Abstract:

Healthcare providers are critical to disaster response throughout the world. Increasingly, there are government and nongovernment sponsored opportunities for providers to participate in disaster response as members of disaster response teams. Training regarding principles and practices of disaster response should begin long before ever deploying for a disaster. Training opportunities on-line and in-person are readily available, but not usually for a specific disaster at the time it occurs. Just-in-time disaster specific training prepares providers for imminent deployment for a real-time disaster. Particularly for disaster response in an austere environment, just-in-time disaster specific training optimizes preparation and response. This manuscript offers topics, strategies, and modalities for just-in-time pediatric-focused disaster training regarding situational awareness, personal preparation and resiliency, and delivery of patient care for austere environments.

Keywords:

Disaster response; just-in-time training; situational awareness; personal preparedness; resiliency; austere environments

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Just-in-Time Training for Disaster Response in the Austere Environment

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Every year natural disasters affect on average approximately 217 million people and kill approximately 76 000 people worldwide.[1,2] Over the last 20 years there have been over 4.4 billion disaster victims.[3] Manmade environmental accidents and intentional CBRNE (chemical, biologic, radiation, nuclear, explosive) disasters, while fewer in number and usually affecting fewer people, are often disasters that have long-term impact.[4] Disasters disrupt the environment, societal infrastructure and services, and by definition result in needs that exceed local capacity. While low- to moderately low-resourced countries are usually the most severely impacted, even in well-resourced countries disasters may cause catastrophic disruption of infrastructure and services. Hurricane Katrina in 2005, which affected much of the southeastern United States (US), forced shutdown of New Orleans, the first and only closure of a major US city. With nearly 400 disasters each year over the last decade, and approximately 1 per week that has required international response, deployment of civilian healthcare providers is critical to augment local, government, and military response.

It is essential that providers considering deployment recognize and are trained for the unique features of disasters and disaster

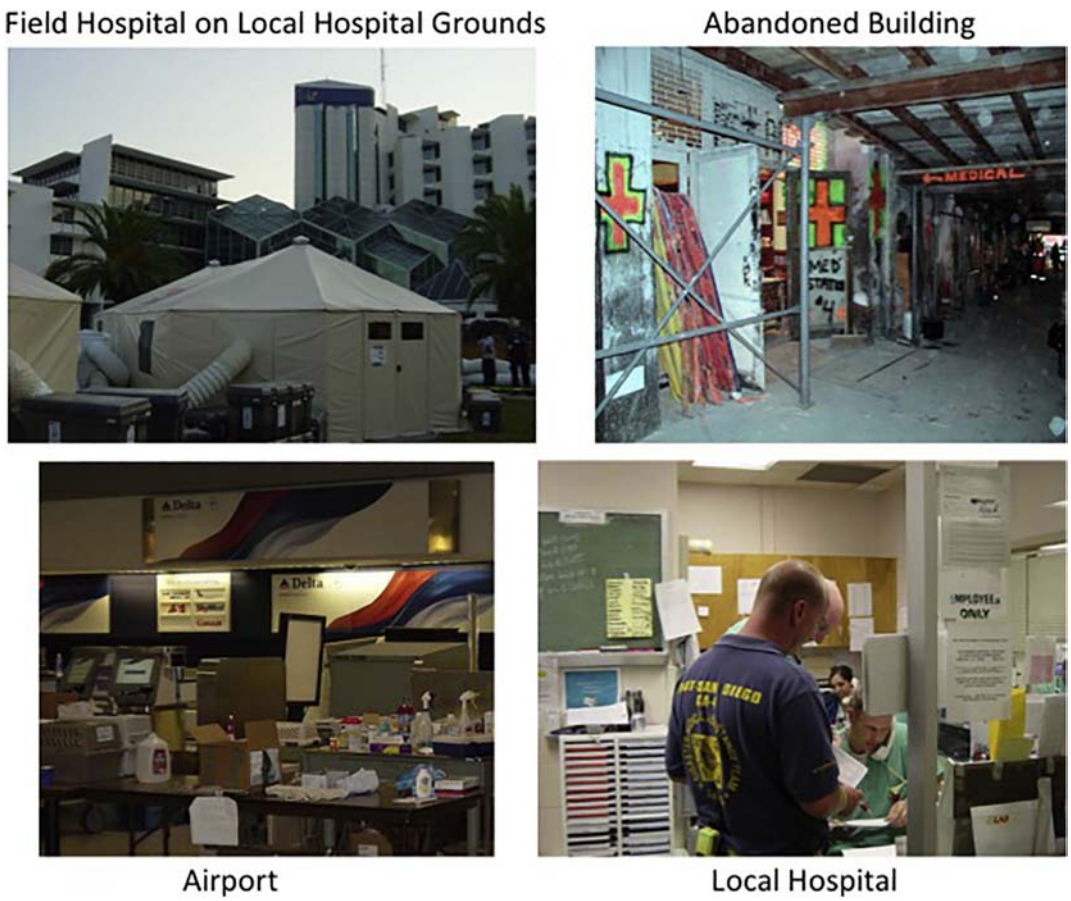

Figure 1. Healthcare delivery sites.

