Emergency Preparedness for Clinicians - From Guidelines to the Front Line

Clinician Outreach and Communication Activity (COCA) Webinar
March 26, 2015
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Objectives

At the conclusion of this session, the participant will be able to:

- Outline the five main levels of disaster preparedness and response from the American College of Chest Physicians’ Guidelines for Care of the Critically Ill and Injured during Pandemics and Disasters
- Discuss the importance of pediatric emergency preparedness for both pediatric and non-pediatric providers
- Identify key lessons learned from the recent Ebola outbreak for improving emergency preparedness in North American
- Describe ways clinicians and public health practitioners can collaborate to respond to disasters and pandemics
TODAY’S PRESENTER

Michael D. Christian, MD, MSc
Chief Safety Officer
Vice Chair, Disaster Network
Niagara Health System
Lewis Rubinson, MD, PhD, FCCP
Associate Professor
University of Maryland School of Medicine
Director of the Critical Care Resuscitation Unit
R Adams Cowley Shock Trauma Center
Timothy Uyeki, MD, MPH, MPP
Chief Medical Officer
Influenza Division
National Center for Immunization and Respiratory Diseases
Clinical Team Lead - CDC Ebola Response
Emergency Preparedness for Clinicians - From Guidelines to the Front Line

Maj Mike Christian MD, MSc (Public Health), FRCPC
The Task Force For Mass Critical Care
Disclosures

- No financial conflicts, no off label products

- The opinions expressed within this manuscript are solely those of the author (MDC) and do not represent the official position or policy of the Royal Canadian Medical Service, Canadian Armed Forces or the Department of National

- The findings and conclusions in this presentation are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry
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Disasters
The challenge...

High quality evidence is lacking, but..
People need guidance
Introduction and Executive Summary

Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

Michael D. Christian, MD, FRCPC, FCCP; Asha V. Devereaux, MD, MPH, FCCP; Jeffrey R. Dichter, MD; Lewis Rubinson, MD, PhD; and Niranjan Kissoon, MBBS, FRCPC; on behalf of the Task Force for Mass Critical Care
Methodology
Care of the Critically Ill and Injured During Pandemics and Disasters:
CHEST Consensus Statement

Joe Ornelas, MS; Jeffrey R. Dichter, MD; Asha V. Devereaux, MD, MPH, FCCP; Niranjan Kissoon, MBBS, FRCPC; Alicia Livinski, MA, MPH; and Michael D. Christian, MD, FRCPC, FCCP; on behalf of the Task Force for Mass Critical Care
Task Force Participants

- 100 participants
- From 9 countries
  - 14 content experts
  - 68 panelists
  - 18 topic editors
- Clinicians/experts from wide variety of disciplines
  - Critical Care, Surgery, Trauma, Burn, Pulmonary Medicine, Internal Medicine, Military Medicine, Disaster Medicine, Infectious Diseases, Hospital Medicine, Ethics, Law, Public Health
- Diverse professions (MD, RN, RRT, Pharm, MPH, Admin, etc)
- Adult and pediatric populations
- 15 different professional societies and organizations
- Extensive Literature Review
- PICO & Delphi Methods
List of Reviewers

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- Curtis Sessler, MD, FCCP – President-Elect
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- Bhavinkumar D. Dalal, MD, FCCP
- Ann Weinacker, MD, FCCP

**Disaster Response Network**
- Sai Praveen Haranath, MBBS, MPH, FCCP
- Derek S. Wheelr, MD, FCCP
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Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

- Twelve manuscripts
- 267 suggestions
- 177 pages
- FREE on line!
Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

Endorsed by:

- American Association of Critical-Care Nurses
- American Association for Respiratory Care
- American College of Surgeons Committee on Trauma
- International Society of Nephrology
- Society for Academic Emergency Medicine
- Society of Critical Care Medicine
- Society of Hospital Medicine
- World Federation of Pediatric Intensive and Critical Care Societies
- World Federation of Societies of Intensive and Critical Care Medicine
Surge Capacity Principles
Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

John L. Hick, MD; Sharon Einav, MD; Dan Hanifling, MD; Niranjan Kissoon, MBBS, FRCP; Jeffrey R. Dichter, MD; Asha V. Devereaux, MD, MPH, FCCP; and Michael D. Christian, MD, FRCP, FCCP, on behalf of the Task Force for Mass Critical Care
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- Conventional: Space (Usual patient care spaces maximized); Staff (Additional staff called in as needed); Supplies (Cached/on-hand supplies); Standard of care (Usual care); Resources (Local); ICU expansion goal (X 1.2 usual capacity (20%)); Operating Conditions (Normal)
- Contingency: Space (Patient care areas re-purposed (PACU, monitored units for ICU-level care)); Staff (Staff extension (supervision of larger number of patients, changes in responsibilities, documentation, etc’)); Supplies (Conservation, adaptation and substitution of supplies with selected re-use of supplies when safe); Standard of care (Minimal impact on usual patient care practices); Resources (Regional/State); ICU expansion goal (X 2 usual capacity (100%))
- Crisis: Space (Non-traditional areas used for critical care or facility damage does not permit usual critical care); Staff (Insufficient ICU trained staff available/unable to care for volume of patients, care team model required & expanded scope); Supplies (Critical supplies lacking, possible allocation/reallocation or lifesaving resources); Standard of care (Not consistent with usual standards of care (Mass Critical Care)); Resources (National); ICU expansion goal (X 3 usual capacity (200%))

