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; Mike Anderson, MD; Babak Sarani, MD; Nathaniel Hupert, MD; Ryan Mutter, MD; Asha V. Devereaux, MD, MPH, FCCP; Michael D. Christian, MD, FRCPA, FCCP; and Niranjan Kissoon, MBBS, FRCPC; on behalf of the Task Force for Mass Critical Care

CHEST 2014; 146 (4 Suppl): e87S - e102S

e-Appendix 1.

“Systems Planning” online appendix

Summary prepared November 2013

Jeffrey R Dichter, MD, who was both a topic editor and executive committee member, prepared this summary.

Note: the “Systems Planning” group was originally called the “Operational Systems” group, a name that was kept until the final manuscript was completed. At this point, the name was changed as “Systems Planning” was felt to more accurately reflect the contents of the manuscript.

The original 9 questions defined by Systems Planning group at June 2012 meeting are listed below:

Summary of Key Questions Operational Systems

1. What are the Boundaries of the project- (likely need Tiers 2-6)
   a. Size and scope?
   b. Optimal size may be defined by defined regions, vs. geographic limits vs. the type of disaster?
   c. Advanced planning will be necessary to determine optimal size?
   d. Needs to be linked to pre-hospital care
2. What are the motivations for hospitals and health systems to form coalitions?
   a. What are the incentives?
b. How do we align incentives?
c. What is in it for the hospital CEO- Economics, among other factors
d. What are the federal mandates?
e. What do we need from federal agencies?
f. Potential controversial issue- disruption of usual coalitions and/or referral patterns

3. How many communities have tried to implement coalitions, and what obstacles have they found,
   a. How many have participated in a disaster event (what can we learn from previous experience?)

4. What mechanisms or triggers determine the need for local vs. state vs. federal resources? Central versus local control
   a. How do we proportionally escalate the level of urgency and disaster preparation proactively to contend with the level of an evolving disaster?

5. What is the role of simulation to determine capabilities and robustness of the system?
   a. Potential controversial issue: clinical cynicism that may not accept simulation as an instructive tool.
   b. What strategic, tactical, and real time data do we need to effectively develop simulations in planning? (see #7 below)

6. How do coalitions engage institutions to take care of populations that they don’t usually take care of (pediatrics, trauma, etc.) while maintaining their level of everyday practice.
   a. These general principles should include all populations, including trauma, medical, burns, pediatrics, and others

7. What are the gaps that we have in our knowledge and what data do we need?
   a. What strategic, tactical, and real time data do we need to effectively manage resources in an event?
   b. How do we set up a registry to collect this data?
   c. Potential controversial issue- who will be responsible for entering data? Who will own it?; be responsible for it?

8. What are the challenges and gaps that we cannot address in this project, but that need to be addressed?

9. Additional question added after meeting:
   a. Examples of what functioning operational systems that are currently in place?
   b. How they currently function. Their strengths, weaknesses, motivations/incentives, and disincentives?

Other Key Questions raised that were felt to likely belong in other groups:
10. What are our responsibilities to the workforce? Workers lives may be at risk, and workers must feel that the organizations will support them.

11. How do we get clinicians engaged in the responses for planning, responding, and initiating (eg may be institutional competition or rivalries, lack of familiarity with each other, or other institutional issues that inhibit collaboration)?

12. What are the issues regarding licensure, credentialing, data sharing and reimbursement across hospitals, state lines, etc. (This question was ultimately addressed in this manuscript).

**Operational Systems panelists:**

1. Tex Kissoon: Topic Editor
2. Jeff Dichter: Topic Editor
3. Babak Sarani
4. David Dries
5. Bruce Cairns
6. Brendan Carr
7. Daniel Talmor
8. Dario Rodriquez
9. David Prezant
10. Matthew Lim
11. Nathaniel Hupert
12. Nick Kuhnley
13. Richard Branson
14. Ryan Mutter
15. Wanda Barfield
16. Bob Kanter
17. John Wilgis
18. Len Weireter
19. Valerie Lucykx
20. Deborah Levy
21. Mike Anderson
Based on the above key questions, the Operational Systems panel was ultimately divided into 3 working groups, with focus on Healthcare Coalitions; Trauma, telemedicine ICU’s, and nephrology systems; and Simulation. The literature searches and results below reflect this organization.

