enable workers to respond to all-hazards, including biohazards. Because courses varied in their duration and focus (operations vs. awareness), certain topics were excluded. Operations courses focused greatly on PPE use, with special attention on donning and doffing, since that was an apparent need resulting from the experience in Dallas.

Gap 2E: The stigma of Ebola.

Participants noted that there was a stigma associated with EVD work. Those with direct contact were often looked upon as being potential spreaders of EVD within the community, a particular concern after the nurses from Dallas became infected. This was also true of those handling EVD waste or of West African origin. Training about how best to address stigma was reported to rarely, or inadequately, be included in any training.

Additionally, we heard that communities had great concern about having sterilized EVD waste being placed in local waste disposal sites because of unfounded fears of EVD waste causing infection. Reasons for this fear likely relate to inaccurate information that was made available through media and other informal sources and due to changing and conflicting government guidance.

This issue directly relates to the paucity of mental health resilience training modules in existing EVD training. Both issues are distinct gaps in overall EVD awareness at the worker and community levels.

Summary

The EVD outbreak highlighted the need to implement changes in biohazard preparedness that endure past the recent EVD outbreak and address future infectious disease outbreaks such as Middle East Respiratory Syndrome, SARS, and pandemic influenza. In conducting a gap analysis, several key themes emerged:

- Better communications across disciplines and organizations is required.
- Official guidance needs to be better coordinated, more timely, and created with the input of end users.
- Sustainability depends upon funding, the elimination of complacency, and application of training to daily functions rather than just for episodic outbreaks.

In addition to emphasizing key competencies in training, mental health resiliency and basic preparedness topics must be integrated throughout training programs. Evolving science and guidance require training programs to be flexible and capable of updating personnel after initial training. Finally, trainers should be encouraged to publish their experiences in peer-reviewed journals so that their knowledge and best practices can be shared among their peers.

Appendix A: Stakeholder Survey

Ebola and Infectious Disease Preparedness Training Questionnaire:

Introduction

The National Institute of Environmental Health Sciences (NIEHS) is working to assess the needs of populations that need various levels of Ebola and infectious disease health and safety training. We appreciate you taking the time to complete this questionnaire.

All responses to this questionnaire will remain anonymous and summaries will include only aggregated results.

Definitions

- *Training*- instruction that is provided to increase knowledge, understanding and skill sets that lead to changes in behavior that reduce or prevent the risk of health impact of a hazard.
- *Awareness training*- usually didactic (video or face-to-face) and textbook presentations that increase one's knowledge about a particular topic.
- *Operations training*- training that develops skill sets and competencies in performing procedures, working with equipment or following protocols.

1. Background: Please identify the type of organization you represent:

- a. Federal government
- b. State or local government agency
- c. Labor union or worker support organization
- d. Training organization
- e. Clinical health care facility
- f. Humanitarian relief organization
- g. Choose not to respond

h. Other: please describe

2. What was your experience with the response to the recent Ebola outbreak?

- a. What did you learn?
- b. What did you need to be successful?
- c. What did you need for training?

3. What worker related issues did you encounter?

- a. Which ones were critical?

Ebola and Infectious Disease Preparedness Training Questionnaire:

4. What employer issues did you encounter?

a. Which ones were critical?

5. Use of personal protective equipment (PPE) is associated with heat stress, limited ability to perform medical procedures and other functional limitations. How did the various guidance on PPE impact the performance of patient care and supportive care responsibilities? What, if any, modifications to PPE or work procedures did you make to accommodate or ease these limitations?

6. Have your employees or members been provided with Ebola training?

- a. Yes- developed by staff from within my organization .
- b. Yes- developed by contractors or consultants hired by my organization.
- c. No

7. Who was the intended primary audience (s) for this training? (Multiple options)

- a. Health care providers- persons with potential direct contact with confirmed Ebola virus disease patients.
- b. Health care providers- persons with potential direct contact with suspected patients.
- c. Environmental services workers - persons with potential direct contact with Ebola virus contaminated materials, including patient bodily fluids or waste.
- d. Laboratory personnel- persons handling bodily fluids or human tissue
- e. Humanitarian response workers
- d. Facility and business administrators
- e. All staff

f. Other: (please specify)

8. What level was the training? Please refer to the definitions that were provided at the beginning of the survey.

- a. Awareness
- b. Operations

c. Several levels were provided: please describe

Ebola and Infectious Disease Preparedness Training Questionnaire:

9. Did you conduct any Train-the-Trainer courses?

- a. Yes
- b. No

10. Duration: Please select the duration of each of your training courses.

	Awareness	Operations	Train-the-Trainer
Less than 2 hours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 2 and 4 hours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 4 and 8 hours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Greater than 8 hours: please specify in space provided below	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please specify if you selected greater than 8 hours

