Workforce Development: Preparing the Next Generation for Infectious Disease Threats

Workshop Report

Prepared by

AAAS Center for Science, Technology and Security Policy
Kavita Marfatia Berger, Ph.D.
William Pinard

AAAS Program on Scientific Freedom, Responsibility and Law
Mark S. Frankel, Ph.D.
Elizabeth C. Lee

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Executive Summary

The importance of a robust public health infrastructure is the cornerstone for preparing for and responding to infectious disease threats regardless of their origin (natural or man-made). During the past 10 years, several infectious disease outbreaks have shaped current policy developments surrounding public health preparedness. While all but one disease outbreak – the 2001 anthrax attacks in the United States – emerged naturally or accidentally in the human population, their impact on domestic and international public health has been profound.

Within the U.S., there has been increased funding to boost scientific, public health, and first response capabilities against a disease outbreak from chemical, biological, radiological, and nuclear agents. High-risk municipalities have been given financial support to improve their public health and traditional first response systems as well as disease surveillance capabilities. States have been given vehicles to stockpile vaccines and drugs against threat agents, and state agencies play important roles in confirming and mitigating infectious disease outbreaks. Policy discussions have gone beyond traditional first responders and public health professionals to scientists, veterinarians, and community leaders.

The U.S. and many other nations have developed national pandemic influenza preparedness plans. In 2005, the World Health Assembly approved a revised version of the International Health Regulations, which requires improvement of national disease surveillance and public health infrastructures, redefines the criteria for a public health emergency of international concern, allows the World Health Organization (WHO) to use unofficial sources to identify unusual disease outbreaks, and gives WHO the authority to impose travel and trade restrictions on nations with uncontrollable disease outbreaks. In the midst of these advances in public health, the U.S. and global community have developed and implemented education programs to train relevant audiences, from first responders to public health officials, on how to prepare for and respond to infectious disease threats. Despite these efforts, there are still major challenges in developing a multi-generational and multi-disciplinary workforce that can respond to unusual infectious disease threats.

Two units of AAAS—the Center for Science, Technology and Security Policy and the Program on Scientific Freedom, Responsibility and Law – have conducted a study on building a knowledgeable workforce to prepare for and respond to infectious disease outbreaks, natural or man-made. The **goals** of this study were:

- to document and describe existing educational programs and materials on infectious disease preparedness programs;
- to highlight major challenges and knowledge gaps associated with existing educational initiatives on preparedness and response; and
- to provide recommendations for improving the overall system of workforce development for human health preparedness and response.

We convened a group of experts in public health, nursing, medical, veterinary, and first responder education on infectious disease response, as well as experts in areas including biosecurity and public health law on May 26, 2009 at AAAS to review existing educational programs on infectious disease

preparedness and response, and provide recommendations for improving workforce development activities in this area.

Workshop Summary

Several education initiatives were presented and discussed at the AAAS workshop. There was consensus among the participants that cross-sector training and exercises are among the most useful tools for educating stakeholders on how to work as a team to respond to an infectious disease outbreak. Educational programs are most successful when lessons are communicated using interactive teaching methods, such as online discussion boards, field experience, and interaction between academic experts and stakeholders in the community. Since all responses start locally, there is a great need to produce a workforce that can work with relevant stakeholders from all appropriate levels of government.

Significant progress has been made in the development of programs, tools, and core competencies for educating health professionals and first responders about preparing for and responding to infectious disease threats. However, several challenges still remain. In the upcoming decade, approximately half of the workforce at public health departments will be eligible to retire and the next generation of public health professionals is not being educated at a commensurate rate to fill this loss. This pending loss in public health workforce is exacerbated by the age of physicians and nurses, whose average age is currently in the late forties. Initial and continuing education about infectious disease preparedness and response must be a priority through sustained funding and development of additional educational resources. There was discussion about the need to cross-train stakeholders in a team-based manner to facilitate cooperation in an actual public health emergency. Participants also noted the utility of defining the national capacity needed, developing decision-type resources, and identifying core competencies and standards for different preparedness stakeholders and functions. While some efforts have been devoted to developing core competencies, these are mainly in the public health and health care communities. Other communities with health-related responsibilities[1] also require appropriate training and could benefit from the development of core competencies and standards around which to design education programs. Questions remain regarding the availability, experience-level, and retention of instructors. Few financial incentives exist for subsidizing education for the relevant workforce and few mechanisms exist for including field training in education programs.

Workshop participants highlighted several major gaps and challenges:

Current Workforce and Education

- The health care workforce (including public health professionals, clinicians, and related health care fields) in the U.S. is approaching retirement age and there is a need for a strategic plan for educating enough health care personnel to fill this gap.
- Although academic institutions are starting to employ retired or adjunct professors with real-world experience to educate students, this is not uniform. There is a clear need to hire educators with real-world experience and to have students participate in apprenticeships or internships to gain field experience.
- There is a need to develop information tools that are duty appropriate. Some information may be critical to have incorporated into formal education programs, some may be appropriate to

[1] 'Other communities with health-related responsibilities' refer to traditional first responders and emergency medical teams, veterinarians, laboratory scientists, and public health lawyers.

provide on a periodic basis as part of continuing education or refresher programs, and some may be appropriate as reference only.
- Few public health lawyers have experience in responding to public health emergencies. There is a greater need to provide public health lawyers with field experience[2] so their guidance is appropriate in a real-world setting.
- There is a shortage of knowledgeable health care workers in many countries due to a lack of educational opportunities and stressful and often-times undesirable working conditions.

Program Development
- There is a need to incorporate communication training into the curriculum for all stakeholders involved in preparedness and response activities. This would include strategies for communicating the needs of relevant communities to policy-makers. There is a need to educate all relevant stakeholders on how to communicate risk before, during, and after an emergency with the general public.
- There are a substantial number of public health preparedness and homeland security programs, but not enough coordination among programs educating the relevant workforce about preparedness and response activities against infectious disease threats.
- There is no single process for vetting existing programs for their content and usefulness. This is particularly problematic since some are not accredited.
- There is a lack of standardized criteria for evaluating whether initial training was successful in raising awareness of or educating about infectious disease preparedness and response. In addition, there are no mechanisms for evaluating whether information has been retained over a long period of time.
- There is a need for educational programs that are interdisciplinary and incorporate information or real-world experience addressing the needs of all sectors involved in preparedness and response activities, as well as building relationships between disparate stakeholders, like law enforcement and public health professionals.
- There are few mechanisms for subsidizing the education of the workforce about infectious disease preparedness and response. There is a need to provide financial incentives for talented individuals to enter the workforce; these may include fellowships, scholarships, or loan repayment.

Recommendations

The programs presented at the workshop and follow-up discussions identified the breadth of existing programs, as well as gaps and challenges in program development. It is our hope that the findings and recommendations of this report will improve education efforts in support of workforce development for preparedness and response to infectious diseases.

1. **The U.S. government and professional and trade associations should cooperate to integrate and expand existing databases to include all education programs that address preparing for and responding to infectious disease outbreaks and relevant teaching materials.**

[2] In this context, the term 'field experience' refers to training in public health departments, hospitals, and other medical facilities or public health facilities.