**Topic: Healthcare coalitions**

**September 2012 to March 2013 searches**

Bob Kanter initially performed a literature search in September 2012.
The search terms used were: (Coalition or alliance or network or integration or partnership) AND (disaster or "public health emergency" or pandemic or "mass casualty")

Jeff Dichter also performed a literature search initially performed in September 2012 and the search term used was: Healthcare Coalitions

Based on these searches, we pulled and reviewed 51 articles requested out of a much greater number. The original searches were unfortunately not kept, only the articles we chose to pull. Of note, when these search terms were used in November 2013 (a year later), 1771 articles were found.

In addition, we asked our NIH librarian Alicia Livinski, to perform a formal literature search on healthcare coalitions, which was done in January 2013. This search returned 438 articles, and its’ strategies are noted immediately below. After review of this search, neither Bob Kanter nor Jeff Dichter found any additional articles to be pulled.

There were no articles found in any of these literature searches felt to provide significant high-grade data addressing the key questions.

The January 2013 search is noted immediately below:

**ACCP Chest – Operational Systems Topic Team**

**Topic Team POC:** Dr. Jeff Dichter

**Search conducted:** 1/25/13 (updated again)

**Search conducted by:** Alicia Livinski, NIH Library
Database searched: MEDLINE/PubMed & Scopus

Search limits used: Publication date 2010-2013.

Search strategy used: Search terms used were primarily suggested by Topic Team POC. These can be changed and search re-run in PubMed with duplicates removed.

Search strategies used:

**MEDLINE/PubMed**

2008-2013 = 458
2010-2013 = 301


2010-2013 = 133

**Scopus**
(coalition OR alliance OR partnership OR {cooperative behavior} OR {Interinstitutional Relations}) AND (disaster* OR {public health emergency} OR {mass casualty} OR {surge capacity} OR {mass casualty incidents} OR {emergency preparedness} OR {11}) =

Limit to 2010-2013 = 341
*if remove “partnership”, results drop to 214

({Health Facilities} OR {health facility} OR {healthcare system} OR Hospital*) AND (coalition* OR alliance OR partnership OR {cooperative behavior} OR {Interinstitutional Relations}) AND (disaster* OR {public health emergency} OR {mass casualty} OR {surge capacity} OR {mass casualty incidents} OR {emergency preparedness}) OR {11})

Limit 2010-2013 = 44
**Note:** Results were exported to EndNote from MEDLINE/PubMed and Scopus, and duplicate references removed. This resulted in a final set of 438 search results, which are listed below. The records include the citation and abstract (if available). Records below include the URL to the citation in MEDLINE/PubMed or Scopus. Click on the link to go to the database and download the article via your institution’s subscriptions. Titles in square brackets (e.g., [title]) are articles where the title was translated into English. The article is most likely not in English.

**Topic: Trauma systems, Telemedicine ICU’s, and Nephrology Operational Systems**

Two different searches were done by Alicia Livinski and reviewed by both Dr. Dichter and Dr. Dries.

The searches and search results are noted below.

There were a total of 515 articles identified from the searches, and 75 were ultimately identified and pulled.

There were no articles found that were felt to provide significant high-grade data addressing the key questions.

Of note, we had originally intended to look at Burn and Neonatology Systems, too but did not have the necessary task force resources to complete this.

**Date Requested:** 8/17/12  **Date Delivered:** 8/24/12

**Search Request(s):** Trauma systems: organizations & outcomes; burn systems

**Search Strategy:**

**Databases searched:** MEDLINE/PubMed; Scopus; Google Scholar
BURN SYSTEMS LIMITS & EXCLUSIONS –
Omitted military or war-related burns;
Included burn rehabilitation re: burn centers
Limited to US only
No date limit

Search strategies:

MEDLINE/PubMed:
Related Citations for PubMed (Select 18997561) = 522
Related Citations for PubMed (Select 8491754) = 240
Related Citations for PubMed (Select 11403250) = 299

( "Burn Units/economics"[Majr] OR "Burn Units/manpower"[Majr] OR "Burn Units/organization and administration"[Majr] OR "Burn Units/supply and distribution"[Majr] ) Filters: Review = 17