response, as well as understand deployment options, roles, responsibilities, and risks.[5,6] The number of disaster victims can quickly exceed healthcare capacity especially when healthcare facilities are compromised. Healthcare facilities and care delivery must often be rapidly established at sites such as field hospitals, schools, stadiums, and airports (Figures 1, 2).[7] Type and severity of injuries and illnesses are often out of the scope of, or rarely seen in, usual clinical practice. Limited resources require allocation strategies and adaptations of healthcare practices to resources available to do as much good for the most patients possible. While very rewarding, disaster response, particularly in austere environments, can be physically demanding, and emotionally and psychologically challenging. Training regarding principles and practices of disaster medicine and deployment should begin long before deploying and should be continuous. Online and in-person trainings developed by government and private entities are available for ongoing training, but not usually targeted for a specific disaster at the time it occurs.[8-15] Just-in-time disaster training just prior to deployment focusing on disaster specific information, tasks, skills and knowledge is important to prepare providers for the deployment experience and to maximize the effectiveness of disaster response. Particularly for providers who work in well-resourced healthcare settings and are deploying to an austere environment, training should impart an understanding of the impact of specific disasters on the environment and infrastructure, population vulnerabilities to specific disasters, and evaluation and management of victims in disrupted, resource-limited environments. This manuscript offers disaster educators and learners topics, strategies, and modalities for just-in-time disaster training for pediatric disaster response deployment to austere environments.

OPPORTUNITIES FOR DISASTER DEPLOYMENT

Most disaster response is performed by disaster medical teams organized and supported by federal,

Figure 2. Field hospital.

state, and/or local governments, non-governmental organizations (NGOs), hospitals and/or professional organizations. Disaster medical teams are mobile, self-contained, self-sufficient, multidisciplinary disaster-trained units that can deploy within hours of a disaster or be pre-positioned prior to disaster; establish their own field hospital; provide healthcare within 24 to 72 hours; and have sufficient equipment, supplies, food and water for at least 72 hours. Team members may include physicians, nurses, midlevel providers, pharmacists, respiratory therapists, emergency medical technicians (EMTs), and paramedics, as well as logistics, communication, security and command personnel. There are many models for disaster medical teams that have been developed around the world. Disaster response entities, in addition to verifying and credentialing, are responsible for assuring appropriate training. Providers should not attempt to deploy independent of a disaster response team, or a sponsoring organization structured to provide disaster response. Despite best intentions, unvetted responders are often Ill-prepared, unable to provide services, cause patient harm, drain valuable limited resources, and put themselves at risk of peril.[16]

Governmental Organizations

In the US, the National Disaster Medical System (NDMS), https://www.phe.gov/Preparedness/responders/ndms/Pages/default.aspx, which is administered by the Department of Health and Human Services (HHS), assists US state and local authorities with disaster response. State, Federal and international medical response is provided by deployable Disaster Medical Assistance Teams (DMATs) and Trauma Critical Care Teams (TCCTs). Deployment through these venues is usually for 2–3 weeks with teams sequentially deploying as needed to provide response, sometimes for several months. NDMS team members become Federal employees when they are deployed or are training. The World Health Organization (WHO), https://www.who.int/hac/techguidance/preparedness/emergency_medical_teams/en/, a specialized agency of the United Nations, has created its own Geneva-based Emergency Medical Team (EMT) and a registry of EMTs worldwide.[17,18] The WHO, along with the Pan American Health Organization (PAHO), has developed standards for EMTs during sudden onset disasters.[19]

Nongovernment Organizations

Established in sites throughout the world, many NGOs provide long-term global health services that include disaster response as part of their mission.[20,21] They are usually well-resourced, integrated into the community, and have buy-in from, and the trust of the community and government. They may have adequate personnel and resources to provide disaster care and can do so nearly immediately if they have intact local infrastructure. NGOs may have their own disaster medical providers or may partner with other entities such as medical and academic institutions. Partners In Health, an NGO with an already established healthcare facility in Haiti, https://www.pih.org/, partnered with the University of Pennsylvania to provide disaster relief within days after the 2010 Haiti earthquake.[22] International Medical Corps (IMC), https://internationalmedicalcorps.org/program/emergency-response-preparedness/, and Americares, https://www.americares.org/en/what-we-do/emergency-programs/, each have their own EMTs which roster and provide disaster training for qualified healthcare providers. IMC has also partnered with academic institutions and/or hospital disaster teams that deploy under the auspices of IMC to disasters including the earthquakes in Haiti in 2010 and Nepal in 2015. Médecins Sans Frontières/Doctors Without Borders (MSF), https://www.doctorswithoutborders.org/, requires a 9–12 month commitment for humanitarian initiatives and if disaster response is needed engages MSF disaster-trained employees.

