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ABSTRACT

The Association of American Medical Colleges (AAMC) convened a multidisciplinary group of experts to share their insights about the learning objectives and educational experiences that they would recommend for the training of future physicians about bioterrorism. The expert panel broadened the scope of their discussion beyond bioterrorism to include other potential weapons of mass destruction (WMD). Their deliberations identified medical student competencies that should prepare students to identify and response specifically to WMD incidents. The panel agreed that an integral component of the curriculum should focus on physicians' interactions with the public health system to help facilitate effective and coordinated medical and public health response to WMD and to more common threats to health. Panelists acknowledged that better coordination between medicine and public health would improve the management of public health challenges ranging from food-borne illnesses to natural disasters to infectious diseases. They recognized that in the absence of WMD incidents, conventional public health threats help "drill" the coordinated health systems that are central to an effective medical and public health response in the event of a WMD incident. Panelists also concluded that medical students should be taught to adopt a life-long learning perspective with regard to this subject. (SLD)

ASSOCIATION OF AMERICAN MEDICAL COLLEGES

Training Future Physicians About Weapons of Mass Destruction: Report of the Expert Panel on Bioterrorism Education for Medical Students

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Introduction

The events of September 11, 2001, the following month's anthrax outbreaks, and the reinstitution of smallpox vaccinations have called dramatic attention to the need for physicians to be prepared for the health consequences of the use of weapons of mass destruction (WMD). WMD include biologic, chemical, physical (i.e., explosive), and radiological agents. Polls have shown that the general public prefers to turn to their doctors for guidance on how to protect themselves and their families in case of public health emergencies, such as a bioterrorism attack.[1,2] In order to meet the expectations of their patients and of their communities, physicians must not only become familiar with rare clinical syndromes and exotic offending agents but must also develop an understanding of their roles in the public health systems' preparedness and response to the use of WMD.

Since the autumn of 2001, considerable effort has been given to assess the capacities of the systems and individuals that are expected to prevent, detect, and respond to terror incidents involving WMD. Public health agencies[3,4] academic health centers[5], public health workers[6], and specific physician specialists in practice[7,8,9] have been the focus of activities to identify competencies that help to assure their readiness. Medical schools have also responded by integrating WMD-related topics into their curricula, but no guidance has existed regarding the content and the teaching methods that would be most appropriate for medical students.

The Association of American Medical Colleges (AAMC) convened a multi-disciplinary group of experts to share their insights about the learning objectives and educational experiences that they would recommend. The group included representatives with expertise in medical, nursing, and public health education, as well as experts in WMD preparedness, from schools of medicine, nursing, and public health, the Centers for Disease Control and Prevention (CDC), and the Uniformed Services University of the Health Sciences (USUHS). They were specifically tasked to respond to two questions:

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1 Harvard School of Public Health/Robert Wood Johnson Foundation Survey Project on Americans' Response to Biological Terrorism, 2002.

2 Lake Snell Perry & Associates Inc. *Americans Speak Out On Bioterrorism and U.S. Preparedness to Address Risk.* Commissioned by the Robert Wood Johnson Foundation, 2002. (www.RWJF.org/special/changingworld).

3 Fraser, MR and VS Fisher. *Elements of Effective Bioterrorism Preparedness: A Planning Primer for Local Public Health Agencies.* National Association of County and City Health Officials (NACCHO): Washington, DC, 2001.

4 Centers for Disease Control and Prevention. Biological and Chemical Terrorism: Strategic Plan for Preparedness and Response. *MMWR.* 2000;48(No. RR-4).

5 Rubin ER, Osterweis M, Lindeman LM editors. *Emergency Preparedness:Bioterrorism and Beyond.* Association of Academic Health Centers: Washington DC, 2002.

6 Columbia University School of Nursing Center for Health Policy. *Bioterrorism & Emergency Readiness: Competencies for All Public Health Workers.* Columbia University: New York, 2002.

7 American Academy of Pediatrics. AAP Task Force on Terrorism to Help Prepare Pediatricians for Disaster Response. *AAP News.* 2002;20:4.