2. **The U.S. government should develop competency-based criteria for education programs to evaluate the effectiveness of their curricula for training individuals and teams.**

3. **Federal, State and local governments should work with educational institutions to provide fellowships, scholarships, tuition remission, loan repayment, or incorporate paid apprenticeships to provide students with real-world experience in their field.**

4. **Internationally, health care professionals should be educated in greater numbers to reduce the stress on health systems and improve the retention of a knowledgeable and capable workforce.**

5. **Education programs should be reconfigured or designed to include competency-training, team-based learning, field experience, risk communication techniques, and communication skills for engaging with policy-makers and the public.**

There are a variety of disciplines involved in preparedness and response ranging from emergency response to public health law; practitioners of these disciplines should be required to obtain some training in infectious disease detection, preparedness and response. The following recommendations are framed with the acknowledgement that the training content and requirements may differ for personnel with different functions.

6. **Three types of education and training should be provided to relevant audiences in preparedness and response.**
   a. **Vital information: Includes symptoms or clinical signs of dangerous infectious diseases, should be provided to all audiences**
   b. **Routine, important information: Includes isolation procedures or therapeutic doses, should be taught to all relevant audiences**
   c. **Emergency-specific information: Includes phone numbers of coordinating agencies (i.e., reference guides), along with a review of vital and important information should be provided in a just-in-time fashion through email communication or embedded within existing decision support software.**

7. **Professional societies should develop educational tools in consultation with experienced experts in public health, medicine, veterinary medicine, law enforcement, public health law, first response, and epidemiology.** These tools would help existing preparedness and response programs teach their students about all aspects of detecting and responding to infectious disease threats. They could also support team-based, cross-sector education.

8. **Practitioners from all relevant sectors should, in the course of their training, participate in internships or externships to gain field experience in infectious disease prevention and mitigation.**

Report

Background

More than 75% of infectious diseases are zoonotic, which means they can infect both animals and humans.[3] Many of the newly emerging pathogens are zoonotic and have existed in animal hosts for decades or centuries before their emergence in the human population. In fact, several of the United States' priority national security threat agents are naturally-occurring zoonotic agents. Smallpox (human only) and foot-and mouth disease (hoofed animals only) are among the few exceptions. The realization in 1992 that the Soviet Union had an extensive biological weapons program[4] and the failed attempt by the Japanese group, Aum Shinrikyo, to disseminate anthrax during the mid-1990's[5] raised attention to the use of infectious diseases as weapons. The emergence of the H5N1 avian influenza virus in Asia in 1997 and the emergence of the West Nile Virus in the United States in 1999[6] further demonstrated the need for trained personnel in preparing for and responding to infectious disease threats. In 2000, a few bioterrorism preparedness programs began to address this need.

The H5N1 influenza in Asia, West Nile Virus in North America, the 2001 anthrax attacks, SARS (Severe Acute Respiratory Syndrome virus) in 2003, the Andrew Speaker case (extremely drug-resistant tuberculosis) in 2007, and most recently, the 2009 H1N1 influenza virus have contributed numerous lessons for public health preparedness and response against infectious diseases.

In 1999, seven Americans died and several more became ill in New York City from a virus misdiagnosed as St. Louis encephalitis virus, which is found in North America. It wasn't until several weeks after the initial outbreak of West Nile Virus in the U.S., that the veterinarians at the Bronx Zoo had the opportunity to share their data with the New York City Department of Health. The sharing of clinical information resulted in the correction of the misdiagnosis of St. Louis encephalitis virus as the causative agent of the human outbreak. Although the pathologies between infected humans and animals were strikingly similar, the St. Louis encephalitis virus is not known to be zoonotic but West Nile Virus is. The West Nile Virus incident demonstrated that animals are generally infected with a zoonotic agent before humans and can serve as a mechanism for sentinel surveillance to a potential human outbreak.[7] This can also be true for a bioterrorism incident, where the fitness of domestic or wild animals can help warn the human population of a potential outbreak or aerosol release of a dangerous zoonotic agent. In 2007, the National Center for Zoonotic, Vector-Borne, and Enteric Diseases (NCZVED), which staffs at least 60 veterinarians, was established to provide the CDC with

[3] Woolhouse MEJ, Gowtage-Sequeria S. *Host range and emerging and reemerging pathogens*. Emerg Infect Dis. 2005 Dec; 11(12):1842-7.
[4] Stone, R. *Down to the Wire on Bioweapons Talks.* Science. 2001 Jul 20; 293(5529): 414-6.
[5] Christopher, GW, Cieslak, TJ, Pavlin, JA, and Eitzen, EM, *Biological Weapons: Limiting the Threat* §33 (2001).
[6] CDC. *Outbreak of West Nile-like viral encephalitis--New York, 1999*. MMWR Morb Mortal Wkly Rep. 1999 Oct 1;48(38):845-9; McLean RG, Ubico SR, Docherty DE, Hansen WR, Sileo L, McNamara TS. *West Nile virus transmission and ecology in birds*. Ann N Y Acad Sci. 2001 Dec;951:54-7.
[7] Gubernot DM, Boyer BL, Moses MS. *Animals as early detectors of bioevents: veterinary tools and a framework for animal-human integrated zoonotic disease surveillance.* Public Health Rep. 2008 May-Jun;123(3):300-15.

expertise for epidemiological studies, bioterrorism preparedness, applied research, disease surveillance, and outbreak response.[8]

The first case from the 2001 anthrax attack was detected in Florida by a physician who had just returned from a bioterrorism training program at the CDC.[9] He accurately diagnosed the patient's symptoms to be consistent with an anthrax infection and requested confirmatory tests from the hospital, state public health laboratories, and the CDC. Once confirmed, exposed individuals were given ciprofloxin, and surveillance and decontamination efforts began. Despite not encountering inhalational anthrax in 25 years, the CDC and the physician from Florida took the necessary actions to rapidly confirm the causative agent and respond to the incident. Additional exposures in New York City, where health officials did not receive the same training, followed a different path.[10] News anchor, Tom Brokaw, has been outspoken about his failed attempts to identify the causative agent for his assistant's illness.[11] A diagnosis for the New York City infections was not confirmed until the overt attack occurred at the Senate Hart Building. This delayed identification of anthrax resulted in an enhanced recognition that training health care professionals and public health officials on bioterrorism preparedness and response is critical to diagnosing the causative agent of an infection. Other very important lessons learned from the anthrax mailings were that public health officials and law enforcement must develop common protocols for handling samples, communicate with one another during an outbreak of unknown or unfamiliar origin, and consider unusual routes of exposure of an infectious agent.

Following the anthrax attacks, the security community became more acutely aware of biological research and laboratories as a possible source of biological agents that can be exploited to do harm. This led to concerns over how to detect and mitigate outbreaks with these agents. During the decade-long negotiation for updating the International Health Regulations (IHRs), the World Health Assembly considered how to expand the list of diseases reportable to the World Health Organization (WHO).[12] (See discussion below for more detail about the revised IHRs.) This list not only included historical health concerns, like cholera, but also security threats, like smallpox and anthrax, and diseases of unknown origin. Towards the end of the negotiations, the SARS epidemic occurred. SARS was a newly emerging virus that initially entered into the human population in China; the virus was transmitted to North America and Europe after an infected Chinese doctor exposed travelers in a Hong

[8] CDC. National Center for Zoonotic, Vector-Borne, and Enteric Diseases (2007) http://www.cdc.gov/nczved/. Prior to the establishment of the NCZVED, the CDC already employed at least 100 veterinarians.