State and Local Teams

Increasingly states and hospitals are creating small, well-trained local teams that can deploy within 6 hours of a disaster.[23] In addition to deployment in response to a request from, and under the auspices of, a well-established NGO that coordinates and manages the deployment and provides equipment and supplies; some teams are supported and equipped to deploy independently. The US Emergency System for Advance Registration of Volunteer Health Professionals (ESAR-VHP) is a federal program administered by the HHS Office of the Assistant Secretary for Preparedness and Response (ASPR) that assists states and territories in establishing state-level standardized volunteer registration programs for disasters, public health and medical emergencies, and verifies identities, licenses, and credentials of volunteers, https://www.phe.gov/esarvhp/Pages/About.aspx.

DIFFERENCES BETWEEN GLOBAL HEALTH AND DISASTER DEPLOYMENT

It is not uncommon that global health providers are interested in deploying for disaster response.[24,25] Disaster response deployment and global health deployment, while similar in some ways, have distinct and important differences. Global health providers have valuable knowledge, skills, and experience applicable to disaster response in the austere environment, but for those without disaster response training and/or experience, it is critical that just-in-time training highlight major differences in disaster response deployment. Global health work is usually planned well in advance, provider roles are usually defined prior to deployment, the work environment is already established, and expectations for local conditions, injury types, and illnesses are mostly known. Goals of global health work may include providing patient care, education and/or capacity building. Disaster response does not allow advance planning for timing or location, and therefore requires that providers have unscheduled blocks of routine clinical time during which they are on call, or that they can be relieved of routine clinical responsibilities for disaster deployment. With the exception of disaster healthcare providers who deploy to established NGO healthcare facilities, disaster providers often do not know where they will be deployed, nearly always have direct patient care roles, may have unanticipated patient care responsibilities, and may work at different locations during their deployment. Deployments for disaster relief are usually short in duration; often 2–3 weeks, and rarely extend beyond 2 months, while global health deployments, are often at least a month if not several months or longer. Disaster response work hours are usually longer, and the patient care and self-care conditions are often more austere. Global health fosters opportunities for ongoing contribution at the same site and relationships with local workers and the community. Disaster deployment is to different sites, and for healthcare providers, interactions are mostly within the disaster team.

JUST-IN-TIME TRAINING

Even for well-trained disaster responders, just-in-time disaster specific training is essential to optimize responder preparedness, performance, and personal well-being. While there are elements common to each disaster response, the specific disaster and site makes each response unique. Just-in-time training should focus on those unique elements of the specific disaster while refreshing

TABLE 1. Training modalities, topics.

	Classroom/Screen *	Tabletop	Workshop *	Simulation
Situational Awareness	· Pre-, post disaster Information, updates			
Personal Preparedness, Resilience	· Images, videos of work environments, previous similar disasters, current disaster i.e. field hospital, buildings adapted for care · Team structure, incident command, team member roles responsibilities · Lists personal supplies, packing instructions, 'go bag'	· Share experiences, challenges, strategies personal care pre-, during, post-deployment · Identify, plan for possible personal health, safety risks, challenges		· Incorporate challenges of austere environment, provider psychosocial challenges related to patient volume, critical injury/illness, death into patient care scenarios
Patient Care	· Principles of crisis resource management · Pediatric vulnerabilities, manifestations, evaluation, management of disaster-specific injury, illness · Principles of teamwork	· Identify patient care needs, obstacles, develop strategies, plans, logistics-space, staff, equipment, supplies · Triage · Allocation of resources, adaptation of care to for resource-limited environment · Working with providers with limited pediatric knowledge and skills · Engaging family in care · Family reunification	· Procedures w/ adaptations for limited-resource environments · Airway management · Vascular access · Hemorrhage control · Needle decompression chest/pigtail tube · Laceration/wound care · Fracture reduction, casting/splinting · Bladder catheterization, suprapubic tap · Abscess incision, drainage · Childbirth, neonatal resuscitation · Ultrasound-diagnosis, procedure guidance · Patient evaluation, monitoring, treatment delivery-equipment, supplies w/ adaptations limited-resource environments · Donning, doffing hazmat PPE, decontamination principles, practices, challenges related to infants and children	**Medical conditions** · Disaster event illness, injury, critical care · Disrupted environment illness, injury, ingestion · Conditions rarely seen · Patients out of scope of usual practice · Acute manifestations of untreated chronic conditions · Psychiatric manifestations **Situational challenges** · Crisis resource management · Limited diagnostics, equipment, supplies, therapeutics · Working with providers with limited pediatric knowledge and skills · Psychosocial challenges, language barrier, difficult conversations, cultural sensitivity

* Consider augmented reality and/or virtual reality if available.

and reinforcing more general disaster response principles and practices. Just-in-time training should include disaster-specific: 1) situational awareness, 2) personal preparedness and resilience, and 3) patient care training. Strategically combining teaching modalities including classroom, screen, tabletop exercises, workshops, mannequin-based simulation and augmented reality (AR) and virtual reality (VR) can maximize efficiency and effectiveness of training (Table 1).[26,27]

As circumstances, resources, and time allow, in-person group training affords opportunities to personalize content to participant knowledge, expertise and experience. It also allows for participants to share experiences, ideas and concerns, and for team building. For those with limited disaster experience, training that creates a deployment-like experience should be a major goal. In our experience, a 4-hour session has been efficient and effective for training 4 teams of up to 6–8 providers. Teams rotate through topics with 30 minutes each for situational awareness and principles of crisis resource management and incident command, then 30–60 minutes for personal preparedness and resilience, and 2.5 to 3 hours for patient care training.

