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PRIORITIZATION OF PEDIATRIC CBRNE DISASTER PREPAREDNESS EDUCATION AND TRAINING NEEDS

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Abstract

Children are the members of our population who are most vulnerable to the effects of a chemical, biological, radiological, nuclear or explosive (CBRNE) attack. It has been over 12 years since 9/11 and the majority of clinicians who would be providing care to children in the event of another attack still lack the requisite disaster preparedness training. The purpose of this report is to provide an overview of the recent developments that will enable the affordable creation of key CBRNE educational and just in time material.

In 2011, the National Center for Disaster Medicine and Public Health (NCDMPH) convened a pediatric disaster preparedness conference. Much of the initial groundwork for development of a pediatric disaster preparedness curriculum, including the identification of target audiences and requisite role specific CBRNE curriculum content, was the product of this conference.

Much of the needed pediatric education and training content for the diagnosis and treatment of the injurious effects of CBRNE has recently been both developed and well vetted. Bringing together these efforts in an educational program will result in a workforce that is better trained and prepared to address the needs of children impacted by these types of disasters.

There are approximately 74 million children in our nation, or 24%, of our total population.

(1) Unfortunately, because of their unique anatomy and physiology, children are particularly

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vulnerable to the impacts of chemical, biological, radiological, nuclear and explosive (CBRNE) attacks.(2–5)

Due in large part to the leadership of the National Commission on Children and Disasters and the American Academy of Pediatrics Disaster Preparedness Advisory Council and the US Department of Health and Human Services (HHS) Public Health Emergency Medical Countermeasures Enterprise's (PHEMCE) Pediatric Obstetric Integrated Process Team, there has been an increased awareness in both the Federal government and medical community about the potentially devastating impacts of disasters on children, as well as the need for development and deployment of appropriate medical countermeasures. However, the majority of clinicians remain inadequately trained to properly utilize these resources.(6–9)

Providing comprehensive disaster preparedness training would be the solution to filling this critical gap, with a program containing various modules including incident response management, mass casualty incident (MCI) triage,(10,11) public health, psychosocial, and community response/recovery issues in addition to CBRNE.(12,13) It is felt by many of the governmental and academic subject matter experts that in this restricted fiscal climate, the greatest impact on reducing pediatric morbidity and mortality can be achieved by providing CBRNE training as a first step for prioritized emergency medical services (EMS), emergency department (ED)/hospital and ambulatory clinicians.(14,15)

Because of the following developments, training providers on the appropriate diagnosis and treatment of children following exposure to CBRNE events is very doable;

- Much of the initial groundwork for development of a pediatric disaster preparedness curriculum, including the identification and prioritization of target audiences, was the product of a conference convened by the NCDMPH in 2011. (16)
- Much of the requisite CBRNE pediatric content for education and training has been both developed and well vetted. These high quality literature and web based resources can be readily reformatted for educational and just in time (JIT) needs.

NCDMPH CONFERENCE OVERVIEW

The NCDMPH was founded in 2008 under Homeland Security Presidential Directive-21 with the following mission: lead Federal and coordinate national efforts to develop and propagate core curricula, education, training and research in all-hazards disaster health.(17) To initiate the process for children, partially in response to recommendations from the National Commission on Children and Disasters,(9) the NCDMPH convened a Pediatric Disaster Preparedness Curriculum Development Conference on March 8–9, 2011 in Bethesda, Maryland. The purpose of the conference was to begin to address the unmet education and training needs of medical responders who care for children in a disaster.

The products of this workshop (as noted below) could be utilized as first steps in the process of developing a role-specific, competency based pediatric disaster preparedness training program. (16)

Subject Matter Experts

The conference goal was to initiate the development of a pediatric disaster education and training program that has the potential for establishing national standards. To ensure that the appropriate and relevant talent was included in this process, the consortium of subject matter experts (SMEs) included wide representation from both the private and public sectors. SMEs included:

- Academic and administrative leaders of the pediatric and adult disaster preparedness community who also continue to provide patient care in the EMS/first responder, ED/hospital or ambulatory settings.
- Academic and administrative SMEs in disaster related sub-specialty subject matter, including but not limited to: CBRNE, psychological, and public health.
- Adult and pediatric health care provider SMEs, including but not limited to, physicians, nurses, paramedics, psychologists, public health practitioners and allied health providers.
- Senior-level representatives from key organizations: American Academy of Pediatrics-Disaster Preparedness Advisory Council (AAP-DPAC), National Commission on Children and Disasters (NCCD), American College of Emergency Physicians (ACEP), Emergency Nurses Association (ENA), American Medical Association (AMA), National Association of Children's Hospitals and Related Institutions (NACHRI), Department of Veterans Affairs (VA), Medical Reserve Corps (MRC), Federal Emergency Management Agency (FEMA), Department of Homeland Security (DHS), Department of Defense (DOD), HHS Office of the Assistant Secretary for Preparedness and Response (ASPR).

Prioritization of Training

The activities of the workshop focused on health provider roles in the following three settings: EMS/first responder, ED/hospital, and ambulatory care settings. SMEs worked in multi-disciplinary groups divided by these areas and each group was asked to identify all of the provider roles in their respective settings that were in need of training. Additionally, they were instructed to identify the key clinical roles for which prioritizing their training would have the greatest impact upon reducing morbidity and mortality. The results of this prioritization for each group are reflected in Tables 1–3.

Curriculum Recommendations

For each of the identified roles, the SME groups were instructed to determine role specific curriculum topics including identification of requisite subject matter areas, key content within those areas, and identification of level of training required. While the three working groups provided recommended curriculum topics regarding the components of a comprehensive pediatric disaster preparedness training program,(16) the area of focus in this paper will be limited to CBRNE.

Training Topics for CBRNE

Four categories were utilized to describe the level of required training by each of the provider groups: foundational (overview), awareness (understanding concepts), proficient (capable of performing tasks), and expert (subject matter expert). The designation expert/proficient (E/P) was chosen for topics in which the group felt strongly that all practitioners should be proficient, but for which there should also be some expert-level assistance available.

EMS/Prehospital Care

The EMS SME group identified several key content areas within CBRNE. For explosives, important concepts in pediatric trauma management included crush injuries, compartment syndrome, and airway management. Chemical weapon topics included toxic syndromes and typical presentations of chemical exposures, including how they might differ in children versus adults, as well as which agents have therapies which need to be given in a time-sensitive manner, specifically organophosphates and cyanide. For biologic agents, the key issues identified included infection control, with respect to isolation and quarantine as opposed to normal hospital disposition, and recognition of patients who may be affected by a biologic agent. With regard to radiation, personal protection and decontamination were perceived to be the most important content areas.

Emergency Department/Hospital Care

The ED/Hospital SME group reviewed the various CBRNE agents (see Tables A.1 – A.4 in appendix). The crosscutting issues in CBRNE included: infection control, transmission, and communication. This group opined that the disaster team leadership needs to be aware of these unique care issues, but cannot be expected to be experts. They should, however, be expected to have access to an expert who can inform them as to how to best allocate resources and/or prepare the institution. Realistically, it is very difficult to expect expertise in any organization on all aspects of CBRNE, but providers need to be personally aware as disease recognition is key; therefore they need to be at the ‘proficient’ level at all times. All staff, in order to protect themselves, their patients and the organization, need to be very much aware of decontamination and containment concepts. Radiation (Table A.3 in appendix) is a uniquely problematic agent, encompassing the need to assess both short- and long-term disease impact, dealing with communication issues and dealing with non-organic disease concerns.

Ambulatory Care

With CBRNE issues (Tables A.5 – A.9 in the appendix), the ambulatory SME group felt that clinicians should be trained to an awareness level, with additional information conveyed through JIT training as appropriate; nevertheless, ambulatory clinicians should still be proficient in terms of recognizing chemical toxidromes, pathognomonic biological agent presentations and radiation sickness. Clinicians would also need to be proficient in personal protective equipment use, decontamination measures, and management of pediatric-specific vulnerabilities. In terms of radiation, in particular, the primary care clinician would be responsible for first line assessment and response, but also continuing care of the patient in

the disaster setting. These responsibilities would include proficiency in monitoring for delayed effects of radiation, such as radiation sickness and marrow suppression. They also would need basic knowledge in monitoring for long-term complications in conjunction with appropriate specialists.