Decreasing Morbidity and Incident demands Increasing
This paper focuses on surge logistics, those elements that provide the capability to deliver mass critical care.

- Stockpiling of Equipment, Supplies, and Pharmaceuticals
- Staff Preparation and Organization
- Patient Flow and Distribution
- Deployable Critical Care Services
- Using Transportation Assets to Support Surge Response
Evacuation of the ICU

Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

Mary A. King, MD, MPH, FCCP; Alexander S. Niven, MD, FCCP; William Beninati, MD; Ray Fang, MD; Sharon Elav, MD; Lewis Rubinson, MD, PhD; Niranjan Kissoon, MBBS, FRCP; Asha V. Devereaux, MD, MPH, FCCP; Michael D. Christian, MD, FRCP, FCCP; and Colin K. Griscom, MD, FCCP; on behalf of the Task Force for Mass Critical Care

- Evacuation & Transport
- Agreements
- Simulation Leadership
- Planning
- Requesting Assistance
- Equipment
- Patients
- Prioritizing
- Preparing
- Distributing
- Information transfer
- Transport Methods
- Tracking

1. No Immediate Threat
   1. Form hospital and transport agreements
   2. Prepare for and simulate ICU evacuation
   3. Prepare for and simulate ICU transport
   4. Designate Critical Care Team Leader

2. ICU Evacuation Threat
   5. Initiate Pre-Event ICU Evacuation Plan
   6. Request assistance
   7. Ensure power and transport equipment
   8. Prioritize patients for evacuation

3. ICU Evacuation
   9. Distribute patients
   10. Prepare patients
   11. Send patient information with patient
   12. Transport patients
   13. Track patients and equipment
Triage
Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

Michael D. Christian, MD, FRCP, FCCP; Charles L. Sprung, MD, FCCP; Mary A. King, MD, MPH, FCCP; Jeffrey R. Dichter, MD; Niranjjan Kissoon, MBBS, FRCP; Asha V. Devereaux, MD, MPH, FCCP; and Charles D. Gomersall, MBBS; on behalf of the Task Force for Mass Critical Care
Special Populations

Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

David Dries, MD, MSE, FCCP; Mary Jane Reed, MD, FCCP; Niranjan Kissoon, MBBS, FRCP; Michael D. Christian, MD, FRCP, FCCP; Jeffrey R. Dichter, MD; Asha V. Devereaux, MD, MPH, FCCP; and Jeffrey S. Upperman, MD; on behalf of the Task Force for Mass Critical Care

- Defining Special Populations for Mass Critical Care
- Planning for Access to Regionalized Service for Special Populations
- Triage and Resource Allocation of Special Populations
- Crisis Standards of Care for Special Populations
- Therapeutic Considerations
System-Level Planning, Coordination, and Communication

Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

Jeffrey R. Dichter, MD; Robert K. Kanter, MD; David Dries, MD; Valerie Luyckx, MD; Matthew L. Lim, MD; John Wilgis, MD; Michael R. Anderson, MD, MBA; Babak Sarani, MD; Nathaniel Hupert, MD; Ryan Mutter, MD; Asha V. Devereaux, MD, MPH, FCCP; Michael D. Christian, MD, FRCPC, FCCP; and Niranjan Kissoon, MBBS, FRCPC; on behalf of the Task Force for Mass Critical Care

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**GOVERNMENT**

- Disasters
- Telemedicine Technology
- Credentialing
- Ventilators, other equipment

**SURGE RESOURCES**

- Specialty Personnel
- Medications, Supplies & Equipment
- Social Media (e.g., Facebook, twitter)
- Use & test communication plans
- Disasters - Planned events
- Directory of contacts
- Healthcare Coalitions and Regional Health Authorities
- Local Governments
- National Governments
- Financial Assistance, Incentives, Requirements
- Disaster Research
- Communication Vehicles (Phones, websites, teleconferencing, walkie talkies, telemedicine)
Business and Continuity of Operations
Care of the Critically Ill and Injured During Pandemics and Disasters
CHEST Consensus Statement

Pritish K. Tosh, MD; Henry Feldman, MD; Michael D. Christian, MD, FRCPC, FCCP; Asha V. Devereaux, MD, M. Niranjan Kissoon, MBBS, FRCPC; and Jeffrey R. Dichter, MD; on behalf of the Task Force for Mass Critical Care