8 American College of Emergency Physicians. *Positioning America's Emergency Health Care System to Respond to Acts of Terrorism.* October, 2002.

9 American College of Surgeons. *Disasters from Biological and Chemical Terrorism—What Should the Individual Surgeon Do?: A Report from the Committee on Trauma.* 2001.

1. ***What should medical students learn about bioterrorism (learning objectives)?***
2. ***What kind of educational experiences would allow students to achieve those learning objectives?***

The expert panel broadened the scope of their discussion beyond bioterrorism to include other potential WMD. Their deliberations identified medical student competencies that should prepare students to identify and to respond specifically to WMD incidents. The panel agreed that an integral component of the curriculum should focus on physicians' interactions with the public health system in order to help facilitate effective and coordinated medical and public health responses to WMD, as well as to more common threats to health, including chronic and infectious diseases, injuries, and substance abuse. Panelists acknowledged that better coordination between medicine and public health would improve the management of public health challenges ranging from food-borne illnesses to natural disasters to emerging infectious diseases such as Severe Acute Respiratory Syndrome and West Nile Virus. They recognized that in the absence of WMD incidents, conventional public health threats help "drill" the coordinated systems that are central to an effective medical and public health response in the event of a WMD incident. Panelists also concluded that because the science associated with WMD-related topics is evolving, medical students should adopt a life-long learning perspective with regard to this subject.

Background

Many of the subjects in a WMD curriculum are part of traditional medical school teaching. Pathophysiology, toxicology, infectious diseases, emergency preparedness/disaster response, biostatistics, and epidemiology introduce concepts and topics that are the foundation for information more specific to WMD preparedness and response. Building upon these familiar concepts should help to assure that medical school graduates are armed with the necessary knowledge and skills to become competent and prepared physicians who will practice effectively in a transformed societal and clinical environment, where the theoretical potential of a WMD event has become a real possibility. Depending on the characteristics of a WMD event, physicians may play critical roles in identifying, responding to, and recovering from the WMD.

Physicians may be the first to recognize the use of a WMD, particularly in the case of a covert (unannounced) release of a biologic agent. Unusual clinical presentations or clusters of cases, particularly in vulnerable populations such as the very young, very old, and the immunocompromised, should raise suspicion. Physicians will also need to routinely consider the possibility of WMD in their differential diagnoses of more typical clinical presentations because many of the early signs and symptoms of exposure to biologic WMD mimic common viral syndromes. Clinicians' abilities to efficiently analyze signs, symptoms, and basic diagnostic tests that lessen or rule out the possibility of a WMD will also be critical. Once the possibility of a WMD event is raised, physicians must know how to elicit critical data from patients, how

to record these data, and how to report their suspicions to their public health agency. After contacting public health authorities, physicians should be prepared to proceed clinically in consultation with their public health colleagues.

During the response to a WMD event, physicians' responsibilities will vary by their practices and their institutional affiliations. Some physicians may not care for any patients who are directly affected by the WMD but should understand the rationale behind the public health and medical interventions that may be implemented to treat and contain the morbidity and mortality associated with the WMD event. Public health interventions can include epidemiologic investigations, environmental testing, public health education campaigns, immunization programs, and quarantines. Physicians may find that they are identified as the experts in their community and may be asked to help explain and clarify these response activities, regardless of their level of involvement, usual practice, or specialty. Physicians may also find that their patients who did not suffer physical exposure or injury are nevertheless concerned about their health and welfare. In addition to understanding when and how to withhold inappropriate diagnostic tests and treatments, clinical practitioners must know how to recognize and care for those suffering from psychological trauma following a WMD event. Physicians who are directly involved with physically injured or exposed populations must have a more intimate knowledge of treatment protocols and their roles in any public health or emergency management interventions that may be implemented. While the details of response plans will vary with regard to physician roles, medical students must be aware that they may have both explicit and implied roles in these plans as practicing physicians, including leadership roles in interdisciplinary teams. As students, they should also be aware of any responsibilities they may have within their medical school and/or teaching hospital's response plans.

