

PREPARING YOUR ICU FOR DISASTER RESPONSE

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FOREWORD

One cannot plan when disaster will strike, but you should be prepared when it does. Is your ICU ready? Where do you begin? What are the necessary tasks and priorities? How do you optimally manage the incoming flow of critically ill and injured patients?

The Society of Critical Care Medicine recognizes that many ICUs lack a systems approach to forecast response to an external disaster that effects their unit. To ensure a smooth response, ICU professionals must take into account resource utilization, staffing, triaging patients, communications strategies, and other important issues for their ICU so that surge capacity planning strategies are accurate and timely.

Preparing Your ICU for Disaster Response was developed to answer these needs. This guidebook will help ICU professionals assess their current levels of ICU preparedness, as well as provide resources for strategizing and implementing a standing plan for disaster preparedness. The information included will help to align your ICU disaster response within your institutional disaster preparedness plan. It also offers tips regarding how to translate your ICU plan to accommodate specific resource needs in the event of a critical care surge.

Presented in an easy-to-follow design, key information in the chapters is presented in box format among five categories:



General Concepts



Action Items



Communication Advice



Disaster Tips



Case Study

The icons associated with these categories appear throughout the book to guide readers to the type of information they need. **Appendix 1-Appendix 12** also supplement this toolkit with additional resources, templates, protocols, case studies, and sample plans to use when preparing your ICU disaster response plan.

The development of this book could not have been possible without the continued involvement of the individuals listed as contributors. They are experts in critical care medicine and disaster response, and we thank them for their time and dedication to the project.

Unfortunately, disaster happens. When it does, have a plan and be prepared. Use this resource as a guide to equip your ICU with the appropriate disaster response.

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Is disaster preparedness important? Why devote scarce ICU resources to preparedness activities?

- Although a disaster affecting your ICU is a low probability, if one does occur, it likely will be a high-consequence event.
- Remember, preparation does not necessarily mean that you must buy “things.” Spending money does not always equal improved response capabilities. Preparation may be limited to planning, education, and training, which are cost-effective measures.
- If you want a candid answer to these questions, ask someone who has experienced a disaster that impacted their hospital and ICU. Consider the case in **Box 1-1**.



Box 1-1. Case Study: A Real Tragedy

On February 20, 2003, a fire broke out in a crowded nightclub in West Warwick, Rhode Island. In less than 10 minutes, the club was engulfed in flames. More than 450 people were in the nightclub; about half were injured from burns, smoke inhalation, and trauma resulting from trampling.

Within the first hours, more than 40 critically ill patients were transported to the nearest hospital two miles away. Transportation by ambulance and private vehicle made consistent communication difficult. The 350-bed institution nearly ran out of ventilators because the majority of the initial patients needed intubation for smoke inhalation and facial burns. The pharmacy dispensed one gram of

You should use this chapter as a(n):

- Introduction to the role of the ICU during disaster response
- Starting point for developing an ICU disaster preparedness plan
- Guide for how to use this publication to improve disaster response in your ICU



morphine in 4 hours' time, approximately 3 months' supply in normal circumstances.

Although the hospital was less than 15 miles from Providence, Rhode Island, and the weather was clear, nearly 5 hours lapsed before any transfers of critically ill patients to other institutions occurred; these centers needed time to make room in their own ICUs to accommodate incoming patients. To further complicate communications, 200 family members needed to be informed of the status of their loved ones' injuries, and emotional support needed to be provided.¹

Consider the logistics of this disaster response—if one conservatively estimates that each critically ill patient received 3 L of IV fluid while at the first hospital, a total of 120 L of IV fluid was required during the first 4 hours after the event. Additionally, how many personnel were needed to provide care for 40 critically ill patients during the first few hours of resuscitation, when the patients were the most unstable? If patient transfers had been delayed due to inclement weather for a full 24 hours, the logistical strain for basic resuscitation supplies, medications, and personnel would have become a second disaster.

If a disaster occurs, what makes the greatest difference for an ICU? How do we ensure a successful response?

- Pre-event planning for ICUs is essential and is the most important variable to ensure a successful disaster medical response.
- Staff education and training are the most effective modalities to enhance ICU preparedness.
- This publication is intended as a *toolkit* to help critical care directors and hospital administrators review, analyze, and ameliorate potential gaps in the ability to surge critical care services expeditiously.

What is disaster medicine, and how many ICU patients (casualties) constitute a disaster?

Disaster medicine is the coordinated medical response to an unexpected disruption of the normal system of healthcare delivery. The goal of a disaster medical response is to mitigate death, disease, and further injury. Over the last decade, multiple events have repeatedly demonstrated that local critical care services may be quickly strained or overwhelmed with a minimal to moderate influx of unstable patients.

Several contributing factors have been cited:

- Increased need for critical care services as our population ages, combined with decreased availability of critical care providers of all disciplines, has resulted in near-capacity occupancy of intensive care beds on a consistent basis.
- Monetary constraints have led to the elimination of healthcare services in many communities, placing further strain on those that remain.
- Hospitals do not normally maintain a surplus of critical care supplies because overstocking increases cost. Just-in-time supply processes keep stocks to a minimum and much of the durable equipment is rented rather than purchased to decrease required expenses for maintenance and storage.
- These and other factors contribute to the inability of many institutions to handle patient surges and sustain care for the unexpected critically ill and injured. Consider the case in **Box 1-2**.



Box 1-2. Case Study: Bringing It Home

You are the director of a busy ICU in Pleasant Haven, Pennsylvania. You direct an eight-bed mixed medical ICU/surgical ICU in a nontrauma hospital of 150 beds. You are staffed with 25 registered nurses and 10 respiratory therapists who work 12-hour shifts. Your only partner lives 25 miles away and is currently vacationing in Mazatlán. During your morning rounds you get a call from the emergency room director, who informs you there has been a train accident in a township 3 miles away. The only information he gives you is that a train carrying chemical products derailed in the middle of town after hitting a stalled “big rig.” Early reports from the town’s volunteer fire services state that there are “several injuries at the site, with at least one burn victim.” The onsite personnel report

fires and significant fumes at the scene. Liquid is reportedly leaking from one of the container cars. Two ambulances are en route from your facility and the emergency room director notes that he has one staff physician, two registered nurses, and one medical technician in the department. You are tasked with the leadership role in the response.

- What do you do?
- Where do you begin?
- What can you expect to happen?
- What needs to be available?
- How can you be prepared?
- Most importantly, what kind of strategy could you employ (now) to improve the odds of a successful disaster medical response by your ICU?

Where do I begin?

Okay—you are it. Everyone is looking to you for instructions. Is there a way to formalize the process? Can you quickly develop a plan of action? What will you do to plan to develop a continuum of care in order to respond in time? How do you set up your communications, crowd security, and flow at your facility? And, OH... NO..., you may need to care for possibly contaminated and poisoned victims. You have minutes to engage. Where do you start? Who do you need at your side? How do you get the process started?

What are some examples of critical processes to be resolved?

Some of the issues that should be effectively addressed during your planning processes include:

- Establishing an effective control process using an incident command center structure/approach (more on that later). This includes defining the human resources assets needed and who to have “at the table” with you (for both planning purposes and for the actual disaster medical response).
- Establishing a redundant and robust communication system using landlines, radios, cell phones, and computer technology in case one or more systems fail.

- Developing a security strategy for crowd control and patient flow, parking, and triage of the worried (panicked) as well as the potentially critically ill.
- Determining if there are sufficient decontamination facilities to keep you and your staff safe.
- You need people, you need help, and you need it now!

What is surge capacity, and how is it relevant to ICU disaster medical response? Is this a planning priority?

Building surge capacity is considered in two categories: enough things and the “right” things.

Enough Things

- Preparedness requires you to be able to augment your resources along a continuum: from the emergency room, to the holding wards, to facilities for the walking wounded, to the acute hospital beds, and into the ICU. There are two general strategies to improve ICU surge capacity:
 - An executable plan to help decrease routine bed demand (load) in your unit
 - The ability to increase the availability of the “3 Ss” of capacity-building: “stuff, space, and staff”
- Your goal is to deploy an adequate quantity of material and personnel into the response. In this case, you need to forget business as usual. That means:
 - Discontinue elective cases and procedures that require ICU bed support—you will need those spaces and people.
 - Expedite discharges and move patients to lower levels of care or home. Send observation-only ICU patients to the acute care units. The outcomes of these patients will be minimally affected.
 - Get some help as soon as possible. At first, it is quantity you are looking for; later, your needs will be more specific. Identify the extra space and beds. Get out those recall lists. Look at surrounding affiliated facilities such as long-term care facilities or nursing homes for help. Bring additional ICU clerical staff onsite and put them to work.

The “Right” Things

- Now you must address the more specialized, specific needs. During a disaster your ICU may need to provide:
 - Burn care
 - Trauma care
 - Care for chemically contaminated or intoxicated victims
 - Help with panicked and psychologically injured people
- What do you have for these patients?

What is the purpose of the guidebook?

This text outlines and describes the process of creating a critical care infrastructure able to surge in capacity and capability in response to extreme or disaster situations. Beginning with the assessment of existing structure and components of an institution’s critical care services, the book guides the reader through the various components of disaster readiness. Disaster basics such as leadership, communication, and integration are reviewed and outlined. An “all-hazards” approach is used when assessing ICU vulnerability. Potential gaps in staff, space, and equipment are the basis for the next phase of constructing a prepared critical care crisis response.

Stepwise planning and prioritization in augmenting an institution’s ICU is discussed in the subsequent sections. The chapters illustrate the multifaceted approach necessary to build a well-organized and effective solution to an exigency. Topics include team building, communications, leadership, special populations, mental health considerations, and others.

The final appendices are rich in resource material, encompassing personnel education and providing useful templates and practice situation scenarios. In summary, the guidebook is a vital toolkit for disaster planners and participants.



Box 1-3. Disaster Tips: Using *Preparing Your ICU for Disaster Response to Improve Disaster Medical Response in Your ICU*

1. Get the team together. Determine who should be a member of the core group of vested, multiprofessional personnel who will lead critical care disaster medical response team activities. Consider the following positions/individuals for your team:
 - ICU medical director
 - ICU nurse manager
 - ICU respiratory care representative
 - ICU pharmacist
 - Hospital administrator
 - Mental health provider
 - Palliative care or ethics committee member
 - Other considerations
 - Emergency department, anesthesia, trauma, and surgery staff
 - Include all intensive care units in the institution
 - Consider pediatric providers, especially if there are no pediatric intensivists in the institution
2. All staff should learn the information provided in this guidebook.
 - Review the guidebook and how it is organized. It provides a stepwise approach.
 - The first several chapters detail specific components of the process.
 - Detailed discussions of the important concepts of communication and critical care augmentation are presented in subsequent chapters.
 - Special considerations of ethics, mental health, and pediatrics are also reviewed.
 - The appendices provide a variety of important forms, templates, case scenarios, suggestions, and resources for your use.
3. Good luck!



REFERENCE

1. Dacey MJ. Tragedy and response—the Rhode Island nightclub fire. *N Engl J Med.* 2003; 349:1990-1992

ASSESSING YOUR ICU: ARE YOU READY TO RESPOND TO DISASTER?



SECTION I. PURPOSE OF THIS CHAPTER

- Provide an outline to assess your unit's current ability to respond to a mass casualty event.
- Demonstrate how a hazard vulnerability analysis (HVA) is utilized to guide an institution's preparations for a mass casualty incident.
- Review key focus areas for the coordination of the ICU disaster response plans with the emergency department and hospital response plans.



SECTION II. KEY POINTS

- A review of your *current* critical care capability is the first step in formulating a disaster response plan for your unit.
- Following the assessment of your current capabilities, an HVA is the next step in the process of formulating an effective emergency management plan for critical care and the hospital.
- A hospital must develop an accurate HVA that identifies the most likely disasters your facility might face. This HVA will allow for a prioritization of ICU supplies, personnel, and training required to mitigate the most likely scenarios.
- Disaster preparedness requires that the ICU/hospital develop a realistic plan and then rehearse the plan in a realistic manner.
- The ICU disaster plan should be integrated closely with that of the emergency department and other hospital areas.

You should use this chapter as a:

- Guide to assessing the readiness of your ICU for disaster response
- Resource for general concepts needed to prepare for a disaster
- Template to optimally prepare your ICU to meet the likely disasters that you might encounter



**SECTION III. FIRST THINGS FIRST***Where do I begin?*

- Overcoming inertia is often the biggest problem in preparing your critical care team to respond to potential disasters. Mass casualty events are low probability events and, as such, costly disaster mitigation efforts often take a back seat to the daily demands of running a busy ICU. To overcome this inertia (and sometimes apathy) we must remind ourselves that mass casualty events are a daily occurrence worldwide.
- In order to avoid the illusion of preparedness and to be optimally prepared, we must realistically assess our units current capabilities, complete an accurate hazard vulnerability analysis, develop an emergency management plan, and regularly conduct realistic drills to develop operational insight into how a mass casualty event might unfold at our institution. Joint Commission standards, professional society guidelines, and governmental regulations can all be utilized to build support for an effective disaster management plans for your unit and hospital.

**Box 2-1. Action Items: How do I organize my thoughts when creating an ICU disaster response plan?**

Step 1. Review and improve current critical care capacity (everyday needs and how to increase capacity when faced with surge) and existing disaster plans (if any). See page 13.

Step 2. Consider what threats you are most likely to experience and will have the greatest impact on your ICU (the HVA). See page 17.

Step 3. Revise your existing plan, taking into account what you have determined regarding ICU capacity and the results of your HVA. See page 20.

Step 4. Meet with the leaders in your emergency department and other areas in the hospital to share your plan, learn about their plans, and work together to revise plans as needed when conflict exists. See page 20.

What are the issues?

- **Inertia.** The presence of thick dusty binders labeled “ICU disaster plan” reflects institutional complacency. Many lessons have been learned about better ways to prepare for disaster, and these need to be applied through review of any existing disaster plans. Threats to your ICU and hospital may have changed over the years, and similarly the resources and capability of your hospital have likely changed. Frequent reassessment of the ICU disaster plan is required, and now is as good a time as any to make sure it is in order.
- **Turf Protection.** Invariably, ICU disaster planning will have to take into account access to critical care-like areas in the hospital that may not be traditionally under the control of the ICU leadership team, such as the post-anesthesia recovery room, operating rooms, and step-down units. You should be prepared for resistance from other teams in your hospital as your plan includes options to impact on their priority activities and their space, stuff, and staff.
- **Limited Resources.** Due to financial constraints and desire for efficiency, many hospitals are challenged to have enough staff and equipment available during even minor surges in demand that may occur in everyday activity. Disaster preparedness plans may require purchase of supplies and equipment that must be protected from use, despite temptations from day-to-day challenges.
- **Do Not Reinvent the Wheel.** Use templates for plans borrowed from other organizations rather than start from scratch. If the old plan was a poorly organized “disaster,” weigh the benefits of revising an old disaster plan versus starting a new one based on a different template.
- **Do Not Let History Repeat Itself.** Consider results from previous actual or drilled disasters within the organization to identify lessons learned. Were the hospital and ICU disaster plans revised after drills/events? If not, try to reconstruct those lessons learned and revise the old plan or take them into account when building a new plan.



SECTION IV. VITAL CONCEPTS

What is the space, staff, stuff approach to managing ICU capacity and capability in disaster planning?

The space, staff, stuff approach is a simplified way to break down factors determining ICU capacity and capability to allow an organized approach to planning (**Box 2-2**).

**Box 2-2. General Concepts: Space, Staff, Stuff in ICU Disaster Planning**

Space: Refers to where you will treat critically ill patients in the hospital, including areas outside of the ICU that can be modified to allow care for critically ill patients

Staff: Refers to the human resources required to care for patients during a disaster event

Stuff: Refers to the equipment and supplies required to manage critically ill patients during a disaster

- **Space** refers to where you will treat critically ill patients in the hospital, including areas outside of the ICU that can be modified to allow care for critically ill patients. You should also be aware of adjacent areas (physically or functionally adjacent) that may have an impact on the flow into and out of the ICU, such as triage areas that will be a frequent source of patient intake or wards for patients who will receive palliative care when critical care is not appropriate.
- **Staff** refers to the human resources required to care for patients during a disaster event. In addition to your usual ICU staff, your ICU may require supplementary assistance from other healthcare providers in the hospital or community. Usual ICU staffing ratios will typically be impossible to maintain during a disaster, and personnel less experienced in critical care may be needed to augment critical care staff, with the necessary supervision provided. Prior and just-in-time training of supporting staff should be considered, and a roster of staff outside the ICU with helpful competencies should be created and maintained.
- **Stuff** refers to the equipment and supplies required to manage critically ill patients during a disaster. This may include equipment such as cardiac monitors, mechanical ventilators, noninvasive ventilation units, IV pumps, medications, medical gases, and other material. Common mistakes include failure to consider disposable or support items (eg, sufficient ventilator circuits to treat the expected number of patients).

What is an HVA?



Box 2-3. General Concepts: Hazard Vulnerability Analysis in ICU Disaster Planning

Hazard vulnerability analysis (HVA) refers to a process that identifies the probability and effects of disasters that your institution might face.

A community's risk from a specific disaster is directly related to probability and the magnitude of the event and inversely proportional to its preparation for such an event.

- An HVA is a process that identifies the probability and effects of disasters that your institution might face.
- Every community faces a unique selection of natural, technological, human, and hazardous material risks that reflect that community's unique local environment. For example, a community in the Midwest located near a large chemical plant will need to prioritize their disaster planning differently than a community located on the hurricane-prone eastern coast of Florida.
- A community's risk from a specific disaster is directly related to probability and the magnitude of the event and inversely proportional to its preparation for such an event.
- A current, thorough, and accurate HVA allows a hospital to prioritize planning, mitigation, response, and recovery efforts directed at the most likely disasters.



SECTION V. BUILDING A PLAN

What are the specific steps to build an effective ICU disaster response plan?



Step 1. Review current plans to improve critical care capacity (to meet usual and unusual surges in demand) and existing disaster plans (if any). You should address the following elements in this plan:

■ Space

- What is the current capacity of your ICU(s)? Average number of occupied beds? Medical-surgical mix? What percent of surgical cases are elective? Are the units open or closed?
- Surge capacity: Can additional ICU beds be added within the existing ICU?
- What other hospital spaces might be utilized for the provision of critical care during a mass casualty event (postanesthesia care unit, step-down units, wards, dialysis center, emergency department, etc)?
- Where would you provide critical care if the current space was unusable (eg, fire)?

■ Staff

- What is the experience level of your staff regarding disaster response? Previous disaster experience? Evaluate the surgical versus medical experience of your staff.
- Has your unit leadership identified a pool of personnel to augment ICU staff during a crisis? Consider healthcare professionals with critical care experience working within the institution, such as staff from cardiac, medical, surgical, and neurosurgical departments, as well as the emergency department, urgent care/walk-in clinics, or other off-campus sites affiliated with the hospital. A secondary pool may be found in recently retired personnel, faculty, medical students, and students from local healthcare schools.
- Has a system been put in place that establishes call and backup responsibility for the staff with well-developed and rehearsed scenarios for call-in?
- What are the factors that would limit the availability of your current staff during a mass casualty incident?

**Box 2-4. Disaster Tips: Staff Availability**

“Purposeful absenteeism” can result from issues such as child care, eldercare, pet care, fear of contracting illness, etc. What current programs are in place that would mitigate these factors?

■ **Stuff** (Supplies and Equipment)

- What critical supplies do you require to manage day-to-day operations? How many days of reserve supplies are readily available in the event of a disruption of the supply chain?
- Do you have strategies in place to access additional equipment or supplies in the event of a surge in demand (eg, contracts to meet surge in demand, hospital-based stockpiles, etc)? Does your staff know how to obtain these supplies?



Box 2-5. Disaster Tips: Stuff Strategy

Many hospitals most often rely on preexisting contracts with vendors or government agencies to provide “just-in-time” additional equipment or supplies in the event of a surge in demand.

These strategies are generally not effective in a regional or larger-scale crisis because all area hospitals will be trying to access external sources of additional equipment and supplies at the same time.

Each ICU and hospital **MUST** have a plan to resupply for a period of time without reliance on external groups or vendors, including state, regional, or federal resources.