EXAMPLES OF POTENTIAL CBRNE CONTENT SOURCES

There is a wealth of high quality, vetted literature and web-based CBRNE resources that will enable the easy development of “user friendly” platforms for educational, reference and just-in-time training purposes.

Examples include:

1. For prehospital and hospital care providers the second generation of the chemical hazards emergency medical management (CHEMM) web site housed at the National Library of Medicine will serve as a comprehensive reference for the diagnosis and treatment of chemical warfare and HAZMAT agents.(18) The development of this web site included SMEs from the following Federal Agencies; the National Library of Medicine (Division of Specialized Information Services), NICHD, NINDS (CounterACT), ASPR, and DHS as well as many academic clinicians. This web site/app will also provide toxidrome/individual agent-based just-in-time sheets for clinicians. The vulnerabilities and treatment of children are also addressed. The format of this website enables the easy development of role specific, competency-based, computer and seminar training.
2. The radiological emergency medical management (REMM) website/app is a comprehensive educational and patient management resource. Utilizing highly user friendly algorithms it provides succinct initial and follow-up care guidance. The app format is particularly conducive to the easy development of computer based training (CBTs). REMM was produced by the HHS ASPR Office of Planning and Emergency Operations, in cooperation with the National Library of Medicine, Division of Specialized Information Services, with subject matter experts from the National Cancer Institute, the CDC, and many US and international consultants. (19)
3. The CDC recently developed a blast injury application. The website’s blast injury fact sheets for professionals (which form the content basis for the app) provides a broad overview of the mechanism, clinical effects and treatment of blast-related injuries (including pediatric content). The key mechanisms of injury in blast-related injury and “regular trauma” are well described. Therapeutic recommendations are provided with the assumption that the clinician already has expertise in the specific area being addressed.(20)
4. Based on the proceedings of a jointly sponsored workshop held at the CDC, in November 2012, SMEs from the CDC and the AAP developed a Pediatric Anthrax Clinical Guidance.(21) This document provides a comprehensive understanding of the pathophysiology and clinical presentation of the disease as well as clinical guidelines for the prophylaxis and treatment of children in the event of a B.

anthracis release. It offers guidance in areas where the unique characteristics of children dictate a different clinical recommendation from that for adults. Included in this review were guidelines of therapeutic resources. This content can be easily modified for role specific competency based education and training purposes as well as JIT sheets.(22)

5. The HHS ASPR Office of Policy and Planning (OPP) is charged with developing, implementing, and coordinating strategies and policies for public health emergency preparedness and response activities. The Division of Medical Countermeasures (MCM) Strategy and Requirements within OPP leads the effort to develop planning and analysis activities, policy initiatives and requirements to protect the US population from CBRNE related emergencies. An example of their work was the hosting of a two-day conference whose focus was the development of clinical utilization recommendations for the use of MCMs held in the strategic national stockpile to treat individuals in a botulinum toxin mass casualty incident. The product of the conference was a highly vetted comprehensive clinical document that provided an excellent overview of the microbiology, toxin mechanism of action, clinical presentation, diagnosis and treatment of children and adults. Utilizing this mechanism (which includes governmental and academic SMEs) for clinical guidance development of other CBRNE agents will result high quality educational content that could be easily be formatted into CBTs/seminars and JIT sheets.(23)
6. There are numerous governmental and private sector based platforms that can be utilized for competency-based role specific learning:(24,25)
 - TRAIN (or Training Finder Real-time Affiliated Integrated Network) is a web-based platform that provides a clearinghouse of on-site training and distance learning opportunities available in local, state, and national jurisdictions. <http://www.phf.org/programs/TRAIN/Pages/default.aspx>
 - Responder e-learn 2.0 is an integrated medical, public health, preparedness and response educational platform currently utilized by the National Disaster Medical System <https://www.respondere-learn.com/>

SUMMARY – NEXT STEPS

While the Federal government has made substantial efforts to prioritize and address the needs of children through agency-specific activities, enhanced interagency collaboration, and the establishment of the U.S. Department of Health and Human Services Public Health Emergency Medical Countermeasures Enterprise's (PHEMCE) Pediatric Obstetric Integrated Process Team, significant education and training gaps still remain regarding the diagnosis and treatment of children exposed to CBRNE agents.