Classroom and screen-based learning are low-cost, efficient modalities for conveying factual information. Classroom learning provides individuals the opportunity to engage directly with faculty and learn from their expertise and experience. Screen offers self-directed, need-focused learning with access to peer-reviewed relevant content, the opportunity to re-access content on-demand, and the ability to track participation and competency. Tabletop exercises offer the opportunity to share expertise and perspectives in order to identify response, topic, or task specific needs and challenges and to develop strategies and plan out logistics while building teamwork within and across provider roles.[28] Workshops provide hands-on, individual, role-relevant skills training and should include adaptive strategies for limited resource environments. Simulation, using high and/or low fidelity mannequins, affords the opportunity to simulate the disaster response environment, and to apply classroom, screen, tabletop exercise and workshop principles and practices of disaster specific care and crisis resource management. It allows participants to hone teamwork skills and to assess knowledge and performance while identifying and addressing gaps. Large scale live simulation drills will not be practical given the time required to plan and resources to conduct them. The use of AR and VR for disaster training is becoming more available and provides an immersive training experience that simulates disaster environments and situations. AR/VR enables interaction between healthcare providers who function in different spaces including first responders who transport patients to care, providers at acute care disaster response facilities, and those at facilities to which patients can be transferred for definitive care.[29-31] For those who have never deployed or trained for disaster or global health, one may consider imposing austere environment conditions by scheduling training after clinical shifts, providing a disaster type meal, and/or having providers sleep overnight at work or outside in a tent before or after training.

SITUATIONAL AWARENESS

Situational awareness training should provide information regarding the disaster event and its impact, known and anticipated disaster response needs, and current disaster response initiatives. Knowing the type of disaster, geographic area, population affected, and infrastructure disruption provides insight into types of injury and illness likely to be seen, as well as the disaster response personnel, resources and duration of response required. Information regarding the region's pre-disaster geography, politics, economy, and culture inform how disaster response is authorized, coordinated and structured, which entities will deploy, and where and how they will augment local capacity. Situational awareness is important not only in setting expectations, but also for enabling providers to determine whether this specific deployment is appropriate for them.

Training

Much of the information regarding the disaster will be available through television, radio print, screen and social media. The goal of training is to provide and contextualize information about the disaster and the region as it is relevant to the disaster response. Classroom, screen, web conference/call or email/social media are likely to be the most efficient modalities for presenting and updating this information, and several modalities should be used to accommodate user access and preferences (Appendix A).

PERSONAL PREPAREDNESS AND RESILIENCE

Perhaps the most under-appreciated aspect of deployment is personal preparedness. As gratifying

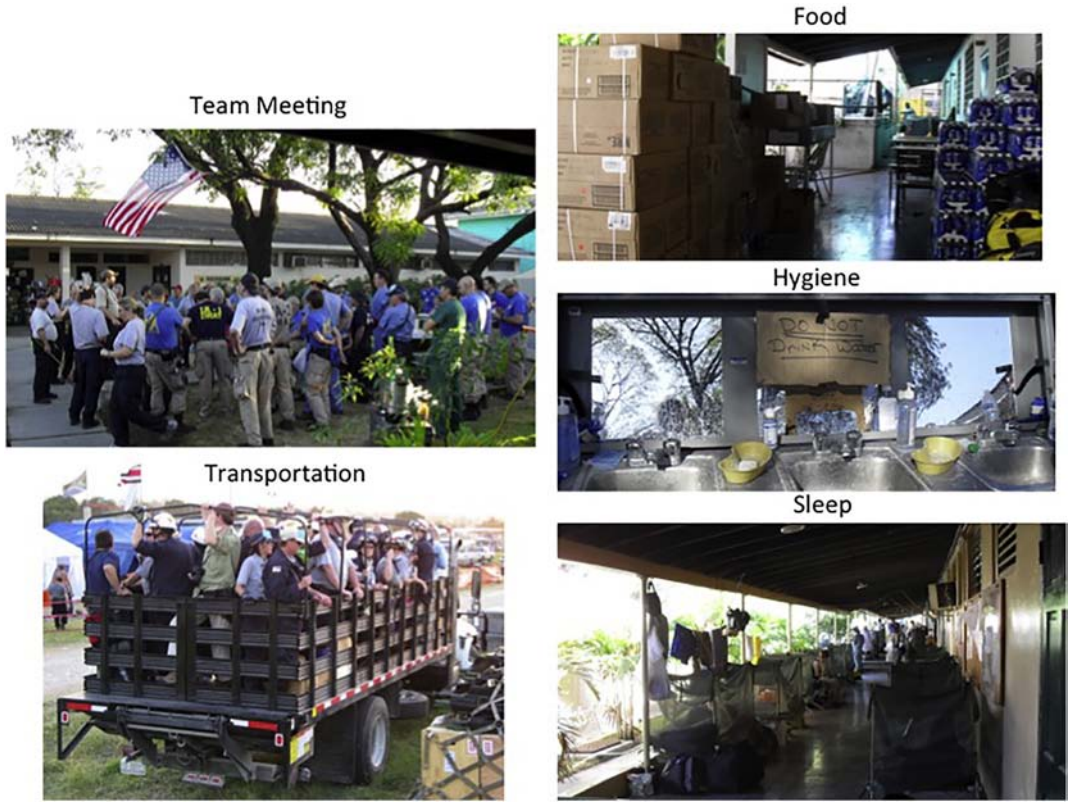

Figure 3. Personal experience, care.