- What lack of supplies and equipment will limit your ability to provide care to larger-than-usual numbers of patients? Ventilators? Oxygen? Electricity?
- Do you have plans to support your staff in the event of disruption of basic support services (eg, food, water, sleeping accommodations)?

■ **Communications**



Box 2-6. Communication Advice: Communicating With Staff

Pagers, home telephone numbers, and cell phone numbers may help, but services may be disrupted in the event of a large-scale external disaster.

Consider e-mail, social media strategies (Facebook, Twitter, etc), link with local media to help with announcements to staff.

- How do you advise your staff in and outside of the hospital about the status of a disaster event?

- Is there an organized system for communicating the need to recall staff? Has the plan been updated and tested on a regular basis?
- How would your ICU leadership team integrate communications with hospital public relations, incident management team, or other stakeholders?

■ Training

- Have you incorporated disaster response training into your annual staff training plan? Is your staff familiar with the current disaster response plan for your facility and community?
- What cross-training programs are in place to augment critical care skill sets and additional staff support (**Table 2-1**)?

Table 2-1. Advance Training for Staff to Assist in Critical Care

Examples	Advantages	Disadvantages
<ul style="list-style-type: none"> ■ Fundamental Critical Care Support (FCCS) course ■ Pediatric Fundamental Critical Care Support (PFCCS) course 	<ul style="list-style-type: none"> ■ Ability to organize a course based on schedules ■ Select willing and interested staff members 	<ul style="list-style-type: none"> ■ Decay of knowledge over time if not practiced/refreshed ■ Generic approach to deal with all hazards rather than specific problem/crisis

Just-in-time Training Options

Timing	Advantages	Disadvantages
<ul style="list-style-type: none"> ■ Use when required just before or during a disaster event. 	<ul style="list-style-type: none"> ■ Can be adapted to current crisis ■ Recent, so won't be forgotten ■ Support for financial and time commitments from stakeholders given imminent crisis 	<ul style="list-style-type: none"> ■ Leadership/educators likely engaged in other activities ■ Organization likely to be difficult ■ Draw on time when staff already required for clinical roles

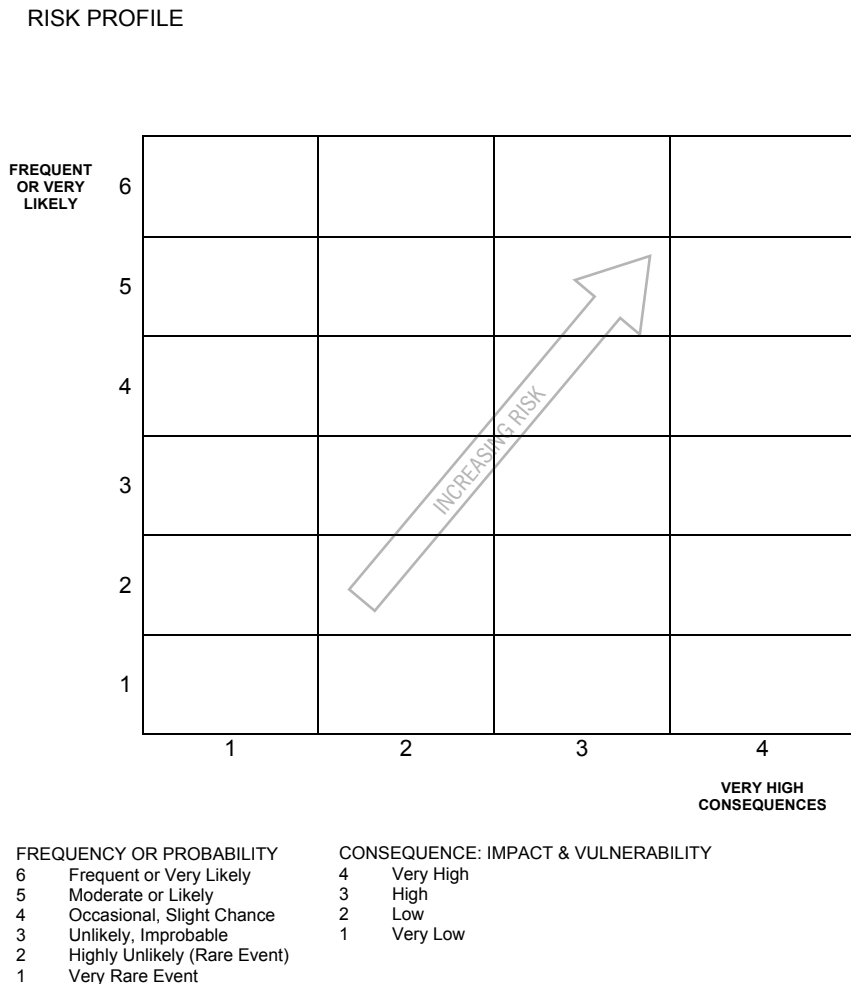


Step 2. Consider what threats you are most likely to experience and/or will have the greatest impact on your ICU (the HVA).

- Why conduct an HVA?
 - Having an organized approach to prioritizing planning for disaster makes sense. The HVA takes into account two elements of risk—the likelihood of an event happening and the potential consequences of the event. Resources should be dedicated to preparedness for events that are likely and events that will have high impact on the ability to deliver critical care in your institution.
 - Example of risk matrix is depicted in **Figure 2-1**.
 - Multiplying the likelihood score by the impact score gives the risk index. Ranking of potential events using the risk index will help prioritize disaster preparedness efforts.
- My state/region/town/hospital has conducted an HVA already. Do I need to do it again?
 - The likely answer is yes. Unless specific critical care requirements (and process input) have been incorporated into prior HVAs, the unique requirements to providing critical care have likely not been adequately represented. At the very least, you should review current HVA results to ensure that they take into account the critical care perspective. To illustrate, consider an event that could scare the population into believing they might be turned into zombies (say, a planned TV movie that pretends to be a newscast). Such an event may overwhelm psychiatric services but will not likely impact on critical care. Weighting of preparedness efforts would differ between mental health and critical care services in deciding how to train staff, prepare supplies, and plan for space.
- Who should be involved in preparing an HVA relevant to critical care?
 - Involvement of hospital staff familiar with prior local efforts to determine the likelihood of events could help eliminate duplication of prior effort. Predictions of likelihood may be borrowed from prior HVA analyses if they are recent and community circumstances have not changed. Hospital risk management staff would be possible contacts with external organizations in the absence of an identified hospital disaster liaison. Local or regional emergency preparedness staff may also be helpful in providing scenario likelihood assessments.

- A multidisciplinary perspective should be taken into account in determining the group to decide the impact of these events. The group should include critical care physicians, nurses, respiratory therapy personnel, pharmacy, and others.

Figure 2-1. Risk Matrix For Use When Conducting an HVA



- What should be the main focus while conducting an ICU-specific HVA?
 - Emergency preparedness officials can calculate the likelihood of different event scenarios based on extensive research and connections with organizations and partners. This is likely beyond the scope and resources of a hospital ICU team.

- Community or regional HVA efforts should lead to mitigation strategies to reduce the likelihood of events through preventive efforts. A hospital ICU team is unlikely to influence the likelihood of many events that occur beyond the walls of the hospital. However, the likelihood (risk) of hospital-induced events (eg, outbreaks of infectious disease, failure of physical infrastructure, release of radiological or chemical substances) may be influenced by the ICU team advocating within the hospital. The team performing the HVA assessment should try to identify events with modifiable risk when possible—prevention of an event is preferable to dealing with the aftermath of an event.
 - Most of the efforts of an ICU-specific HVA should focus on identifying the potential impact on critical care services of different events and identify mitigation strategies to reduce this impact (note that this is different than reducing the likelihood of an event actually occurring). The assessment of this impact should take into account the capacity of the ICU to respond to an event and the ability to augment response capacity and/or recover to normal function, given the nature of the event.
- Are there definitions to help score the likelihood of an event?
- An influenza pandemic seems to occur every 10 to 30 years; therefore, it is an occasional risk (**Table 2-2**). An unusual pandemic may occur less frequently (say, every 30 to 100 years). The potential severity of an event may lead to overestimation or underestimation of event likelihood; therefore, be cautious in describing the event in question.

Table 2-2. Predicting the Likelihood of a Disaster Event

Frequent or very likely	Every 1-3 years
Moderate or likely	Every 3-10 years
Occasional, slight chance	Every 10-30 years
Unlikely, improbably	Every 30-100 years
Highly unlikely, rare event	Every 100-200 years
Very rare event	Every 200-300 years



Step 3. Revise your existing plan, taking into account what you have determined regarding ICU capacity and the results of your HVA.

- Do the existing disaster plans take into account the most likely and most severe disaster scenarios? Are there unique needs related to specific events (eg, atropine supplies for a chemical event related to the pesticide factory nearby) that haven't been taken into account? If the current or developing plan does not prepare for these priority scenarios, then it's time to go back and revise them.
- Look for opportunities to reduce the likelihood of hospital-related events that can be prevented through better planning and safer practices.
- Look for opportunities to mitigate the risk of impact on critical care services through improved planning for space, staff, and staff relevant to the key event scenarios identified through the HVA.



Step 4. Meet with the leaders in your emergency department and other areas in the hospital to share your plan, learn about their plans, and revise plans as needed when and where conflict exists.

- How do you identify the important stakeholders to involve in ICU disaster plan development and overall preparedness efforts?
 - Individuals who can add to your planning efforts by bringing to the table the following assets: knowledge, resources, existing relationships, and authority to approve plans.
 - Individuals who will likely be stripped of resources due to planning efforts, stockpiling, or a disaster event. Can you work with them in advance to mitigate potential opposition to your plans?
 - Groups within or outside the hospital with whom to collaborate to make our planning efforts more efficient (eg, shared stockpile of equipment or supplies with another local hospital)
- How do I engage these stakeholders to ensure support for our plan?
 - Review the HVA results. Ensure that stakeholders understand the likelihood and potential impact of events on critical care services and what that may mean to their ability to meet their priorities.

- Expect that many stakeholders will not understand the impact of surge on critical care. Review the current state of ICU resource availability (often already near capacity) and the current plans/limitations to augment ICU capacity given day-to-day surges in demand.
- Clearly explain how the required resources will augment critical care capacity to better serve the rest of the hospital, your community, and others. People outside of the ICU team may be asking themselves, “What’s in it for me/us?” Make sure you answer that frequently unspoken question.
- Use of external standards can be helpful in encouraging other groups to support your plan. Potential impact on hospital rating or accreditation can be a helpful motivator to build support.



SECTION VI. IMPLEMENTING THE PLAN

- Ensure that you identify who in the hospital needs to review and approve the plan. In many cases, the plan should be presented to major leadership groups within the hospital (eg, medical advisory committee, hospital senior management team).
- Make sure the plan clearly indicates triggers for various events and strategies to differentiate between day-to-day stressors and major disaster events.
- Indicate how often the plan needs to be reviewed and revised. In addition to regular reassessment, review the plan after any events affect your hospital, or other organizations, to determine if lessons learned from the event should be incorporated into the plan.
- Consider how the plan should be made available to staff for review. Printed copies may be useful in the event of infrastructure failure; however, electronic copies are more easily updated in the event of change and they can be viewed remotely.
- Develop an accompanying strategy for familiarizing your team with the ICU disaster plan. Most hospital committees look favorably on an education plan accompanying any new policies and procedures, so ensure this is included with submission to any relevant approving committees or groups within the hospital.
- Incorporate a process for evaluating the effectiveness of the plan. Have a clear strategy for tracking successes and failures of the plan during drills and events. Conduct after-event reviews for a critique of the plan. Envision what an effective plan implementation would look like. Can you quantify it?



SECTION VII. SUMMARY

- Remember the key steps in assessing your state of readiness for a disaster affecting your ICU, as highlighted in **Box 2-1**.
- Use space, staff, stuff as an initial approach to breaking down the otherwise daunting task of assessing your current state of readiness. Other chapters in this publication will provide more detailed strategies and examples to help assess the adequacy of your current ICU disaster plan and help you improve the relevant sections.



SUGGESTED READINGS

Emergency preparedness and response. Centers for Disease Control and Prevention Web site. <http://emergency.cdc.gov/>. Updated November 16, 2011. Accessed December 22, 2011.

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CHAPTER THREE

LEADERSHIP DURING A DISASTER



SECTION I. PURPOSE OF THIS CHAPTER

- Discuss the hospital incident command system (HICS) and how it differs from routine hospital and health system management.
- Discuss the leadership interface between HICS and the community/region.
- Define key traits necessary for effective disaster leadership.
- Discuss concepts of team development during a disaster.
- Describe situational awareness and how it can impact or undermine disaster leadership.



SECTION II. KEY POINTS

- The state/regional incident command system (ICS) is responsible and accountable for the overall direction and coordination of disaster management activities using public health resources during a wide-scale disaster.
- Each hospital must develop a HICS.
- The HICS needs to be integrated into the community and regional ICS.
- A hospital's disaster leadership must be identified prior to an event.
- A hospital's disaster leadership is the key to the success of the ICS.

You should use this chapter as a:

- Guide for developing the necessary leadership structure for a hospital incident command system
- Guide for integration of critical care with the community and regional incident command system
- Guide for delegating disaster leadership under the auspices of the hospital incident command system and the regional incident command system





Box 3-1. Case Study: Toronto SARS Epidemic, 2003¹⁻⁶

In the spring of 2003, the city of Toronto, Canada found itself in the midst of the severe acute respiratory syndrome (SARS) epidemic. Over the course of the epidemic, 225 probable or suspected SARS cases would be diagnosed from the 2,132 investigated, of which 55 required ICU care and 38 died. At that time, the city of Toronto was already operating with a reduction of ICU beds with high ICU occupancy rates due to years of cost containment and a lack of critical care nurses.

The rapid onset of the SARS epidemic was a frightening experience for the Toronto critical care community. The disease was previously unknown, and at the beginning it was unclear what infection control measures could prevent transmission. The mortality rate was likely to be high. When SARS cases were encountered, entire ICUs were placed in quarantine, often up to 12 to 14 days. ICU providers developed decreased trust because of the lack of information and frequent infection control changes. They suffered emotional duress as they faced a high rate of SARS among their peers, quarantine, distancing from others in society, and feelings of isolation.

SARS crippled the healthcare system, especially the delivery of critical care, and damaged the local economy. There seemed to be no systematic way for critical care clinicians, hospital administrators, or government and public health officials to communicate. Infection control protocols needed to be changed quickly and rapidly disseminated to frontline workers.

In an attempt to establish a communication infrastructure and coordinate leadership, the Toronto critical care community organized regular teleconferences three times weekly. Participants were critical care clinicians and invited experts in infection control and infectious disease, public health and government officials, and hospital administration. Strategies used to identify participants included using personal email lists and communications, announcements to hospital administrators through the Ontario Hospital Association, and sometimes simply calling a hospital to try to identify leadership.

The teleconferences immediately helped clarify media reports and dispel rumors, synthesize the large volume of faxes and government directives, exchange clinical information and advice, and answer questions. Perhaps most importantly, it identified critical care leaders that would focus on

specific tasks and provided the authority and resources necessary to complete them. The Ministry of Health and individual hospitals' leadership were highly supportive of these efforts, which brought outstanding results, including:

- ICU leaders from the critical care community were appointed to work directly with the Ministry of Health with one voice to bring forward critical care issues and assist in finding system-wide solutions. Some of the issues included maintaining essential services while ICUs were closed for SARS, providing up-to-the-minute epidemiologic information to frontline workers, identifying and training an adequate potential ICU workforce (either from Toronto or elsewhere).
- A team of critical care clinicians and infection control colleagues collaborated to develop guidelines for ICU practices that might have risked SARS transmission (eg, intubation, CPR, others). Guidelines quickly received government approval and mandates, and were disseminated using email distribution lists, a broadly advertised Web site, instructional videos, and via remote and local training.
- Rapid development of research protocols, with expedited ethics approval, data collection, dissemination of results, and improved patient care based on the findings
- One of the most significant changes was the development of an effective communication infrastructure. In addition to scheduled teleconferences, other communication strategies included updated email distribution lists, a Web site, free SARS-specific software developed for handheld computers, and a 24-hour on-call clinical support phone line staffed by intensivists and sponsored by a government toll-free line.
- ICU and hospital leaders, recognizing the importance of supporting frontline staff morale, helped facilitate regular meetings and psychological interventions. Leadership communicated regularly with ICU staff in quarantine and those admitted with SARS.

Infection control measures were effective in preventing the further spread of SARS. Although the number of new cases stopped, the volume of patients with SARS that required ICU services lagged behind by several weeks. The communication, organization, and coordination of key stakeholders were ultimately crucial in effectively fighting the epidemic.

The Toronto critical care community felt there were a number of important lessons learned from this experience:

- **They were not prepared for the SARS epidemic.**
- **Effective leadership and communication infrastructure and systems were not in place.**
- **Medical centers were not prepared to accommodate a rapid surge in patients due to SARS.**

Since that time, the city of Toronto has developed an organized infrastructure of designated physicians and other leadership, as well as a communication network in case another disaster occurs. The Ministry of Health has supported the development of a disaster database. Toronto hospitals and other healthcare partners now periodically practice surge capability by having joint exercises and drills.

Some of the feelings shared afterwards were poignant reminders of what was most important:

Sharing information and learning from collective experience requires unprecedented collaboration and open communication between all levels of government, healthcare organizations, and frontline workers...System-wide thinking may challenge even the most seasoned of critical care providers because the scope of current barriers, the number of people involved, and the effort needed to get them to collaborate on such a broad scale is not something that they will necessarily have experienced or tried to tackle in the past...

These individuals (ICU healthcare workers) elected to put their own health and potentially the health of their families on the line and work in enormously stressful conditions, often for mere strangers, and these are the true heroes of the SARS battle we faced.



SECTION III. VITAL CONCEPTS

How is an incident command system (ICS) part of the leadership structure?

- It is a management process that hospitals, health systems, and other non-healthcare organizations use for emergencies, disasters, or specific preplanned incidents or events.

- It is a temporary organizational structure to be used for the express purpose of coping with a specific emergency or event until it is concluded.
- It is characterized by *management by objective*, which means identifying the emergency, planning and structuring the appropriate response, and mobilizing the resources necessary for effective action.
- It is a complementary structure to a hospital or health system's routine administrative (leadership) hierarchy, although it may take precedence when the disaster or event requires more attention, focus, and/or resources (**Box 3-2**).⁷⁻¹⁰



Box 3-2. General Concepts: The Incident Command System and the National Incident Management System: History and Foundation⁷⁻¹⁰

Incident Command System (ICS)

The ICS was originally designed in the 1970s to address the needs of firefighters during major incidents. Prior to this time, weaknesses in communication and terminology, lack of a standardized management structure, and lack of a systematic planning process and personnel accountability were detected. In brief, personnel from different agencies did not communicate with standard equipment or terminology, had difficulty integrating into and coordinating with a larger organization when fighting a large fire, and did not always know what they were responsible or accountable for. As a consequence, the ICS was developed and designed to:

- Be a management system that focused on the key problem at hand, identify and implement the appropriate response, and assign suitable resources (management by objective)
- Establish a clear chain of command, independent of event size or type
- Facilitate personnel from different agencies or departments to be integrated into a common structure that effectively addressed issues and delegated responsibility
- Provide for appropriate logistic and administrative support, and ensure key functions are covered without duplication of efforts

- Be used extensively by fire, police, emergency medical services, and military agencies

National Incident Management System (NIMS)

NIMS was established in 2003 by President George W. Bush with Homeland Security Presidential Directive 5. It is the standard ICS developed under the Department of Homeland Security and is required to be used by all state, territorial, tribal, and local governments in order to receive federal preparedness assistance. Most government agencies were required to be compliant with this by 2006 and hospitals by 2008.

Why is the hospital incident command system (HICS) important to hospital and clinical leaders?

- It is utilized by many or most hospitals because it provides a proven disaster management system that is compatible with the NIMS (**Box 3-2**), and is widely known and accepted. It will be discussed as the prototypical ICS later in this chapter.
- Although other non-NIMS ICSs are in use, they will likely employ most, if not all, of the same principles and elements.^{8,11-13}
- **Figure 3-1** in **Box 3-3** outlines the organizational structure of an ICS.