( "Burn Units/economics"[Majr] OR "Burn Units/manpower"[Majr] OR "Burn Units/organization and administration"[Majr] OR "Burn Units/supply and distribution"[Majr] ) = 346


("Burn Units/economics"[Majr] OR "Burn Units/manpower"[Majr] OR "Burn Units/organization and administration"[Majr] OR "Burn Units/supply and distribution"[Majr] OR “burn unit”[tiab] OR “burn unit”[tiab] OR “burn unit”[tiab] OR “burn unit”[tiab])

**Scopus**

(“burn unit” OR “burn center” OR “regional burn center”) AND (personnel OR manpower OR supplies OR “organizational structure” OR facility OR facilities OR compensate* OR payment) Limit: Article or Review = 78
All = 95

({burn unit} OR {burn center} OR {regional burn center}) AND (personnel OR manpower OR supplies OR {organizational structure} OR facility OR facilities OR compensate* OR payment) = 317

**Google Scholar**

(“burn unit” OR “burn center” OR “regional burn center”) AND (personnel OR manpower OR supplies OR “organizational structure” OR facility OR facilities OR compensate* OR payment) = 8580
Limited 2008-2012 = 2840

allintitle: "burn unit" OR "burn center" OR "regional burn center" Limited 2008-2012 = 172

**TRAUMA CENTERS/SYSTEMS LIMITS & EXCLUSIONS**

Omitted military or war-related burns;
Included trauma centers, rural trauma systems/centers, level I-III
Did not limit to US only; however separated out those non-US
No date limit

**MEDLINE**

( "Trauma Centers/economics"[Majr] OR "Trauma Centers/history"[Majr] OR "Trauma Centers/manpower"[Majr] OR "Trauma Centers/organization and administration"[Majr] OR "Trauma Centers/supply and distribution"[Majr] ) = 1669
Limited: Reviews = 80
From January 2012 search: for Dr. Mike Christian, I used these terms:


Scopus

(trauma system} OR {trauma center}) AND (personnel OR manpower OR supplies OR “organizational structure” OR facility OR facilities OR compensate* OR payment) = 120

(“trauma center” OR “trauma system”) AND (personnel OR manpower OR supplies OR “organizational structure” OR facility OR facilities OR compensate* OR payment)

Accessing the Full-Text of Articles:
To access the full-text of these articles, there is a hyperlink back to the record in the database from which it was originally retrieved (eg, Scopus or PubMed). If your institution has a license to Scopus, you will be able to see the abstract and record. If not, please let either myself or your institution’s librarian know that you would like to order that article. For the articles indexed in PubMed, you should have a button or link for your institution’s journal access. Please check with your institution’s library on how to get the full-text of journal articles from PubMed search results. If you do not have a library at your institution, please contact Alicia Livinski (Alicia.Livinski@nih.gov).

Search Request(s): Operational systems, outcomes & organizations: nephrology, neonatology, electronic ICU

Date Delivered: 9/30/12

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Search Request(s): Operational systems, outcomes & organizations: nephrology, neonatology, electronic ICU

Search Strategy:

• **Databases searched:** MEDLINE/PubMed; Scopus

• **Search strategies used:**

**MEDLINE/PubMed**


  *Very specific to the various renal networks in the US and studies on certain outcomes or changes in practice*


"NICU Network" doesn't add much that is helpful


Scopus

(“electronic ICU” OR “e-ICU” OR “electronic intensive care unit” OR “tele-ICU” OR “tele intensive care unit”) = 77

Limited to 2008-2012 = 67

("renal network" OR “renal disease network” OR “nephrology network” OR “Nephrology/organization & administration”) AND (personnel OR manpower OR supplies OR “organizational structure” OR facility OR facilities OR compensate* OR payment) = 30

Limited to 2008-2012 = 7

("neonatology network” OR “neonate network” OR "Neonatology/economics" OR "Neonatology/manpower" OR "Neonatology/organization and administration” OR “NICU Network”) AND (personnel OR manpower OR supplies OR “organizational structure” OR facility OR facilities OR compensate* OR payment) = 4
Accessing the Full-Text of Articles:

To access the full-text of these articles, when you click on the links below, you will be brought to the record in the original database for which the record was retrieved (e.g., PubMed or Scopus). To get the full-text, you will need to determine if your institution’s library has established a button to access the full-text.