[9] Traeger MS, Wiersma ST, Rosenstein NE, Malecki JM, Shepard CW, Raghunathan PL, Pillai SP, Popovic T, Quinn CP, Meyer RF, Zaki SR, Kumar S, Bruce SM, Sejvar JJ, Dull PM, Tierney BC, Jones JD, Perkins BA; Florida Investigation Team. *First case of bioterrorism-related inhalational anthrax in the United States, Palm Beach County, Florida, 2001*. Emerg Infect Dis. 2002 Oct;8(10):1029-34; Jernigan DB, Raghunathan PL, Bell BP, Brechner R, Bresnitz EA, Butler JC, Cetron M, Cohen M, Doyle T, Fischer M, Greene C, Griffith KS, Guarner J, Hadler JL, Hayslett JA, Meyer R, Petersen LR, Phillips M, Pinner R, Popovic T, Quinn CP, Reefhuis J, Reissman D, Rosenstein N, Schuchat A, Shieh WJ, Siegal L, Swerdlow DL, Tenover FC, Traeger M, Ward JW, Weisfuse I, Wiersma S, Yeskey K, Zaki S, Ashford DA, Perkins BA, Ostroff S, Hughes J, Fleming D, Koplan JP, Gerberding JL; National Anthrax Epidemiologic Investigation Team. *Investigation of bioterrorism-related anthrax, United States, 2001: epidemiologic findings.* Emerg Infect Dis. 2002 Oct;8(10):1019-28.

[10] Holtz TH, Ackelsberg J, Kool JL, Rosselli R, Marfin A, Matte T, Beatrice ST, Heller MB, Hewett D, Moskin LC, Bunning ML, Layton M. *Isolated case of bioterrorism-related inhalational anthrax, New York City, 2001*. Emerg Infect Dis. 2003 Jun;9(6):689-96.

[11] Commission on the Prevention of WMD Prevention and Terrorism, *World at Risk*. § 7 (2008)

[12] World Health Organization. International Health Regulations (2005) resource page. See http://www.who.int/ihr/en/.

Kong hotel.[13] To control the outbreak in Canada, health officials in Toronto imposed isolation on infected individuals and quarantine on exposed individuals.[14] To limit the spread of the virus, the WHO imposed travel and trade restrictions on Canada and China.[15] Although the WHO did not have the legal authority to do this at the time, the revised IHRs ultimately gave it this authority. The SARS outbreak demonstrated that international collaboration among scientific experts was vital to identifying the novel agent and developing medical interventions against that agent. Within nine months of the outbreak, the international community identified SARS as a coronavirus, sequenced its genetic material, and developed the first vaccine against the agent.[16]

In 2007, an individual from Atlanta, Andrew Speaker, contracted tuberculosis and refused treatment through his local public health department.[17] Unheeding of the CDC's warning, Mr. Speaker went on his honeymoon, traveling to at least six countries within two weeks. While he was in Europe, the CDC initially confirmed that he was infected with extremely drug resistant tuberculosis (XDR-TB) against which no prescribed antibiotic is effective.[18] Following his European travels, Mr. Speaker returned to the U.S. via a land port between the U.S. and Canada. Upon his return, he was taken to Colorado for isolation, where tests later determined that he did not have XDR-TB, but rather was infected with multi-drug resistant tuberculosis, a serious, but less severe strain of the bacteria.[19] He was given appropriate treatment and sent home. This case demonstrates the importance for rapid and accurate identification of causative agents, which is critical to assessing the appropriate response from the public health system and international community.

In March and April 2009, a new strain of H1N1 influenza was detected in Mexico and shortly thereafter, in the U.S. and globally.[20] On June 11, 2009, the World Health Organization (WHO) raised its pandemic alert level to 6, which means that the virus has been found in multiple geographic regions and has demonstrated sustained human-to-human transmission.[21] In the U.S., the National Pandemic Influenza Plan was implemented and a public health emergency was declared. This triggered a series of actions, including school closures due to actual or suspected infected individuals, forward deployment of antivirals (e.g., Tamiflu) throughout the country, active research and development of a

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[13] U.S. Centers for Disease Control and Prevention. *Update: Outbreak of severe acute respiratory syndrome – worldwide, 2003*. MMWR Morb Mortal Wkly Rep. 28 Mar 2003;52(12):241-6, 248.

[14] Svoboda T, Henry B, Shulman L, Kennedy E, Rea E, Ng W, Wallington T, Yaffe B, Gournis E, Vicencio E, Basrur S, Glazier RH. *Public health measures to control the spread of the severe acute respiratory syndrome during the outbreak in Toronto*. N Engl J Med. 3 Jun 2004;350(23):2352-61.

[15] See http://www.who.int/csr/sars/travelupdate/en/.

[16] Cavanagh D. *Severe acute respiratory syndrome vaccine development: experiences of vaccination against avian infectious bronchitis coronavirus*. Avian Pathol. Dec 2003 ;32(6):567-82.

[17] Valentine, V. A Timeline of Andrew Speaker's Infection. NPR (2007). See http://www.npr.org/news/specials/tb/

[18] U.S. Centers for Disease Control and Prevention. *Public Health investigation seeks people who may have been exposed to extensively drug resistant tuberculosis (XDR TB) infected person*. 29 May 2007. See http://www.cdc.gov/media/pressrel/2007/r070529.htm; Altman, LK. TB *Patient Is Isolated After Taking Two Flights*. New York Times (2007). See http://www.nytimes.com/2007/05/30/us/30tb.html.

[19] Altman, LK. *Traveler's TB Not as Severe as Officials Thought*. New York Times (2007). See http://www.nytimes.com/2007/07/04/health/04tb.html

[20] U.S. Centers for Disease Control and Prevention. *Outbreak of swine-origin influenza A (H1N1) virus infection - Mexico, March-April 2009*. MMWR Morb Mortal Wkly Rep. 2009 May 8;58(17):467-70; World Health Organization. *New influenza A(H1N1) virus infections: global surveillance summary, May 2009*. Weekly Epidemiological Record. See http://www.who.int/wer/2009/wer8420.pdf.

[21] World Health Organization. *Transcript of statement by Margaret Chan, Director-General of the World Health Organization 11 June 2009*. See http://www.who.int/mediacentre/influenzaAH1N1_presstranscript_20090611.pdf.

vaccine against the new H1N1 strain, and issuance of an emergency use authorization for antivirals and N-95 masks.[22] These actions were based on early epidemiological data suggesting that the new H1N1 virus could be highly fatal. However, these early data were not accurate, a fact likely due to selection and reporting biases as well as poor surveillance capacity, and recent reports have indicated that the case fatality rate approximates that of seasonal flu.[23] We are now faced with learning more about the novel influenza, developing and making available an effective vaccine against the pathogen, reviewing and resolving the legal instruments used during the past few months, and looking at the infection and mortality patterns of H1N1 during the winter months of the Southern Hemisphere. Collectively, these activities have the potential to inform the global community of the true pandemic potential of the 2009 H1N1 influenza virus and of national capacities to detect and mitigate outbreaks. The public health and health care communities worldwide will be required to address these issues in addition to their daily duties.