Box 3-3. General Concepts: History of the Development of the Hospital Incident Command System^{7,8,14}

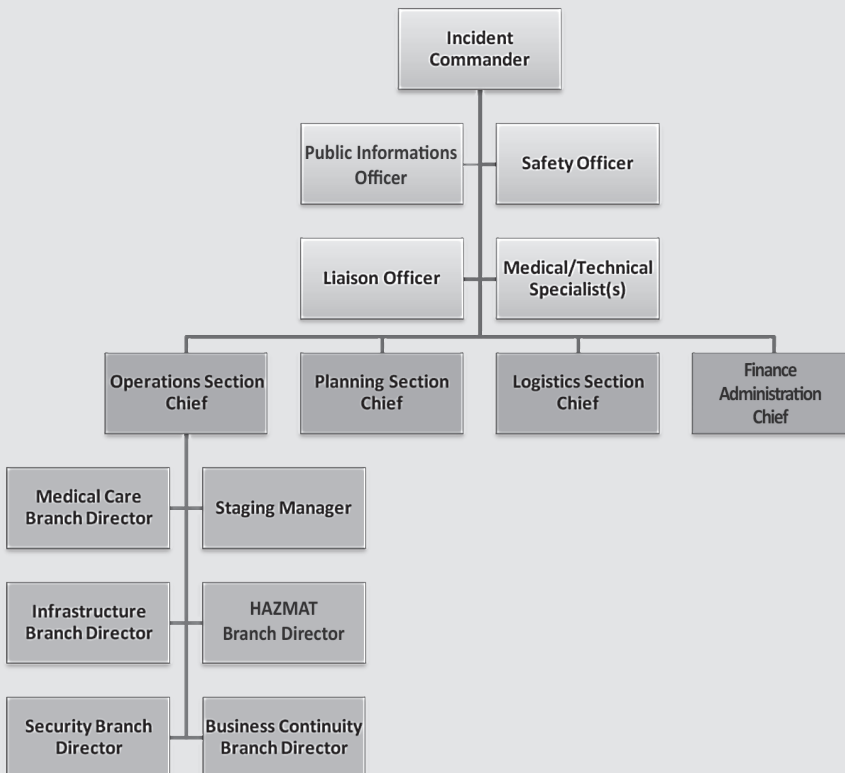
The HICS is an incident command system used by hospitals to develop disaster preparedness. The first HICS, developed in 1991, was called the “hospital emergency incident control system.” This system was started to provide a foundation for emergency management, but over time its value with preplanned events and nonemergent situations became evident. “Emergency” was dropped in 2006, and the system was given its current name.

HICS employs a common job title position nomenclature that enables like positions in different hospitals, health systems, or other agencies to have the same name and function(s). The positions are organized by required responsibilities and tasks.

- Positions should have a realistic span of control, meaning they can function effectively and not become overloaded, either with the work they are doing themselves or in overseeing the work of others. A typical span of control may have one position overseeing three to seven others.
- Positions may expand or contract based on the needs of the situation. For instance, a specific position may assume several different titles and responsibilities, with these delegated to others as the scope of an incident grows. Likewise, some positions may not be required at all and will not be filled.

HICS specifically does not define individuals. It focuses on the expertise needed for each position, and the most qualified persons. This structure (**Figure 3-1**) also facilitates the transition of responsibilities to others, particularly during prolonged incidents or disasters, to ensure personnel remain rested.

Figure 3-1. Incident Command System Organizational Structure



The top hospital leader is the incident commander, the only position that is absolutely required. There are four key positions supporting the incident commander. In a small incident or disaster or in a smaller hospital, the incident commander may assume any or all of these roles.

The medical and technical specialists, who are health professionals, and others with specialty expertise provide expert counsel to the incident commander. Critical care input must be included here in any incident or disaster where critically ill patients are likely to be cared for. The public information officer, safety officer, and liaison officer also support the incident commander.

Below the incident commander are the section chiefs. The operations section chief oversees inpatient clinical areas and their immediate logistic and administrative support. This is likely to be the largest section in HICS because this is where patient care is delivered. There is also a planning section chief, a logistics section chief, and a finance and administration section chief.

Within the operations section, the medical care branch director has oversight of all clinical care areas, including inpatient and outpatient care. The inpatient unit leader is next in the chain of command and oversees all inpatient care.

The inpatient clinical areas are not further defined within HICS but should include intensive care, hospital medicine and/or other ward-level care (including intermediate care), emergency medicine, and other specialty care areas.

In a large incident or emergency affecting multiple hospitals or health systems, an individual hospital would be integrated into a larger network, which would typically involve a regional or state department of health. These entities together are referred to as an *emergency operations center*.

What are the key organizational (leadership) differences between the HICS and routine hospital administrative structure and function?

- HICS defines positions and responsibilities of positions filled by personnel with the appropriate qualifications for the incident or disaster, independent of hierarchical considerations.
- Positions may be filled by several personnel with appropriate qualifications, with responsibilities transitioned among them in order to facilitate all personnel being able to perform at a high level (shifts).
- Positions are established by the needs of the incident or emergency and may be added, expanded, contracted, or eliminated based on the nature of changing circumstances.

- HICS is a standardized management process that facilitates an individual hospital or healthcare entity to be easily integrated into a much larger system or emergency operations center. In a significant emergency, this regional integration would be crucial in providing the highest quality, most equitable care to all patients.

What is the Hospital Preparedness Program?

- In 2002, after the September 11, 2001 terrorist attacks, the United States Congress established the Hospital Preparedness Program (HPP) (since renamed the National Healthcare Preparedness Program). The intent of this program was to increase the preparedness of both hospitals and their collaborating partners to respond to acts of bioterrorism, infectious diseases, and other possible disasters.^{1,2} HPP funds have been largely responsible for the improvement in American hospital disaster preparedness over most of the last decade.
- Since the 2001 terrorist attacks, “disaster preparedness of individual hospitals has improved significantly ... healthcare planning for catastrophic emergencies is in its early stages,”¹⁵ and “our healthcare system is still underprepared to manage a large-scale, catastrophic health event.”¹⁶

What is a healthcare coalition?

- A *healthcare coalition* (HCC) is defined as a formal collaboration among hospitals, public and government health departments, emergency management, emergency response agencies, and other community healthcare entities organized and coordinated to respond to a potential disaster with mass casualties. HCCs are the United States’ first endeavor at organizing and coordinating community healthcare resources, especially acute care hospitals, for disaster preparedness and response (**Box 3-4**).^{12,16,17}
- HCCs are organizations of geographically neighboring hospitals, health systems, government health departments, and other entities that have joined to develop a network from which to increase disaster preparedness. Hopefully, they will be the foundation of system-level communication and coordination essential for managing a disaster too large for an individual hospital or health system to handle alone.
- It is important for ICU leadership to recognize that HCCs are highly variable in terms of sophistication and their ability to function together effectively. While there are four published examples of more developed HCCs (Los Angeles, Minneapolis/Saint Paul, New York City, and Seattle and King County), there is little published

data describing the state of HCCs in the rest of the United States.¹³ The capacity of any HCC to operate effectively in a crisis is not assured, especially given the conclusion that our healthcare system remains underprepared.



Box 3-4. General Concepts: Overview and Status of Key Success Factors for Healthcare Coalitions in the United States^{12,15,16}

- Evolution of healthcare coalition (HCC) organizations and governance
 - Formation of HCCs has arisen from many different mechanisms.
 - Built on preexisting structures or entities
 - A dominant health system bringing neighboring hospitals together
 - The public health department serving as organizing body
 - Collaboration among local healthcare hospitals and systems to create a new entity
 - Other mechanisms
- Keys to HCC success
 - Effective leadership and strong commitment to the HCC among members
 - Compacts or mutual aid agreements to legally define the organization
 - Defined leadership structure
 - Authority to compel action (“trigger”) likely dependent on local public health or government entities declaring an emergency
 - Inclusivity, as discussed below
- Geographic boundaries are highly variable and based on hospital or health system historical relationships, established referral patterns, proximity to each other, and other factors.
 - The key to HCC success is being inclusive, with all hospitals and appropriate healthcare entities invited to participate.
 - Not all hospitals or healthcare entities will choose to participate.
 - Membership varies from primarily hospital members to involving multiple other healthcare entities, and HCC effectiveness again depends on being inclusive.

- Hazard vulnerability analysis and planning, training, and exercising
 - o Successful HCCs jointly analyze and prioritize potential threats to their community and share sufficient information such that all are aware of each other's needs and potential resources.
 - o They also plan collaboratively, create community emergency response plans involving all members, and engage in joint training activities.
- Communication
 - Coalitions recognize the importance of reliable communication for the exchange of information among partners, with local and state agencies within the incident command system, and with other coalitions.
 - Coalition partners have a mechanism for connecting to the local or state incident management structure, but connections are highly variable. As of this writing, the NIMS does not formally incorporate the concept of an HCC.

It is recognized that HCCs must play a central role in obtaining, compiling, and sharing individual hospitals' information (data clearinghouse), and they must participate uniformly in surge capacity-altered standards and potential triage of scarce resources. Though some HCCs may be quite advanced, it is unclear to what extent this capability exists for most coalitions, or for our healthcare system as a whole.



SECTION IV. FIRST THINGS FIRST

Where do I begin?

- Identify your hospital's critical care leadership team and other professionals who should be involved in ICU disaster planning.
 - **In a hospital with a single ICU:** The intensive care leadership team will be the unit leadership, including the ICU medical director, nurse manager, and representatives from other health professionals providing ICU care (respiratory therapy, pharmacy, etc). This group may also include experienced clinical personnel such as physicians, charge nurses, or charge respiratory therapists, and other experienced and respected professionals.

One member of the leadership team would assume the position as team leader that reports to the inpatient leader; this responsibility may shift among

leadership team members, depending upon circumstances. This intensive care leadership team would be responsible for all healthcare personnel providing critical care services within the ICU, so ongoing communication with them is important. This leadership team would likely represent a reasonable span of control and not require further subdivision into smaller groups.

- **In a hospital with more than one ICU:** The intensive care leadership team would be composed of representatives from each ICU's leadership team. In addition, team leadership would likely include critical care department heads or chairpersons, nursing directors, and other department heads (eg, respiratory care, pharmacy, others). Experienced and well-respected members of the physician, nursing, and other professional staff should be included.

This team would choose a member to serve as team leader and report to the inpatient leader. Similar to a smaller environment, this responsibility might shift among team members. Each ICU would have its own leadership team, with member composition as described above, and would organizationally represent a subdivision of critical care.

- Identify the necessary key critical care interface relationships for disaster preparedness in your hospital.
 - Critical care expertise must be included within an incident commander's office as a medical or technical specialist. As part of preparedness planning, critical care leadership should develop an effective working relationship with those individuals likely to serve as incident commander. During an actual disaster or planned event or incident, this relationship will become even more important.
 - In a major disaster, hospitals may be called upon to surge up to 300% of their usual ICU capacity.¹⁷ Though addressing surge is beyond the scope of this chapter, this demand for increased ICU disaster capacity would require the provision of critical care services beyond the boundaries of the ICUs.¹⁷ Most healthcare professionals working within other potential service areas would be called upon to help provide critical care services. Maintaining effective and supportive relationships with these other service areas and departments is therefore important for critical care leadership and personnel (**Box 3-5**).



Box 3-5. Disaster Tips: Ensuring Interface Relationships for Disaster Preparedness

The HICS organizational chart needs to be expanded to include the following areas that can and will impact critical care in the event of a disaster.

- The emergency medicine department
- The anesthesia department and operating rooms and the postanesthesia recovery unit
- The intermediate care areas, which include hospital medicine and internal medicine, family practice, and other physician groups that provide most of the hospital-based primary care. It would also include the other professional disciplines (ie, nursing, respiratory therapy, pharmacy, and others).
- Other potential critical care service areas and departments based on local resources, such as cardiac catheterization labs, procedure areas, and other potential critical care service areas.
- Hospital administration in order to maintain routine hospital functioning and established professional relationships



SECTION V. BUILDING A PLAN

What should be the primary ICU leadership objectives when building an ICU disaster response plan?



Box 3-6. General Concepts: Three Objectives of ICU Leadership in Disaster Planning

1. To define the necessary leadership, communication, and coordination infrastructure. Quantify and list the strengths and potential weaknesses of your hospital and/or health system (this will help you design the most efficient and effective system).

2. To ensure that critical care is effectively integrated into your healthcare coalition

3. To ensure that critical care can facilitate and augment disaster preparedness capability. There is no gold standard for how an HCC should function, and the purpose of this assessment is to define coalition capability and opportunities to improve.

- In both planning for and contending with a disaster, critical care leadership is faced with working with imperfect and often inadequate systems of communication and coordination.
 - Leaders work to augment effectiveness by finding other partners to help accomplish needed objectives, or to help to interconnect other leaders, departments, or agencies in new ways.
 - This type of leadership, also termed *meta-leadership*, may require working beyond one's immediate scope of authority, utilizing reputation and informal power to help influence and support others into a new or different course of action.¹⁸
 - Meta-leaders should create change in a way that is wholly supportive and sensitive to the current systems and leadership already in place. It is equally important for system leadership to remain open to the opportunities that meta-leaders create.⁸
- As discussed in the SARS case study, critical care professionals organized teleconferences that supported the Ministry of Health and local hospital administrations, leading to effective coordination and implementation of changes. The case study:
 - Provides a good example of the system-level critical care challenges that an underprepared healthcare system may encounter in a disaster.
 - Illustrates the issues a severe epidemic presented and the strategies ultimately used to succeed in fighting it. It is a good starting point for discussing HCCs.
 - Emphasizes the development of effective system-wide communication and coordination of efforts – the single most important success factor in the SARS epidemic.

How do I assess the current preparedness state of the HCC leadership? What are the steps?

- Starting with your own hospital or health system leadership, first determine if you belong to an HCC. (This section assumes that you are already a member of an HCC.)
- On paper, define the leadership, communication, and coordination infrastructure of the HCC.
- Investigating what is known about the HCC your hospital or health system belongs to has several purposes.
 - It helps to define the HCC strengths and weaknesses that you may confront if or when an actual disaster occurs.
 - It helps define what needs to be fixed through your involvement in your HCC. Speak with your hospital leadership to find out who your coalition partners are and if they meet on a regular basis.
- If possible, volunteer to become involved in the coalition and utilize the opportunity to get to know the coalition leadership.



Box 3-7. Action Items: What to Look for When Assessing an HCC

1. Define the governance structure – how each institution or partner is represented, how governance is managed, and how decisions are made.
2. Realize the resources, strengths, and potential weaknesses that each partner brings to the coalition.
3. Understand what coalition partners do in terms of hazard vulnerability analysis planning and disaster exercises they participate in together.
4. Recognize the communication systems that coalition partners individually and collectively rely upon in an emergency. This would include conference call ability, email distribution lists, social networking, Web sites, cell phone numbers and digital pagers, ham radios, and any other devices.

How do I operationalize this? How can I ensure that critical care is appropriately involved with “big picture” disaster planning?

Critical care expertise should be formally included at the HCC level. It is important that all partners have critical care expertise included in these processes. Also consider the credentials of these representatives—what is their professional background (eg, MD, RN, etc), who has prior disaster preparedness experience, etc.

- Seek the assistance and support of your hospital and health system leadership to ensure that your critical care department and hospital/health system is represented within coalition leadership, including committees, meetings, and/or forums, and at the level of local government including local, regional, and state departments of health.
- Anecdotally, most health departments have difficulty getting physicians to participate in disaster planning and usually welcome volunteers when available.

How can critical care leaders ensure that they have identified all professionals that should be included in HCC disaster planning?

- Work to establish the necessary “people contacts” in order to help disaster preparedness planning. These are critical care and other professional contacts that will become your coalition partners in advancing critical care disaster preparedness, and the same individuals that you will call to help activate a network during an actual disaster.
- You should seek leadership-capable critical care professionals that you know personally in other hospitals or health systems, and include their complete contact information in your institutional plans; they should also have your complete contact information. Ideally, this information-sharing should include their contact lists as well as contact information for critical care professionals known to them.
- Other potential information resources for finding these professionals:
 - Local or state medical societies, which typically maintain contact lists and information for members, often by specialty (consider DocBookMD: www.docbookmd.com)
 - Local or state governments or health departments may also maintain lists and contact information for local, regional, and state critical care professionals.
 - National professional organizations routinely have lists and contact information for local professionals, particularly if local chapters exist. Some of these professional organizations are listed in **Table 3-1**.

Table 3-1. Professional Organizations with Disaster Planning Resources

Society of Critical Care Medicine	www.sccm.org
American College of Chest Physicians	www.chestnet.org
American Thoracic Society	www.thoracic.org
American Association of Critical-Care Nurses	www.aacn.org
Society of Hospital Medicine	www.hospitalmedicine.org
American Society of Health System Pharmacists	www.ashp.org
American Association of Respiratory Care	www.aarc.org
American Hospital Association	www.aha.org
Advisory Board Company	www.advisory.com

- Other professional societies and resources may help identify potential allies and resources.
- If critical care professional groups are already meeting (professional chapter meetings, other forums), it is helpful to have disaster preparedness as a topic of discussion.

A final note on incorporating the proper leadership strategies into your plan.

- The ultimate focus of critical care leadership in disaster preparedness is planning for the surge of resources necessary to meet the potential demand of critically ill patients.¹⁹
 - Preparing and supporting the surge of personnel who may be providing critical care services is first among leadership disaster worries. This includes critical care-trained personnel and other professionals who may be asked to provide this care.
 - ICU space (critical care treatment areas) and staff (ICU equipment and supplies) are the two other important logistical considerations.
- Your critical care professionals will provide direct patient care to critically ill and injured patients.
- These same critical care professionals are also responsible for the education and oversight of noncritical care professionals. This requires planning, direction, and leadership.

- The noncritical care professional staff will function as “force multipliers” by providing a large amount of the needed care, often beyond their professional scope and comfort levels.
- Monitoring and caring for the psychological and emotional health of all personnel is one of the most significant challenges for ICU leadership.



Box 3-8. Disaster Tips: Recommendations for ICU Infrastructure Preparedness

Dr. Lee Hamm, Chairman of Medicine at Tulane University, who was actively involved in the aftermath of the Hurricane Katrina disaster, recommends the following points of critical infrastructure preparedness that can translate to the ICU.²⁰

- **Prepare, prepare, prepare.** Do not ignore disaster drills, but do not think they will encompass everything your disaster may require.
- **Constantly consider what can go wrong.** Ask yourself: What am I relying on that might not work? You must realize that you can't count on many things, particularly early on.
- **Be as self-sufficient as possible.**
- **Realize that many people are willing to help you.** However, they are not necessarily the people you might think. Says Dr. Hamm: “I developed a great lack of confidence in government to do things quickly at all levels. But, other academic and medical organizations were hugely beneficial.”
- **Have a backup plan to the backup plan ready.**



SECTION VI. IMPLEMENTING THE PLAN

What are effective leadership attributes of ICU leadership in a disaster?

- Leadership, instead of management, is the key to a successful outcome following a disaster.
 - A leader who communicates well, thinks through barriers, and considers the needs of his or her team brings order to a disaster scene.

- Given the nature of the disaster, your professional expertise and organizational abilities may be simultaneously required.
 - First and foremost, make sure your family and home are safe and secure. Effective leadership will only occur if you are not distracted or worried.
- The effective leader will need to delegate or forego functions that are primarily performed day-to-day to meet the multitude of demands during an exodus or influx of patients.
- Knowing how and when to “flip the switch” into disaster mode can be critical to an effective response and help prevent micromanagement and a vortex of information.



**Box 3-9. General Concepts: Quarantelli’s
10 Criteria for Good Disaster Management⁸**

1. Correct identification of the differences between agent- and response-generated needs and demands
2. Adequate performance of generic functions
3. Effective mobilization of personnel and resources
4. Proper division of labor and delegation of tasks
5. Adequate processing of information
6. Allowance of proper exercise of decision making
7. Development of overall organizational coordination
8. Emergent aspects blended with established aspects
9. Provision of the mass media with appropriate information
10. Performance of a well-functioning emergency operations center

How can you become an effective ICU leader during a disaster?

- Know and understand your ICU personnel’s strengths and weaknesses.
- Have you properly prepared yourself to be a critical care disaster leader? Do you have the necessary knowledge and demonstrated abilities at triage? Do you have emergency medical services or military training?
- Are there any personnel with formal disaster, trauma, or military experience that you may want as leaders in disaster preparedness?