Notes: Very little was retrieved for the nephrology network question. Most of the literature was specific to the End-Stage Renal Disease Network (ESRD) or specific studies comparing treatment procedures at the ESRD network hospitals. There was also very little retrieved for the neonatology networks; what was retrieved was specific to Europe especially the UK. There was reference to NICU Networks in the UK and Canada or clinical networks in the UK. I did not include these in the results as they were outside of the US. For electronic-ICU, I included tele-ICU, which is most of the current literature available. I included some articles that presented the results of various studies comparing tele-ICU care vs. conventional critical care.

Topic: The use of simulation for Operational Systems

Nathaniel Hupert ran the following literature searches using the terms noted below (December 2012-January 2013). These literature searches returned 598 citations, and Both Dr. Hupert and Dr. Dichter reviewed them in an End Note database. 80 of these papers were ultimately pulled and reviewed.

There were no articles found that were felt to provide significant high-grade data addressing the key questions.

Scopus
(TITLE-ABS-KEY(planning OR organization OR organizational OR administrative OR administration OR strategic)) AND ((TITLE-ABS-KEY(model OR models OR modeling OR simulation*)) AND (TITLE-ABS-KEY(emergency OR emergencies OR trauma OR disaster)) AND (TITLE-ABS-KEY(system OR systematic)) AND (TITLE-ABS-KEY(computer OR mathematical OR engineering)))
PubMed
(planning OR organization OR organizational OR administrative OR administration OR strategic)) AND (model OR models OR modeling OR simulation*) AND (emergency OR emergencies OR trauma OR disaster) AND (system OR systematic) AND (computer OR mathematical OR engineering) AND (Hospital OR health care system)

(((Mathematical or Simulation) and Model) and Emergency Medicine = 202 hits

(Complex Systems Science) and (Emergency Medical Services) = 47

(((emergency services or emergency medicine or emergency medical services) AND complexity) AND model) AND (simulation or mathematical) = 7

((nonlinear) AND model) AND (emergency services or emergency medicine or emergency medical services) = 21

Trauma Systems
Highly effective trauma systems require financial support, strong leadership with physician commitment, and with close collaboration between trauma system leaders, hospitals, emergency medical services, and government (see table 2).1-5 Trauma system leaders facilitate teamwork among specialists, promote effective communication across the system, engage others in training and simulation, and are motivated by program quality data, especially mortality, with increasing focus on integration of best practices and functional level outcomes.6,7 Hospitals are categorized based on acuity level of trauma care they provide, engage pre-hospital EMS personnel in development of training and triage protocols as an integral part of getting the right patient to the right place at the right time.1,3 Linkage of emergency medical data and trauma center outcomes through development of trauma registries is essential to monitoring trauma system quality and outcomes.7
As an example, effective response in the Boston Marathon bombings in 2013 was the product of repeated drills including simulation and communication among disciplines providing initial care including EMS, the ER, and trauma surgeons.\textsuperscript{8}

Challenges to trauma center success include centers having too little or too much clinical volume (too few or too many centers per geographic region); \textsuperscript{3,5-14} inconsistent performance between centers, with Level I centers sometimes out-performing Level II centers for equivalent patients; \textsuperscript{3,5,15-18} and inconsistent performance in rural trauma centers despite training of on-site professionals to assess, manage, or transfer patients based on their injury severity.\textsuperscript{19-22}

**Telemedicine ICU’s**

Telemedicine ICU’s focus on support to bedside caregivers, provide monitoring and immediate input and counsel during clinical emergencies, and help to ensure consistent adherence to ICU best practices.\textsuperscript{23,24} In the United States as of 2012, up to 8\% of non-federal ICU beds are part of telemedicine programs, some with installations located in other countries, and growth driven in large part by an Intensivist shortage.\textsuperscript{24-27} Technology itself offers important value, but it is the culture of collaboration that is responsible for improved quality of patient care, an especially important factor given the cost of these programs.\textsuperscript{24,28,29}

Published data demonstrate improved outcomes after telemedicine ICU implementation, including decreased ICU and hospital mortality and LOS, and improved adherence to ICU best practices (Table 2).\textsuperscript{23,30-34}

Not all data support telemedicine ICU related success.\textsuperscript{35,36} To encourage clinician engagement during implementation, some programs offer options to choose involvement on a limited basis or not at all, an important consideration in these non-beneficial outcomes.\textsuperscript{35,36}