International Health Regulations

In May 2005, the World Health Assembly of the World Health Organization (WHO), following almost 10 years of negotiation, unanimously adopted revisions to the International Health Regulations (IHR), hereafter known as IHR (2005).[24] This event, monumental in the history of global health governance, outlined a structure for international cooperation in the fight against infectious diseases and other emerging health threats. IHR (2005) entered into force on June 15, 2007 globally, and on July 17, 2007 in the U.S. In 2009, nations will be entering the second phase of IHR(2005) compliance, during which each country will be required to implement programs to address the gaps and vulnerabilities to improve their public health system.

This agreement forms the only binding international health agreement among WHO member states and aims to control infectious diseases. The revised IHRs strive to become a model for good global public health governance, particularly through the encouragement of strong national level capacity and an enhanced role for the WHO governing body.[25] IHR (2005) sets global regulations for surveillance, inspection and response against natural, accidental or intentional release of chemical, biological and radiological agents. The regulations reframe the concept of public health emergency, attempting to provide for appropriate response mechanisms to public health threats, while avoiding interference with international trade and protecting individual rights.

Translating and internalizing international principles of law in domestic legal and political systems represents a major challenge for any nation, especially for those nations without existing infrastructures dedicated to public health. All nations will not only need to meet basic criteria for

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[22] U.S. Department of Education. *H1N1 Flu & U.S. Schools: Answers to Frequently Asked Questions. 5 May 2009.* See http://www.ed.gov/admins/lead/safety/emergencyplan/pandemic/guidance/flu-faqs.pdf; U.S. Department of Homeland Security. *Remarks by Secretary Napolitano at Today's Media Briefing on the H1N1 Flu Outbreak. 30 April 2009.* See http://www.dhs.gov/ynews/releases/pr_1241140344050.shtm; U.S. National Institute of Allergy and Infectious Diseases. *NIAID 2009 H1N1 Influenza Research Program*. See http://www3.niaid.nih.gov/topics/Flu/understandingFlu/2009h1n1.htm; U.S. Department of Agriculture. 2009 *H1N1 Influenza A Virus*. See http://www.ars.usda.gov/2009H1N1/; U.S. Centers for Disease Control and Prevention. *H1N1 Flu: Emergency Use Authorization (EUA) of Medical Products and Devices.* See http://www.cdc.gov/h1n1flu/eua/.

[23] See http://www.cdc.gov/h1n1flu/update.htm; See http://www.who.int/csr/don/2009_06_26/en/index.html. Both accessed June 26, 2009.

[24] World Health Organization. International Health Regulations (2005) resource page. See http://www.who.int/ihr/en/.

[25] Gostin, LO. *International Infectious Disease Law: Revision of the World Health Organization's International Health Regulations.* JAMA. 2004 Jun 2; 291(21):2623-7.

disease surveillance, detection, communication and control, but will also need to cooperate and assist international partners in efforts to track and contain public health emergencies.[26] All 193 nations are financially responsible for building their own capacity, and when doing so is impossible given resource limitations, nations must rely upon the goodwill of wealthier nations to deliver aid.

The AAAS Project

Two units of AAAS—the Center for Science, Technology and Security Policy and the Program on Scientific Freedom, Responsibility and Law – have conducted a study on building a knowledgeable workforce to prepare for and respond to infectious disease outbreaks, natural or man-made. The **goals** of this study were:

- to document and describe existing educational programs and materials on infectious disease preparedness programs;
- to highlight major challenges and knowledge gaps associated with existing educational initiatives on preparedness and response; and
- to provide recommendations for improving the overall system of workforce development for human health preparedness and response.

We held a workshop on May 26, 2009 at AAAS headquarters in Washington, DC, with a group of experts in educating the public health, nursing, medical, veterinary, and first responder communities on infectious disease response, and biosecurity experts and a public health lawyer to review current education programs on infectious disease preparedness and response as well as to discuss how well these programs address the information needs of different audiences. The agenda, questions asked, and lists of speakers and participants are included in the Appendix. Workshop reading material was provided in advance to each attendee.[27] Government representatives from Department of Health and Human Services (Centers for Disease Control and Prevention and Office of the Assistant Secretary for Preparedness and Response), Federal Bureau of Investigation, and Department of Homeland Security (Office of Health Affairs) attended the workshop.

We invited instructors to discuss their educational programs with the group, and workshop participants raised questions about the content of the programs, the level of understanding of the students, the audience, and challenges in designing and implementing the program. Along with these discussions, workshop attendees were asked to consider other educational offerings before proposing possible recommendations for developing the workforce for responding to infectious disease incidents. International as well as U.S. education initiatives were discussed.

Workshop Summary

Several education initiatives were presented and discussed at the AAAS workshop. There was consensus among the participants that cross-sector training and exercises are among the most useful tools for educating stakeholders on how to work together as a coordinated team to respond to an infectious disease outbreak. Educational programs are most successful when lessons are communicated using interactive teaching methods, such as online discussion boards, field experience,

[26] World Health Organization. *International Health Regulations (2005).* See http://whqlibdoc.who.int/publications/2008/9789241580410_eng.pdf.
[27] AAAS set up a workshop website with reading material (see http://cstsp.aaas.org/BiosecurityWorkshop2/).

and interaction between academic experts and stakeholders in the community. Since all responses start locally, there is a great need to produce a workforce that can work with relevant stakeholders from all appropriate levels of government.

Existing Education Programs in the United States

Following the global eradication of smallpox, the medical and scientific communities considered infectious diseases a solvable problem. However, with the rapid and uncontrollable spread of Human Immunodeficiency Virus (HIV) in the later half of the 20th century, this notion was dispelled. As more infectious diseases emerged in the human population, schools of public health and medicine began offering an infectious disease concentration to build the workforce capacity to prevent and mitigate outbreaks with infectious agents. In addition, epidemiology is taught as a core component in all schools of public health. Towards the turn of the 21st century, concerns over the use of infectious agents for criminal and/or terrorist purposes prompted the U.S. government to develop its own bioterrorism preparedness training programs for health care providers, public health professionals, and public health laboratory personnel. Some university schools of public health have begun to incorporate bioterrorism preparedness into their curriculum or concentration offerings. Following the events of 2001, governmental and academic training programs were developed under the auspices of homeland security to train traditional first responders in bioterrorism preparedness.