- Who will you designate to act in your place if you have to go to the ICS?
- Who are your best teachers? If you need to develop just-in-time training for non-ICU personnel to do ICU work, who might be the best at teaching them?
- What are your personal and professional strengths and weaknesses?
- What formal training courses have you taken? Are you a member of your local disaster medical assistance team?
- Understand where your disaster supplies are stored and who has access.
- What is your inventory of ventilators and oxygen supply?
- What if you require total ICU isolation for a biological event? Do you have adequate personal protective equipment and communication?
- Work with your disaster coordinators to set up a realistic disaster drill involving an influx of patients.

What are some practical leadership-related suggestions?

- Try to do ICU work for 1 hour while wearing respiratory personal protective equipment. How can you adjust your personnel work-flow and schedules to accommodate these difficulties?
- You should anticipate exacerbation of preexisting illnesses, power failure, and injuries based on your hazard vulnerability analysis.
- You need to know your hospital's ICU evacuation plans. Do you have transfer agreements with other hospitals or health systems?
- Once an exercise is completed, act upon your "after-action report."
- Create a culture of disaster preparedness in your daily rounds and professional activities at the hospital.
- Ask employees what would happen if Mrs. X needed immediate evacuation?
- Work through some ethical dilemmas with your staff.
- Surprise the night shift with a drill. Often, disasters happen during nonbusiness hours and weekends (eg, California Easter Sunday earthquake, 2010).
- Give lectures and grand rounds presentations routinely on disaster preparedness.
- Establish a framework for disaster management evaluation:
 - Before the disaster
 - During the disaster
 - Following the disaster

- Maintain a list of resources and reference materials that contain the following:
 - Names and cell phone numbers of your ICU staff and physicians
 - Names and cell phone numbers of ICU colleagues at local area facilities—this may help if you need to transfer patients or share resources and expertise during a disaster.
 - Printed copies of standard order sets (geared toward likely illnesses identified in your hazard vulnerability analysis)
- Be prepared to think outside of the box, clinically, but act within the established HICS/Department of Homeland Security/Federal Emergency Management Agency organizational framework.
- Avoid silos of information and strive to be a meta-leader, working across organizational or institutional barriers in the spirit of cooperation and sharing.¹

These suggestions will help you plan your leadership role. However, according to Dr. deBoisblanc, who successfully evacuated Charity Hospital's ICU following the 2005 Hurricane Katrina disaster in the United States, "Leadership is often borne under duress, and from every corner...young physicians, nurses, and allied health professionals (rose) to meet unique challenges."⁷

The disaster itself and the resulting patient care needs may create a leader from someone within your organization who brings a unique skill-set to meet the challenges. The effective leader will permit this talent to work to maximum capacity within the disaster response framework without becoming distracted by ego or titles. Power struggles in the midst of a disaster are very counterproductive and result in miscommunication on multiple levels.

What is the leadership role of an ICU nurse manager during a disaster?

- Depending on the level of involvement your ICU medical director has played in disaster preparedness, the ICU nurse manager may either assume leadership during the disaster or serve as the immediate associate of the ICU leader, implementing the charges set forth from the leadership.
- When an ICU needs to evacuate patients or has a surge of critically ill patients, there is little time to train new staff or determine who is the most capable. This information should be preidentified so patient care can flow smoothly. Nursing ratios will need to be modified and usual protocols relaxed.

- Key considerations:
 - Who are your highest-level performers? Are they able to effectively supervise lower-level performers? Would they be able to supervise non-ICU staff at managing ICU patients?
- You may need to call upon charge nurses, clinical nurse specialists, charge respiratory therapists, or clinical pharmacists with formal residency training to augment your staff's capabilities (**Box 3-10**). Being certain that your ICU staff is comfortable with delegation of duties and able to supervise others will be important.



Box 3-10. Disaster Tips: Increase Staff to Meet Surge of Patients

Develop a group of people that can effectively perform in an ICU with appropriate support or supervision. Submit a plan through the medical staff office for submission for emergency credentialing prior to an event. These personnel resources might include:

- Patient care technicians
- Hospitalists
- Residents and interns
- Medical students
- Nursing students
- Non-ICU nurses (especially telemetry nurses)
- Specialty nurses (eg, dialysis nurses, others)
- Respiratory therapy students
- Pharmacists

How do you build team strength?

- In order to build an effective team and response during a disaster, a team leader must be able to build trust among its members quickly.
- A leader who also addresses the morale and welfare of his members will find that he or she has a more successful outcome and sense of accomplishment following the disaster or catastrophic event.

- An ICU leader can help develop and train teams according to different anticipated scenarios (**Box 3-11**). This will permit opportunities for team building during the planning stages.
- Routine scheduled disaster exercises are an excellent means of not only disaster planning, but also building team strength.



Box 3-11. General Concepts: Specialty Teams

- It is imperative to know who the specialty personnel will be and to establish relationships ahead of time.
- Examples of these teams will be based on the type of disaster likely to be encountered:
 - Earthquake: May particularly need surgeons and nephrologists
 - Pandemic: May call for teams focused on respiratory care and infectious diseases
 - Hurricanes: May result in massive relocation; may need to have teams that are experts at planning multiple transfers
 - Bioterrorism: May need infectious disease and infection control specialists to help plan care
 - Fire: Will need burn surgeons and wound care specialists
 - Nuclear: May need burn and hematology support
- Other examples:
 - Cross-training development by ancillary personnel
 - Sedation holidays coupled with ventilator breathing trials, driven by nursing and respiratory personnel
 - Multidisciplinary rounds where everyone participates and understands each other's roles

What is situational awareness? How does it relate to communication for effective leadership?

- *Situational awareness (SA)* is knowing what is going on around you, and involves working memory. It is relevant to dynamic, evolving situations and supports response to the unexpected. SA includes the integration and interpretation of data necessary to project the future status.
- Successful implementation of HICS requires an understanding of SA and high-reliability teams.²¹ Simple adoption of HICS does not necessarily ensure an effective response to a mass casualty incident.
- In addition to SA, an adequate response requires collaboration between hospital teams and external agencies, with flawless communication in a rapidly changing environment.
- External agencies, such as local police, HAZMAT crews, state public health departments, and the Centers for Disease Control, may not be accustomed to working with hospital systems or ICUs on a regular basis. These external agencies need to function as high reliability teams that use SA to maintain close communication in order to address and mitigate any disaster situation.
- Communication of critical care needs in a disaster (immediate and anticipated) will be a key priority for the ICU leader during a disaster.
- Establishing and further developing an electronic medical record system that can effectively communicate internally and externally is and will be a key element to reliable, error-free disaster response.
- There is a great deal of work yet to be done with integrating of ICUs into disaster communication networks; however, it is important to start considering this as you build your electronic medical record platforms.



SECTION VII. SUMMARY

- Leadership in a disaster begins first with the planning and development of a HICS.
- The HICS must integrate successfully with community, regional, and national command systems for effective implementation.
- Key leadership roles must be identified in advance of an event.
- Regular training of all personnel involved in the HICS must be undertaken prior to an event.
- Specific teams addressing different types of disaster should be developed prior to an event.

- Successful implementation of a HICS requires an understanding of SA and high reliability teams. *Situational awareness* (SA) is simply knowing what is going on around you.



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CHAPTER FOUR

BUILDING AN ICU RESPONSE PLAN FOR DISASTERS



SECTION I. PURPOSE OF THIS CHAPTER

- Outline the critical issues to be included when creating an ICU disaster response plan.
- Highlight the necessary integration of an ICU disaster response plan into a larger healthcare plan of action.
- Discuss the development processes for building a detailed ICU disaster response plan.
- Address critical issues and shortfalls of ICU disaster management that should be addressed during plan development.



SECTION II. KEY POINTS

- The most important ICU asset is its staff – all plans must properly ensure staff safety and well-being.
- ICU disaster planning is a smaller subset of the larger hospital response plan.
- The larger hospital plan must integrate with local, regional, and national plans.
- ICU-based command and control, staffing, resource requests, and communications will be the same as those used throughout the hospital.
- Resource utilization, patient care type, staffing needs, and triage protocols will differ in the ICU when compared to the rest of the hospital health system.
- When completed, the detailed ICU disaster response plan must be fully integrated and “templated” into the larger hospital plan.

You should use this chapter as a:

- Guide for developing your ICU disaster response plan
- Template for ICU-specific and larger hospital-wide discussions
- Rough outline for developing a written ICU disaster response plan





SECTION III. FIRST THINGS FIRST

Where do I begin?

You should begin the planning process in the ICU. The ICU disaster response plan must integrate with the overall hospital disaster response plan, but start with what you own. **Box 4-1** lists the recommended sequence of initial steps within the ICU.



Box 4-1. Action Items: Initial Steps for Building an ICU Disaster Response Plan

1. Designate who will be the overall ICU plan champion.
2. Obtain and review existing ICU and/or facility disaster response plans/protocols.
3. Create a to-do list.
4. Complete a hazard vulnerability analysis (HVA), ICU equipment inventory, ICU staff inventory, and incident command system (ICS).

1. Designate who will be the overall ICU plan champion. Ideally, this will be a position, such as nurse manager, rather than a specific person. In the event of ICU staff turnover, the authority and responsibility will transfer to the new individual.
2. Obtain and review existing ICU and/or facility disaster response plans/protocols. Many ICUs do not have a specific plan, but specific protocols (eg, ventilator triage) may exist. These protocols should fit into the specifics of making an ICU plan, particularly under operations (patient care).
3. Create a to-do list. This list should be based on vital concepts listed below. It should include things that are ICU-specific as well as those that require reaching outside of the ICU to the hospital and the community.
4. Before reaching outside of the hospital and healthcare system, the ICU plan champion should complete the following:
 - An ICU-specific HVA (discussed in detail in Section IV)
 - A detailed ICU equipment inventory
 - A detailed multidisciplinary ICU staff inventory, with special attention to potential personnel shortfalls, such as specialty care (respiratory therapy, burn surgery, etc)

- A basic ICS. This should include the incident commander and basic operations chiefs within the ICU (discussed in detail in Section IV).

After completing the steps above, reach out to hospital administration regarding the big picture. It is important to define how ICU-focused planning interfaces with hospital disaster response planning.

What are the hospital and ICU interface issues that are most important and will require the most detailed planning efforts?

- It is most important to facilitate efficient casualty flow among the ICU, emergency department, and operating suites. In order to maximize flow among these interfaces, the disaster plan should include the elements listed in **Box 4-2**.



Box 4-2. General Concepts: ICU Disaster Plan Elements to Address Interface Issues

To maximize flow among the ICU, emergency department, and operating suites, an ICU disaster plan should include:

Triage Schema. This enables ICU beds to be emptied following a disaster event, so the ICU is ready to accept patients from the emergency department on extremely short notice.

Casualty Flow Algorithm. This allows for critically injured patients to be admitted to nonsurgical ICUs. These casualty attributes must be clearly delineated and enumerated.

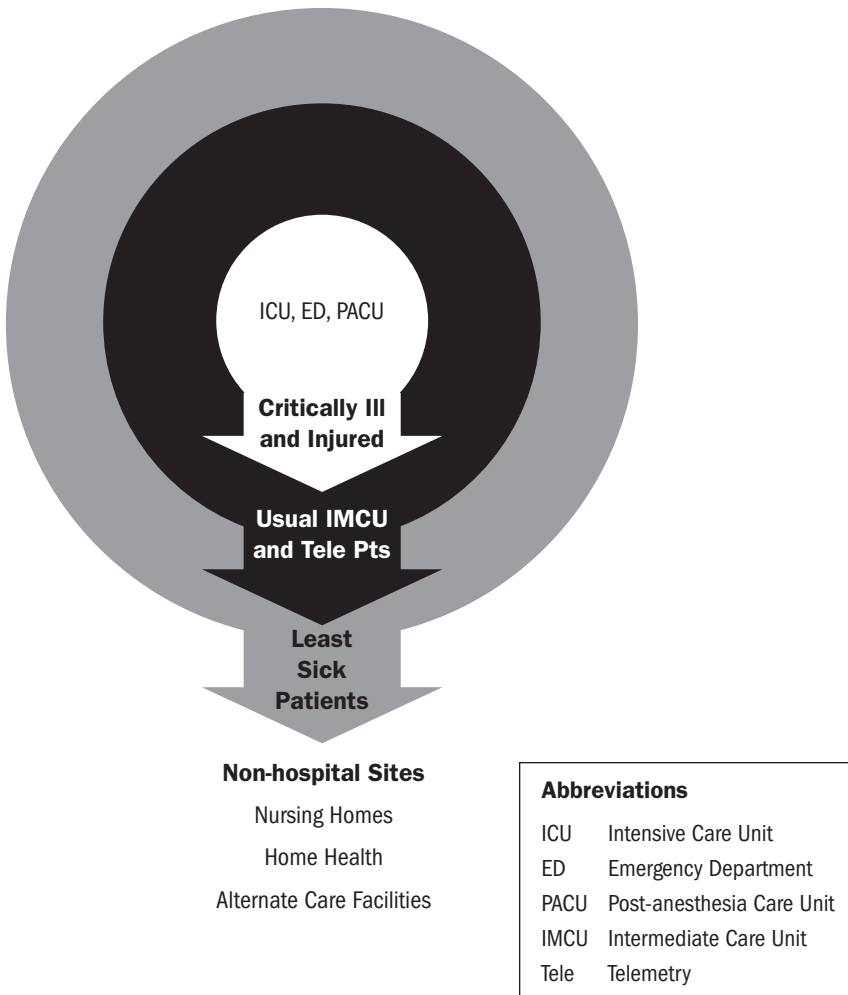
Patient Care Strategy. This is a defined patient care strategy for holding critically injured patients in the ICU while awaiting urgent but not emergent surgery, so they may be monitored and resuscitated as needed.

Communication Plan. This is a plan that is not dependent on individuals, computers, or phones and connects the ICU, the emergency department, and operating suites.

Casualty Contamination Strategy. This is a strategy to deal with casualties with wounds that are possibly contaminated with chemical or other substances and may be harmful to ICU staff.

Transport Plan. This is a plan between clinical areas (including radiology) for contagious ICU patients who require respiratory isolation.

- Next, “downstream” casualty flow must be specifically considered. Where will patients go when they are able to leave the ICU? What if there are more ICU patients than there are ICU beds? Where will these patients go? Planning and patient flow must be coordinated among all regions of the healthcare system, and this responsibility may fall outside of the ICU. However, these general principles should be considered:
 - The plan must include provisions to discharge patients from the wards to other lower-acuity facilities (eg, nursing homes, skilled nursing facilities, home, hotels) on very short notice.
 - If possible, do not plan to use unmonitored ward beds as back up ICU beds. Logistical requirements and personnel skill set limitations make this a difficult option. Furthermore, because ICU staff will provide secondary oversight for these patients, distance is problematic.
 - Similarly, do not plan to use tents in the hospital parking lot or other outlying structures/shelters (like nearby hotels, schools, etc) for ICU space. Think in concentric rings of acuity, with the sickest casualties aggregated towards the center where oxygen, suction, medical equipment/devices, and multidisciplinary advanced skill sets are most concentrated. If you must plan to stray beyond the ICU, then stay close to the center (**Figure 4-1**).
 - When building a plan, remember that non-ICU rapid response team or medical emergency team members are excellent secondary personnel for critically injured casualties located outside the ICU.

Figure 4-1. Casualty Flow During ICU Disaster Response^a

^aReproduced with permission from the American College of Chest Physicians. Rubinson L, Hick JL, Curtis JR, et al. *Chest*. 2008;133(Suppl 5):32S-50S.

As ICU surge expands, it will extend to the wards and unlicensed ICU beds within the hospital, allowing the hospital to be the site for the most critically ill patients. An ICU plan should include the location of this expansion as the hospital administration works to move non-ICU patients to nonhospital sites.

- How will the ICU receive the necessary supplies during a disaster response? Your requests for resources must be sent from the ICU to the hospital's central supply area, along with simultaneous requests from many others. This process, during which ICU planning and logistics interact with those of the entire health system, is critical. These considerations must be addressed early in the planning process.
- Outside contact and communication with public health and emergency services must also be considered. This will allow for ICU equipment and staff replacement, along with the flow of vaccines, medications, and information.
- Before initiating the development of your ICU disaster plan, seek outside materials for additional insight, such as those listed in **Table 4-1**.

Table 4-1. Resources for ICU Disaster Plan Development

Medical organizations	<ul style="list-style-type: none"> ■ Society of Critical Care Medicine ■ American Association of Critical-Care Nursing ■ American College of Chest Physicians ■ Society of Respiratory Care
Federal and international programs	<ul style="list-style-type: none"> ■ Department of Health and Human Services ■ Centers for Disease Control and Prevention ■ National Incident Management System ■ World Health Organization ■ National and state hospital associations for regional and state ICU disaster templates
Other institutions	<ul style="list-style-type: none"> ■ Reviewing ICU disaster response plans from other institutions will allow you to identify early gaps in your plan and to address local issues that are specific to your institution.

**SECTION IV. VITAL CONCEPTS**

What are the major elements of an ICU disaster response plan that must absolutely be included in your plan?

**Box 4-3. General Concepts: ICU Disaster Response Plan Elements**

- Hazard vulnerability analysis (HVA)
- Command and control
- Communications
- Staffing
- Resources and equipment
- Surge capacity and ICU expansion
- ICU triage and limitation of ICU services for individual patients

What are the elements of a hazard vulnerability analysis?

Before constructing an ICU disaster response plan, you must know what you are planning for: What are the threats to my community and region that impact my ICU? What must we be prepared to deal with – number of casualties, types of casualties, etc? This objective and disciplined planning process is called a *hazard vulnerability analysis (HVA)*.

- The specific processes for completing an HVA are discussed in detail in **Chapter 2**.
- The HVA provides a systematic approach to recognize hazards that may affect demand for hospital services within the ICU.
- The risks associated with each hazard are analyzed to prioritize planning, mitigation, response, and recovery activities.
- The HVA serves as a needs assessment for the emergency management program.
- Each HVA will be different, depending on location, community and healthcare risks, and institutional support.
- An HVA should be performed for the ICU, along with the entire hospital.
- The HVA should be performed annually after its first assessment.

- For additional information: <http://www.calhospitalprepare.org/category/content-area/planning-topics/healthcare-emergency-management/hazard-vulnerability-analysis>

What is command and control, and where does this fit into an ICU disaster response plan?

Command and control is essential for hospital and healthcare response. Command and control has several components:

- Who is in charge?
 - How do we communicate effectively?
 - What am I supposed to do?
- **Who is in charge?** Command and control uses the ICS, which is identical throughout the hospital and community response system. Process variation = confusion, decreased team performance, and error.
 - **How do we communicate effectively?** The ICS allows for structured and delineated communication within the ICU, cross-communication between departments and agencies, and information flow (eg, patient clinical data) to asset (eg, personnel) and logistical (eg, supply) requests.
 - **What am I supposed to do?** The positions in the ICS are based on job action sheets, not people. A *job action sheet* is a written job description that includes a task list, responsibilities, and the role of that position during a disaster. Each job action sheet is specific to the tasks that position will perform. Thus, a physician will work as a medical officer under operations. A nurse manager might be incident commander.
 - Response to a disaster incident has a standardized approach and is well outlined by various sources (eg, National Incident Management System, etc).
 - ICS structure will follow the standard approach outlined in the National Incident Management System, but it can be created to have specific job actions for your ICU (eg, triage officer or respiratory therapy specialist).
 - All ICU staff will need to be trained on the basics of ICS.

What communications elements must be included in an ICU disaster response plan?

Disaster communications are discussed in detail in **Chapter 6**. When building a disaster response plan, include the following communications elements.

- A “disaster-proof” method to communicate with ICU staff members who are not at the hospital (eg, the ability to call them to report to work, to let them know if they are [or are not] needed to assist, status of the disaster response, and the need for personal immunizations, etc)
- Communications protocols for triage and other similar needs (eg, transport requirements, patient flow among the operating room and ICU, emergency department and ICU, etc) that are NOT fully dependent on phone lines (phone lines may not be functional)
- A method for patient data retrieval if the computers are down
- A plan for the ICU incident commander to perform communications updates with hospital administration and outside sources
- ICU communications updates (**Box 4-4**)



Box 4-4. Communications Advice: ICU Communication During Disaster

- A situation status should be performed at least once per shift, with ICU and disaster updates provided to ICU staff and hospital leaders.
- A public health/emergency medical services update should be performed regularly, at least once per shift. Information should include treatment guideline changes, an assessment of situational awareness, and epidemiology updates.
- A debrief during which staff should communicate to the ICU incident commander should occur once per shift, ideally at the end of the shift.