- Supply Chain Vulnerabilities in Mass Critical Care
- Health Information Technology Continuity in Disasters
- Hospitals and healthcare information technology preparedness planning
“The following suggestions should assist hospital disaster planners, medical education societies, and public health systems in the engagement of critical care clinicians in ICU disaster preparedness.”
Legal Preparedness
Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

Brooke Courtney, JD, MPH; James G. Hodge Jr, JD, LLM; Eric S. Toner, MD; Beth E. Roxland, JD, MBioethics; Matthew S. Penn, JD, MLIS; Asha V. Devereaux, MD, MPH; FCCP; Jeffrey R. Dichter, MD; Niranjan Kissoon, MBBS, FRCP; Michael D. Christian, MD, FRCP, FCCP; and Tia Powell, MD; on behalf of the Task Force for Mass Critical Care

- Mass Critical Care plans
- Evacuation, Resource Allocation, Multi-jurisdictions
- Activation of plans
- Legal protections for HCWs during disasters
- Licensing, credentialing & scope of practice
Ethical Considerations
Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

Lee Daugherty Biddison, MD, MPH; Kenneth A. Berkowitz, MD, FCCP; Brooke Courtney, JD, MPH;
COL Marla J. De Jong, PhD, RN [USAF]; Asha V. Devereaux, MD, MPH, FCCP; Niranjan Kissoon, MBBS, FRCPC;
Beth E. Roxland, JD, MBioethics; Charles L. Sprung, MD; Jeffrey R. Dichter, MD; Michael D. Christian, MD, FRCPC, FCCP;
and Tia Powell, MD; on behalf of the Task Force for Mass Critical Care

- Triage and Allocation
- Responding to Ethical Concerns of Patients and Families
- Responsibilities to Providers
- Conduct of Research
- International Disaster Response
Resource-Poor Settings: Infrastructure and Capacity Building

Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

James Geiling, MD, MPH, FCCP; Frederick M. Burkle Jr, MD, MPH; Dennis Amundson, DO, FCCP; Guillermo Dominguez-Cherit, MD; Charles D. Gomersall, MBBS; Matthew L. Lim, MD; Valerie Luyckx, MD; Babak Sarani, MD; Timothy M. Uyeki, MD, MPH, MPP; Dennis Amundson, DO, FCCP; Guillermo Dominguez-Cherit, MD; Charles D. Gomersall, MBBS; Matthew L. Lim, MD; Valerie Luyckx, MD; Babak Sarani, MD; Michael D. Christian, MD, FRCP, FCCP; Asha V. Devereaux, MD, MPH, FCCP; Jeffrey R. Dichter, MD; and Niranjan Kissoon, MBBS, FRCP; on behalf of the Task Force for Mass Critical Care

Resource-Poor Settings: Response, Recovery, and Research

Care of the Critically Ill and Injured During Pandemics and Disasters: CHEST Consensus Statement

James Geiling, MD, MPH, FCCP; Frederick M. Burkle Jr, MD, MPH; T. Eoin West, MD, MPH, FCCP; Timothy M. Uyeki, MD, MPH, MPP; Dennis Amundson, DO, FCCP; Guillermo Dominguez-Cherit, MD; Charles D. Gomersall, MBBS; Matthew L. Lim, MD; Valerie Luyckx, MD; Babak Sarani, MD; Michael D. Christian, MD, FRCP, FCCP; Asha V. Devereaux, MD, MPH, FCCP; Jeffrey R. Dichter, MD; and Niranjan Kissoon, MBBS, FRCP; on behalf of the Task Force for Mass Critical Care
Pediatric Emergency Preparedness

Niranjan “Tex” Kissoon, MD, FCCM,FRCP(C),FAAP,FACPE,CPE
Vice President Medical Affairs,
BCCH and Sunny Hill Medical Center,
BC Children’s and UBC Professor Global Child Health,
University of British Columbia,
Vancouver, Canada
Disclosures

• No financial conflicts, no off label products

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Pediatric Emergency Preparedness

• Is the threat real? Worth the effort?
• Challenges
• Planning & Preparedness
  – PCCM
  – IOM
  – ACCP
Russia School Siege Ends in Carnage
Hundreds Die As Troops Battle Hostage Takers

By Peter Baker and Susan B. Glasser
Washington Post Foreign Service
Saturday, September 4, 2004; Page A01

BESLAN, Russia, Sept. 4 -- Hundreds of children, their parents and teachers died in the bloody culmination of a 52-hour siege that began when heavily armed Muslim guerrillas stormed their school Wednesday and ended in an hours-long battle with Russian troops Friday.