The greatest impact on reducing pediatric morbidity and mortality following an incident would be achieved by providing CBRNE training as a first step for prioritized EMS, ED/ hospital, and ambulatory care clinicians. Significant cost savings can be achieved because many of the identified roles have significant curriculum content overlap, thus making the

development of a modular based program feasible. Much of the content of a pediatric disaster preparedness education and training program could also be utilized to treat adults, and the current availability of high quality, previously vetted literature, and web-based resources enable the easy development of “user friendly” platforms for educational purposes.

In order to facilitate the successful development of this program the authors recommend that a steering committee composed of public and private sector academic and professional organization SMEs be created to oversee development and implementation. The formation of a National Advisory Committee on Children and Disasters offers a potential venue for further progress towards the adoption of core competencies for pediatric care, and the alignment of educational resources for the many roles and disciplines involved in disaster response.

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APPENDIX

Table A.1

ED/hospital care providers – chemical agents.

Topic	Roles With Level of Performance			
	EC Providers	Surge Providers	Disaster Leadership	Support Providers
Nerve Agent/Organophosphates	P	P	A	A/P
Cyanide	P	P	A	A/P
Mustard	P	P	A	A/P
Lewisite	P	P	A	A/P
Chlorine	P	P	A	A/P
Phosgene	P	P	A	A/P
Ammonia	P	P	A	A/P
Solvents	P	P	A	A/P
Unidentified chemical	P	P	A	A/P
Incapacitants	P	P	A	A/P
Recognition	P	P	P	A

Topic	Roles With Level of Performance			
	EC Providers	Surge Providers	Disaster Leadership	Support Providers
Decontamination	P	P	P	P
Containment/provider protection	P	P	P	P

Table A.2

ED/hospital care providers – biological agents.

Topic	Roles With Level of Performance			
	EC Providers	Surge Providers	Disaster Leadership	Support Providers
Anthrax	P	P	A	A/P
Pandemic influenza	P	P	A	A/P
Smallpox	P	P	A	A/P
Viral hemorrhagic fevers	P	P	A	A/P
Botulism	P	P	A	A/P
Ricin	P	P	A	A/P
Plague	P	P	A	A/P
Brucellosis	P	P	A	A/P
Recognition	P	P	A	A
Infection control	P	P	P	P
Transmission	P	P	P	P
Communication	P	P	P	A
Professional self care	P	P	P	P
Identifying new agents	P	P	A	F

Table A.3

ED/hospital care providers – radiation.

Topic	Roles With Level of Performance			
	EC Providers	Surge Providers	Disaster Leadership	Support Providers
Recognition	P	P	P	P
Decontamination	P	P	P	A
Containment provider protection	P	P	P	P
Professional self care	P	P	P	P
Dose estimation	P	P	P	A
Specific communication	P	P	E/P	A

Table A.4

ED/hospital care providers –explosives.

Topic	Roles With Level of Performance			
	EC Providers	Surge Providers	Disaster Leadership	Support Providers
Assessment of trauma patient	P	P	A	A/P
Initial management of burns, airway management	P	P	A	A/P
Traumatic brain injury	P	P	A	A/P
Injuries to skull, spine & chest	P	P	A	A/P
Mangled extremities in MCI	P	P	A	A/P
Crush & compartment syndrome	P	P	A	A/P

Table A.5

Ambulatory care providers – chemical agents.

Topics	Roles-Level		
	PCP	PC(RN)	APCP
Toxidromes	P	P	P
Rescuer protection/PPE	A	A	A
Decontamination	A	P	A
Pediatric vulnerabilities	P	P	P
Treatment	P	P	

Table A.6

Ambulatory care providers – biologicals.

Topics	Roles with Level of Performance		
	PCP	PC(RN)	APCP
Recognition, clinical signs and symptoms	P	P	P
Decontamination	A	P	A
Isolation-transmission based precautions, PPE	P	P	P
Communication-hospital infection control, public health	P	P	P
Differential Dx	A	A	A
Laboratory testing	A	A	A
Treatment, prophylaxis	A	A	A

Table A.7

Ambulatory care providers – specific biological agents.