- Standardized and structured rounds should be performed once per shift. These may be based on a template during normal operations. For communications purposes, the following should occur:
 - Medical rounds with the physicians
 - Nutritional and ancillary rounds to support preventive and standardized care

- Pharmacy rounds to limit and substitute medications
- Respiratory therapy rounds for enhanced weaning and resource utilization monitoring
- Triage rounds based on the severity of illness or in situations of allocating scarce resources
- The time to perform these rounds and communicate information should be set per shift and should not change
- The incident commander or the information officer should lead the communications sessions and be present at rounds

What staffing elements should be included in an ICU disaster response plan?

- Staffing is likely to be greatly altered during a disaster (**Box 4-5**). The ICU disaster response plan should address these needs.



Box 4-5. General Concepts: Changes to ICU Staffing During a Disaster

- Increased (extended) nurse-to-patient ratio
- Extended scope of practice of nurses, respiratory therapists, and physicians
- Increased waiting time for rounds and physician input
- Decreased testing and out-of-ICU transport
- Decreased availability of ancillary services

- In addition, there may be increased staff absenteeism for various reasons. The following should also be considered in the plan:
 - Estimate projected staff shortfalls (eg, 20% loss, 40% loss, etc) based on the type of disaster
 - After this estimation, the most critical areas should be incorporated into the ICU HVA. For example, if respiratory therapy personnel is considered “short” when a 20% casualty surge occurs, this should be considered a weakness and integrated into the ICU disaster response plan.
 - Staffing models will vary and depend on local support and influences. However, reasonable estimates can be made in advance of an actual event.

What resource and equipment elements should be included in an ICU disaster response plan?

- Logistics and planning identify the support and needs for the ICU. The ICU-based plan should be able to anticipate and communicate ICU needs, from staffing to equipment, in a timely manner. A reliable mechanism to ensure that these needs are met should be included in the ICU disaster response plan.
- The flow of requests should utilize ICS and National Incident Management System protocols and should be directed to the appropriate planning and support liaison sections.
- The ICU disaster response plan should also define a prioritization schema for requests. For example, if more mechanical ventilators are required, the estimated time and need, along with consequences if not met, should be included.

What surge capacity elements should be included in an ICU disaster response plan?

- During normal operations, critically ill patients will remain in the ICU. Non-critically ill patients will be cared for on the wards.
- However, during times of casualty surge (or exceedingly high ICU census), it may be necessary for these patients to be cared for on wards and other locations outside the ICU. As noted in Section III, this can be counterproductive and must be tightly regulated in order to ensure that care standards are not unintentionally degraded.
- This will require a stepwise approach to placement of patients in a standard location within the hospital (eg, postanesthesia care unit, then ward, then alternate care site).
- Placement will require that less severely ill patients in the ward be moved to other locations, including alternate care sites. The hospital command MUST control patient flow in order for the ICU to respond.
- Bed flow will be from areas such as the operating room, emergency department, and other alternate care sites.
- The most critically ill should be cared for in ICU, followed by the less critically ill on wards and alternate care sites (eg, ill but not using mechanical ventilation)
- On occasion, ICU admission criteria may need to be required to limit flow.
- Critically ill patients require many resources and should not be cared for in resource-scarce sites such as alternate care sites in the community.

What elements of ICU triage should be included in the ICU disaster response plan?

The usual elements of triage are based on color-coding schemes that prioritize individual patients for care – who goes first, second, third, etc. These systems of triage use various determinants to define sequencing. These priorities are acknowledged in the ICU disaster response plan, but they are not the primary emphasis of triage. Instead, the focus of the plan should be to define the following things:

- Treatment plan for chronic critical illness
 - Admission criteria during mass casualty event
 - Admission criteria during pandemic (including ventilator allocation)
 - Daily bed triage
 - Triage to temporary ICU space
-
- What is your plan for chronic critical illness? Following a disaster, many patients with severe chronic medical disorders (eg, severe heart failure, dialysis, post-transplant disorders, liver failure, end-stage respiratory diseases, chronic multiple organ failure, etc) may destabilize because they do not have access to their usual frequency of medical interventions. Who will care for these patients? Will they consume limited ICU resources? Who decides? What are the criteria? Is it severity of illness? Probability of survival?
 - In the event of a mass casualty event, what are the admission criteria for a patient to get an ICU bed? Who gets the bed, for what reasons, and what are the triggers/thresholds? Probability of survival? Injury severity score? Need for a major surgical procedure? Who makes these determinations – during a disaster is there an ICU bed coordinator? If “yes,” what criteria are needed to hold this position?
 - In the event of a pandemic, what are the criteria for admission of a patient to an ICU bed? Who gets the bed, for what reasons, and what are the triggers/thresholds? Who gets a ventilator in a resource-constrained setting? What are the criteria? Is it severity of illness? Probability of survival? Oxygenation index? Who makes these determinations – during a pandemic is there an ICU ventilator coordinator? If “yes,” what criteria are needed to hold this position?
 - Bed triage is a dynamic process—a casualty who occupies an ICU bed on one day may not qualify to keep that bed the next day. Who makes these determinations? What are the objective criteria? How will these criteria be applied to individual patients? Who is responsible for these determinations? How do you ensure consistency of practice from one day to the next, and from one individual to another?

- If a non-ICU hospital space is designated to become a temporary ICU during a disaster, how do you decide which patients go to the ICU and which patients go to (or are moved) to the temporary ICU space? What about the placement of surgical patients into medical ICUs during a mass casualty event? What about the placement of medical patients into a surgical ICU during a pandemic? Who makes these determinations? How? What criteria are used for decision-making? How do you ensure consistency of practice from one day to the next, and from one individual to another?



SECTION V. BUILDING A PLAN



Box 4-6. Disaster Tips: ICU Disaster Plan Examples

Some examples of ICU disaster plan templates are available online:

- www.redcross.org
- www.calprepare.gov
- www.cha.org

What tasks are involved in developing the plan?

1. Meet with your hospital ICS leadership and/or the hospital disaster medicine committee to discuss plans to build a robust and complete ICU disaster response plan. Identify specific and focused needs (priorities). Discuss the completion of an ICU-related HVA. Define a timeline for plan development and implementation.
2. Identify an ICU disaster response plan leader. As previously stated, this role should be assigned to a position (eg, ICU nurse manager or medical director), not an individual.
3. Define the ICU disaster response plan team. All involved stakeholders (factions) should have representation. Do not limit this to physicians and nurses or ICU personnel only. However, the total team size should be as small as is reasonable, otherwise these processes will become mired with difficulty attaining a necessary quorum at meetings, arriving at a consensus on contentious issues, etc.
4. Conduct an ICU-focused HVA that is well aligned with hospital disaster response priorities.

5. Write an outline for the ICU disaster response plan. What are the plan sections, elements, and priorities?
6. Assign team leaders for each section of the plan.
7. Define a timeline for task completion, including milestones along the way (if necessary).
8. Define clear deliverables for each team (section) leader.

Delegation: Who performs each of these tasks?

- When assigning individuals to be responsible for the development (writing) of the various ICU disaster response plan sections and elements, it is important that all stakeholder groups “own” some of these leadership responsibilities.
- Query group members about their disaster-related experience. You likely will discover that individuals have prior involvement with these issues (eg, military experience, work with government disaster agencies, Peace Corps work, etc), which may or may not be aligned with their current job descriptions. Assign jobs based on knowledge and abilities, not just current titles.

Project Management: How do we keep track of the planning and work processes? Who does this? What are the elements?

- Once the plan outline is written, build a spreadsheet or table that shows each section and plan element. Include a column that names the individual responsible for this part of the plan. Then include a column that enumerates the deliverables for this section of the plan. There should be a column that shows deadlines, milestones, etc.
- The ICU disaster response plan team leader must directly manage this project. A secretary might enter the data into the table or spreadsheet, but the leader must manage the overall project. This is analogous to being the editor of a multi-authored book.
- When developing the plan, it should be written and saved in both written and electronic locations that are accessible to staff.
 - All staff should have access to and know the location of the plan.
 - All changes in the plan should be documented and drafts of the plan should be tracked (eg, Version 1.1, 1.2, etc).
 - A copy of the plan should be located within hospital administration as well.



Box 4-7. Disaster Tips: ICU Disaster Plan Development Pitfalls to Avoid

- 1. Territoriality!** It may be of value to meet with department and/or division leadership at the outset of this project and discuss the “whys” and “hows” of these tasks being undertaken. Buy-in is key.
- 2. Nonperformance.** Section or element leaders, for various reasons, do not complete their work. Coaching and accountability are key.
- 3. Communications.** You must keep institutional leaders informed of the overall project status, new directions, unexpected findings, etc. This includes ongoing discussions with institutional disaster response leaders. Regularly scheduled updates are key.
- 4. Consensus.** Despite all efforts, the group may experience strong differences of opinion regarding appropriate plans and strategies for specific ICU disaster response plan elements. It is best if all agree, but this is not always feasible. Set the rules for this possibility at the outset of the project and define how decisions will be made. Following the rules is key.
- 5. Project scope.** Do not try to solve world hunger. Better is the enemy of good – do not seek to achieve perfection. Setting realistic project goals is key.
- 6. Finances.** Do not write a plan that requires major purchases of devices and other resources. It won’t happen. These expenses will compete with nondisaster capital priorities. For example, do not write a pandemic plan that requires the purchase of numerous ventilators, which will exceed daily operational needs. Consider alternative strategies, like using anesthesia machines, etc. Creativity is key.

What are the deliverables?

The final work product is a fully populated ICU disaster response plan that addresses major priorities and issues in your unit(s).



SECTION VI. IMPLEMENTING THE PLAN



Box 4-8. Action Items: ICU Disaster Response Plan Implementation

- A single staff person should be in charge of maintaining and updating the ICU disaster plan.
- The active version of the plan should have a location within the ICU as well as within hospital administration.
- The plan should be only be activated by ICU leadership, including management or other staff (eg, medical director).
- Activation of the plan should require notification of hospital administration.
- All versions of the plan should be kept in a single location, with only the most active version maintained in multiple locations.

How do we ensure that the ICU disaster response plan works?

The plan requires repeat testing and evaluation. The individual who led the ICU disaster response plan development process should also play the lead role of coordinating ICU plan testing and change.

- ICU-only tests should be tabletop exercises and functional drills.
 - Tabletop exercise: Incident command and leadership use a case-based scenario to evaluate response based on plan direction.
 - Functional drill: A smaller scale aspect of ICU care is tested (eg, communications, ICU expansion).
- At least two ICU tabletop exercises and one functional drill should be performed yearly.
- A larger-scale exercise involving the entire hospital should be performed annually. These exercises are optimal to evaluate surge capacity, hospital-wide triage, and

response to the staff's need for resources and supplies. The scenario for these exercises should be based on the highest risk events identified in the HVA.

- At the end of each drill or exercise, a 30- to 60-minute debrief should be performed to determine areas of strengths and weaknesses.
- Each position within the ICS should complete a post-exercise evaluation, outlining strengths and weaknesses.
- Based on these evaluations, changes should be made to improve to the plan.
- These should be completed within 30 to 45 days after an exercise. All intended changes in the plan should be documented, and modifications to the plan should be linked to after-action reports.
- Based on the evaluation of the post-drill debriefing as well as individual ICS position evaluations, the ICU disaster plan should be rewritten within three months of an exercise. This should be accomplished by the plan manager and champion. All copies should be updated after the change.
- Repeat drills and exercises should focus on the improvement(s) made to the plan from prior drills and exercises.



SECTION VII. SUMMARY

- A disaster plan requires a champion and manager within the ICU.
- Building a functional and accurate ICU disaster response plan is a team effort and requires integrated, disciplined, and orderly processes.
- ICU-based disaster response plans should not be developed in isolation and must be integrated with hospital and health system plans.
- An ICU plan must address:
 - Incident command system (ICS)
 - Surge capacity plan
 - Critical resource and staff management (logistical planning)
 - A plan for triage and the allocation of scarce resources
 - A highly functional communications plan
 - A communication and rounding structure plan
- The plan should be tested and evaluated regularly.
- The plan champion and manager should document and manage all changes to the plan.
- Once the changes occur, the plan should be tested again.

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SECTION I. PURPOSE OF THIS CHAPTER

- Discuss priorities when implementing an ICU disaster response plan.
- Define who needs to be involved to effectively implement an ICU disaster response plan.
- Describe and outline pitfalls and practical lessons when implementing an ICU disaster response plan.
- Outline and discuss effective project management strategies that will facilitate the successful implementation of an ICU disaster response plan.



SECTION II. KEY POINTS

- To optimize an ICU disaster response, it must be organized. If the implementation of your ICU disaster response plan is flawed or lacks sufficient organization, it will become obvious during an actual disaster. The results will be less than an optimal response. This translates into less favorable outcomes for victims.
- For the hospital incident command system and hospital emergency executive control group to be fully effective, all roles and tasks must be clearly delineated.
- Your hospital disaster planning committee must actively oversee the process of developing the disaster response plan, with clear timelines and accountabilities.
- All members of the disaster response team must work well together. Conflict can be avoided by a clear understanding of the chain of command and clear delineation of assignments and tasks.
- Essential conflicts must be resolved. Conflicts that are not essential should be deferred. This rule applies not only during a disaster response, but also during the development of your disaster response plan. Once the entire draft plan is developed, many conflicts should spontaneously resolve as the big picture becomes clear to all involved.

You should use this chapter to:

- Develop effective project management strategies that will facilitate the implementation of a disaster response plan for your ICU.
- Delegate disaster response plan development tasks to the most appropriate staff members.
- Develop effective conflict mediation and resolution strategies during disaster planning and implementation.





SECTION III. FIRST THINGS FIRST

Where do I begin?

This chapter focuses on implementation strategies for your ICU disaster response plan and assumes that you already have this plan in hand.

- Like the planning and writing of your ICU disaster response plan, the implementation phase continues to necessitate representation on your hospital disaster planning committee. If you do not “have a place at the table,” it is very difficult to effectively integrate your work into the plan at large.
- Use your existing ICU disaster planning committee for plan implementation. They know and understand the plan, have experienced the pitfalls, and already have exposure to the politics of your institution. They will be aware of any existing attitudes of complacency.
- Organize and direct your committee members with clear, well-communicated guidance. Eliminate ambiguity, and be transparent in all processes and interactions.
- Develop a written project management plan that includes individuals who are accountable for deliverables, and timelines for task completion. A project management template is offered in Section IV.

What are the key issues?

- **Don't reinvent the wheel.** Your institution will have defined project management methodologies in place that they employ for process improvement, facility projects, other committees, etc. Use what is already there and is familiar to others. Utilize and leverage these existing hospital resources. The unique skill sets of team members could help you get organized and lead to a more efficient process and better end product. Discuss this project with hospital leadership and request that a trained project manager joins your working group.
- **Get the correct people involved.** You must have others, in addition to critical care professionals, assisting with ICU disaster plan implementation. **Table 5-1** outlines an array of stakeholders to consider as part of the team who will implement the ICU disaster response plan. Ensure that you include frontline staff representation in addition to members of your leadership team. Frontline staff often have tremendous insight into practical solutions for challenges, and their participation will lend greater credibility to the plan developed. During a disaster, frontline staff must trust that the plan will work, so the plan should take into account their perspective whenever possible.

- **Consider the big picture.** Ensure that the team implementing your ICU disaster response plan understands how the ICU will function within the hospital incident command system structure. Educate your disaster planning committee about basic concepts in the incident command structure used in your hospital so they understand how the ICU disaster response plan and team fit into the overall response. Plans developed in isolation from the big picture of the hospital-wide response are doomed from the start.

Table 5-1. Potential Staff Members to Consider in ICU Disaster Preparation and Response

- Incident command system leader (eg, medical officer, operations officer)
- Nursing administration leader
- Physician(s) representation (eg, emergency medicine, surgery, institutional chief medical officer/vice-president of medical affairs/chief of quality)
- Respiratory care leader (does not need to be a physician)
- Pharmacy leader
- Nutrition services leader (does not need to be a physician)
- Infection control leader (does not need to be a physician)
- Radiology leader (does not need to be a physician)
- Laboratory services/phlebotomy representative
- Housekeeping/laundry and linen services representative
- Hospital engineering representative
- Bioengineering representative
- Information technology representative
- Communications, switchboard representative
- Medical staff services representative
- Volunteer organization representative
- Materials management, purchasing representative
- Transportation services (in hospital) representative
- Hospital security representative
- Clergy representative

NOTE: This list is not all-inclusive, nor does this mean that you need ALL of these individuals. Limit membership to key stakeholders in your institution. Consider what competencies can be brought to the team outside of traditional job responsibilities but within the knowledge, skills, and scope of practice of different staff members.



SECTION IV. VITAL CONCEPTS

This section will outline the specifics of project management, including the specific methods and steps required for implementation of an ICU disaster response plan. It will also cover identifying and assigning disaster-related tasks, which should be assigned by the hospital or ICU department or section.



Step 1. Get organized!

What are important elements of a successful project?



Box 5-1. General Concepts: Necessary Ingredients to Successful Project Completion

- A well-thought-out plan
- Qualified personnel
- Clear expectations
- A timeline with milestones and deadlines
- Good communication
- A budget

The goal of project management is to ensure that a project is completed correctly, accurately, and in a timely manner. Basic project management steps:

1. Define the project goals.
2. Be sure all involved understand the project goals.
3. Participants in a project should sign off on their assignments to ensure they entirely understand what is expected.
4. Establish a deadline for project completion.
5. Discuss milestones that must be accomplished.
6. Identify tasks that must be accomplished in order to meet milestones.
7. Place major milestones on a timeline.
8. Hold participants to milestones, but allow them to manage their own tasks and utilize their own work styles.
9. Clearly and quickly communicate changes in the project plan or timeline.

How do I organize implementation activities to ensure that important elements are not overlooked?

- A simplified Gantt chart (**Table 5-2**) can be used and applied to hospital and ICU staff to specify who is to do what, and when milestones and the full project are to be completed.
- This chart should include rows with names and tasks, and columns with the timeline and milestones, as well as the scheduled completion date. (**Table 5-3** illustrates a simplified version of this chart.)

Table 5-2. A Detailed Project Management Gantt Chart

Disaster Planning/ Management Project	Action/ Issue Description	Assigned To	Milestone Number and Description	Milestone Expected Date of Completion	Milestone Status/ Update/ Comments	Milestone Date of Completion	Project Expected Date of Completion	Project Completion Date/Comments
			#1					
			#2					
			#3					

Table 5-3. A Simplified Project Management Gantt Chart

Task	Category	Action/Issue Description	Assigned To	Expected Resolution Date	Status/Update/Comments



Step 2. Identify and assign disaster-related tasks!

What are key issues in task assignment?



Box 5-2. Communication Advice: Facilitating Task Assignments and Good Outcomes

- Employ a specialty, discipline, or department chair to serve as the overall team leader.
- Write a clear outline of expectations, timelines, and deadlines.
- Emphasize to team members the importance of abiding by the command structure (no freelancing).
- Emphasize teamwork.
- Emphasize the importance of sharing of responsibilities.
- Emphasize unique knowledge, skills, and individual strengths.
- Establish processes to modify and update assignments, tasks, and timelines.

- **Prepare.** Consider what work can be done prior to a disaster (planning) versus what needs to be done during a disaster (just-in-time). Tasks such as identifying support staff, recruitment, and education can take place in advance. This work may need to be revised when a disaster appears imminent (if warning is available) or in the early stages of a disaster event. Identifying appropriate “space” and planning for appropriate “stuff” should occur prior to a disaster, but it is necessary to continuously monitor whether or not the plan is working. An interprofessional team with the ability to think on their feet is required to ensure flexibility to respond to changes in the nature of the disaster and the capability of the ICU and hospital to respond.
- **Separate leadership roles from clinical frontline roles.** Although patient care during a disaster is the ultimate goal, those responsible for command and control cannot be hands-on for patient care responsibilities. Without accurate situational awareness (**Chapter 3**) and a sense of perspective for the big picture, the disaster response will be inefficient and ineffective.