Simulation disaster models demonstrate the valuable potential of a telemedicine hub to improve situational awareness, assistance in field triage, augmentation of surge capacity, enhanced planning, and in delivery of post-event support.\textsuperscript{37} Telemedicine shows great promise for getting information to distant specialists and rapidly returning this expertise to onsite caregivers, and will increase as the technology evolves and is increasingly integrated into routine care.\textsuperscript{38,39}
The Renal Disaster Relief Task Force (RDRTF)
The RDRTF is an organization that provides international aid for patients with acute kidney injury-related crush syndrome resulting from mass disasters, and includes the provision of advice, sending supplies, urgently deploying clinician and technical specialists linked with resources and capital to provide nephrology expertise in disaster affected countries in conjunction with Medecins Sans Frontieres.40-42 (see table 2)

They have successfully intervened 23 times since 1997.43 The most effective intervention was after the Marmara earthquake (1999), where the RDRTF arrived within 22 hours, treated 639 crush syndrome patients, and dialyzed 477 of them with a mortality of only 15.2%, and a ratio of 27.3 dialyzed per 1000 deaths.44 Success factors included effective leadership, local physicians' awareness about crush syndrome management, and geographic location, which facilitated rapid movement of patients to safer regions for dialysis, and proximity to Europe for rapid shipment of equipment, supplies and volunteers. Real-time data collection during this intervention has contributed to ongoing advances in the field.

In contrast, the intervention in the Kashmir earthquake in 2005 dialyzed only 55 patients with a ratio of 0.8 dialyzed per 1000 deaths.45 Major impediments included difficulties in transportation of resuscitation fluid to remote affected areas, which delayed institution of preventive measures, and difficulties in timely transportation of crush victims to the RDRTF dialysis facility in Islamabad. Additionally, initial local projections of need for dialysis were underestimated, shipments of supplies were delayed by transportation time and customs, and local regulations prohibited the use of second-hand parts for dialysis machines. These factors contributed to reducing the effectiveness of the intervention and increasing mortality.

Key areas for improvement identified from the Kashmir experience include: improved transportation of patients, personnel, and supplies, by potentially utilizing military and other organizations; communication with local key people to gain early accurate information; awareness of relevant local regulations to pre-empt foreseeable delays; and ongoing education of medical and emergency personnel regarding crush-syndrome and its prevention and management through local continuing medical education.45
**TABLE 2: Comparison of 3 Advanced Regional Care Systems: Trauma systems, Telemedicine ICU’s, and the Renal Disaster Relief Task Force (RDRTF)**

<table>
<thead>
<tr>
<th>Advanced Regional Care System</th>
<th>Structural Design</th>
<th>Required Resources</th>
<th>Outcome Measures and Results</th>
<th>Success Factors/ Barriers to Success</th>
<th>Patient and Family Support from Program</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trauma Systems</strong></td>
<td>References^4,5</td>
<td>References^46-48</td>
<td>References^5-7,49-52</td>
<td>References^10,12,53</td>
<td>References^19,22,54</td>
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<td>Partnership between local government, hospitals and emergency medical services (EMS). Trauma centers usually designated by a medical society such, the American College of Surgeons (ACS) in partnership with local government. Government and/or ACS set criteria for trauma centers but does not regulate distribution of trauma centers. Level I centers are the regional resource for trauma care, and requirements include: • Must see adequate volume of trauma admissions and</td>
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<td>Cost of trauma programs underwritten by local government (infrastructure) and participating hospitals (very expensive). <strong>Revenue:</strong> Payment for professional service is provided to hospitals and physicians. In some cases, trauma programs require underwriting from hospitals or other health care groups. <strong>Overall estimated trauma costs &gt;35 billion U.S.</strong> <strong>Trauma program costs &gt;3 million U.S.</strong></td>
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<td>Mortality rates- with improved mortality reflecting placement of patients immediately into a system of appropriately trained and committed practitioners. While review of functional outcomes is just beginning in defining optimal processes of care and the impact of complications are becoming part of the trauma center verification process. <strong>Significantly decreased relative risk of mortality at one year .75 vs non-trauma centers with acuity adjustment.</strong> Other specific outcome measures: <strong>Discharge disposition; Quality of survival; Adherence to best</strong></td>
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<td><strong>Success Factors:</strong> Strong program leadership with effective relationships with local government. <strong>Financial:</strong> Sufficient financial underwriting by local government and participating hospitals. <strong>Success at maintaining high levels of staffing and compliance with structural expectations.</strong> <strong>Barriers to Success:</strong> Integrated support for the patient and family beginning with initial injury through the rehabilitation process. For rural or lower level trauma centers, patients and families, there is potential to maintain patients in their home community, rather than transfer outside the immediate residential area.</td>
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*References: [4,5], [46-48], [5-7,49-52], [10,12,53], [19,22,54]*