For decades, the CDC has educated doctoral- or masters in public health- level professionals in epidemiology through its 2-year Epidemic Intelligence Service.[28] The CDC has also established Field Epidemiology Training Programs to educate entry- and mid-level health professionals in applied epidemiology, field investigation, and disease detection and surveillance.[29] The CDC has several training opportunities available to build public health capacity – Emerging Infectious Disease Laboratory Fellowship Program,[30] American Society for Microbiology Postdoctoral Research Associate Program,[31] James A. Ferguson Emerging Infectious Diseases Fellowship,[32] and Division of Laboratory Science Post Doctoral Program.[33] Since 2000, the CDC has developed an all-hazards preparedness program[34] and bioterrorism preparedness program.[35] The bioterrorism training program is a series of training courses, consisting of webcasts and videos (distance-learning) or in-person instruction. The content covered in the program may include basic epidemiology and case management, the history of bioterrorism, and information regarding federal guidelines for the particular audience. The Laboratory Response Network (LRN) training program that the CDC runs is an onsite biosafety training program, which includes hands-on training and video-based training.[36] In addition, the CDC offers LRN Reference Methods Bench training, which is designed to educate laboratory personnel on new diagnostic techniques and methods. The anthrax attacks in 2001 demonstrated the need for coordinated procedures and training on microbial forensics. In response, the CDC and the FBI developed the Joint Criminal Epidemiological Investigations Course, which educates state, local, and federal law enforcement and public health authorities on how to investigate suspicious

[28] See http://www.cdc.gov/eis/index.html.
[29] See http://www.cdc.gov/cogh/dgphcd/fetp.htm.
[30] See http://www.aphl.org/profdev/fellowships/eid/Pages/default.aspx.
[31] See http://www.asm.org/Education/index.asp?bid=15497.
[32] See http://www.cdc.gov/ncidod/EID/announcements/ferg_ann.htm.
[33] See http://www.cdc.gov/nceh/dls/orise.htm.
[34] See http://www.bt.cdc.gov/hazards-all.asp.
[35] See http://www.bt.cdc.gov/bioterrorism/.
[36] See http://www.bt.cdc.gov/lrn/.

outbreaks.[37] Finally, the CDC has engaged the public via community workshops to provide appropriate information regarding pandemic influenza.

In addition to its own training programs, the CDC recognized the importance of establishing education programs for emergency preparedness and response at universities. In 2000, the CDC established the Centers for Public Health Preparedness (CPHP) program, which seeks to improve terrorism and emergency preparedness and response by establishing connections between academia and local and state public health agencies.[38] Five-year cooperative agreements (2004-2009) were issued with schools of public health to strengthen public health readiness and local and state capacity for emergency and terrorism response, and to develop a network of academic programs on terrorism preparedness through which experiences and resources can be shared with local and state agencies. The CPHP designed several educational tools, including online modules and webinars, lectures, and practical exercises. Each module is directed to different audiences, topics, and learning styles. The CPHP has compiled an extensive database of these resources. All CPHP grantees are required to evaluate the effectiveness of their activities using pre- and post-tests as well as follow-up tests. In addition, exercises have been used to evaluate the educational tools taught in the programs. Currently, CPHP is providing technical assistance to state and local health officials on how to conduct exercises.

Following the anthrax attacks, the Public Health Security and Bioterrorism Response Act of 2002[39] created the Bioterrorism Training and Curriculum Development program (BTCDP) to develop a curriculum to educate health professionals on how to identify a public health emergency, meet patient care needs, and alert appropriate authorities.[40] The program funded academic institutions to build a health professional workforce capable of identifying and responding to bioterrorism incidents. The program used in-person instruction, online courses, video-conferencing, CDs, and exercises to educate human and animal health professionals and first responders from all relevant facilities. With the passage of the Pandemic and All-Hazards Preparedness Act (PAHPA),[41] this program was transferred from the Office of the Assistant Secretary for Preparedness and Response to the Health Resource Service Administration. In 2008, the BTCDP held a national meeting to summarize the findings of all activities.[42] The meeting highlighted several challenges, essential elements of training, and unaddressed needs. The challenges faced by these programs include inconsistent government priorities and lack of coordination among the federal government; lack of financial and technical resources; lack of consistent and standardized criteria for evaluating the effectiveness of the training program; and a lack of interest and low level of priority for bioterrorism training among clinicians, which stems from issues regarding a lack of financial compensation for participating in the program as well as relevance to daily activities. The program evaluation indicated the critical components of a successful training program as individual and community preparedness against all hazards; partnerships among public, private, academic, and community stakeholders; standardized, competency-based curriculum; flexible programs that address the information and educational needs of diverse audiences; multiple learning modalities; incentives for participation in the program; and continuous evaluation and adaptation. The outcome of the BTCDP review was a set of recommendations to improve future educational efforts.

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[37] See http://www2.cdc.gov/phlp/Phel.asp.
[38] See http://www.bt.cdc.gov/cotper/cphp/.
[39] Public Law 107-188
[40] See http://www.hhs.gov/aspr/opeo/nhpp/btcdp/btcdp.html.
[41] Public Law 109-417
[42] See http://www.hhs.gov/aspr/conferences/btcdp/btcdp-draftag0812.html.

These include the requirements for funding, a national body that can advocate for all health professionals, uniform standards for training and evaluation, certification, and a repository for standardized curricula.

In response to coordination issues, the PAHPA and Homeland Security Presidential Directive 21, Public Health and Medical Preparedness,[43] established a multi-disciplinary and interagency organization on preparedness training. The Federal Education and Training Interagency Group (FETIG) is charged with providing recommendations on establishing an academic joint program in preparedness and disaster medicine, to oversee and contribute to developing core competencies, to facilitate the application of academic findings in disaster medicine, and to inform research activities that help to improve public health and disaster medicine.[44]

The PAHPA also required the CDC to develop core curricula for degree-granting programs within schools of public health that are based on established competencies. In 2008, the CDC asked the Association of Schools of Public Health (ASPH) to explore how to implement the PAHPA requirements. This included a study of the law's implications and the feasibility, opportunities, and challenges for implementing such curriculum. The ASPH found that there are currently no common, national standards for defining a "prepared public health or medical professional" and proposed how to establish common educational competencies that could be used to develop standards.[45] ASPH is currently working on developing these core competencies, the result of which is scheduled for completion in 2010.

In addition to these efforts, the CDC has funded several Preparedness and Emergency Response Research Centers to evaluate effective strategies and educational tools for training public health professionals to detect, mitigate, and recover from public health emergencies.[46] In addition, the St. Louis University Institute for Bio-Security established a program to educate public health students about bioterrorism preparedness and response.[47] This program has trained mid-career professionals in public health and related fields on bioterrorism preparedness and response since 2000. More recently, they have begun to provide students the opportunity to receive masters or doctoral degrees in bioterrorism and disaster preparedness. The topics required include disaster planning, infectious disease control, disease surveillance and epidemiology, risk communication, biosecurity, and ethical and legal implications of disasters. Students can also take elective courses, which include medical intelligence, threat characterization, resilience and stress response, international bioterrorism, and business continuity. The program educates via distance-learning and incorporates interactive tools, like online message boards, competency-training, and evidence-based training.

In 2003, the Association of American Medical Colleges published a report on education of medical students on bioterrorism preparedness.[48] The American Medical Association published consensus-based competencies for preparing health professionals to respond to disasters.[49]

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[43] See http://www.fas.org/irp/offdocs/nspd/hspd-21.htm.
[44] See http://www.hhs.gov/aspr/conferences/nbsb/nbsb-fetig-080328.pdf.
[45] See http://www.asph.org/document.cfm?page=1081.
[46] See http://www.cdc.gov/media/pressrel/2008/r081006.htm.
[47] See http://www.bioterrorism.slu.edu/.
[48] Association of American Medical Colleges. *Training Future Physicians About Weapons of Mass Destruction: Report of the Expert Panel on Bioterrorism Education for Medical Students.* 2003.