- **Anticipate that people will come and go, but the roles will stay the same.**
Ensure that the tasks assigned to specific roles could be completed by someone who would typically fit the role. Most team roles require specific knowledge, skill, and attitude characteristics associated with the qualifications of people who fill those roles. Avoid allocating tasks based on a specific individual who may not be in your organization in a few years.
- **Divide tasks appropriately.** Identify the key members of your ICU disaster planning work group and divide tasks into the following four phases of disaster response: planning and preparedness, predisaster, during the disaster, and recovery.
- **Create a table of activities by role and by disaster phase (Table 5-4).**

Table 5-4. Four Phases of Disaster Response

Role	1. Planning and Preparedness ^a	2. Pre-disaster ^b	3. During the Disaster	4. Recovery

^aConsider participation in the development of the ICU disaster response plan and ongoing reassessment to ensure new hazards and changes in response capability

^bWhen warning is provided

How should disagreement and conflict be managed during development and implementation of our ICU disaster response plan?

- Anything related to disasters has the potential to generate conflict.
- Planning and preparedness activities can create conflict between the need to invest time and resources in usual operations versus time required to prepare for what some perceive as a highly unlikely problem (low probability).
- Competing interests among areas of the hospital, different professions, and individuals can contribute to conflict. The stress of anticipating a real disaster, not to mention being in the middle of the disaster, can bring out the worst in people.
- Discussion about strategies for conflict resolution, particularly in the context of an ongoing disaster, may be helpful to keep you prepared for trouble.

What are key steps in conflict management?

1. Start on a positive point. Make it clear that not all conflict is negative.
 - Different ideas and ways of performing tasks can emerge.
 - Innovation, progress, and growth are possible through disagreement and conflict.
 - Coming to an agreement can strengthen relationships when consensus is achieved.
2. Listen attentively to all sides.
3. Get an understanding of who is involved and everyone's particular needs, attitudes, values, beliefs, and interests.
4. Analyze the conflict at hand.
5. Be sure that both sides:
 - Completely understand the other side's position
 - Have knowledge of the background circumstances and history that led to the conflict
 - Are assured that both sides will be treated fairly and equally in all respects during the process of conflict resolution
6. Outline the options for conflict resolution (**Box 5-3**).



Box 5-3. Communication Advice: Methods for Conflict Resolution

- Consensus
- Compromise
- Negotiation
- Mediation
- Arbitration
- Judicial Resolution

- **Consensus.** Resolution through consensus, and ultimately collaboration, is the best method of achieving agreement. It is often successful when the interest of mankind or society is an issue, as in a disaster situation, and results in a win-win situation for all parties.

- **Compromise.** This is often necessary. The possibility that there may be a need for compromise must be understood by all prior to bringing the individuals or groups together.
 - **Negotiation.** The individuals or groups must understand that they may win on some issues and lose on others. Everyone involved should prioritize issues according to importance when making their case.
 - **Mediation.** If conflicting individuals or groups cannot come to an agreement through consensus, compromise, or negotiation, a mediator or mediating body may be selected by both parties. Both parties must agree to abide by the mediation decision.
 - **Arbitration.** An outside party or group may be contracted to resolve conflict. In this case, the conflicting individuals or groups may not be given the choice to resolve their differences.
 - **Judicial Resolution.** This may be necessary when consensus, compromise, negotiation, or mediation fail, or if the conflict gets out of hand and there is no other choice. All conflicting individuals or groups must be aware of this option.
7. Arrange meetings with those involved in the conflict.
- Establish an agreed-upon time and place for meetings.
 - Be sure all parties involved attend.
 - Take minutes of meetings.
 - Discuss the interests of opposing parties, not their position.
 - The goal is to satisfy and accommodate the interests of both parties.
8. Progress to the next step (negotiation, mediation, arbitration, etc) if a resolution has not been achieved.
9. Once a resolution is achieved:
- Both parties must endorse the resolution.
 - Both parties should collaborate and be monitored as the resolution is instituted.



SECTION V. PREPARING TO IMPLEMENT THE PLAN

How do we successfully finish what we start?

- Organization of job activity requires monitoring.
- You must come full circle and go back to the disaster planning committee. This is where planning and projects begin and are finalized.
- All departments and department and section heads should report back to the disaster planning committee. Reports should include:
 - Names of individuals on specific teams
 - Responsibilities of teams and individuals
 - Assignments to departments, sections, teams, or individuals
 - Progress on assignments and tasks to departments, sections, and teams
- The disaster planning committee must analyze these reports and information for all projects to ensure all aspects of disaster planning are coordinated and progressing or completed according to schedule. Activities to monitor:
 - Communicate with all departments regarding their disaster planning activities and the status of the schedule and completion of their tasks and assignments (**Table 5-2**, **Table 5-3**, and **Table 5-5**)
- Has the disaster planning committee put together tabletop exercises and drills to be sure that everyone will be able to function properly in a real-life disaster scenario?

Table 5-5. Selected Questions for Departmental Implementation Planning

Check with all departments to monitor the status of their surge staffing implementation planning.

- Has surge staffing planning been initiated? What stage is completed?
- Has cross-training been performed and completed? What stage of preparation is in place?
- Are physicians, nurses, pharmacists, respiratory therapists, nutritionists, etc, prepared to expand their functions during a mass casualty event/disaster surge?
- Have just-in-time training plans been addressed and initiated where applicable?
- Have educational endeavors been initiated?
- Have disaster credentialing projects been initiated and completed?
- What milestones have been reached in communicating roles and responsibilities to command personnel as well as the “doers, getters, payers, and planners?”

**Box 5-4. Disaster Tips: Drilling Your Plan**

- The basic principles of project management apply to planning and pursuing tabletop exercises and drills.
- Tabletop exercises and drills are the ultimate project and test the ultimate success of disaster preparation.

**SECTION VI. IMPLEMENTING THE PLAN**

- All assignments and tasks must be in place. Everyone must know their job and where they fit into the response.
- All projects must be completed and reviewed by the disaster planning committee.
- There is no place for conflict during a disaster response. Stipulations regarding conflict management and disruptive behavior must be addressed and emphasized in the planning stages.
- Finalizing a disaster response requires coordination of all activity through a hospital disaster planning committee when possible.
- Activation and management of the command must be through the hospital incident command system.
- The critical care response is coordinated through the ICU executive emergency control group.
- Clear triggers are necessary to escalate the levels of response from conventional to contingency and, if necessary, to crisis systems of response.
- Near-disasters in your facility and a review of lessons learned from other organizations should prompt review of your plan.

**SECTION VII. SUMMARY**

- Any plan is better than no plan.
- Getting the right people involved is the first step.
- Getting people motivated to be better prepared is the next step.
- Effective project management will ensure that your plan gets off the ground and progresses to a workable first version.
- Use available templates to help structure your plan.

- Consider all four phases of disaster response in designing your plan (planning and preparedness, pre-disaster, during the disaster, recovery).
- Be inclusive when creating your response plan working group.
- Be prepared for conflict during preparedness activities and during disasters. Plan for conflict in your ICU disaster response plan by establishing a clear command and control structure through role definitions and appropriate task assignments.
- Take your plan out for a test drive, using tabletop exercises and other simulations.
- Learn from the lessons of others – be prepared to revisit your plan on a regular basis.



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CHAPTER SIX

COMMUNICATION DURING DISASTER



SECTION I. PURPOSE OF THIS CHAPTER

- Highlight important concepts in developing a communication plan.
- Discuss tools, including technological and other support options, for communication.
- Outline concepts for patient tracking and medical records in a disaster.
- Provide specific information regarding communication with the media, public, patients, and families.



SECTION II. KEY POINTS

- Effective disaster communication requires a predetermined plan that is tested under realistic training.
- Communication plans must include the process for communicating with external parties as well as managing internal resources.
- Communication plans should include redundancy with a variety of technologies and low-tech capabilities.
- Large numbers of patients will require effective patient tracking and medical records management.
- Media operations require input and support from public affairs personnel and employ principles of risk communication.
- Employees and their families require special attention in order to protect and preserve the organizations' human capital.
- Implementation depends greatly on the situation and context of the ICU location, as well as the communication infrastructure supporting the ICU and its hospital within a community.
- Only through robust, realistic disaster training can the concepts highlighted in this text be tested for each ICU and hospital. What works for one group may not work best in a different ICU, given different resources, predicted disasters, and personalities.

You should use this chapter as a:

- Template of ideas for disaster communication
- Template of ideas for disaster training





SECTION III. FIRST THINGS FIRST

Inadequate or confusing communication capabilities remain a difficult challenge for most disaster response efforts, whether they be training events or real-world disasters (**Table 6-1**). Developing a robust, redundant, and streamlined communication plan helps mitigate much of the confusion regarding disaster preparation, recognition, response, and recovery. Without planning, ICUs will lack the information needed to provide optimal care to their patients.

Where do I begin?

Communication support to an ICU disaster plan should be prepared by disaster phase in parallel with the overarching goals of the plan. Additionally, the communication capabilities must be integrated into the hospital and community's response effort. Thus, having access to communication, and thereby information, in the community would help ICU planners and providers.

- Pre-event: What is the communication plan, capabilities, and frequencies of the hospital and community medical groups?
- What is the nature of the event when it occurs – time, location, situation, etc?
- How is the event progressing?
- What types of victims are at the scene, fleeing, etc?
- Is information on injuries or illnesses available? What is the severity of injury or illness – are they traumatic and/or medical in nature, etc?
- How are patients' demands being distributed and tracked around the community?
- Are there any potential dangers to staff from arriving patients (eg, chemically contaminated patients)?
- Will this event require help from the state or federal government or outside agencies?
- What messages are being communicated with the media, victims, and their families?

Table 6-1. Examples of Common Communication Mistakes Made During Disasters

Hurricane Katrina, 2005	Failure to develop a communications plan among responding agencies resulted in the inability of US Army National Guard to communicate with elements of the US Air Force responsible for patient movement.
Kings County NE Emergency Recall Drill, 2007	Failure to maintain and rehearse the use of a telephone tree recall roster resulted in the required 60-minute recall to take almost four hours.
Discothèque Fire in Götenburg, Sweden, 1998	<p>Calls to hospital switchboards and overloaded radio traffic impeded response, leaving many patients to move on their own to the closest facility, which became a new disaster.</p> <p>“Babel Effect”: Communication breakdown due to overwhelming, sudden surge of message/call/cell traffic</p>

Creative Solutions

Daily Hospital “Hot Sheets,” Hurricanes in Florida, 2004	The Martin Memorial Health System in Stuart, Florida had to respond to consecutive hurricanes (Frances and Jeanne) in 2004. Two hospitals printed daily “hot sheets” to keep healthcare response elements up to date on current and anticipated events.
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**SECTION IV. VITAL CONCEPTS***What are the necessary means of communication?*

- During a disaster, managing the pathway of information flow into and out of an ICU is vitally important. What does this entail? It means that before a disaster occurs, ICU leaders must coordinate (plan and codify) with other areas in the hospital (as well as other regional ICUs) about how information will flow. What is the substance of information to be communicated, what is the expected sequence of information flow, who will receive this information, etc?
- Key communication concepts focus on internal and external communications (**Table 6-2**). Internal methods ensure the smooth sharing of knowledge around the organization and, importantly, remain in contact with key organization decision makers and leaders.

Table 6-2. Necessary Communication Schema

Internal Communication	<ul style="list-style-type: none"> - Plan to ensure effective internal communication within the command structure - Leaders need to be in contact with the operations center while moving around the facility. - Communicate with staff up and down the chain of command. - Communicate with families to ensure an engaged workforce.
External Communication	<ul style="list-style-type: none"> - Communicate with organization/healthcare system leadership structure. - Communicate with community and state resources—emergency medical service, public health, security. - Communicate with other healthcare facilities to facilitate/orchestrate transfer or distribution of patients. - Include a provision to communicate with media

- Sharing information outside the institution aids situational awareness regarding the event and helps coordinate community resources, support, and processes (**Chapter 3**). In addition, ensuring that staff can link to family and friends helps maintain an effective workforce. It also helps in shaping media messages.
- Simple, standard message formats can aid these communications, such as the mnemonic, SBAR:
 - S**ituation: Why am I calling?
 - B**ackground: What will the provider need to know?
 - A**ssessment: What is the patient’s current status?
 - R**esponse/Recommendation: What is needed from the healthcare provider?
- Communication capabilities continue to evolve with technology (**Table 6-3**). What previously required separate devices and large bandwidth can now be accomplished with a smart phone and short message service (SMS) text messaging.
- Reliable communication is always threatened in disasters, so communication strategies not involving the telephone must be planned and exercised.

- All plans should allow for modular expandability.
- You *must* consider in advance: battery life, electrical power outage, need for electrical generators and other sources of electrical power, written message forms, and message tracking.

Table 6-3. Necessary Communication Tools and Capabilities During Disaster

Tools	Capabilities
<i>Telephone/Internet-Based</i>	
Fixed line (frequently down in a major catastrophe)	<ul style="list-style-type: none"> - Voice: one-to-one or several individuals - Fax: written messages can be sent to many - Message pagers: quick and can be transmitted to many
Cellular phones	<ul style="list-style-type: none"> - Efficient, battery operated - Walkie-talkie mode, another backup mode - Short message service (SMS) text requires less bandwidth - Camera phones allow transmission of photos of disaster
Satellite phones	<ul style="list-style-type: none"> - Not dependent on cellular towers or power (exc. battery) - Not functional indoors
Email	<ul style="list-style-type: none"> - Effective over large distances - Sends messages to multiple recipients - Requires email service and internet service provider
<i>Radio-Based Communication</i>	
Ultra-high frequency (UHF)	<ul style="list-style-type: none"> - Short distance
Very high frequency (VHF)	<ul style="list-style-type: none"> - Long distance
RACES (Radio Amateurs Civil Emergency Service)—US	<ul style="list-style-type: none"> - Network volunteer HAM radio operators, often supported by state
RAYNET (Radio Amateurs Emergency Network)—UK	

Table 6-3. Necessary Communication Tools and Capabilities During Disaster (continued)

Tools	Capabilities
<i>Radio and Television (Emergency Broadcast System)</i>	
	<ul style="list-style-type: none"> - Reaches large numbers - Can mobilize additional emergency and medical services - Can direct large numbers of the general population - May serve as stress reliever
<i>Telemedicine—Multiple Venues</i>	
Video/VTC	<ul style="list-style-type: none"> - Store and forward (email attachments)
Web sites	<ul style="list-style-type: none"> - Useful to link medical personnel for direction and consultation (scene to hospital staff and command center)
<i>Low Tech</i>	
	<ul style="list-style-type: none"> - Couriers: messengers, runners, amplification systems, bullhorns, written communications - Use when other means fail

- Tracking patient medical records
 - Disasters alter the way patient information is gathered and communicated. In most daily emergencies, the event location and dynamics are known, family and friends are available with the patient, hospitals can locate next-of-kin, transfers occur with hand-offs of information, and telecommunications infrastructure remains functional.
 - Following a disaster, these “rules” and expectations are dramatically altered: the disaster location, size, and impact remain unknown; large numbers of unidentified patients arrive without medical histories or knowledgeable friends or family; emergency medical service (EMS) transports patients to the closest facility; hospitals may be damaged; and telecommunications are nonfunctional or overwhelmed. Thus, tracking patients into the facility and around the region become problematic.
 - An effective patient tracking system aids information sharing, to allow for regional distribution of patients to the most appropriate facilities and ensure that next-of-kin know the condition and whereabouts of the patients.

- Critical patient tracking functions
 - Unique patient identifier to be physically attached to each patient (this may eventually include biomarkers such as iris scans)
 - Standard patient information to be included in the database (name, address, date of birth, etc)
 - A system to track anonymous patients
 - Data entry at each point along the medical continuum (point of care, EMS, emergency department, ICU, etc)
 - Patient updates by subsequent providers
 - Patient disposition
 - Tracking multiple patients from multiple locations
 - Data that can be searched by specific fields (eg, all patients from a specific zip code or with a specific condition)
 - Data that can be viewed from multiple locations (eg, the hospital and regional medical planners)
 - Compliant with privacy laws and secure/encrypted information
 - Exportable for analysis and real-time epidemiologic evaluation

- Patient-tracking system features
 - The system can be used for routine daily operations as well as for disasters.
 - It allows for onsite data entry.
 - Medical information can be reliably and simply entered at each point of care for the patient.
 - The information is available in real time to EMS, incident command, and medical facilities.
 - Medical evacuations and transports can be tracked.
 - The system is compliant with privacy laws.
 - The system supports multiple users simultaneously without crashing.
 - The data can be queried, in real time, to aid epidemiologic evaluation.
 - The vendor provides training and support.

- Challenges when creating an effective patient tracking system
 - A lack of standardization of the minimum data set or interchange capability
 - Vendors with market and product experience but with no experience using medical data
 - Few vendors have fully deployed their product to gain field experience.
 - The system relies on proprietary technology.
 - The system may require periodic upgrades or subscriptions.
 - The system requires specific supporting technologies.

- Medical recordkeeping following a disaster
 - Unfortunately, disasters challenge even the most robust and technologically advanced patient recordkeeping and tracking systems. The backup plan normally employed includes paper records that accompany the patients as they move through the healthcare system, or worse, a written record on the patient (**Figure 6-1**).
 - What is most important is that you have a plan for recordkeeping before a disaster strikes. This plan must be reliable, should not be dependent on high-technology equipment availability (ie, low-tech answers are more predictable and functional), and should be practiced (ie, conduct drills).



Box 6-1. Case Study: Recordkeeping During Hurricane Katrina

Ideally patient tracking systems would integrate into a healthcare system's electronic health record. One successful case example is the US Department of Veterans Affairs' (VA) electronic medical record, which tracks patients wherever they are seen within the healthcare system. During Hurricane Katrina in 2005, VA patients that were evacuated from the New Orleans VA hospital had intact and complete healthcare records available system-wide within 48 hours, ensuring continuity of care.

Figure 6-1. Example of Medical Recordkeeping Following Disaster^a



Medical records handwritten on chart and patient following 2010 Haiti earthquake.

^aPhotograph courtesy of James Geiling, MD, FACP, FCCM.

How do we communicate with families during and after a disaster?

- A key to successfully managing a disaster is communication with family members, not only to allay their concerns and fears regarding the condition of their loved one, but also to assist in mitigating the effects of the disaster.
- It is not uncommon for multiple family members to call or physically appear at the facility, adding to the noise of overloaded communications and busy emergency departments. Thus, communication plans need to be employed expediently and efficiently to meet urgent demands.

- You need a detailed plan for communicating with family members (**Box 6-2**). Given the anxiety and panic that often accompanies the aftermath of a disaster, a centralized area for families to gather and receive information should be identified. This should be away from patient care areas because crowd control can become problematic when panicked family members become assertive.
- Similarly, media members will also come to the hospital following a disaster and can impede patient care. The media communications plan outlined below must ensure that the media is sequestered away from patient care and family areas.



Box 6-2. Communication Advice: Common Principles in Relaying Information to Families and Relatives in a Disaster

- Deliver information tactfully, accurately, promptly, and with empathy.
- Be prepared to translate information into other languages and be aware of special cultural sensitivities for patients and families.
- Employ trained experts (eg, clergy, social workers).
- Avoid speculative statements and complex language or medical jargon.
- Use principles of risk communication.
- Regular announcements are beneficial.
- Provide adequate facilities for relatives.
- Don't be afraid to say "I don't know."

How do we communicate with the media in a disaster?



Box 6-3. Case Study: Communication Following the 1995 Oklahoma City Bombing

Following the 1995 Oklahoma City Bombing, the media, without prior coordination, directed volunteers with medical training to report to the disaster site. This "convergent volunteerism" resulted in more than 300 additional bystanders at the scene who either impeded ongoing rescue operations or became victims of the tragedy, with one dying as a result of being in an unsafe part of the building.

- Working effectively with the media can be an important tool in shaping the disaster response, whether that is in mitigating the effects, directing the public towards specific behaviors or resources, or helping to disseminate general information regarding the scope and timeline of the disaster (**Box 6-4**).
- Planners need to work with the media during preparation and training to ensure healthcare systems and the media can work together effectively during the response.
- Problems with the media often result from failure to plan for their presence and involvement. They will be present, so failing to plan for media relations predisposes to problems that could disrupt the disaster response. Normally, the media will always want the same information – casualty information, property damage, disaster response and relief activities, other characteristics of the crisis, and theories on the cause of the disaster.