as it is to contribute to disaster relief efforts, it is physically and mentally challenging for even the most seasoned disaster response providers.[32] Recognizing and acknowledging one's own strengths and limitations, needs, stressors, adaptability, and coping mechanisms is critical. Personal preparedness is essential for maximizing contribution to the disaster response and minimizing the likelihood of becoming a victim who increases demands on the relief effort.[33,34]

Location and work setting will have implications for personal preparedness and resiliency. Incident command leadership, working with federal and local government and nongovernmental community stakeholders, will determine where the team will be positioned, the role of the team in supporting local healthcare capacity, and the interactions of the team with local providers. Travel to disaster sites may be lengthy due to disrupted transportation infrastructure and services. Obtaining government permissions and clearances may also delay travel. On arrival, teams may need to establish self-sufficient, free-standing field hospitals and/or transform existing structures such as a school, stadium, or airport into medical care facilities (Figure 1). Teams may interface with existing functional health care facilities if they are in close proximity. Alternatively, team members may be assigned to work directly with local healthcare providers within existing healthcare facilities or those established by local entities for disaster response. Shifts are usually at least 8–16 hours covering 24 hours a day with many days in a row. Sleep, diet, exercise, and hygiene will undoubtedly be suboptimal (Figure 3). Exposure to disaster related health hazards, weather, air quality, and insects may all pose risks.[35] Perhaps least expected are the challenges faced on return. Assimilation back into everyday life can be difficult and takes time physically, socially and emotionally. Sleep, thoughts, life and work obligations, and interactions may all be challenging.

Training

Classroom/screen are well suited for informational content regarding deployment site(s) and the healthcare setting(s), team structure, member roles and responsibilities, travel and packing. Tabletop exercises teach providers to identify and share experiences, challenges, and concerns, and plan strategies for personal preparedness and resiliency. Content from classroom/screen and tabletop exercises are ideally linked to patient care scenarios to contextualize and apply content and concepts (Appendix A, B).

TABLE 2. Disaster-related medical conditions

- Trauma
- Food and water related illnesses: hepatitis A, typhoid fever, cholera
- Infectious diseases: SARS, MERS, influenza, Ebola, tuberculosis
- Insect borne illness: yellow fever, malaria, dengue, West Nile, Zika, eastern equine encephalitis, Chikungunya
- Rashes, skin infections
- Heat and cold illness and injury
- Chronic disease exacerbations
- Toxic exposures due to disrupted environment: ingestion, inhalation
- Electrocution
- Man-made environmental accident, CBRNE exposures

PATIENT CARE TRAINING

Just-in-time disaster patient care training should reinforce prior disaster training but emphasize the specific disaster, the response setting(s), current operational local healthcare facilities and capacity, other healthcare disaster response entities and their capacity, local condition-specific healthcare practices, disaster team roles and individual roles, the unique disaster-specific vulnerabilities of children, anticipated injuries and illnesses due to the disaster event and the post-disaster environment (Table 2), and duration over which patients are likely to present.[36-39] Disasters such as hurricanes, tornados, floods, tsunamis, and earthquakes rapidly impact large geographic areas and can result in large numbers of victims and profoundly impact infrastructure. These will likely require disaster response from remote entities. Furthermore, local healthcare facilities may be forced to close due to structural damage, loss of utilities and/or communication capabilities, or because they are inaccessible. Individual healthcare providers and/or their families may be personally affected by the disaster and therefore unable to work or get to work. The goals of disaster medical care are evaluation, definitive care if possible, stabilization and evacuation of victims whose needs exceed disaster team capabilities, and comfort measures for victims who cannot be saved. Disaster response should augment, not replace, local healthcare and should be respectful of local practices and culture.

Figure 4. Low-resource adaptations.

Figure 5. Simulation to 'transport' providers to austere disaster response environment.

Victims with acutely life-threatening injuries usually present within the first 24 hours if they can get to care. Pre-deployed disaster teams and NGOs already established in the region may be able to provide immediate medical services for these patients, but by the time most disaster response providers are positioned to provide care, the most severely injured will have either received care or died. In the days following the onset of disaster the number and severity of injuries due to the disaster event decreases, but there are increases in the injuries due to the hazardous environment and limited supervision; such as fractures, lacerations and head trauma due to falls or falling debris, burns from fires and generators, electrocution due to downed power lines, and unintentional injuries secondary to the use of tools. Temperature extremes may cause heat and/or cold related conditions, particularly for those at extremes of age. Infectious diseases increase due to crowded conditions, compromised water and food supplies, and breeding of disease-carrying mosquitos, particularly after disasters that result in flooding.