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|                                | adequate high acuity patients.  
• 24-hour in-house surgeon availability.  
• Must engage in training and research.  
• Post-graduate residents participate in trauma care but do not substitute for the attending surgeon.  
• Surgically directed critical care service.  
• Have outreach activities, injury prevention and control programs.  
• Specialists available including Neurosurgery and Orthopedics.  
Level II centers provide comprehensive trauma care but are not obligated to fulfill a training role or participate in trauma-related research. | | practice guidelines  
CME credits/year/provider  
Trauma registry comparison benchmark (combined hospital and EMS data) to other institutions | | governments unable to underwrite regulatory infrastructure.  
**Political:** programs may be subject to non-medical politics.  
**Economic:** in depressed areas, maintaining trauma systems can be a significant expense for hospitals. | |
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<td>Level III centers provide initial management and have transfer agreements with Level I or Level II centers. General surgeons lead establishment of a team with appropriate field activation criteria. Typical Level IV hospitals are located in rural areas and supplement care within a larger trauma system. These hospitals have 24 hour emergency coverage by a physician. Transfer plans must be in place. Require close cooperation between hospitals and EMS: • Develop triage and care protocols • Train EMS and hospital-based providers with essential trauma management skills</td>
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<tr>
<td>Telemedicine ICU’s</td>
<td>References²⁴,²⁸,³⁸</td>
<td>References²⁴,²⁹,³⁸,⁵⁵,⁵⁶</td>
<td>References²³,²⁴,²⁸,³⁵,⁵⁷,⁵⁸</td>
<td>References²⁴,²⁶,²⁸,³⁵,⁵⁹,⁶⁰</td>
<td>References⁵⁵</td>
</tr>
<tr>
<td>Predominantly central hub linked to ICU’s; or sites may utilize mobile robot(s) technology. Alternatively, decentralized system with physician support potentially available anywhere via internet, often situated remotely from hospitals. Central hub staffed by Intensivist and RN’s, clerical personnel; occasionally pharmacists, other professionals. Hub linked to ICU’s via computer audiovisual (AV) links, phone; and may share electronic medical record, and/or have access to patient data (lab, X-ray, other data.)</td>
<td></td>
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<td>Decreased ICU mortality RR 0.79-.80</td>
<td><strong>Success factors:</strong> Active engagement of e-ICU with all clinical care and best practices in bedside ICU’s; Proactive collaboration with bedside clinicians;</td>
<td>Patients benefit from improved quality of care. Families and patients appreciate being cared for by their “home” hospital rather than being transferred.</td>
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<td>Decreased Hospital mortality RR 0.83</td>
<td>Timely intervention by e-ICU staff with bedside alerts and alarms.</td>
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<td>Decreased ICU LOS 0.62 to 1.26 days</td>
<td>Active involvement with night time care in ICU’s</td>
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<td>Decreased hospital LOS 1.26 days</td>
<td>Active use of telemedicine data resources to support clinical quality improvement</td>
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<td>Improved compliance with best practices: DVT prevention 85% to 99% Stress ulcer prevention 83% to 96% Cardiovascular protection 80% to 99% VAP prevention 33% to 52% Lower rates of ICU complications -VAP 13% to 1.6% -CRBSI 1.0% to 0.6%</td>
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| Services may be provided at different levels of intensity and involvement, based on bedside clinician discretion. | | | Other measures: staff acceptance; severity of illness measures routinely measured. |  | Processes  
**Barriers to success:**  
Inconsistent practices across telemedicine programs  
Low rates of collaboration between e-ICU and bedside caregivers; lack of collaborative culture.  
“opt out” option for not using e-ICU, or using it at low level of involvement  
Not having formal e-ICU sign out/sign in processes  
Not timely in response to bedside alerts and alarms  
Insufficient number of onsite care |
## Renal Disaster Relief Task Force (RDRTF)