The battered, burned and scorched survivors of Beslan's School No. 1, many of them half-naked children, filled the region's hospitals as troops continued to fight through the afternoon with guerrillas holed up inside the school. Twenty-seven of the fighters, described as Chechens, Russians, Ingush and Arabs, were killed, and at least three were captured, officials said.

Only by late Friday did the scale of the bloodshed in this small town in the region of North Ossetia, west of war-torn Chechnya, become clear. A top Russian official admitted what anguished relatives had been saying for days: There had been more than 1,000 hostages inside the school, the majority of them children.

Between 500 and 700 injured former hostages were hospitalized Friday, more than 300 of them children.
Worth the effort?

- Only 6% of emergency departments have all of the supplies for managing pediatric emergencies.
- Only half of hospitals have at least 85% of those critical supplies.
- Pediatric emergency care skills deteriorate quickly without practice, yet training is limited.
- Disaster preparedness plans often overlook the needs of children even though their needs differ from those of adults.

Worth the effort?

- 3748 EMS agencies contacted
- 73% written response plan to mass casualty event
- 13% had pediatric specific plan
- 69% no plan for school based event
- 19% pediatric specific triage plan
- 12% had a pediatrician involved in local medical control
- 69% had participated in local or regional disaster drills, only 49% included children

Shirm S et al, Pediatrics 2007
A thing of the past?
Pediatric Emergency Preparedness

• Is the threat real? Worth the effort?
• Challenges
• Planning & Preparedness
  – PCCM
  – IOM
  – ACCP
Pediatric-specific Care

- Under normal circumstances, survival is better when children with high risk, complex conditions receive care in a pediatric hospital
- Teams of pediatric specialists, volume-quality
  - PICU
    - Tilford, et al; Crit Care Med 2000;106:289
    - Ruttiman et al; Pediatr Crit Care Med 2000;1:133
  - NICU
  - Trauma
    - Osler, et al; J Trauma 2001;50:96
Pediatric Disaster Preparedness Challenges

• Vulnerability of children
  – Biological (airway, dehydration, immunological, radiation, etc)
  – Behavioral
  – Emotional
  – Intentional targeting
  – Socioeconomic
  – Legal

• Care specific for anatomic & physiologic maturation

• Deficiencies in each of the “Four s’s” (Space, stuff, staff, system) for children
A young boy runs in front of a group of security guards wearing masks to protect against the SARS virus as they patrol in Beijing's Wangfujing shopping street. (Associated Press, May 9, 2003)
Pediatric Disaster Preparedness Challenges

“Emergency departments and emergency medical services systems that are unable to meet everyday pediatric care challenges are unlikely to be prepared to deliver quality pediatric care in a disaster.”
Pediatric Disaster Preparedness Challenges – Scarce Resources

• Prehospital EMS - No pediatric specialists

• Hospital emergency departments
  – Almost 90% of every-day pediatric emergency visits are to a nonpediatric ED (half of EDs <10 children/day).

• Hospital inpatient
  – NY State <20% of hospital vacancies for disaster surge would be suitable for care of children.
  – Pediatric beds are clustered at a minority of hospitals.
Pediatric Disaster Preparedness Challenges – Scarce Resources

• Critical care
  – PICU beds account for <20% of all ICU beds in US.
  – The PICU beds are clustered at a small number of hospitals.

• Regionalization for everyday circumstances
  – Common low risk conditions – community hospital
  – High risk, complex conditions – pediatric hospital
    – AAP, SCCM; Crit Care Med 2000;28:236-9
Pediatric Disaster Preparedness Challenges – Lack of Data

• Regional and state information systems must be developed to track critical care needs and resources in real time.

• Establish real-time rapid analyses
  – to characterize clinical syndromes, age-specific differences, risk factors for severe disease, clinical complications - which require resources

• Rapid feedback mechanisms to inform about clinical findings and effective therapies.
Pediatric Disaster Preparedness Challenges – Lack of Research

• Clinical trials of drugs for all ages including premature infants (safety issues, dosing and metabolism issues).

• Pediatric clinical research networks that can be "turned on" - pre-approved protocols.

• Consent issues for children in clinical research, include indigenous, minority, underserved, lower SES, and culturally and language appropriate issues.
Pediatric Emergency Preparedness

• Is the threat real? Worth the effort?
• Challenges
• Planning & Preparedness
  – PCCM
  – IOM
  – ACCP
Reflections on Planning

“In preparing for battle I have found that plans are useless, but planning is indispensable”

Dwight Eisenhower 1890-1969
Planning & Preparedness
Introduction and Executive Summary

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Children and Disasters

Niranjan “Tex” Kissoon, MBBS, FRCPC

on behalf of

The Task Force For Mass Critical Care
Surge Capacity Principles

- 9a: We suggest regional planning include the expectation that the hospital be able to provide initial stabilization care to unique populations that they may not normally serve such as pediatrics, burn and trauma patients.