Unique to the WMD context is the illicit and purposeful exposure of individuals and communities to harmful agents. Because of the unlawful nature of the exposures and the potential population-wide impact, physicians may be interacting with law enforcement, emergency personnel, public health agencies, the media, and their communities in a manner that is qualitatively different from their typical day-to-day practice. In addition to clinical knowledge and skills, medical schools will need to equip their students with the skills to interact within multi-disciplinary teams in the context of WMD preparedness and response, including the collection and preservation of forensic evidence.

Curriculum Content

General Principles

Although the meeting of the expert panel was entitled "Bioterrorism Education for Medical Students", the group determined that focusing only on biologic agents of terrorism was inappropriately limiting. Because physicians in practice should be prepared to respond to any event that may result in mass casualties, the expert panel agreed to adopt an "all-agents" approach by considering biologic, chemical, physical, and radiological agents.

1. ***In the medical school curriculum, WMD education should be considered in the context of any threats that may result in mass casualties, including the use of biologic, chemical, physical, and radiological agents.***

The expert panel acknowledged that with this broader perspective, the list of potential agents of terrorism, particularly when considering chemical agents, is extensive. Requiring medical students to memorize the characteristics of all possible agents was not thought to be a productive activity. Focusing on general concepts that distinguish particular classes of agents, their mechanisms of injury, and their containment/treatment options was recommended.

2. ***General concepts should be emphasized rather than details regarding every potential agent.***

The expert panel stressed that in addition to becoming familiar with potential WMD agents, medical students needed to augment their clinical knowledge with an understanding of their roles in the implementation of WMD preparedness and response interventions. The panel identified working in multidisciplinary teams and working in coordination with public health systems as critical aspects of a physician's responsibility.

3. ***The roles and responsibilities of physicians during a WMD event should be presented, including the need to work in multidisciplinary teams and in coordination with the public health system.***

Learning Objectives

The expert panel identified learning objectives that could be integrated into the traditional basic science and clinical curricula, as well as learning objectives that focus on the public health system, the emergency management system, the physicians' roles in the public health and emergency management response to a WMD event, and professional ethics, topics that may not be included in existing coursework at all schools.

Basic Sciences

The basic science curriculum includes natural opportunities to discuss WMD examples in the presentation of core concepts of biochemistry, microbiology, pathology, pathophysiology, physiology, pharmacology, and radiation physiology.

For its part the medical school must ensure that before graduation a student will have demonstrated, to the satisfaction of the faculty, the following:

- Knowledge of the biochemical, infectious, physical, and radiological mechanisms and properties that characterize potential WMD
- An understanding of the multiple routes of potential exposure to WMD and the associated pathophysiology of injuries and illnesses
- Knowledge of the pharmaceutics and pharmaceuticals used to combat WMD (e.g., burn therapies, biochemical antidotes, antibiotics)
- An understanding of the epidemiology of classes of WMD
- Knowledge of prevention strategies associated with WMD
- Knowledge of specific Category A and B biologic agents and general classes of chemicals identified as potential WMD

Clinical Sciences

During clinical training, medical students should learn how to recognize and treat patients who have been exposed to WMD, along with the precautions they should take to protect the safety and health of other patients, staff, and themselves.

For its part the medical school must ensure that before graduation a student will have demonstrated, to the satisfaction of the faculty, the following:

- The ability to take medical histories that:
  - Determine the absence or presence of symptoms that are characteristic of exposure to WMD
  - Identify patients who may have psychological trauma following a WMD event
  - Identify occupational and psychosocial risks for exposure to potential WMD
  - Characterize exposures to potential WMD, including type of agent, timing, and length of exposure
- The ability to conduct physical exams that:
  - Are guided by exposure or potential exposure to WMD
  - Determine the absence or presence of physical signs that are characteristic of exposure to WMD
- The ability to identify patterns of signs and symptoms likely to be associated with occult exposure to WMD
- The ability to incorporate evidence-based diagnostic procedures and laboratory studies to confirm the diagnoses and/or causative agents
- The ability to consider WMD exposure when establishing differential diagnoses and developing problem lists
- The ability to interpret results of the medical history, physical exam, and diagnostic workup to rule out, when possible, the likelihood of WMD exposure
- The ability to interpret results of the medical history, physical exam, and diagnostic workup to determine an accurate diagnosis of WMD exposure
- The ability to consider critical aspects of treatment plans for patients who may have been affected physically and/or psychologically by WMD, including:
  - Acute care management
  - Long-term management
  - Secondary and tertiary prevention
  - Attention to mental health concerns
  - Referrals
  - Awareness of concomitant psychosocial issues
  - Consultation with public health authorities
- The ability to use appropriate precautions to prevent WMD exposure to other patients, care providers, and themselves (e.g., isolation, decontamination, personal protective equipment, appropriate waste disposal)

- The ability to utilize risk communication skills when informing patients and their families about WMD
- The ability to recognize the need for, and to collect and preserve, forensic evidence from patients who may be victims of a WMD event

Public Health System

Information regarding public health is not yet a standard part of medical school curricula. Nevertheless, medical students should understand the structure and function of their public health system, including the linkages between the medical care and public health systems during public health emergencies, such as one involving a WMD. As physicians, they may be asked to explain and to clarify public health policies and programs to their patients and to their communities.

For its part the medical school must ensure that before graduation a student will have demonstrated, to the satisfaction of the faculty, the following:

- An understanding of public health system interventions that prepare for public health emergencies, such as the use of WMD (e.g., public health education, disease and syndromic surveillance, vaccination programs and their rationale, risk communication, public health laws)
- An understanding of public health interventions that are part of the response to public health emergencies such as the use of WMD (e.g., mass vaccination, quarantine, epidemiologic investigations, environmental decontamination, public health laws)

Emergency Management System

Information regarding emergency management systems is also not a standard part of medical school curricula. Medical students should understand the structure and function of emergency management systems, including the rationale for incident command systems.

For its part the medical school must ensure that before graduation a student will have demonstrated, to the satisfaction of the faculty, the following:

- An understanding of community emergency response systems
- An understanding of the incident command system
- An understanding of community and hospital all hazards planning
- An understanding of state and federal resources that contribute to emergency management and response at the local level

Public Health and Emergency Management Roles and Responsibilities

Medical students should also be aware of the spectrum of roles and responsibilities of physicians within the public health and emergency management systems to prepare for and respond to emergencies.

For its part the medical school must ensure that before graduation a student will have demonstrated, to the satisfaction of the faculty, the following:

- Knowledge of local and national resources that provide information about WMD
- Knowledge of unusual clinical scenarios that may represent sentinel cases of victims of an unannounced use of WMD

- An understanding of procedures used to collect patient data for surveillance or tracking
- An understanding of procedures for reporting cases that are suspicious for WMD
- An understanding of their assignment, if any, within the community response plan, the incident command system, and their school or hospital's emergency response plan
- An understanding of their community's public health and medical response system and its interactions with law enforcement, National Guard, emergency medical system, etc.
- An understanding of the methods and rationale for environmental decontamination
- An understanding of the importance of risk communication skills when informing communities or the media about WMD

Professional Ethics

Physicians may confront a variety of moral and ethical issues regarding their professional obligations to treat and protect their patients and themselves in the face of a WMD event. Medical students should understand the framework and limitations of the professional ethics that guide their actions.

For its part the medical school must ensure that before graduation a student will have demonstrated, to the satisfaction of the faculty, the following:

- An understanding of their professional obligations to treat
- An understanding of their rights to protect their personal safety
- An understanding of their responsibilities and rights as a volunteer
- An understanding of professional liability issues in the context of WMD events

Learning Opportunities

General Principles

The existing medical school curriculum includes opportunities to introduce WMD topics throughout the four-year curriculum, building upon and augmenting the students' growing knowledge and skill base. The panel agreed that WMD-related learning objectives should be integrated into the existing curriculum across all four years.