In addition to efforts by the health community, several homeland security degree-granting programs were established after 2001. The Department of Homeland Security (DHS) established education initiatives and developed educational resources for emergency preparedness. These activities concentrate on educating about broader homeland security issues, which includes bioterrorism preparedness and response. DHS is currently in the process of creating a compendium of U.S. government preparedness training programs, grant funding opportunities, and standards known as the Clearinghouse of Medical and Public Health Preparedness Allocation, Skill Development, and Standards (CoMPASS). This database will compile opportunities from multiple agencies, including the Departments of Homeland Security, Transportation, Veterans Affairs, and Defense. Future plans include the possibility of opening the opportunities up to federally funded programs. CoMPASS will be publicly accessible and give user specified search results that include the program description, accreditation and licensure information, professional credit, funding history, and links to the host website, among other information. Additionally, search results will be compiled for all training, funding, and standards into subsets allowing views of each type of program, allowing for the compilation of all opportunities available to individuals and groups.

One notable homeland security program is the Center for Homeland Defense and Security (CHDS) at the Naval Postgraduate School.[50] Its mission is to build the homeland security workforce to "meet long-term leadership of needs responsible for Homeland Defense and Security." The CHDS offers master's degree programs in homeland security for state and local professionals, a program for executives in leadership positions, and mobile education teams. To reach a broader audience than what can be accommodated on-site, the CHDS has established the University and Agency Partnership Initiative, which uses the curricula developed at CHDS.[51] The curricula includes educational materials for partnering schools and enables access to the Homeland Security Digital Library.

International Programs

Compared to much of the world, the U.S. preparedness programs are well advanced. Internationally, the public health infrastructure per capita is fairly uneven. The revised International Health Regulations have attempted to remedy this inequity by requiring that all nations identify and address any problems in their public health infrastructure. There are general shortages of health care workers in developing nations and significant staffing problems in the global health infrastructure. In addition, the disease surveillance infrastructure suffers in many cases because diagnostic laboratories tend to be disease-specific rather than have general disease detection capabilities. This is partially due to the infectious disease burden and low priority level afforded to health as well as a lack of technical and financial resources.

Recent global pandemics, like SARS and H1N1 (2009), have demonstrated the need for more general disease surveillance capability globally and many countries are interested in building this capacity with regard to infrastructure and workforce training. The threat of H5N1 influenza becoming a human

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[49] Subbarao I, Lyznicki JM, Hsu EB, Gebbie KM, Markenson D, Barzansky B, Armstrong JH, Cassimatis EG, Coule PL, Dallas CE, King RV, Rubinson L, Sattin R, Swienton RE, Lillibridge S, Burkle FM, Schwartz RB, James JJ. *A consensus-based educational framework and competency set for the discipline of disaster medicine and public health preparedness*. Disaster Med Public Health Prep. 2008 Mar;2(1):57-68.

[50] See http://www.chds.us/?academic.

[51] See http://www.chds.us/?special/info&pgm=Partner.

pandemic strain drove all nations to develop a pandemic influenza preparedness strategy. These strategies contain information regarding building national public health infrastructure and workforce development strategies. It is important to note that infrastructure and a trained workforce are interdependent; one without the other does not improve national capacity. In addition, the World Health Organization (WHO) and its regional offices have issued resolutions to address workforce shortages in public health globally.[52]

As nations attempt to comply with the revised International Health Regulations, many nations will struggle with alleviating the shortage of health care and laboratory workers. This shortage creates a system where existing personnel are overworked and stressed, and thus at higher risk of leaving the local community for better opportunities elsewhere. Training more health care and laboratory professionals throughout the world is critical to building effective public health capacity and achieving the legal obligations of the IHR 2005. In addition to health care and laboratory personnel, community members, policy-makers and educators, and governmental and non-governmental organizations contribute to disease surveillance and response internationally. Strategies critical for building global health expertise include training individuals in traditional public health disciplines and in the field; developing local cadres of epidemiologists, infection control specialists, and laboratory professionals; encouraging partnerships among academic and community specialists to share lessons learned from disease outbreaks, educational opportunities, and resources; using educational consortiums to build institutional training capacity; and providing short courses to quickly train professionals. Schools in Africa are training public health professionals to interact and work with community members to enhance disease detection and surveillance. This training is generally both didactic and hands-on. While there is no single repository of information, schools of public health are interested in sharing lessons learned from disease outbreaks in other countries and developing research collaborations between academia and the public health communities.

Several field-based programs are being used to develop the public health laboratory and clinical workforce internationally and to provide external support for such activities. The U.S. CDC's field epidemiology training program (FETP) is based on the epidemic intelligence service (EIS) and has been training public health professionals for 30 years.[53] The FETP was sustainable in middle-income countries because of the internal mentoring support system employed by the program. Although the FETP trainees were traditionally from the human health background, the program has started educating other relevant stakeholders, like veterinarians. The European Union offers a 2-year fellowship called the European Programme for Intervention Epidemiology Training.[54] Public-private partnerships – Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET)[55] and the African Field Epidemiology Network (AFENET)[56] – offer international training opportunities for public health professionals. The TEPHINET is a network of training programs in applied epidemiology with a mission to enhance international public health capacity through building nationally- and regionally-based field training. It is a 2-year program that includes apprenticeships and practicums, and applies epidemiologic principles to public health problems. The main goals of the program are to support and enhance existing training programs, link professionals with epidemiological expertise to

[52] See http://www.who.int/hrh/resolutions/en/.
[53] See http://www.cdc.gov/cogh/dgphcd/.
[54] See http://www.epiet.org/.
[55] See http://tephinet.org/.
[56] See http://www.afenet.net/english/index.html.

agencies responsible for responding to outbreaks, assist in developing new training programs, and enhance applied research activities to address scientific and public health needs. TEPHINET is modeled after the CDC's EIS program, and has expanded since 1997 to include more than 41 programs in nearly all continents and activities related to training, communication, and accreditation. Challenges associated with this program include lack of technical and financial support, the need for more networking among epidemiological training programs, improved accreditation process, and better dissemination of training materials.

Gaps and Challenges

Several challenges still remain despite the significant efforts and progress that have been made in developing programs, tools, and core competencies for educating health professionals and first responders about preparing for and responding to infectious disease threats.

In the upcoming decade, approximately half of the workforce in public health departments will be eligible to retire and the next generation of public health professionals is not being educated at a commensurate rate to fill this loss. This pending loss in public health workforce is exacerbated by the expected shortage of physicians and nurses in the next ten years. While the Health Resources and Services Administration (HRSA), through Titles VII[57] and VIII, [58] provides education and training programs to build a well-prepared primary care workforce (Title VII), and nursing workforce (Title VIII) for disease prevention and mitigation, these programs have been under-funded for many years, thus limiting their impact. This highlights two impending challenges with regards to the health care workforce: 1) the declining primary health care and public health workforce; and 2) issues regarding sustainable funding for education programs to address the declining workforce.