- 9b: We suggest access to regional expertise for care of all patients who require specialty critical care services including participation in the planning phase and access to just-in-time consultation for care coordination during a response.
Surge Capacity Logistics

• 5: We suggest regional and hospital stockpiles include equipment, supplies, and pharmaceuticals that can be used to accommodate the needs of unique populations that are likely to require critical care in centers other than specialty care centers, including pediatric, burn, and trauma patients.

• 12 Should expert consultation (e.g., pediatrics, trauma, burn, or critical care) not be available locally, we suggest every effort be made by hospitals to ensure that such expertise be provided at a minimum through remote consultation.

• 13: We suggest hospitals consider the utilization of technology (e.g., telemedicine) as an important adjunct to the delivery of critical care services in a disaster, to serve as a force multiplier to support response to disaster events. Where no such systems are currently in place, development of a telemedicine or other electronic platform to support patient care delivery is suggested.
Evacuation of the ICU

- 3b. We suggest pre-identifying unique transport resources that are required for movement of specific populations such as critically ill neonates, children, and technology-dependent patients at a regional level. This information can then be used in real time to match allocated resources to patients.

- 7b. We suggest availability of adequate portable, energy and medical gas flexible ventilators that can provide accurate small tidal volumes or pressure limits for the premature and neonatal patients expected at designated hospitals (for instance pediatric centers or hospitals with a NICU). Special consideration should be given to creating a standard quickly accessible regional stockpile of mechanical ventilators for evacuation of neonatal patients as it may not be feasible for some non-pediatric centers to have adequate numbers of portable, energy and gas flexible neonatal ventilators.
Triage

- **Triage Officers**: 7c. We suggest in trauma or burn disasters, triage be carried out by triage officers who are senior surgeons/physicians with experience in trauma, burns, or critical care and experience in care of the age group of the patient being triaged.

- **Triage Process**: 11a: We suggest tertiary care triage protocols for use during a disaster that overwhelms or threatens to overwhelm resources be developed with inclusion and exclusion criteria.

### TABLE 3: Age-Based BP Parameters for Defining Hypotension

<table>
<thead>
<tr>
<th>Group</th>
<th>Age</th>
<th>BP Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>&gt;10 y</td>
<td>SBP</td>
<td>&lt;90</td>
</tr>
<tr>
<td>Child</td>
<td>1-10 y</td>
<td>SBP</td>
<td>≤[70 + (2 × age in y)]</td>
</tr>
<tr>
<td>Infant</td>
<td>1 mo-1 y</td>
<td>SBP</td>
<td>&lt;70</td>
</tr>
<tr>
<td>Neonate</td>
<td>Term newborn-1 mo</td>
<td>SBP</td>
<td>&lt;60</td>
</tr>
<tr>
<td>Premature neonate</td>
<td>Preterm newborn</td>
<td>MAP</td>
<td>&lt;Gestational age in wk</td>
</tr>
</tbody>
</table>

MAP = mean arterial pressure. See Table 2 legend for expansion of other abbreviation.
Triage con’t

- Triage Process: 11c. We suggest patients who will have such a low probability of survival that significant benefit is unlikely be excluded from ICUs when resources are overwhelmed.
- 11d. We suggest consideration be given to excluding patient groups that have a life expectancy <1 year.

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Short Life Expectancy Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Condition</td>
<td>Age Group</td>
</tr>
<tr>
<td>Metastatic malignancies</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>Hematologic malignancies with poor prognosis</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>End-stage organ failure with expected survival &lt;1 y, such as end-stage cardiac failure (NYHA class IV), severe chronic lung disease, advanced hepatic failure (MELD score &gt;20)</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>Very advanced age</td>
<td>Adult</td>
</tr>
<tr>
<td>Advanced and irreversibly immunocompromised, such as drug-resistant AIDS</td>
<td>Adult and pediatric</td>
</tr>
<tr>
<td>Congenital anomalies with expected survival &lt;1 y</td>
<td>Pediatric</td>
</tr>
</tbody>
</table>

MELD = Model for End-Stage Liver Disease; NYHA = New York Heart Association.
Special Populations

1. We suggest the definition of special populations for mass critical care be those patients that may be at increased risk for morbidity and mortality outside a fully functional critical care environment or those patients that present unique challenges to providers when a full complement of supportive services is not available. We include the chronically ill and technologically dependent as the fragility of their baseline health puts them at significant risk for progression to a higher level of medical need.

Our definition of special populations does not include the general pediatric population because they are a core component of all communities impacted by disasters and pandemics in proportion to their presence in the local population. However, children who have special needs and are technologically dependent are included here.
System Level Planning, Coordination, and Communication

- 2e Healthcare coalition/regional health authority Identify clinical experts to oversee and address the needs of specific populations, especially pediatrics, and also specialty populations such as trauma, burns, oncologic, etc.