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<td><strong>Renal Disaster Relief Task Force (RDRTF)</strong>&lt;sup&gt;61&lt;/sup&gt;</td>
<td><strong>References</strong>&lt;sup&gt;40-42&lt;/sup&gt;</td>
<td><strong>Reference</strong>&lt;sup&gt;41&lt;/sup&gt;</td>
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<td>Administered under the umbrella of International Society of Nephrology from Belgium, embedded within Medecins Sans Frontieres (MSF) for operations. The RDRTF headquarters are in Belgium, but regional contact persons are in place globally to optimize local responsiveness. Volunteers are recruited at international meetings and on website. Database of volunteer physicians, nurses, and technicians includes members from as many parts of the world as possible who can act as local point people in the event of a regional disaster.</td>
<td>Partners with MSF, which stores and maintains dialysis equipment and supplies for emergency shipment from Brussels MSF facilitates registered RDRTF clinical staff entering host nation, along with needed drugs and supplies. Physical supplies provided by the RDRTF include dialysis machines, reverse osmosis machines, hemodialysis consumables, dialysis catheters, and related medications</td>
<td>Since its’ inception, the RDRTF has participated in 23 interventions, providing all or some of these supports as needed, including 5 major interventions involving direct provision of emergency dialysis <strong>Data from Marmara earthquake 1999</strong> Time to initiation of intervention – 22 hours <strong>Incidence of hospitalized AKI/crush syndrome:</strong> 12% (639 patients) <strong>Number dialyzed:</strong> 477 (74.6%) <strong>Mortality:</strong></td>
<td><strong>Success factors:</strong> Very dedicated team leadership with growing expertise Good rapport with MSF, which facilitates logistics globally, and has broad network of local “point” people, which permits rapid assessment of local needs. Iterative process of learning and adapting, overlap of clinical teams facilitates handover and communication within the team.</td>
<td>Provide short-term interventions for potentially reversible AKI Facilitates administration of transfusions and antibiotics in crush victims on dialysis. Provides advice on prevention of crush syndrome to limit extent of AKI if patients identified early</td>
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<td>Advanced Regional Care System</td>
<td>Structural Design</td>
<td>Required Resources</td>
<td>Outcome Measures and Results</td>
<td>Success Factors/Barriers to Success</td>
<td>Patient and Family Support from Program</td>
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<td>Once needs identified, experienced teams can be mobilized within hours to perform needs assessment and initiate dialysis.</td>
<td>(e.g. heparin, antibiotics, kayexalate, antihypertensives). Supplies are obtained through MSF or donations. The annual funding from MSF is up to $15,000 USD, expenses above this are paid for by the International Society of Nephrology (rare) Logistical support includes medical and technical training, psychological support, transport and delivery of materials Volunteers rotate on a two-weekly basis to facilitate participation of members fully employed elsewhere. Current volunteers include: 41</td>
<td>15.2% of all AKI patients 17.2% among those dialyzed Antibiotics given 20.2% non-dialyzed patients 79.8% of those dialyzed Blood transfusions required: 14.7% non-dialyzed patients 85.3% of those dialyzed</td>
<td>success: Communication inadequate with other local intervention teams (non-MSF) to inform availability of dialysis Short “institutional memory” on the ground because of staff turnover Geographical barriers may prevent rapid institution of dialysis, and unlikely all crush syndrome patients are identified, with patients sometimes lost in the chaos Suboptimal awareness of necessity of resuscitation by evacuation teams misses the window</td>
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<td>physicians from 17 countries; 74 dialysis nurses; 11 dialysis technicians</td>
<td>of opportunity to prevent crush syndrome</td>
<td>Ethical dilemmas of providing dialysis in areas where it is not local standard of care</td>
<td>Local regulations may prohibit use of second hand machines and supplies</td>
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<td>IStat® machines are provided by MSF for scout teams to screen for AKI and monitor treated patients</td>
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<td>Transportation difficulties for personnel and supplies in host country; incomplete knowledge of local infrastructure; unusable donations</td>
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