Disaster victims with chronic medical conditions (eg, seizures, diabetes, thyroid disease, cardiac disease, asthma, renal disease, malignancy) who do not have access to their medications; require infused medications or blood transfusions, and/or require treatments dependent on electricity (e.g. respiratory support or dialysis) and may become acutely ill in the absence of access to ongoing care. Poor air quality may exacerbate cardiac and pulmonary disease. Limited formula and water may result in dehydration, particularly for neonates and young infants. Medical history may not be known or available, particularly for young or very ill children separated from their families and brought to medical care by those who do not have that information. Births not only continue, but the stress of disaster increases premature delivery.

Patient evaluation and management will be dependent on available resources and local practices. Disaster principles of care to do the most good for the greatest number begins with accurate triage[40-43] and often requires making difficult decisions throughout care. Diagnosis is often based only on history and physical exam given limited availability of laboratory testing and imaging. Treatment options may be limited and care delivery may require adaption. Patients who are treated and released may need adaptive plans for medications, wound care, and follow up, particularly if they do not have access to

Figure 6. Simulation scenarios.

electricity and/or clean water. Consideration must be given to long-term care for patients with life-changing injuries, such as those who require amputation. Psychosocial impact and manifestations in children should be recognized, mitigated and managed as part of immediate care, with plans and capacity developed for long-term support.[44] Parents often seek care for their children prior to themselves so it is important to recognize when adults with children also require care. Shelter, safe water and food, clothing, a safe environment and security are important in mitigating healthcare needs. Disaster teams benefit from partnering with local healthcare and public health entities to identify and manage public health emergencies due to the disrupted environment.

Training

Classroom/screen training can reinforce principles and practices of disaster specific resource management, as well as provide information about clinical care of specific disaster relevant injuries and illnesses.[45-54] Workshops give providers opportunities to hone role-specific procedural skills[55-60] and learn low resource adaptations (Figures 4, 5),[55-56] contextualize bedside ultrasound skills to disaster medicine, and experience the use of hazmat personal protective gear and decontamination of victims.[57] Tabletop exercises provide opportunities to focus on specific disaster relevant care needs, challenges, gaps, and to explore options. A scenario can be presented and groups can be assigned based on expertise and role(s). Then, a scenario-related topic or task is given to each group and they should present their summarized discussion. This can prepare participants for mannequin simulation, and, if necessary substitute for a simulation (Appendix A, Appendix B).

Simulation and debriefing provides opportunities to reinforce classroom/screen, tabletop exercises, and workshop training in a simulated disaster environment.[58-60] Unlike simulation for most other training, which strives to create a well-controlled, well-resourced environment, a major value of simulation for disaster training is that it allows creation of an unfamiliar, under-resourced, chaotic environment (Figure 5, 6). Simulation sessions should begin with a brief introduction and state the goals of the session. Specific attention should be paid to recognizing that the austere environment and unfamiliar conditions may be stressful and assuring psychological safety with debriefing that assesses team rather than individual performance while also providing opportunities to identify and close personal gaps. Scenarios should combine principles and practices of disaster response, disaster-specific injury and illness, teamwork and limited resources (Table 3, Figure 6). Facilitators contextualize objectives based on provider's expertise and role. We suggest scenarios run long enough to allow frustration to build, and if necessary use a comment or question to redirect participants without pausing the scenario until ready to stop the case. Debriefing should immediately follow each case. The PEARLS (Promoting Excellence and Reflective Learning in Simulation) approach to debriefing provides a conceptual