- 4c We suggest healthcare coalitions/regional health authorities should have the ability to track the number of available ICU capable personnel (“force multipliers”) and other designated specialist “resources” (e.g. pediatric and special populations) through their partner hospitals. Partners with telemedicine capability (such as tele-ICU’s) should have plans for how to utilize this resource to optimize the use of pediatric and specialty expertise across hospitals served by the telemedicine resource.
System Level Planning, Coordination, and Communication con’t

- 5a We suggest HC/RHA have identified, and be familiar with, the following pediatric disaster/pandemic designated resources including, but not limited to:

  - Pediatric consultative specialists available by dedicated phone line support and/or dedicated video or telemedicine consultation.
  - Designated pediatric surge personnel (e.g., pediatric hospitalists, others) available to non-pediatric hospitals and health systems to support surge in contingency or crisis level events, with a defined plan for how to activate this resource when needed.
  - Identified pediatric capable transport resources for allocation and matching of pediatric patients to available HC/RHA pediatric resources.
  - Knowledge of available key supplies, medications, and other pediatric assets; location of these assets with a defined process for how they may be accessed urgently; and ability to monitor when asset reserves fall below a defined critical threshold.
  - Pediatric educational resources. If web-based, they should be found on HC/RHA websites, or with links to appropriate resources. If published, resources should be readily available to all partners.
LESSONS LEARNED FROM THE 2013-2015 EVD OUTBREAK:

Implications For Hospital/ Critical Care Preparedness and Response

Lewis Rubinson MD, PhD
Director, Critical Care Resuscitation Unit
R Adams Cowley Shock Trauma Center
Associate Professor of Medicine
University of Maryland Medical Center
RELEVANT DISCLAIMERS AND DISCLOSURES

• I was a World Health Organization consultant clinician in Sierra Leone. This talk has not been approved by the WHO and should not be considered to express any official policies or information releases. The details and opinions expressed are only my own.

• I am a subcontractor to ICF international for an Ebola preparedness effort for the US DHHS Office of the Assistant Secretary for Preparedness and Response

• I am the Site PI for a US DHHS FDA/BARDA contract for the United States Critical Illness and Injury Trials Group Program in Emergency Preparedness

• Scientific Advisory Board member for GlaxoSmithKLine and Phillips/Respironics

• The findings and conclusions in this presentation are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry
EVD as with numerous transmissible illnesses causes severe organ dysfunction-

Critical care will be needed for many patients
ORGAN DYSFUNCTION AND DEATH

Figure 1. Case Fatality Rates among Patients with Ebola Virus Disease (EVD) in Sierra Leone.
Shown are case fatality rates among patients with confirmed EVD, a known outcome, and available data, according to age and viral load.

EVD and CRITICAL ILLNESS

- Actual incidence of organ dysfunction in West Africa poorly described
- Suggestion that if supportive care started late—MOSD—high risk of death
  - 21% mortality rate in US/Europe
- Efficacy of disease-specific therapeutics uncertain at forestalling or treating critical illness of EVD

- Treatment sites must be able to provide critical care support for any EVD patient
- Given risk of transmission to other pts and HCWs, delivery of critical care may have to be modified
  - Who makes decision?
  - Who is at risk for tough decisions?
Consensus collaboration of public health, ethics, and acute care experts to rationally develop a circumscribed set of key supportive care interventions for many rather than maximal care for few in wake of disaster.

Criteria such as efficacy/effectiveness, alternatives, resource requirements, preparedness costs were evaluated.
1. Minimization of numbers of people in patient’s room

2. Minimization of exposure
   a) Role of routine exam and assessments
   b) Balancing patient needs with staff safety

3. Limited organ support reasonable but many interventions/diagnostics will put staff, institution at high risk

4. There should be no emergencies

5. Procedures should be pre-briefed, choreographed and done by experienced, team-players
   a) PACE

6. Novel therapeutics should be used in clinical trial if possible
The Devil is in the Details:

System Level Planning, Coordination and Communication must include acute care specialists
**GENERAL ISOLATION STRATEGIES**

- Pt is cared for in dedicated space and not moved (except from Emergency Department depending on hospital plan)

- Diagnostics - most labs are only using POC tests
  - CDC guidance suggests can use general labs but most hospitals will not be doing so
  - Limited labs (will vary by equipment and process solutions)
  - Bedside ultrasound mainstay of imaging
    - Some facilities are using portable diagnostic X-ray as well
    - No CT-scan, MR imaging, cath lab, etc for suspected or confirmed EBV at most hospitals
POSSIBLE ADVERSE CONSEQUENCES OF PUI PROCESS

Person travels recently from impacted country
  – Has neurological signs/symptoms suggestive of acute CVA

How do you decide what is best for the patient?

How are facility and staff safety factored in?

If there is a time sensitive window, what process is in place to optimize outcomes when EBV PCR from LRN cannot be turned around in necessary window?