1. WMD-related learning objectives should span all four years of medical school.

WMD-related topics cut across a variety of subjects that are part of the standard medical school curriculum. The expert panel agreed that WMD-related topics should be integrated across subjects such as microbiology, pathology, and toxicology. Horizontal integration may also be achieved in the clinical sciences across specialties such as emergency medicine, primary care specialties, and infectious diseases.

2. WMD-related learning objectives should be integrated horizontally through the curriculum.

The panel agreed that the most effective methods of teaching should be used to teach the WMD-related topics. For early, basic knowledge acquisition, didactic methods could be utilized; however, for later learning objectives that require the integration of knowledge and skills, experiential learning is preferred.

3. A combination of didactic sessions and experiential learning exercises should be used.

Educational Strategies

The panel described a spectrum of teaching strategies that correspond to the varying levels of knowledge and skill desired of students. Many medical students may achieve WMD-associated competencies through a combination of didactic and experiential learning exercises that are folded into existing curricula. The integration of WMD examples in their basic science and clinical experiences, the inclusion of information regarding the public health system, and the use of WMD case scenarios for discussions regarding professional ethics may provide a minimum level of competency for medical students. Alternatively, schools with a special interest or obligation to train physicians for the military and the U.S. Public Health Service, such as the Uniformed Services University of the Health Sciences, can require large-scale disaster drills in their curriculum. Other schools could also consider fourth-year capstone activities to help consolidate the information from all four years, such as a tabletop exercises or case study discussions.

Educational strategies to help students achieve the necessary competencies in the area of WMD preparedness and response include:

- Lectures
- Directed reading
- Use of standardized patients
- Objective structured clinical examinations
- Review and discussion of case studies
- Use of existing distance-learning courses, including those developed by the Centers for Disease Control and Prevention
- Research in WMD and WMD-related health care delivery
- Seminars to address student anxiety and fears regarding their responsibilities
- Tabletop exercises
- Disaster drills
- Participation in public health emergency planning activities
- Participation in community emergency planning activities

Implementation Strategies

In addition to the development of curricular resources, the expert panel agreed that increasing the cadre of faculty prepared to teach WMD topics, and including WMD topics in student and institutional evaluation activities will be critical to the successful integration of this subject into the medical school curriculum.

Development of Curricular Resources

The panel identified a need to develop curricular resources, such as standardized patients, on-line study modules, and elective opportunities that could be shared by institutions and departments.

Faculty Development

Although a paucity of medical school faculty currently identify themselves as "WMD experts", a desire to quickly impart this information to medical students exists. The expert panel identified a variety of opportunities in which their faculty could be trained in WMD competencies. These range from distance-

based, self-study experiences to fellowship experiences at institutions with expertise in WMD.

Activities that would facilitate faculty development in the topic of WMD preparedness and response include:

- Establishing distance-based self-study modules for medical school faculty
- Establishing "train the trainer" symposia for medical school faculty
- Requiring faculty to participate in medical school/teaching hospital disaster drills
- Establishing partnerships with Veterans Administration Centers, Department of Defense medical facilities, and Centers for Public Health Preparedness to facilitate faculty development
- Establishing month-long "faculty-in-residence" programs that allow faculty to observe and learn at institutions with a robust WMD curriculum
- Establishing year-long fellowship programs in WMD preparedness and response for faculty

Evaluation Activities

The panel agreed that students' competency in WMD topics and medical schools' teaching of WMD topics should be assured through the existing evaluation systems. Written examinations as well as the evaluation of students' clinical skills should include cases of WMD use. WMD content should also be considered for inclusion in national examinations and in reviews and evaluations of medical school curricula.