TABLE 3. Table simulation scenarios

Disaster Sequelae	Disaster Disrupted Environment	Conditions Rarely Seen
History: 10 y/o M w/ fever, decreasing LOC over last 2d since earthquake 4d ago, now seizing, carried by family members, each holding one extremity. **Exam**: 02sat 88%, battle sign **Testing**: ± blood, CSF testing when stable **Treatment**: lorazepam. Antibiotic, antipyretic **Additional history**: head injury during due to earthquake building collapse **Diagnosis**: presumed meningitis, basilar skull fracture **Disposition**: ICU, local or field hospital **Key learning**: unfamiliar environment, unknown team members, unknown if intracranial injury, unable to r/o increased ICP, exposure of team to meningitis requires prophylaxis **Other cases**: respiratory distress due to near drowning **Key learning**: flood, tsunami, hurricane related conditions	**History Case 1**: 3 y/o M fever, vomiting, diarrhea, lethargy **Exam**: dehydration, rash, distended tense abdomen **Testing**: glucose **Treatment**: IVF, glucose, antibiotics **Diagnosis**: typhoid fever **Disposition**: field hospital **Key learning**: disaster specific conditions after flood-typhoid, cholera, leptospirosis, hepatitis precautions **History Case 2**: 3 M y/o found unresponsive, breathing, carried to care by mother **Exam**: unresponsive **Evaluation**: glucose **Treatment**: observation by mother, no monitor **Diagnosis**: presumed ingestion **Disposition**: discharged once alert **Key learning**: disrupted environmental hazards **Other cases**: severe heat illness, hypothermia **Key learning**: weather related critical illness	**History**: 3 wk. old male twin B neonate with fever, lethargy, poor feeding **Exam**: tetany **Testing**: glucose, + blood, urine, CSF testing **Treatment**: antipyretic, glucose, IV antibiotics, tetanus immunoglobulin **Diagnosis**: tetanus **Additional history**: born outside, twin A well, scalpel to cut umbilical cord in dirt after use for twin A **Disposition**: ICU, ventilator **Key learning**: Diseases rarely seen, clinical diagnosis, allocation of resources, limited treatment options tetanus, withdraw of support **Consider**: 2nd patient-adult with tetanus, wound requiring foot amputation **Key learning**: age differences in etiology, manifestations, treatment **Other cases**: dengue, malaria, Chikungunya, West Nile, eastern equine encephalitis, yellow fever **Key learning**: endemic mosquito borne illness
Acute on Chronic Disease, Untreated Disease **History**: ~2–6 mo old M, dropped in basket by helicopter, no other information **Exam**: alert, macrocephaly, sun downing **Testing**: none **Treatment**: ICP precautions **Diagnosis**: hydrocephalus **Disposition**: hospital with a neurosurgeon **Key learning**; stabilization, evacuation **Other cases**: rheumatic fever, hyperthyroid crisis **Key learning**: manifestations of untreated disease, initial management	**Childbirth** **History**: 24 y/o F 30 weeks pregnant in labor **Exam**: dilated 8 cm, contractions every 2 min **Testing**: none **Treatment**: child delivery, neonatal resuscitation, routine newborn care, respiratory distress **Diagnosis**: preterm newborn, mild respiratory distress **Disposition**: baby on site vs. evacuation **Key learning**: austere environment delivery, resuscitation, teamwork **Other cases**: neonatal hypoglycemia, hypothermia, fever, jaundice **Key learning**: recognizing, treating common conditions resource limited environment	**Adult** **History**: 30 y/o M gunshot wounds **Exam**: GCS 14, groaning, bleeding R back, L lower leg, trachea midli, R chest expanded, breath sounds decreased R, abdomen soft **Testing**: bedside ultrasound E-FAST after chest tube **Treatment**: R chest tube, leg hemorrhage control, IV fluids, transfusion, antibiotics, ± intubation **Diagnosis**: R hemothorax, L lower leg arterial bleed, tibia and fibula fracture **Disposition**: Field hospital OR vs. evacuation **Key learning**: patient age, penetrating injury out of scope of practice, ultrasound, environmental safety **Other cases**: penetrating spine, abdominal, trauma, tension pneumothorax **Key learning**: diagnosis, management, teamwork

TABLE 4. Disaster simulation principles, practices

Introduction	Scenarios	Debriefing
Goals of simulation training · Experience unfamiliar elements of disaster medicine · Supportive, safe learning experience **Scenarios focus on, combine** · Principles of disaster response · Disaster, region specific conditions · Prioritizing doing the most good for the greatest number · Teamwork · Environment-based obstacles and challenges · Limited resources · Differences in culture, beliefs, norms · Personal safety **Participation, debriefing** · Acknowledge participants may feel stressed given simulated disrupted, limited-resource setting, scenarios focus on the unfamiliar · Encourage suspending disbelief · Assure assessment will focus on team not individual performance to identify, close gaps and provide tips for disaster response **Orientation to mannequins, rules of engagement**	**Multidisciplinary team** · Limit number of providers, allow team to assign roles, ± engage others · Assign observers **Disrupted, austere environment** · Room too hot or cold, unfamiliar layout, noisy, suboptimal lighting, limited equipment, supplies **Disaster-specific patient care** · Limited patient information · Unfamiliar injuries/illnesses · Patients out of scope of usual age or subspecialty practice · Multiple patients · Distressed family members · Allocation of resources · Difficult decisions **Allow frustration to build, refrain from pausing case**	**Reaction** · How did that go? · How did that feel as related to disaster setting, disaster care? · How did you feel? **Reflection, self-assessment knowledge, performance** · How would you summarize the case? · What are key points related to disaster vulnerabilities, evaluation and management? · What was unexpected? What strategies did you use to overcome the unexpected? · How did it feel working as a team? What went well, what could be improved, how? · What else could you have done? What else would you have wanted or wanted to know? What would you do differently? · What did you learn about what you need to know, prepare for disaster response in the austere environment? **Feedback, teaching, tips** · Strengths, gaps, challenges, successes, opportunities disaster specific focus on crisis resource management, knowledge, performance as identified by participants, observers and facilitator

framework well suited for disaster simulation training debriefing. Based on learning goals, debriefing combines learner self-assessment, facilitated discussion, directive feedback and learning, and engage all participants, facilitators, and observers. Debriefing should be scripted but allow flexibility to focus on provider needs identified during the scenario and debriefing (Table 4).