11. For any didactic instruction, please provide the approximate hours for each of the topics noted.

West Africa outbreak/U.S. cases	<input type="text"/>
Clinical signs and symptoms	<input type="text"/>
Treatment	<input type="text"/>
Transmission/occupational exposure	<input type="text"/>
Risk assessment	<input type="text"/>
Prevention/worker protection/hazard controls	<input type="text"/>
PPE and respiratory protection	<input type="text"/>
Decontamination	<input type="text"/>
Use of the Buddy system	<input type="text"/>
Post-exposure procedures	<input type="text"/>
Site-specific procedures	<input type="text"/>
Other: please specify	<input type="text"/>

Ebola and Infectious Disease Preparedness Training Questionnaire:

12. For any hands-on training, please provide the number of hours devoted to each of the topics noted.

Donning and doffing of PPE	<input type="text"/>
Decontamination procedures	<input type="text"/>
Respiratory protection	<input type="text"/>
Hand washing	<input type="text"/>
Waste handling	<input type="text"/>
Sharps handling	<input type="text"/>
Performing duties while in PPE	<input type="text"/>
Other: please specify	<input type="text"/>

13. How was the training delivered? Select all that apply.

- a. Classroom
- b. Web/computer-based video
- c. Webinar

Other: please specify

14. Is this training part of another training program?

- a. Yes
- b. No

15. If this training was part of another training program, select which one.

- a. Health and safety
- b. Infection control
- c. Hazardous waste operations and emergency response (HAZWOPER)
- d. Blood borne pathogens
- e. NIEHS Worker Training Program

Other: please specify

16. Is your training ongoing?

- a. Yes
- b. No

Ebola and Infectious Disease Preparedness Training Questionnaire:

17. What is the frequency of your ongoing training?

- a. Weekly
- b. Monthly
- c. Quarterly
- d. Annually

Other (please specify)

18. Has your training curriculum been revised since it started?

- a. Yes
- b. No

If yes, please explain

19. Do you offer continuing education credits for your training?

- a. Yes
- b. No

20. Did you identify any gaps in the training your constituents received?

- a. Yes
- b. No

If yes, please explain

21. Did you identify any best practices in your training program?

- a. Yes
- b. No

If yes, please explain

22. Did you identify any challenges in delivering the training?

- a. Yes
- b. No

Ebola and Infectious Disease Preparedness Training Questionnaire:

23. What challenges did you encounter? select all that apply

- a. Funding
- b. Time off for workers to participate in training
- c. Ensuring any new workers get training
- d. Logistics-classrooms, equipment, materials, planning
- e. Finding the appropriate curricula
- f. Finding qualified trainers

Other: please specify

24. What were the reasons that you did not provide training?

- a. Staff was at a very low risk of exposure
- b. No funding for this type of training
- c. Could not identify appropriate training courses or trainers

Other: please specify

Thank You

Thank you! If you would like to provide additional information, share course materials, or discuss lessons learned in further detail, please email wetpclear@niehs.nih.gov. A staff member will be in touch to arrange further discussions within a week. If you choose to identify yourself via email, your specific answers will not be used as examples, case studies, or in quotations without your permission.

Appendix B: Invitation List for Stakeholder Meetings

Individuals from the following agencies, businesses, and organizations were invited to participate in stakeholder meetings.

Federal agencies:

- U.S. Department of Agriculture
 - Animal and Plant Health Inspection Service
- U.S. Department of Defense
- U.S. Department of Health and Human Services
 - Centers for Disease Control and Prevention
 - National Institute for Occupational Safety and Health
 - Centers for Medicaid and Medicare
 - National Institutes of Health
 - Office of the Assistant Secretary for Preparedness and Response
- U.S. Department of Homeland Security
 - Customs and Border Patrol
- U.S. Department of Labor
 - Occupational Safety and Health Administration
- U.S. Department of Veterans Affairs
- U.S. Environmental Protection Agency

Health departments from major cities, counties, and states

Union and worker organizations representing:

- Airport and aircraft workers
- Environmental service workers
- Firefighters, police, and emergency medical technicians
- Other hospital and health facility workers
- Physicians and nurses
- Public service
- Teachers and day care workers
- Transportation workers

Professional associations and businesses representing:

- Hospitals and health care facilities
- Infection control, biological safety
- Laboratories
- Mortuaries and funeral homes
- State and local public health
- Waste handling, treatment, and disposal

Front line workers, trainers, and researchers from:

- Community advocates
- Ebola treatment and referral hospitals
- Major metropolitan hospitals
- Major universities
- Worker training institutions



National Institute of
Environmental Health Sciences
Worker Training Program