Examples of Innovation

Almost immediately after the events of September 11, medical schools across the country began to include or enhance information regarding mass casualty events, including the use of WMD, in their curriculum. Many schools sponsored grand rounds lectures or other special presentations on the identification and treatment of potential biologic agents of terrorism. While not a comprehensive listing, the following schools have developed educational opportunities beyond the insertion of isolated lectures on WMD, and may serve as models for other schools:

Medical College of Ohio

The Medical College of Ohio offers an eight-hour mandatory course, "Basic Anti-Terrorism Emergency Lifesaving Skills", to their students. The course includes an overview of disaster management and focuses on preparedness. Medical students cover topics such as triage, treatment of blast and crush injuries, hazardous materials situations, biological and chemical agents, and mass casualty management. The multi-disciplinary faculty also presents information regarding epidemiology, surveillance, and public health. A case scenario of a smallpox outbreak in their area is featured. This course is a cooperative effort between the Medical College of Ohio and the University of Findlay Center for Terrorism Preparedness.

Uniformed Services University of the Health Sciences

The Uniformed Services University of the Health Sciences (USUHS) was established in 1972 with a mission to educate health profes-

sionals dedicated to career service in the Department of Defense and the United States Public Health Service. Because topics that are unique to military medicine have been woven into typical medical school courses, students at USUHS are provided with more than 28 hours of training in WMD-related subjects throughout the four years of the curriculum. These experiences range from the inclusion of WMD information in pharmacology, biochemistry, and microbiology curricula to extensive field operations. Topics in the curriculum include the medical effects of nuclear, biological, and chemical agents on the human body; the response to suspected exposure, including detection, decontamination, and medical countermeasures; and the psychological stresses of combat and trauma.

The University of Arizona College of Medicine

The University of Arizona College of Medicine, in collaboration with the other colleges within the University of Arizona Health Sciences Center, developed and presented an "interprofessional" seminar, *Bioterorrism and Consequence Management*, in the spring of 2002. The Colleges of Medicine, Nursing, Pharmacy, and Public Health developed a four-hour program that highlighted the clinical, environmental, public health, and emergency response issues associated with the use of WMD. Faculty from all four colleges, along with members of the local emergency response and public health communities, contributed to the development of the program and participated as speakers. The audience consisted of third-year medical students, graduate students in public health and epidemiology, fifth-semester and graduate nursing students, and third-year pharmacy students and residents. The format of the seminar included didactic sessions as well as a case-based, interprofessional small-group discussion. The University of Arizona Health Sciences Center plans to repeat the seminar in an intercollegiate setting as a method of fostering the interprofessional teamwork necessary to respond to public health emergencies.

University of Pittsburgh School of Medicine

The University of Pittsburgh School of Medicine originally introduced a small-group case-based workshop, "The Medical Management of Biological and Chemical Exposures", into the required third-year clinical curriculum in the summer of 2000. Emergency Medicine faculty taught the workshops during the students' integrated clerkship in Internal Medicine/Emergency Medicine/Critical Care Medicine. The workshops focused on mechanisms of toxicity, common agents used as weapons, differential diagnoses, syndrome recognition, decontamination, and treatment. Although student feedback was positive regarding the relevance of the topics and the teaching method prior to September 11, 2001, their perception regarding the relevance of WMD subjects increased after the identification of the Florida anthrax cases in October 2001. In 2003, WMD topics have been integrated throughout the curriculum as a four-year longitudinal theme, titled "Biologic Threats to Society". WMD issues are presented in a variety of courses ranging from neuroscience to ethics.

University of Tennessee College of Medicine

At the University of Tennessee College of Medicine, a group of first-year medical students established the "University of Tennessee Community Disaster Response Unit" as their Longitudinal Community Program project, a requirement in their first and second years. The goal of the project was to identify and train student volunteers to participate in disaster response activities, should any WMD or general disaster events occur in their community. Since its establishment in spring 2002, students have prepared and delivered two two-hour training modules on biological agents and chemical agents to medical students at their university. Future plans include the development of modules on general disaster response and radiological agents, as well as participation in a disaster drill. Students interacted with their local Emergency Management Agency, the Tennessee Emergency Management Agency, and hospital administrators in the development of this program, and hope to sustain this effort beyond their participation in the Longitudinal Community Program course.