While disaster training prior to deployment is essential, opportunities for effective, safe training en route to and during deployment should also be provided if possible, particularly as applicable to patient care conditions seen during the course of disaster. In addition, pre-deployment training and deployment should identify future opportunities for topics, and strategies for just-in-time pre-deployment training as well as how to incorporate training while on deployment.

SUMMARY

Civilian healthcare providers are essential to disaster response. Deployment should be as part of a disaster medical team. Disaster training that covers the principles and practices of disaster medicine and deployment should begin long before deploying and should be ongoing. Disaster specific, just-in-time training, particularly for austere environment deployment, should address situational awareness, personal preparedness and resilience, and patient care. This is necessary to optimize the effectiveness of disaster response and protect the physical and psychosocial wellness of disaster team members.

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APPENDIX A. TRAINING-SPECIFIC CONTENT

Topics for Situational Awareness Training

1. Country/state/region location, geography, population, language, government, economy, social structure
2. Country relations with entities deploying disaster providers,

(continued on next page)

Appendix A, (continued)

Topics for Situational Awareness Training

local authoritative disaster response entity/entities
3. Culture, religion, beliefs, values, norms
4. Politics
5. Weather
6. Healthcare system, facilities, and resources
7. Endemic conditions
8. Pre-disaster infrastructure and Impact of disaster on infrastructure-transportation, communication, healthcare facilities, housing, food, water, safety
9. Number, demographics of victims, types of injuries, illnesses resulting from disaster
10. Setting realistic expectations for disaster responders regarding disaster site conditions, known and anticipated specifics of the disaster response, other entities deploying with whom there may be interface or that may provide services (e.g. public health, CDC, military)

Topics for Preparedness and Resilience

1. What to expect: schedule, duration of deployment, work environment, physical/emotional impact, expect the unexpected, prepare for the worst, hope for the best
2. What to bring/how to pack-personal gear, foods, medications
3. Personal health: who should not deploy, how to prepare yourself, prophylaxis, immunization if time allows
4. Personal safety equipment and practices
5. Family preparation: strategies for meeting home obligations while away, communicating with family, friends
6. Employer/colleague expectations and garnering buy-in
7. Team structure: team member roles and expertise, personal roles and responsibilities
8. Physical and psychosocial challenges during deployment, maximizing wellness
9. Recognizing signs/symptoms of personal or co-workers physical, emotional and/or psychological stress and options for ideally mitigating stress and, if necessary, relinquishing responsibilities
10. What to expect on return home, opportunities for addressing physical and psychosocial challenges

Topics for Patient Care Training

1. Providing care in disrupted, austere environment
2. Disaster triage-tools
3. Teamwork: working with providers who do not know each other, roles based on knowledge and skills rather than titles, working with limited number of providers
4. Treating critically injured and ill patients
5. Conditions rarely seen and/or out of scope of usual practice
6. Patient age out of usual scope of practice (i.e. pediatric providers taking care of adults), supervising adult providers taking care of children
7. Care based on physical exam centered evaluation, treatment resources, options for definitive care, follow-up

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8. Crisis resource management principles and practice; most good for the greatest number; allocation of resources, difficult decisions, role of incident command in prioritizing patient care, disposition
9. Psychosocial: recognizing manifestations, patient, family care, reunification
10. Cultural sensitivity

APPENDIX B. TRAINING STRATEGIES

Training Strategies
1. Recreate the look and feel of the disrupted austere environment. Sheets on walls, unfamiliar arrangement of objects in the room, poor lighting, room temperature cold or hot, noise, limited equipment and supplies, monitor must be requested and may not be available. Consider training after a clinical shift when providers are tired
2. Practice use of established pediatric disaster triage tools recognizing their strengths and limitations for individual victim assessment, prioritizing multiple disaster victims
3. Multidisciplinary team providers who do not know each other or do not usually work together. Emphasize assigning roles, closed loop communication, tasks appropriately performed, shared decision making, limit number of available providers
4. Engage trainees in Pediatric Advanced Life Support, Neonatal Resuscitation Program critical care skills (e.g. airway management, ventilation, vascular access)
5. Use scenarios with disaster specific conditions outside of scope of usual practice, and superimposed psychosocial circumstances common in disaster care, including distraught family members, delivering bad news, language barrier, unaccompanied children, limited medical history
6. Identify age-specific considerations that other disaster providers may not know or be comfortable with: age specific vulnerabilities to injury and illness, vital signs, history, exam findings, airway, breathing, circulation, diagnoses, fluids and medication dosing and administration
7. Emphasize diagnosis based on history, physical exam, limited laboratory, imaging; use of unfamiliar equipment, adaptive substitutions, approaches; limited treatment options
8. Impose the requirement to allocate critical care equipment and personnel support, and deny, withdraw support for patients with low likelihood of survival
9. Provide insights into recognizing psychosocial stressors for patients and family members and providing psychosocial supportive environment and care
10. Identify and facilitate integrating cultural beliefs and values into disaster care

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