Initial and continuing education about infectious disease preparedness and response must be a priority, with sustained funding and development of additional educational resources. There was discussion at the workshop about the need to cross-train stakeholders in a team-based manner to facilitate cooperation in an actual public health emergency. Participants also noted the utility of defining the national capacity needed, developing decision-type resources, and identifying core competencies and standards for different preparedness stakeholders and functions. While some efforts have been devoted to developing core competencies, these are mainly in the public health and health care communities. Other communities with health-related responsibilities also require appropriate training and could benefit from the development of core competencies and standards around which to design education programs. In addition, there exist a series of open-ended questions regarding the availability, experience-level, and retention of instructors. There are few financial incentives for subsidizing education for the relevant workforce, and few mechanisms exist for including field training in education programs.

There is little doubt that all responses are local, and in many nations, individual states or provinces and localities are principally responsible for the welfare of their constituents. While the U.S. government has developed plans to facilitate and coordinate response efforts between states and federal agencies, individual states have not necessarily developed their response plans for public health emergencies.

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[57] Title VII, Section 747; HRSA. Preparing Primary Healthcare Providers to Meet America's Future Healthcare Needs: The Critical Role of Title VII, Section 747, U.S. Department of Health and Human Services (2004). See http://bhpr.hrsa.gov/medicine-dentistry/actpcmd/reports/fourthrpt/2.htm.

[58] HRSA Title VIII.

This is due to a lack of funds, planning tools, and guidance by the federal government, shifting priorities from bioterrorism to pandemic preparedness, declining interest in bioterrorism, and the perception that the risk of bioterrorism is low in many localities. The priority for federal funding has vacillated between bioterrorism and pandemic preparedness, resulting in no strategic plan for infectious disease response and leaving localities and states without guidance on how to develop effective and coordinated plans or training programs. While several education programs exist, there is currently no process for vetting or accrediting existing programs.

Although both bioterrorism and pandemic preparedness are critical, a focus on a holistic approach to infectious disease detection and response would benefit response efforts against bioterror and infectious disease incidents, including outbreaks of pandemic influenza. In addition, the current method of focusing on preparedness for a single infectious disease, whether natural or man-made (accidental or deliberate), does not allow for the flexibility to plan in advance or to react to a novel infection. However, the challenges of an aging workforce, a lack of sustainable education programs, a lack of standardized core-competencies and evaluation criteria, little field experience during formal education, and no financial incentives or compensation for training are all exacerbated in an all-infectious disease hazard system as compared to a bioterrorism- or pandemic influenza- only public health response system. These challenges must be met in order to build a flexible and knowledgeable workforce that is capable of responding to any infectious disease threat.

In addition to public health professionals, several other community stakeholders play roles in preparing for and responding to infectious disease outbreaks. These stakeholders include first receivers (e.g., nurses, clinicians, veterinarians, and physicians assistants), first responders (e.g., police, fire, emergency response technicians, those involved in protecting critical infrastructure), public health laboratory personnel, and public health lawyers. There is a clear need for all stakeholders to learn how to communicate risk to the lay public as they are a critical component to preventing the spread of and responding to an infectious disease outbreak. Although some educational programs or guidance documents do exist to educate all stakeholders in public health response, there is a lack of wide-spread and standardized programs available to build a well-coordinated and knowledgeable workforce. Workshop participants indicated that different audiences have different needs for information, and development of audience-specific education programs and just-in-time information is lacking. Challenges in developing these programs include a lack of competency- and evidence-based training programs for various stakeholders, lack of standardized education curricula and evaluation metrics, the focus of topics about which to be trained (i.e., all hazards training versus disease- or hazard-specific training, interdisciplinary versus occupation-specific), legal guidance, funding, and instructors with field experience. Furthermore, there is a need for all stakeholders to learn how to communicate effectively with policy-makers to convince them of the need to fund these programs.

Internationally, the workforce capacity for public health is transitioning away from external support to regional and local support. However, because there is a noticeable shortage of local health care and laboratory workers, existing personnel are overworked and stressed, making them at higher risk of leaving the environment. Training more health care and laboratory professionals is critical to maintaining and building effective local public health capacity and achieving the legal obligations of the IHR 2005. There is also increasing interest in accrediting training programs and public health professionals internationally, as well as developing international standards for education of public health professionals. Recent efforts in developing training programs that could meet international

standards include self-assessment of existing programs for validated practices, transparency in lessons learned, and embodying "train as you fight." Challenges for building robust and sustainable public health systems in many nations include: a lack of national and international investments in education and training of human and animal health professionals, a poor public health infrastructure to support the capabilities and skills of trained personnel, a shortage of trained personnel that leads to "burn out," problems associated with international migration of trained personnel, and a lack of laboratory capacity and training in a sustainable and coordinated fashion.

Recommendations

The programs presented at the workshop and follow-up discussions not only describe the breadth of existing programs but also identified gaps and challenges in programs development. It is our hope that the findings and recommendations of this report will improve education efforts regarding workforce development for preparedness and response to infectious diseases.

1. **The U.S. government and professional and trade associations should cooperate to integrate and expand existing databases to include all education programs that address preparing for and responding to infectious disease outbreaks and relevant teaching materials.**

2. **The U.S. government should develop competency-based criteria for education programs to evaluate the effectiveness of its curricula for training individuals and teams.**

3. **Federal, State and local governments should work with educational institutions to provide fellowships, scholarships, tuition remission, loan repayment, or incorporate paid apprenticeships to provide students with real-world experience in their field.**

4. **Internationally, health care professionals should be educated in greater numbers to reduce the stress on health systems and improve the retention of a knowledgeable and capable workforce.**

5. **Education programs should be reconfigured or designed to include competency-training, foster team-based learning, field experience, risk communication techniques, and communication skills for engaging with policy-makers and the public.**

There are a variety of disciplines involved in preparedness and response that range from emergency response to public health law; practioners of these disciplines should be required to obtain some training in infectious disease detection, preparedness and response. The following recommendations are framed with the acknowledgement that the training content and requirements may differ for personnel with different functions.

6. **Three types of education and training should be provided to educate relevant audiences in preparedness and response.**
   a. **Vital information: Includes symptoms or clinical signs of dangerous infectious diseases, should be provided to all audiences**

   b. **Routine, important information: Includes isolation procedures or therapeutic doses, should be taught to all relevant audiences**
   c. **Emergency-specific information: Includes phone numbers of coordinating agencies (i.e., reference guides), along with a review of vital and important information can be provided in a just-in-time fashion through email communication or embedded within existing decision support software.**

7. **Professional societies should develop educational tools in consultation with experienced experts in public health, medicine, veterinary medicine, law enforcement, public health law, first response, and epidemiology.** These tools would help existing preparedness and response programs teach their students about all aspects of detecting and responding to infectious disease threats. They could also support team-based, cross-sector education.