University of Utah School of Medicine

The University of Utah School of Medicine addresses bioterrorism through activities that span the four-year curriculum. The topic of bioterrorism is introduced to first-year students by the inclusion of potential agents of bioterrorism in their medical microbiology course. After potential agents have been presented individually, a one-hour summary lecture is offered on bioterrorism. During students' third-year clerkships, bioterrorism cases are included in their "Topics in Medicine" discussions. Bioterrorism cases are also in development for their fourth-year required public health rotation.

Electronic and Print References

Internet Resources

(Please note that this list is not exhaustive. Many medical and scientific professional societies have included information related to WMD that is most relevant for their membership on their websites.)

Agency for Toxic Substances and Disease Registry (ATSDR)

www.atsdr.cdc.gov/HEC/primer.html

A Primer on Health Risk Communication Principles and Practices

Agency for Healthcare Research and Quality (AHRQ)

www.ahrq.gov/clinic/tp/biotrtp.htm

Training Clinicians for Public Health Events Relevant to Bioterrorism Preparedness, an evidence report by the Johns Hopkins Univeristy Evidence-based Practice Center regarding effective methods of training health care providers about bioterrorism preparedness

American Academy of Dermatology (AAD)

www.aad.org/BioInfo/BioInfo.html

AAD educational materials that focus on the cutaneous manifestations of WMD

American Academy of Family Physicians (AAFP)

www.aafp.org/btresponse.xml

AAFP activities, press releases, and educational resources on WMD preparedness and response

American Academy of Pediatrics (AAP)
www.aap.org/terrorism/index.html
"Children, Terrorism, and Disasters", a compilation of resources and materials on disasters, bioterrorism, and psychological support of children

American College of Emergency Physicians (ACEP)
www.acep.org/1,4634,0.html
ACEP reports and guidelines regarding bioterrorism

American College of Physicians (ACP)
www.acponline.org/bioterro/index.html
ACP activities, press releases, and educational resources on WMD preparedness and response. Strong emphasis on anthrax and other biologic agents

American College of Surgeons (ACS)
www.facs.org/civiliandisasters/intro.html
ACS reports: *Disasters from Biological and Chemical Terrorism—What Should the Individual Surgeon Do?: A Report from the Committee on Trauma* and *Statement on Unconventional Acts of Civilian Terrorism: A Report from the Board of Governors*

American Medical Association (AMA)
www.ama-assn.org/go/DisasterPreparedness
AMA activities, press releases, and *JAMA* articles related to WMD preparedness and response

American Psychiatric Association (APA)
www.psych.org/pract_of_psych/disaster_psych.cfm
Educational resources for psychiatrists in preparing for and responding to disasters and other traumatic events

American Public Health Association (APHA)
www.apha.org/united/
APHA activities, press releases, and educational resources on WMD preparedness and response from a public health perspective

American Society of Microbiology (ASM)
www.asmusa.org/pasrc/bioprep.htm
ASM resources, including articles and reports associated with biologic agents

Association of American Medical Colleges (AAMC)
www.aamc.org/newsroom/bioterrorism/
AAMC activities, press releases, and summaries of federal activities associated with WMD preparedness and response

Association of Medical School Microbiology and Immunology Chairs (AMSMIC)
www.amsmic.org/educational_links.html
Presentation on a study of the opinions of microbiology chairs with regard to teaching bioterrorism related topics to medical students

Association of State and Territorial Health Officials (ASTHO)
www.astho.org/index.php?template=1bioterrorism.html
ASTHO activities, press releases, and educational resources on WMD preparedness and response from the perspective of state health departments

Association for Professionals in Infection Control and Epidemiology (APIC)
www.apic.org/bioterror/
Links to a broad range of WMD educational resources from government agencies and professional societies

Center for Civilian Biodefense Strategies
www.hopkins-biodefense.org/index.html
An independent, non-profit organization of the Johns Hopkins Bloomberg School of Public Health and the School of Medicine, the Center for Civilian Biodfense Strategies addresses a broad spectrum of science and policy issues associated with bioterrorism. The Clinician's Biodefense Network, a free, not-for-profit email and web-based system that was created to facilitate communication and information exchange among clinicians in the event of a bioterrorism event, is housed here.