Responsibility of clinician, hospital, Public Health in decision
RAPID EBV ASSESSMENT TEAM

Must be able to rapidly assess likelihood of EBV

Risk to patient if delayed diagnosis or treatment
  – Are there alternatives?

Risk to HCWs or facility for proposed evaluation/treatment
  – CT scan vs procedure

Requires immediate activation of multi-disciplinary team

Public health, infectious disease/infection control, clinicians, risk management

Must have endorsement by hospital leadership to make decision or must make rapid rec and hospital leadership must make timely decision

Should be formalized and tested prior to need
Potential for transmissibility of EVD to health care workers dramatically reduces surge capacity and capability
HOW IS AND WHEN IS EBOLA TRANSMITTED?

- EVD is transmitted from infectious body fluids entering your body (through mucus membranes or skin breaks)

- Sicker people with more symptoms have production of larger volumes of body fluids (emesis, diarrhea) ---typically more infectious
  - Healthcare workers…in US especially ICU workers (intensity of exposure and duration of exposure)
    - 450 HCWs infected as of Oct 2014

- Fomite transmission less likely but depends on ambient conditions

- Airborne transmission unconfirmed but aerosolization with projectile vomiting, therapeutic interventions, flushing of toilet with large infectious burden of stool all plausible
Virus culture and reverse-transcription polymerase chain reaction (RT-PCR) results from 54 clinical samples collected from 26 patients with laboratory-confirmed Ebola hemorrhagic fever.

<table>
<thead>
<tr>
<th>Sample type, phase of illness</th>
<th>Patients, no.</th>
<th>Samples, no.</th>
<th>Day after disease onset that sample was collected, range (mean)</th>
<th>Virus culture positive, no. % sample type tested</th>
<th>RT-PCR positive, no./total tested (%)</th>
<th>Latest day positive after disease onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saliva</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>10</td>
<td>12</td>
<td>4–14 (6)</td>
<td>1 (8)</td>
<td>8/12 (67)</td>
<td>8</td>
</tr>
<tr>
<td>Convalescent</td>
<td>4</td>
<td>4</td>
<td>12–23 (16)</td>
<td>0 (0)</td>
<td>0/4 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Skin*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>7</td>
<td>8</td>
<td>4–10 (7)</td>
<td>0 (0)</td>
<td>1/8 (13)</td>
<td>6</td>
</tr>
<tr>
<td>Convalescent</td>
<td>3</td>
<td>3</td>
<td>7–15 (12)</td>
<td>0 (0)</td>
<td>0/3 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Urine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>5</td>
<td>7</td>
<td>5–22 (14)</td>
<td>0 (0)</td>
<td>0/7 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Convalescent</td>
<td>4</td>
<td>4</td>
<td>8–40 (28)</td>
<td>0 (0)</td>
<td>0/4</td>
<td>...</td>
</tr>
<tr>
<td>Vomit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>1</td>
<td>1</td>
<td>NA (9)</td>
<td>0 (0)</td>
<td>0/1 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Convalescent</td>
<td>1</td>
<td>1</td>
<td>NA (20)</td>
<td>0 (0)</td>
<td>0/1 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Sputum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>1</td>
<td>1</td>
<td>NA (8)</td>
<td>0 (0)</td>
<td>0/1 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Convalescent</td>
<td>1</td>
<td>1</td>
<td>NA (16)</td>
<td>0 (0)</td>
<td>0/1 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Breast milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>1</td>
<td>1</td>
<td>NA (7)</td>
<td>1 (100)</td>
<td>1/1 (100)</td>
<td>7</td>
</tr>
<tr>
<td>Convalescent</td>
<td>1</td>
<td>1</td>
<td>NA (15)</td>
<td>1 (100)</td>
<td>1/1 (100)</td>
<td>15</td>
</tr>
<tr>
<td>Stool,† acute</td>
<td>4</td>
<td>4</td>
<td>4–12 (8)</td>
<td>0 (0)</td>
<td>2/4 (50)</td>
<td>12</td>
</tr>
<tr>
<td>Sweat,‡ acute</td>
<td>1</td>
<td>1</td>
<td>NA (9)</td>
<td>0 (0)</td>
<td>0/1 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Tears,§ acute</td>
<td>1</td>
<td>1</td>
<td>NA (6)</td>
<td>0 (0)</td>
<td>1/1 (100)</td>
<td>6</td>
</tr>
<tr>
<td>Nasal blood,∥ acute</td>
<td>1</td>
<td>1</td>
<td>NA (10)</td>
<td>0 (0)</td>
<td>1/1 (100)</td>
<td>10</td>
</tr>
<tr>
<td>Body louse,¶ acute</td>
<td>1</td>
<td>1</td>
<td>NA (9)</td>
<td>0 (0)</td>
<td>0/1 (0)</td>
<td>...</td>
</tr>
<tr>
<td>Semen,* convalescent</td>
<td>1</td>
<td>2</td>
<td>40–45 (43)</td>
<td>1 (50)</td>
<td>1/2 (50)</td>
<td>40</td>
</tr>
<tr>
<td>Subtotal acute</td>
<td>23</td>
<td>38</td>
<td>4–22 (9)</td>
<td>2 (6)</td>
<td>14/37 (41)</td>
<td>12</td>
</tr>
<tr>
<td>Subtotal convalescent</td>
<td>8</td>
<td>16</td>
<td>7–45 (21)</td>
<td>2 (13)</td>
<td>2 (13)</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>26*</td>
<td>54</td>
<td>4–45 (12)</td>
<td>4 (7)</td>
<td>16/30 (53)</td>
<td>...</td>
</tr>
</tbody>
</table>