Topics	Roles With Level of Performance		
	PCP	PC(RN)	APC
Anthrax	A/P*	A/P*	
Pandemic Influenza	A/P	A/P	
Smallpox	A/P	A/P	
Viral hemorrhagic fevers	A/P	A/P	
Botulism	A/P	A/P	
Ricin	A/P	A/P	
Plague	A/P	A/P	
Brucellosis	A/P	A/P	
Tularemia	A/P	A/P	

Table A.8

Ambulatory care providers – radiation.

Topics	Roles With Level of Performance		
	PCP	PC(RN)	APCP
Overview radiation concepts, delivery sources	A	A	A
Shelter in place, evacuation	A	A	A
Radiation triage, decontamination, And PPEs	P	P	P
Acute radiation sickness (diagnosis and management)-biodosimetry, biomarkers, other lab testing, treatment	A	A	A
Radiation–management of burns, blast, and blunt trauma-surgical guidance	A	A	A
Internal contamination-treatment modalities (i.e. blocking agents, chelating agents)	A	A	A
Assessing dose; pediatric vulnerability	P	A	A/P
F/U - include long term management	A	A	A

Table A.9

Ambulatory care providers – explosives.

Topics	Roles with Level of Performance		
	PCP	PC(RN)	APCP
Primary injury (shockwave)	A	A	A
Secondary injury (fragments/shrapnel& penetrating trauma)	A	A	A
Tertiary injury (blast wind, collision w/objects; blunt and penetrating),	A	A	A
Quaternary injury (burns, inhalation)	A	A	A
Assessment of trauma patient (1st responder)	A	A	A
Initial management of burns, airway management (1st responder)	A	A	A

Topics	Roles with Level of Performance		
	PCP	PC(RN)	APCP
Traumatic brain injury	A	A	A
Injuries to the skull, spine and chest (1st responder)	A	A	A

Table 1

The EMS/first responder SME group prioritized three tiers of potential disaster responders for training:

Tier One	Tier Two	Tier Three
Medical professionals that are involved in initial field response		
EMTs	Fire	Teachers
Paramedics	Police	Secondary responders
	School nurses	Child care workers
	Search & rescue	Home healthcare
	911 dispatchers	Teachers

Table 2

The ED/hospital SME group created three tiers of responders to target for training.

Tier One	Tier Two	Tier 3
Medical professionals that are involved in initial field response		
ED physicians	Hospitalists (physicians caring for hospitalized children)	Other hospital-based staff (laboratory, environmental services - Tier 2–3)
ED nurses	Medical sub-specialists (that can function as hospitalists)	
ED communication staff	Mid-level practitioners	
Trauma surgeons	Respiratory care providers	
General surgeons, neurosurgeons, orthopedic surgeons	Surgical sub-specialists	
ED mid-level practitioners	Critical care specialists	
Radiation officer		
Security		

Table 3

The ambulatory SME group created three tiers of responders to target for training.

Tier One	Tier Two	Tier 3
Medical professionals experienced in pediatric primary care (longitudinal, all-encompassing)	Medical professionals experienced in adult primary care or pediatric subspecialty care	Other medical specialists (adult ambulatory specialists)
<i>Rationale:</i> Would already be usual source of care for children, most pediatric experience, least amount of pediatric disaster-specific training required	<i>Rationale:</i> Should be able to see children with specific pediatric training, preferably under direction of a pediatrician familiar with pediatric issues but would need training for care issues outside of their specialty	<i>Rationale:</i> May be independent if necessary but preferably supervised by pediatrician; will need enhanced education of pediatric basics
Primary care pediatrician (MD, NP, PA)	Family practice, not pediatric-oriented	Adult ambulatory/cognitive specialist
Primary care pediatric nurse	Primary care internist	Adult specialist RN
Primary care family (who regularly sees children)	Pediatric ambulatory/cognitive subspecialists	
Pediatric specialist who treats "whole child"	Adult primary care RN	
	Pediatric subspecialty RN	
	Pediatric primary care office staff	