Centers for Disease Control and Prevention (CDC)
www.bt.cdc.gov/
CDC activities, press releases and educational resources on WMD preparedness and response

Federal Emergency Management Agency (FEMA)
www.fema.gov
Curricular materials and other information regarding emergency management systems

Food and Drug Administration (FDA)
www.fda.gov/oc/opacom/hottopics/bioterrorism.html
FDA counter-terrorism initiatives and information on food safety

Infectious Diseases Society of America (IDSA)
www.idsociety.org/BT/ToC.htm
IDSA educational materials, including medical summaries and clinical pathways, slide sets, and other images associated with bioterrorism agents

National Association of County and City Health Officials (NACCHO)
www.naccho.org/NACCHO-RespondsToBT.cfm
NACCHO activities, press releases and educational resources on WMD preparedness and response from the perspective of local health departments

National Library of Medicine
www.nlm.nih.gov/medlineplus/biodefenseandbioterrorism.html
Links to updated Internet references from government, academic, and other sources

Society for Healthcare Epidemiology of America (SHEA)
www.shea-online.org/BTprep.html
Summaries of CDC updates on bioterrorism-related clinical issues and links to other sites.

Uniformed Services University of the Health Sciences
www.usuhs.mil
Disaster/terrorism care resources from their Center for the Study of Traumatic Stress, as well as an online version of the *Medical Management of Radiological Casualties Handbook, Second Edition*, published in April 2003

U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID)
www.usamriid.army.mil/education/bluebook.html
Online version of USAMRIID's February 2001 edition of *Medical Management of Biologic Casualties Handbook*

U.S. Army Medical Research Institute of Chemical Defense (USAMRICD)
http://ccc.apgea.army.mil/products/handbooks/books.htm
Online versions of many handbooks and guides, including USAMRICD's August 1999 edition of *Medical Management of Chemical Casualties Handbook* and *Medical Management of Radiological Casualties Handbook.*

Virtual Naval Hospital
www.vnh.org/Providers.html#NBC
Comprehensive list of links for information on biological, chemical and nuclear warfare and radiation safety

WaterHealthConnection.org
www.waterhealthconnection.org
Recognizing Waterborne Disease and the Health Effects of Water Pollution, a comprehensive on-line reference designed for physicians on water quality, safety, and health issues. Includes a section titled *Physician Preparedness for Acts of Water Terrorism*, with direct links to many of the resources listed above. Topics range from clinical subject areas, to epidemiology, to risk communication. CME offering sponsored by the American College of Preventive Medicine.

Published Resources

Darling RG, Eitzen EM, Mothershead JL and Waeckerle JF, ed. *May 2002 Emergency Medicine Clinics of North America: Bioterrorism.* WB Saunders and Co: Philadelphia, PA, 2002.

Knobler SL, Mahmoud AAF and Pray, LA, ed. *Biological Threats and Terrorism: Assessing the Science and Response Capabilities.* National Academy Press: Washington, DC, 2002.

Novick LF, Marr JS, ed. *Public Health Issues in Disaster Preparedness: Focus on Bioterrorism.* Aspen Publishers, Inc: New York, NY, 2001.

Conclusion

Although integrating WMD subjects into the already-full curriculum of medical students is a challenge, the insertion of WMD-based examples and cases into the existing basic science and clinical curriculum may be an effective and relatively uncomplicated first step. The current focus on WMD preparedness and response also highlights what has been a deficit in the education of many medical students—an understanding of their role in their public health system. An effective response to a public health emergency, such as the use of a WMD, requires a physician workforce that is familiar with the resources and interventions of their local and state health agencies. The learning objectives and learning activities for medical students should reflect the need for a greater familiarity with potential WMD agents, as well as an understanding of their roles and responsibilities as physicians within the public health system. Because the science, scope, and context of WMD-related topics will continue to evolve, medical students must be encouraged to stay abreast of new developments as they continue their training and begin their practices.

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