**NOTE.** Samples are classified as either acute phase (serum ELISA antigen positive and/or RT-PCR positive) or convalescent phase (previously serum ELISA antigen positive or RT-PCR positive but now reverted to negative, often with the appearance of ELISA IgG antibody). Clinical samples were classified as acute or convalescent phase on the basis of the results of the most closely matched serum sample by date, which was a mean difference of 1.2 days (range, 0-13 days) and 7.3 days (range, 0-29 days) for acute- and convalescent-phase samples, respectively. NA, not applicable.

* Samples were swabbed from the hand (10) or forehead (1). The sole positive sample was from a hand.

† No convalescent-phase samples were available for this sample type.

‡ No acute-phase sample was available for this sample type.

§ Both acute- and convalescent-phase samples were collected from some patients.
RECENTLY IN GERMANY

Kreuels B et al. A Case of Severe Ebola Virus Infection Complicated by Gram-Negative Septicemia

*N Engl J Med* 2014
THE UNCERTAINTY IMPACTS CAPACITY AND CAPABILITY

• Anecdotally most designated Ebola Treatment Units in US said could manage 1-3 critically ill EVD pts
  – My facility could do up to 2 (> 200+ ICU beds)

• “Higher” levels of Personal Protective Equipment may reduce quantities of available product, trained staff, or ability to deliver care

• Reduced willingness to respond vs other Public Health Emergencies
MODERN ORGAN SUPPORT AND TRANSMISSION

Transmission data in resource-limited environments may not entirely translate for modern means to deliver organ supportive care.

- Can patient survive to transmit in respiratory droplets and what is impact of different means to deliver supplemental oxygen (high flow nasal cannula, NIPPV, invasive mechanical vent) on transmission?
Resource-intensiveness to prepare and respond for EVD requires regional collaboration
REGIONAL COLLABORATIONS

- Cannot control where patients “presents”
- CDC recommended tiers of hospitals
- 5700+ US hospitals, 3000+ with ICUs
  - Cannot control where patients present
  - Can control where patients get definitive care
- ASPR HPP grant to resource Ebola Treatment Units in each HHS region
- Ideally should not be EVD-specific
Learning during an outbreak (especially clinically) is very challenging.
1. Can Ebola be transmitted by respiratory droplets or droplet nuclei?
   a) Supplemental oxygen

2. How early can PCR rule out disease?
   a) Previous outbreaks suggested 72 hrs (incredibly difficult and dangerous to operationalize)

3. Which supportive care treatment regimens are effective?
## STRENGTHS AND OPPORTUNITIES FOR LEARNING

### Strengths
- Epidemiology of outbreak
- Viral sequencing
- Vaccine trials

### Opportunities
- Patient level physiologic data
  - Especially when needed to aggregate across multiple facilities
- Disease-specific therapeutic trials
- Supportive care strategies and effectiveness
UNDERSTANDING THERAPEUTICS IN CRITICALLY ILL PATIENTS

• With high incidence of organ dysfunction (e.g. EVD), safety determination is not much easier than efficacy/effectiveness.

• Well-defined organ failure measurements, temporal relationships between organ failure and intervention as well as safety data needs to be as rigorous as outcomes data.

• United States Critical Illness and Injury Trials Group Program in Emergency Preparedness (USCIITG-PREP) has novel contract with FDA and BARDA to create infrastructure for rapid data collection, analysis and reporting in midst of public health emergencies
  – Additional CDC grant to promote international North American collaboration.

• Data collection must be done by experienced clinical investigators, but roles must be separate from responding clinicians.

• Working with international collaborators from around the globe to meet rapid learning during public health emergency needs.
Thank You

Lewis Rubinson MD, PhD

lrubinson@umm.edu
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  - “Click” in the white space
  - “Type” your question
  - “Click” ask

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  - State your name
  - Listen for the operator to call your name
Thank you for joining!
Please email us questions at coca@cdc.gov

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Atlanta, Georgia

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