8. **Practioners from all relevant sectors should, in the course of their training, participate in internships or externships to gain field experience in infectious disease prevention and mitigation.**

Appendix

Workforce Development: Preparing Health Professionals for Infectious Disease Threats

May 26, 2009
Abelson/Haskins Room, AAAS
9:00 am – 5:00 pm

Agenda

9:00am	**Welcome**: Opening Remarks by AAAS
9:15am	**Workforce Education and Training in the U.S.** *R. Gregory Evans, Ph.D., M.P.H.,* Saint Louis University Institute for Biosecurity *Elizabeth Ablah, Ph.D., M.P.H.,* University of Kansas *Rima Khabbaz, M.D.,* Centers for Disease Control and Prevention
10:30am	**Break**
10:45am	**Global Perspectives on Workforce Education and Training** *Julie Fischer, Ph.D.,* Henry L. Stimson Center *Dionisio Herrera Guibert M.D., Ph.D.*, Training Programs in Epidemiology and Public Health Interventions Network Inc (TEPHINET)
12:00pm	**Lunch**
12:30pm	**Panel Discussion: Roles and Needs of the Community** *Evan Anderson, J.D.,* Johns Hopkins University Bloomberg School of Public Health *Terri Rebmann, Ph.D., R.N., C.I.C.*, Saint Louis University Institute for Biosecurity *Rika Maeshiro, M.D., M.P.H.,* Association of American Medical Colleges *Stephen Cantrill, M.D.,* Denver Health Medical Center *Sandra Amass, D.V.M., M.S.,Ph.D., Dipl. ABVP*, Purdue University School of Veterinary Medicine *John M. DeBoy, II, DrPH, M.P.H.*, Maryland Laboratories Administration
2:45pm	**Break**
3:00pm	**Discussion on Findings and Recommendations**
5:00pm	**Adjourn**

Workforce Development: Preparing Health Professionals for Infectious Disease Threats

May 26, 2009
Abelson/Haskins Room, AAAS
9:00 am – 5:00 pm

Discussion Questions

- What is the best program design?
  - What content/topics should be included in the program?
  - What audience (i.e. health care specialization) is appropriate for these programs?
  - What resources are already available and what additional resources are needed?
  - How can the effectiveness of programs be assessed?

- How can we effectively implement these programs?
  - What are the challenges for implementing these programs?
  - What are effective strategies for engaging different communities involved in public health preparedness (e.g. first responders, medical students, public health officials etc.)?

- Are these programs sustainable?
  - Are there any methods for certification?
  - Are programs integrated into degree-associated course work, continuing education, or job-training programs?

- How do these findings and recommendations fit both domestic and international needs?

Workforce Development: Preparing Health Professionals for Infectious Disease Threats

May 26, 2009

Speaker List

Elizabeth Ablah, Ph.D., M.P.H
University of Kansas
316-293-2627
eablah@kumc.edu

Sandra Amass, D.V.M., M.S., Ph.D.
Purdue University School of Veterinary Medicine
765-494-8052
amasss@purdue.edu

Evan Anderson, J.D.
Johns Hopkins University
Bloomberg School of Public Health
443-287-4737
eanderso@jhsph.edu

Stephen Cantrill, M.D.
Denver Health Medical Center
303-436-7174
Stephen.Cantrill@dhha.org

R. Gregory Evens, Ph.D., M.P.H.
St. Louis University
Institute for Biosecurity
314-977-8133
evansrg@slu.edu

Julie Fischer, Ph.D.
Stimson Center
202-478-3419
jfischer@stimson.org

Dionisio Herrera Guibert, M.D., Ph.D.
TEPHINET
404-592-1412
dherrera@tephinet.org

John DeBoy, Jr., Dr.P.H., M.P.H.
Maryland Laboratories Administration
410-767-6100
DeBoyJ@dhmh.state.md.us

Rima Khabbaz, M.D.
Centers for Disease Control and Prevention
404-639-3967
rfk1@cdc.gov

Rika Maeshiro, M.D., M.P.H.
Association of American Medical Colleges
202-828-0436
rmaeshiro@aamc.org

Terri Rebmann, Ph.D., R.N., C.I.C.
Saint Louis University
314-977-8260
rebmannt@slu.edu

Workforce Development: Preparing Health Professionals for Infectious Disease Threats

May 26, 2009

Participant List

John W. Barbrey, Ph.D.
Longwood University
434-395-2061
barbreyjw@longwood.edu

Georges Benjamin, M.D.
American Public Health Association
202-777-2430
georges.benjamin@apha.org

Daniel Boatright, Ph.D.
University of Oklahoma
405-271-2070 X46769
Daniel-Boatright@ouhsc.edu

Kathryn Brinsfield, M.D.
Department of Homeland Security
617-512-0525
kathryn.brinsfield@dhs.gov

Allison Chamberlain
Emory University
404-727-8717
allison.chamberlain@emory.edu

Gigi Kwik Gronvall, Ph.D.
Center for Biosecurity of UPMC
443-573-3308
ggronvall@upmc-biosecurity.org

Elin Gursky, Sc.D.
ANSER
703-416-3458
Elin.Gursky@anser.org

Michael Handrigan, M.D.
Department of Health and Human Services
202-245-0715
michael.handrigan@hhs.gov

James J. James, M.D., D.PH, M.H.A.
American Medical Association
312-464-5719
james.james@ama-assn.org

Rebecca Katz,,Ph.D., M.P.H.
George Washington University
202-530-2355
rlkatz@gwu.edu

CDR Matthew Kleiman
Department of Homeland Security
202-447-0723
Matthew.Kleiman@dhs.gov

David Marcozzi, M.D.
Homeland Security Council
David_E._Marcozzi@who.eop.gov

Marguerite Pappaioanou, DVM, MPVM, Ph.D.
Association of American Veterinary Medical Colleges
202-371-9195, ext. 15
MPappa@aavmc.org

Laurence M. Raine, M.S., DrPH
Department of Homeland Security
202-254-6112
Laurence.Raine@dhs.gov

Sandra Schneider, M.D.
American College of Emergency Physicians
585-463-2943
sschneider@acep.org

Kenneth Schor, D.O., M.P.H.
Uniformed Services University of the Health Sciences
301-295-1606
kschor@usuhs.mil

William So
Federal Bureau of Investigation
202-324-5536
William.So@ic.fbi.gov

CAPT Barry Stern, M.P.H.
Department of Health and Human Services
202-245-0731
barry.stern@hhs.gov

Ian Tizard, BVMS, Ph.D., ACVM
Texas A&M College of Veterinary Medicine
979-845-4276
itizard@tamu.edu

Cheryl Vos
Federation of American Scientists
202-454-4692
cvos@fas.org

Christopher Woolverton, Ph.D.
Kent State University
330-672-4648
cwoolver@kent.edu

AAAS Staff

Kavita Berger, Ph.D.
Project Director
Center for Science, Technology, and Security Policy
202-326-7027
kberger@aaas.org

Mark S. Frankel, Ph.D.
Director
Program on Scientific Freedom, Responsibility and Law
202-326-6793
mfrankel@aaas.org

Elizabeth C. Lee
Program on Scientific Freedom, Responsibility and Law
202-326-6236
elee@aaas.org

Kathryn A. Luke, Ph.D.
Center for Science, Technology, and Security Policy
202-326-6652
kluke@aaas.org

David Noll, Ph.D.
Center for Science, Technology, and Security Policy
202-326-6477
dnoll@aaas.org

William Pinard
Center for Science, Technology, and Security Policy
202-326-6652
wpinard@aaas.org

Jennifer Sta.Ana
Program on Scientific Freedom, Responsibility and Law
202-326-6217
jlstaana@aaas.org