Box 6-4. Communication Advice: Important Concepts for Effective Media Management in a Disaster

- Identify a single public information officer.
- Schedule periodic briefings and conferences.
- Prepare standard press releases.
- Understand that media and the public often have similar information agendas.
- Minimize delays in information release in order to minimize suspicion.
- Avoid speculation and opinionated commentary.
- Monitor media reports for accuracy.

What are the principles of risk communication?

- The concepts of communication with families and the media help shape the disaster and mitigate the effects on victims' relatives and the general public (**Box 6-5**).
- In addition to the guidelines just offered, current message dissemination in disasters, so-called crisis communication, should employ the concepts of risk communication – providing the receiver of the information with the expected outcome (type, magnitude, severity) and important guidance (evacuation, medication or immunization recommendations).

- In addition to the message, how that message is crafted plays an important role in the communicator's success.



Box 6-5. Communication Advice: Initial Communications With the General Public in a Disaster

- Get the bottom line out quickly in a short, concise message using simple (6th-grade level) phrases.
- Provide only pertinent knowledge, avoiding superfluous background information.
- Use positive terms for action steps.
- Repeat the message.
- Craft the message for action steps in threes, a rhyme, or an acronym.
- Communicate using personal pronouns for the organization.
- Avoid technical or complicated medical jargon.
- Avoid blame.
- Do not discuss monetary costs.
- Stay away from humor, speculation, and promises.



SECTION V. BUILDING A PLAN

What tools and guidelines are necessary to build a communications plan to support the facility's emergency management plan?

- Integrate communication specialists into the planning process early, and assign responsibility to supervise and coordinate each communication area (eg, media, family communications, interfacility transfers, etc).
- The communication plan should support the communication requirements identified in the hazard vulnerability analysis. Review communication issues and lessons learned that previously arose in similar events.
- Review the communication requirements, develop a template for the necessary supporting technologies, and apply them to both internal and external communications up and down the chain of command.

- While redundant communication devices and methodologies should be the norm, a plan too complex can become ineffective; thus, keeping it relatively simple is preferred.
- Train with the communication plan, instructing personnel on standard procedures and protocols and using simulated radio and message traffic during table-top exercises.
- Incorporate appropriate patient tracking and medical recordkeeping capabilities.
- Develop pre-event standard message sheets in order to communicate effectively with families and the media.



SECTION VI. IMPLEMENTING THE PLAN

- Implementing the plan requires a diligent, stepwise progression from planning, to equipment purchases, to training.
- Acceptance and support from hospital leadership is a highly important element of successful plan implementation.
- Organizational leaders must be comfortable with the post disaster event communication plan, as well as the devices developed to support them during the turbulent times surrounding the event.
- The key to the success of the plan will be ongoing. Realistic exercise of the plan is needed in order to identify ongoing or new requirements. Measures of success should be developed and then tested to know when the plan is ready.



SECTION VII. SUMMARY

- Disaster communication remains THE linchpin to effective disaster management.
- Rarely do exercises or real-world events have excellent communications. Typically, communications are inadequate, overloaded, or ineffective, thereby resulting in poor or failed disaster response.
- The issues and steps outlined in this chapter should provide critical care and hospital-based providers with the basic concepts for developing an effective disaster management communication support plan. The key points highlighted at the beginning of this chapter serve as a final summary of the important take-home points.
- As with any technology, innovations and advances will hopefully lead to more effective, streamlined, and efficient communication capabilities. The handheld

device or phone will likely play a major role in these advances, coupled with deployable mobile broadband network capabilities.

- The key to a successful communication plan lies in the diligent planning and testing of processes under realistic conditions, using the leaders and personnel who will be called upon to use them in a disaster event. Only then can planners and responders best prepare for the communication challenges found in the chaos of a disaster.



SUGGESTED READINGS

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CHAPTER SEVEN

HOW TO BUILD ICU SURGE CAPACITY



SECTION I. PURPOSE OF THIS CHAPTER

- Define the role of the ICU in the overall hospital surge plan.
- Recognize differences in noninfectious and infectious casualty surge requirements.
- Assist in developing the overall hospital needs assessment for “space, staff, and stuff” during a surge.
- Understand the most important therapeutic drug classes to consider for the surge supply list (and offer advice on selecting agents to stock them).



SECTION II. KEY POINTS

- It is important to accommodate space considerations during an infectious disease outbreak that requires surge capacity (ie, patient isolation space requirements).
- It is important to identify/enumerate equipment and resupply requirements (logistics) to accommodate surge capacity.
- As ICU expansion is required to accommodate a surge of patients, it must occur as part of a bigger plan within the hospital system and as a subset of state and national plans.
- A tiered approach to ICU surge expansion with well-defined protocols will help address the appropriate allocation of resources.
- Similarly, it is important that the surge plan delineates staffing augmentation processes as well as the specific positions (eg, staff ICU nurse, respiratory therapist, etc) to be increased. This should include a clear definition of the expected roles and function of these personnel.
- In order to properly execute ICU surge activity, effective presurge education and training must occur.

You should use this chapter as a:

- Guide to developing your ICU surge capacity plan
- Template-builder for ICU-specific “space, staff, and stuff” plans





SECTION III. FIRST THINGS FIRST

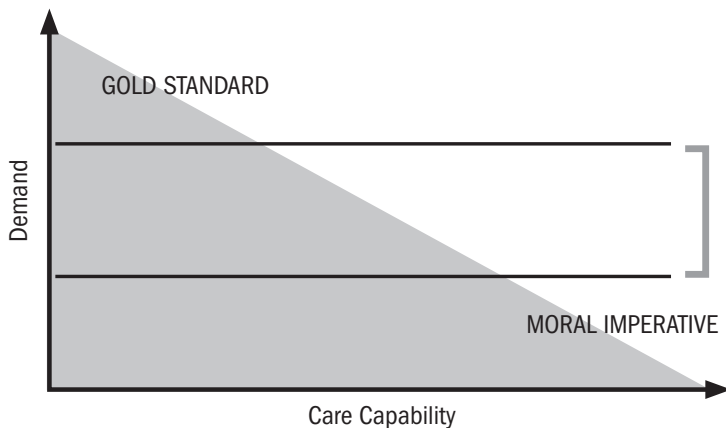
Where do I begin? What are the initial steps in building an ICU surge plan?

Top 10 Important Initial Steps and Considerations

1. Discuss/organize/categorize potential surge requirements as space, staff, and stuff, although not necessarily in that order. Begin consensus discussions and start making lists.
2. To build an ICU surge plan, you must have knowledge of the hospital-wide disaster plan, your hazard vulnerability assessment, and existing memoranda of understanding (MOU) between your hospital and other facilities that maintain ICUs. This will help you define your ICU surge expectations (ie, patient flow, triage of patients and resources, allocation of equipment and staff, and a clearer delineation of provider roles).
3. With regard to the space concept, the first steps include delineating your ICU's designation in the hospital-wide plan.
 - What are the expectations for surge?
 - Is there a change in venue (ie, alternate ICU patient care location) if the surge is considered infectious?
 - What are your capabilities to support off-ICU expansion areas (ie, oxygen and suction abilities, staffing, etc)?
 - You will need to develop a plan that addresses expected numbers of casualties (based on your regional population), with the expectation that you will need stand-alone capabilities for up to 72 hours (ie, assume that there is no rescue team).
4. Address expectations of care received in the ICU during surge (ie, gold standard care versus “sufficiency of care”). This concept is depicted graphically in **Figure 7-1**.
 - In the event that equipment, space, and personnel are not available, what are the basic expectations of care during surge? What standard of care will every ICU patient receive? Which care modalities may become optional if demand exceeds capacity?
 - Based on these consensus determinations, equipment and supply needs can be defined.

- This needs to be developed with input from regional, state/provincial, and national entities as well as with input from your hospital legal department.

Figure 7-1. Gold Standard Versus Sufficiency of Care



Defining ICU standards of care during times of clinical surge. You must achieve consensus regarding the zone in the middle. What is considered “optional” versus “essential?”

5. Equipment and supply issues are broad, and initial ICU surge-related considerations should include:

- Where in the institutional “food chain” is your ICU with regard to augmenting ventilator stockpiles? Is this an institutional priority, or is it superseded by other concerns?
- Are there other areas in the hospital with ventilators that will not be utilized during surge? Are there outpatient surgical centers with anesthesia machines? What about research labs, etc?
- Predisaster MOUs with hospital supply companies should be reviewed frequently and updated as needed.
- Understanding the normal daily equipment and supply use is key when planning for surge capacity.
- Monthly audits of frequently used items should be reviewed as probable must-have items. Of these must-have items, how much/many do you have, and how much/many will you need during a surge?

- What equipment utilizes disposables? Are these disposable supplies reusable? If yes, what are their cleaning requirements (personnel, time) and are these items sufficiently available?
 - You must include staff needs in the ICU surge plan (eg, nutrition, water, personal care items, waste disposal, rest space, etc).
- 6.** Despite multiple articles and checklists relating to hospital surge capacity, few good planning frameworks exist to support the process of assessing pharmaceutical resources required to support a specific ICU surge. The current healthcare model discourages overstocking of supplies or the use of multiple pharmaceutical suppliers. Hospital pharmacy departments typically maintain varied reserves of drug therapies based on several factors such as institutional utilization, shelf life, and associated acquisition costs. These may be useful:
- Involve pharmacists in the process of determining the institution's list of essential drug therapies and to help facilitate prenegotiated agreements with manufacturers to minimize delays in stock acquisition, as well as helping to coordinate efforts to pool resources with other hospitals.
 - Supplies such as antibiotics and vaccines are stockpiled by the Centers for Disease Control and Prevention's Strategic National Stockpile program (<http://www.bt.cdc.gov/Stockpile>), but are not considered a first-response supply due to the delay of arrival (hours to days). However, it is important to know what supplies are available to you from national stockpiles.
- 7.** Personal protective equipment (PPE) needs must also be addressed and can change depending on type of surge and impact. What are the needs related to surge requirements, and what are the access and supply lines?
- 8.** Evacuation and transport of patients and casualties must be addressed. What are the requirements for transport? Are there designated transport teams available or identified? What patient tracking systems are in place, and do they need to be modified for surge? Is there a tracking method for intra- and interhospital transports? Does your facility have local and regional MOUs in place for transfer of patients, should this become necessary?
- 9.** Patient triage needs to be defined within the scope of ICU care. Whose role and what triage system will be used? Will there be a set time and/or condition that will define the need for retriage of patients or reallocation of resources? What support systems exist for the ICU triage officer? Will triage criteria be modified during times of ICU surge?

10. Personnel triage must also be developed. What system will best deliver the care that has been designated (eg, staffing ratios, expanded job descriptions, etc)?



SECTION IV. VITAL CONCEPTS

What major elements and “things” must you include in an ICU surge plan?



Box 7-1. Action Items: ICU Surge Plan Issues

A number of major components/concerns must be addressed (in detail) by the ICU surge plan. Use these as a checklist of issues that must be broadly discussed and resolved by ICU and hospital leadership.

1. Obtaining resources
2. Medical supplies
3. Reuse of medical equipment
4. Pharmaceutical supplies
5. Personal protective equipment (PPE)
6. Evacuation and limitations to transport of ICU patients and casualties
7. Patient triage
8. Personnel triage

What will ICU (and other) personnel need to know from the surge plan to understand how the plan will be executed?

1. Obtaining resources

- Understand the supply chain and just-in-time delivery – What is your plan when/if this is not available? Depot of supplies locally? Which ones? How much?
- Where is the supply warehouse located, and will it be impacted?
- MOUs with relevant supply companies – Are they in place?
- Utilization of off-site equipment (eg, dialysis machines, mechanical ventilators, etc) – How will this be transported to your hospital? Who will troubleshoot these devices for safety and function, etc?

2. Medical supplies

- Identification of needs as described above – What are the must-have items?

3. Reuse of medical equipment

- Is reuse plausible? What are the manufacturer's recommendations? What can and cannot be reused? Under what circumstances? Clarify and specify this in your surge plan.
- Do you have cleaning protocols and access to these supplies under conditions of increased need?
- Disposables – Which are reusable, etc, as described above?

4. Pharmaceutical supplies

- The most recent publication from the Working Group on Emergency Mass Critical Care¹ recommends that hospitals stockpile agents deemed necessary to support an acceptable level of ICU care. These should cover the first 10 days following a disaster. Have you reviewed these lists? Has your facility decided which specific surge medications will be dependent on stockpile delivery to your facility and which drugs you will maintain locally (eg, oseltamivir)?
- Critical care medication resource planning for a severe influenza pandemic should account for the fact that resource consumption will likely be high, with scarce resources accessible for a number of weeks (ie, potentially limited human resources required to support surge manufacturing and hoarding). However, expecting each hospital to stockpile for 6 to 12 weeks is unrealistic and not required for most other critical care disasters.

- As with all resources, the same basic approach of “adapt, substitute, conserve, reuse, reallocate” should be applied to extend limited pharmaceutical resources as far as possible. For example, benzodiazepines can be substituted for propofol since they are less expensive, widely available, and can be given as intermittent boluses as well as infusions.

5. Personal protective equipment

- Identify needs (type and quantity) of PPE related to surge type (infectious versus noninfectious, HAZMAT)
- Reuse of disposal PPE equipment (eg, powered air purifying respirator masks) – What are the guidelines and protocols for reuse? Under what circumstances?

6. Evacuation and limitations to transport of ICU patients and casualties

- Codify criteria for identifying patients who may be eligible to move/transfer/transport.
- Are MOUs between institutions in place?
- Preidentification of a suitable evacuation site (written into the surge plan)
- Tracking methodologies for surge patients and their records as they move through the system from the front door to the back door (and beyond when transported)

7. Patient triage

- Are the algorithms for ICU surge scenarios written?
- Illness severity score: It is important to be as objective as possible when defining who will receive resources and who will not. A severity score can be helpful, but this must be encoded into the surge plan, predisaster. Consistency is necessary.
- Protocols for care in an austere environment and alternative care sites: There will be a need for communication with national and state accrediting agencies and the hospital legal department.

8. Personnel triage

- What is the role of licensed noncritical care personnel during a surge in your ICU?
- What is the role of nonlicensed, noncritical care personnel during a surge in your ICU?

- What is the role of volunteers during a surge in your ICU?
- What presurge preparation and education can be accomplished to minimize confusion, misallocation of resources, and care errors?
- Development of personal disaster plans (<http://www.fema.gov/plan/index.shtm>)
- Is there an identification of tiered care in the surge plan?



SECTION V. BUILDING A PLAN

We are ready to build our ICU surge plan. Now what?

- After identifying your needs and understanding of ICU expectations in the overall hospital surge plan, it is time to build the individualized ICU plan.
- Think in terms of space, staff, and stuff!
- Most aspects of the plan can be developed using an all-hazards approach, but this is where delineation between infectious and noninfectious surge has the most impact.



Box 7-2. Action Items: A Conceptual Approach for Defining and Planning ICU Surge Capacity Requirements (continued on pages 101-102)

Space

- In addition to previously stated requirements, have laminated floor plans of identified ICU and expanded ICU space
 - This can be used for patient census, identification of storage space for expanded PPE and equipment needs, and sleeping space for staff if needed.
 - Identify negative pressure rooms.

Staff

- Develop a unit-based multidisciplinary disaster committee
- Develop protocols for care in a surge event
- Role cards
- Tiered staffing patterns
 - Reporting/chain of command
- Information cards
 - Disease
 - Workflow
 - Transport/discharge
- Identification strategies for roles
 - Vests/lanyards with color coding
- Communication
 - Internal/external
- Team meetings
- Patient rounding and triage strategies
 - Daily goal sheets
- Work plan
 - Laminated and write-on/dry erase work plan (useful for noncritical care personnel)
- Education program
 - Multidisciplinary
 - Development of personal disaster plan to assist with decrease in nonreporting of staff
- Drill (exercise) program
 - Hospital-wide
 - Unit-based
- Psychological and spiritual support
 - Critical incident debriefing
 - Use of journaling

Stuff

- Inventory list
- Schedule for reassessment
 - What is relevant?
 - What still needs to be on the list?
 - What has changed?
 - What needs to be updated?

Pandemic ICU surge capacity: How do we define these needs? What is different?

- Unlike other surge planning, consider that, in a pandemic, hospital and ICU staff members may become casualties. This must be embedded into surge planning for the facility.

Table 7-1. Planning Template for Week 1 Moderate Flu Pandemic

Region newly sick	Hospital staff newly sick #	Staff dep. newly sick #	Potential facility absenteeism ^a	Seeking outpt. care
			3.1%	
Hospitalized	General care	ICU	Mechanical ventilation	Deaths

^aUse the formula in **Table 7-2** to calculate the absence rates for your department for this week. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table 7-2. Formula to Calculate Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent
	X	0.031	=	
Total department staff	-	Staff absent	=	Staff available
	-		=	

- The template-based approach in **Table 7-1** is a useful tool for bringing the various hospital stakeholders together into a unified plan. This requires that the planner consider space, staff, and stuff.

Institutional Assumptions and Plan

- Hospital incident command system activated
 - Hospital practice leaders meet twice daily to triage resources for duration of pandemic.
 - Surgical committee leaders meet daily to triage surgical resources for duration of pandemic.
 - Outpatient practice leaders meet daily to triage outpatient resources for duration of pandemic.
- To the extent possible, hospitalized patients will be located at ____ hospital (or medical center).
 - First admissions will be scattered to isolation rooms and the medical ICU.
- Control flow of outpatients and hospital admissions.
 - Upon the first case, all entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout the pandemic.
 - Centralized control of admissions from regional hospitals with a goal of keeping as many patients as possible in local hospitals
 - Offsite fever clinics established and staffed by personnel
- Reduce elective patient volume to allow room for pandemic patients.
 - As required, prescheduled patients will be contacted by supervising service to postpone or cancel their appointments.

What are some of the pitfalls to avoid when building an ICU surge plan?

- The clinical guidelines for medications that would be necessary for a mass critical care event tend to focus on antiviral therapies for pandemics or disease-specific antidotes for a bioterrorism attack.
- Although vaccines, antimicrobials, and antidotes are an essential part of a contingency plan based on the available H1N1 publications, the emergency plan should include estimations of a wide range of critical care drug therapies, including those to support mechanical ventilation (eg, sedation and chemical paralysis).
- There are several general factors to consider when generating the medication surge list:

- Likelihood that the drug could be used to care for most patients. Supplies for special populations should be addressed (eg, pediatric, burns).
- Proven or generally accepted efficacy by most practitioners
- Manufacturer's availability
- Ease of use – administration or preparation (eg, skills required; type of IV access required; frequency of administration/day; speed of administration, such as bolus doses versus continuous infusion and if the product may be administered by gravity drip rather than IV pump when needed)
- Cost
- Storage space required to house the increased supplies
- Expiration date – Can the expiry date be extended, or can the stock be rotated into general hospital use prior to expiration date?
- Allow use of personal medications in the hospital (eg, home oral antihypertensive drugs, oral hypoglycemic agents, inhalers).
- Consider the impact if medications are not taken during the shortage (eg, statin, acetylsalicylic acid).

Are there any other surge planning pitfalls particular to critical care?

- Numerous individual drug therapies are used in the ICU during routine operations, many of which are complex or labor-intensive (eg, dialysis, tight glycemic control) or expensive (eg, activated protein C).
- Because supplies and trained staff to support the use of such complex drug therapies are likely to be impacted during a disaster, we suggest a narrow critical care formulary—this offers the greatest potential benefit to the largest numbers of patients, and at relatively reasonable costs.
- **Appendix 4** provides an illustration of the selection of essential ICU medications to consider as well as how to estimate the quantities that may be required. Numerous gaps in knowledge were encountered in researching and developing the list, given the limited published resources available. Perhaps the most notable point in developing stockpiling lists is the need to rely upon assumptions in order to calculate quantities. For example, estimate the severity of disease (eg, how many will need pressors, sedations, paralysis medications) and the rate of development of ICU-related complications (eg, atrial fibrillation).

**Box 7-3. Disaster Tips: Important Therapeutic Items**

- IV resuscitative fluids (eg, NaCl 0.9%, Ringer's lactate 1 L bags, sodium bicarbonate)
- Vasopressors, inotropes, antiarrhythmics (eg, digoxin, metoprolol, amiodarone)
- Sedation, analgesia, antianxiety, paralytics, antiseizures (eg, lorazepam IV/PO, morphine, phenytoin, acetaminophen, topical anesthetics)
- Electrolyte replacements
- Supportive and prophylactic therapies (eg, corticosteroids; antiemetics; antihistamines; insulin; venous thromboembolism, ventilator-associated pneumonia, and stress ulcer prophylaxis; chlorhexidine mouth rinse for ventilator-associated pneumonia prevention; natural tears)
- Antimicrobial therapies for general infections and sepsis (eg, skin infections, open fracture care, pneumonia)
- Antidotes or antimicrobials for the specific diseases processes (eg, 2PAM, atropine, sodium thiosulfate, vaccines, immune globulins, doxycycline, ciprofloxacin, oseltamivir)

**SECTION VI. IMPLEMENTING THE PLAN**

- Define meeting times – preferably monthly in the initial phases, but after key development this may decrease to quarterly.
- Organize a drilling and education schedule.
- Drill to weaknesses.
- Develop after-action reporting.
- Include all departments.

**SECTION VII. SUMMARY**

- Identify the ICU's role in the overall hospital plan.
- Conduct a needs assessment survey related to concept of space, staff, and staff.
- Utilize a unit-based disaster committee.
- Organize tiered care concepts and their applicability to surge care in ICU.
- Develop protocols and role cards to assist in tiered care.

**REFERENCE**

1. Rubinson L, Hick JL, Hanfling DG, et al. Definitive care for the critically ill during a disaster: a framework for optimizing critical care surge capacity: from a Task Force for Mass Critical Care summit meeting, January 26-27, 2007, Chicago, IL. *Chest*. 2008 May;133(5 Suppl):18S-31S.

CHAPTER EIGHT

ETHICAL DECISION MAKING IN DISASTERS: KEY ETHICAL PRINCIPLES AND THE ROLE OF THE ETHICS COMMITTEE



SECTION I. PURPOSE OF THIS CHAPTER

- Discuss the planning process and anticipate ethical issues that may present during a time of stress on ICU capacity, and when there is a need to manage large-scale demands on a healthcare system.
- Outline basic ethical issues that arise during a disaster.
- Discuss the planning process with regard to ethical problems that one might encounter.
- Discuss the planning process with regard to medical decision making (population-based versus individual-based decision making).
- Discuss the planning process with regard to personnel-related ethical issues (ie, not enough personnel to care for the patients either because of an absolute shortage or, in some cases, because some healthcare professionals will decline to be involved secondary to a fear of their own safety).
- Understand the ethical issues associated with triage.
- Understand the implications of limits on interaction and quarantine.
- Understand the necessity of support for those who provide care, and their families, in disaster situations.



SECTION II. KEY POINTS

- Preplanning will make the process easier.
- Plan for the unexpected and insufficient resources.
- Plan for a shortage of personnel.
- Educate all professionals on their duties during the disaster.

You should use this chapter as a:

- Means to anticipate ICU ethical issues that may arise during a disaster
- Template for ICU-specific and larger hospital-wide discussions regarding ethical issues during a disaster
- Rough outline for developing an ethics-inclusive ICU disaster response plan





Box 8-1. Disaster Tips: Key Ethical Issues¹

- “Duty to care” of healthcare professionals in some circumstances can actually confuse appropriate medical decision making during a disaster.
- Priority setting of limited resources may be one of the most difficult concepts to codify in your ICU disaster response plan.
- Restrictive measures such as quarantine must also be addressed in the ICU disaster response plan.
- Global governance regarding who gets to decide and who is in control must be addressed in the ICU disaster response plan.
- Transparency of process must be preserved in the ICU disaster response plan.



Box 8-2. Disaster Tips: Things to Remember During Ethical Decision Making in Disasters

- Response to disasters involves tough decisions that will alter the usual ethical framework in which we typically make these tough decisions.
- These decisions have implications on healthcare as a whole and on individuals (patients and staff) in the ICU.
- Advance ICU planning increases the probability that you will have answers prior to the need. This will make it much more likely that you will respond in an ethical manner.
- Making the process transparent, with wide input by both providers and recipients, will help accomplish the same ends. Advance planning facilitates transparent, consistent ICU medical decision making (eg, allocation of scarce resources).
- Understanding and incorporating ethical principles in advance hardwires these principles into the response plan design. Your institution’s ethics committee may be an excellent resource for these processes.

**SECTION III. FIRST THINGS FIRST**

Where do I begin to properly incorporate ethical considerations into our ICU disaster response plan?

Simply stated, you need to ensure that these ethics-related elements are specifically addressed in your ICU disaster response plan and in your subsequent training.

Deciding

- Decide what you need to decide.
- Decide who will decide.
- Decide who will be involved in the planning and include people from the public.
- Decide what will be in short supply and how you will manage.
- Decide how you are going to decide the triage routine.
 - Who will do it?
 - What ethical principles will guide the process?
 - Is there a shortage of essential equipment?
 - Is there a shortage of essential personnel?
- Decide what the responsibilities of the healthcare professionals will be and the responsibility of the organization as a whole to the professional.
 - What support will be provided by healthcare workers?
 - Will there be choices to opt out?
 - Will there be support of healthcare workers by the institution and the government?

**Box 8-3. Disaster Tips: Common Mistakes**

The most common ethics-related planning (and execution) mistakes that occur related to ICU disaster response are as follows.

- Not planning
- Underestimating the risk to the public and healthcare workers
- Not having necessary personal protective equipment to shield healthcare workers

- Not planning for overuse of morgue or other facilities
- Not being transparent²
- Not recognizing that the trust of the public is important³
- Not involving ethics planning from the beginning
- Not practicing (and teaching) the plan
- Not involving a critical mass of the ICU providers in exercises that include ethical challenges

Priorities are primarily in planning.



SECTION IV. VITAL CONCEPTS

What are the major ethics-related elements of an ICU disaster response plan that absolutely must be addressed?

- “Duty to care” of healthcare professionals, including these issues:
 - Assumption of personal risk (eg, exposure to contagious diseases or toxins)
 - Vulnerability of ICU decision makers (eg, legal issues)
 - Support of public and other healthcare workers (eg, psychological impact of care limitations)
 - Support of healthcare worker family members during and after the disaster (eg, not coming home, concerns about children’s safety, concerns about exposure to contagious diseases)
- In a setting of limited resources, care priorities must be clearly defined and communicated to all providers. All providers must be able to apply and consistently reproduce these standards (**Table 8-1**).

What are the potential clinical issues that may invoke ethical concerns, and how can/should these be codified?

- **Shortages and priorities.** Triage and a lack of available care modalities for all patients often raises significant ethical concerns. To address this, the ICU disaster response plan should specifically address and enumerate the following.
 - Which procedures, medications, etc, should you maintain as essential for all patients?

Table 8-1. Ethical Processes During a Disaster^a

Value	Description
Accountability	There should be mechanisms in place to ensure that ethical decision making is sustained throughout the crisis.
Inclusiveness	Decisions should be made explicitly with stakeholder views in mind and there should be opportunities for stakeholders to be engaged in the decision-making process. For example, decision making related to staff deployment should include the input of affected staff.
Openness and transparency	Decisions should be publicly defensible. This means that the process by which decisions were made must be open to scrutiny and the basis upon which decisions are made should be publicly accessible to affected stakeholders. For example, there should be a communication plan developed in advance to ensure that information can be effectively disseminated to affected stakeholders and that stakeholders know where to go for needed information.
Reasonableness	Decisions should be based on reasons (ie, evidence, principles, values) that stakeholders can agree are relevant to meeting healthcare needs in a pandemic influenza crisis, and they should be made by people who are credible and accountable. For example, decision makers should provide a rationale for prioritizing particular groups for antiviral medication and for limiting access to elective surgeries and other services.
Responsiveness	There should be opportunities to revisit and revise decisions as new information emerges throughout the crisis, as well as mechanisms to address disputes and complaints. For example, if elective surgeries are cancelled or postponed, there should be a formal mechanism for stakeholders to voice any concerns they may have with the decision.

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- Which procedures, medications, etc, can you defer as nonessential (nice-to-have versus must-have care)?
- What are your allocation protocols for life-saving medical equipment that may be in short supply (eg, mechanical ventilators)?
- How do you allocate ICU and non-ICU personnel to care for critically ill patients (staffing ratios, care of ICU patients by non-ICU staff, care of ICU patients in non-ICU equipped locales, etc)?
- How do you maintain privacy of patient information in the often chaotic setting of a disaster, in which normal modalities of communications are disrupted?
- **When setting priorities, it is essential that the public recognize the legitimacy, fairness, and equity in the process.** Plan and involve healthcare providers as well as non-healthcare community leaders and citizens who are not affiliated with the hospital.
 - Public (citizens)
 - Ethicists - the ethics committee may be the best source
 - Clergy
 - Professionals from non-healthcare disciplines
 - Government officials when appropriate
- **Decide on a program of triage.** The following must be included and codified into a written triage plan for the ICU.
 - Process needs to be transparent and have the trust and solidarity of the public and comfort with overall stewardship of the process.
 - The development of codified triage criteria ideally should occur as a predisaster process.
 - The triage program should have a well-defined and choreographed appeal process.
 - According to hazard vulnerability analysis results, define patient populations most likely to benefit from ICU care (initial and ongoing care measures).
 - According to hazard vulnerability analysis results, define patient populations most likely to require triage (eg, mass casualty respiratory failure).
 - Professionals participating in the care of disaster victims should be given triage priority.

- By extension, this same logic can be applied to others who serve the public welfare (ie, may be of social utility: healthcare workers and law enforcement or those with responsibility to maintain the general status).
- **Define necessary restrictive measures.** During a disaster, medical circumstances may develop that can limit personal liberties, along with attendant ethical concerns. These should be addressed in the ICU disaster response plan as well as during exercises involving ICU professionals. These may include:
 - Quarantine, parameters and criteria of when (or if) this is appropriate:
 - Place (in-hospital, out-of-hospital, etc)
 - Person (screening criteria, which individual(s) makes the determination, etc)
 - Maintaining and protecting the workforce from medical or other conditions (circumstances) that would keep individuals from caring for patients
 - Protecting the workforce (eg, personal protective equipment, medications, preferential immunization, etc)
 - Protecting the family of the workforce (eg, personal protective equipment, medications, preferential immunization, etc)
 - Defining consequences
 - Compliance (expected behaviors)
 - Noncompliance (outlier behaviors)
 - A public discourse on restrictions is essential—this is much bigger than an ICU disaster response plan.



SECTION V. BUILDING A PLAN THAT ENCOMPASSES RELEVANT ETHICAL CONCERNS AND ISSUES

- Recognize that there is a need to plan.
- Decide whether this is a single institution or a regional issue and how you will cooperate.
- Decide who is involved in the process and bring them to the table.
- Assess the ethics resources that are available at the institution or in the area.
- Start the planning process.
- Ensure ethics representation during the planning process.

- Decide how this representation will be available or function during the crisis, if needed.
- Develop guidelines on the rationing and triage process for those responsible for this process.
 - Set priorities for utilization during the crisis.
 - Develop a process for dispute resolution during the triage or rationing period—when someone is going to be denied a therapy, what options will the person, family, or community have to challenge?
- Communicate the plan in your institution and to the public.



SECTION VI. IMPLEMENTING THE PLAN

- Codify the process so everyone understands and can retrieve the information.
- Educate participants on their roles and responsibilities during the process.
- Explain the professional responsibilities and associated legal implications for disasters, as well as expectations.
- Use case scenarios to practice using the triage and rationing process with those responsible for this process.
- Continue to review and update the process.



Box 8-4. Disaster Tips: Key Ethical Pitfalls to Avoid

- Failure to include ethics representation in the planning process from the beginning
- Recognizing that what is seen by the public is not necessarily the same as what the planners see
- Failing to include the public representatives' input during the planning process
- Planning the triage method and practicing
- Failure to protect those who must perform triage and care for patients
- Recognizing that there is a legal right to refuse to work during a disaster and the professional responsibilities that all healthcare workers have



SECTION VII. SUMMARY

- Remember that the planning process never stops and must be reviewed frequently.
- Make sure that the processes that will be used are transparent and take the public into consideration.
- Input from ethics committees, clergy, and representatives from the public will ensure public trust in the process while maintaining buy-in from healthcare workers and the institutions.



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CHAPTER NINE

BEHAVIORAL HEALTH ISSUES

Material referencing the Anticipate, Plan, Deter Responder Resilience System Pilot Model; the PsySTART Force Mental Health Triage Tag; Listen, Protect, and Connect Psychological First Aid; and references to provider stress in disasters are being reprinted with permission from Merritt Schreiber, PhD.



SECTION I. PURPOSE OF THIS CHAPTER

- Describe how disasters create a continuum of risk for short- and long-term psychological morbidity for ICU staff, patients, and family members. Typically, these issues are not addressed as a part of hospital disaster planning efforts.
- Highlight specific mental health gaps and challenges in the ICU following disasters and provide concrete next steps to build the resilience of staff, patients, and their families.
- Address and recommend disaster mental health planning, response, and recovery challenges in the ICU, and review suggested literature and tools.



SECTION II. KEY POINTS

- In the pre-event phase, hospitals must take specific, proactive steps to plan for a range of mental health consequences of disasters in staff, patients, and their families.
- Hospitals must include the mental health consequences of disasters as a regular and expected part of facility disaster planning and response plans, policies, and procedures to help facilitate “mission assurance” of the primary medical mission and functionality of the ICU.
- Hospitals must plan to support the mental health resiliency of patients, staff, and families of patients across a continuum of risk for short- and long-term psychological effects. These needs may occur over an extended duration of time beyond the immediate impact of the event.
- Hospital ICUs are extremely vulnerable to psychological effects from disasters and surge events.

You should use this chapter as a:

- Guide for developing a plan to address mental health issues in a disaster
- Guide for developing a plan to address concerns of patients, families, and staff
- Template for ICU-specific and larger, hospital-wide discussions and planning
- Plan to determine what appropriate staff should be assigned as the mental health unit leader and the employee health and well-being unit leader.



- The benefit to hospitals developing a robust mental health response plan is that, by taking proactive mental health measures, the risk of a longer-term impact on staff, patients, and family members is reduced and functionality of the ICU is likely preserved, if not enhanced.



SECTION III. FIRST THINGS FIRST

Where do I begin?

Assess the current state of your facility disaster plans in regard to behavioral health issues (ie, patients, family members, staff members). Hospital and ICU disaster plans and response efforts typically lack the following elements:

- Anticipation of the psychological consequences of disasters on staff, patients, and families, including specific planning and response elements for the ICU
- Inclusion of a surge of patients with either primary or secondary mental health presentations, particularly those presenting in the ICU as a part of planned hospital disaster exercises
- Inclusion of appropriate staff (mental health or clinical staff with mental health expertise, spiritual care, key ICU staff) in the hospital disaster planning committee
- Plans to eliminate barriers to staff reporting to work during a disaster, including sheltering staff, their family members, and pets, etc
- Plans to support the emotional resiliency of staff and referring staff for mental health follow-up beyond a single critical incident meeting that is focused on a one-time recital of events
- Assignment of appropriate staff to the two mental health positions in the hospital incident command system (HICS), including the mental health unit leader and the employee health and well-being unit leader
- Use of an appropriate evidence-based mental health triage tool to prioritize mental health response following a large-scale event
- A facility disaster mental health response plan to address the postdisaster mental health needs of patients, staff, and family members.
- A preselected facility disaster mental health response team that includes mental health personnel, spiritual care workers, clinical staff, volunteers, and other staff that can assist with mental health response issues during a disaster for patients, staff, and their families
- Appropriate risk communication plans and procedures for staff, patients, and families, particularly for chemical, biological, nuclear, or other disasters

- Planning for a family information/assistance area within the facility where family members of patients hospitalized during the disaster can wait and receive updated information and other support



SECTION IV. VITAL CONCEPTS



Box 9-1. General Concepts: Key Elements of a Successful Mental Health Plan During a Disaster

- **Preparedness**
Integrate mental health planning into the overall facility disaster planning efforts.
- **Response**
Plan for the appropriate level of mental health response for staff, patients, and family members that includes the specific challenges of the ICU.
- **Recovery**
Build community partnerships with nearby hospitals and clinics for surge disaster mental health capability and capacity. Include community response partners such as local first responders, the American Red Cross, and county/state departments of mental health to ensure that the appropriate mental health referrals are available to patients, staff, and family members in the wake of a disaster.

In what ways do surge demand and capacity affect the mental health of ICU staff, patients, and families?

- Many disaster scenarios result in tremendous surge demand for ICU care beyond existing capacity while at the same time experiencing a decreased availability of human resources (trained ICU staff), equipment shortages, and disruption in the baseline functioning of hospital mission-critical systems (power, water, security, communications, supply chain).
- Exposure to patients with increased morbidity and higher mortality rates, many with pronounced severity of injuries, including:
 - Burns
 - Dismemberment

- Mutilation
- Multiple deaths and serious injuries of children
- Death and serious injuries of fellow staff members and/or family members
- The necessity of implementing crisis standards of care that staff may be unfamiliar with due to surge in demand for care, combined with lack of vital supplies (including pharmaceuticals, ventilators, and IV pumps), damage to the ICU or broader hospital infrastructure and key environmental systems, having to work without power or traditional patient monitoring equipment, etc
- Having to care for patients beyond the usual scope of practice, including pediatric patients in nonpediatric hospitals, atypical cases (eg, burns), assignment of staff from non-ICU units, etc
- Fear and concern for staff, patients, and family members regarding the nature of the event, including potential exposure to chemical, biological, radiological, or nuclear agents
- Compound risk of work-related stress with the added potential to be a direct victim of the disaster, including loss of loved ones, evacuation, home loss, being separated from loved ones or unable to determine their status
- Increased contact and provision of support to grieving family members, including families with concerns regarding scarce resource allocation decisions and a lack of available family to discuss medical history and advance care directives



SECTION V. BUILDING AND IMPLEMENTING THE PLAN

Table 9-1. Recommendations for Preparing for Mental Health Issues During a Disaster

Challenges	Disaster Preparedness	Disaster Response	Disaster Recovery	Suggested Tools and Literature
<ul style="list-style-type: none"> ■ Stress resulting from ICU surge ■ Response and implementation of crisis standards of care 	<ul style="list-style-type: none"> ■ Develop a surge response plan. ■ Credential professionals for staffing augmentation. ■ Exercise plan. 	<ul style="list-style-type: none"> ■ Augment staffing with non-ICU staff. ■ Limit interventions to those deemed necessary. ■ Utilize resources that support critical care response. 	<ul style="list-style-type: none"> ■ Rely on strong institutional and regional emergency operations plans to ensure a return to normal operations. 	<ul style="list-style-type: none"> ■ American College of Chest Physicians <i>Chest</i> guidelines¹ ■ Working Group on Emergency Mass Critical Care guidelines²
<ul style="list-style-type: none"> ■ Standards of care 	<ul style="list-style-type: none"> ■ Develop an approach to managing scarce resources, in coordination with existing emergency operations plan. 	<ul style="list-style-type: none"> ■ Prioritize use of key resources, including ventilators. ■ Emphasize conservation, substitution, and adaptation strategies for resource utilization. 	<ul style="list-style-type: none"> ■ Continuously put forth efforts to reduce the need for reuse and reallocation strategies. 	<ul style="list-style-type: none"> ■ Institute of Medicine. Establishing crisis standards of care for use in disaster situations: A letter report.³⁻⁵
<ul style="list-style-type: none"> ■ Mental health issues arising from traumatic and work stressors 	<ul style="list-style-type: none"> ■ Develop a plan to address mental health staff support, possibly as an off-shoot of the healthcare organization's existing emergency operations plan. 	<ul style="list-style-type: none"> ■ Enhance resilience and manage expectable psychological casualties. 	<ul style="list-style-type: none"> ■ Promote use of Psychological First Aid tools for healthcare worker self triage. ■ Provide real-time impact intervention counseling and treatment, when needed. 	<ul style="list-style-type: none"> ■ REPEAT planning tool⁶ ■ Anticipate, Plan, Deter Responder Resilience System Pilot Model^{7,8} ■ Psychological First Aid training for all staff⁹

Abbreviation: REPEAT, Readiness for Events with Psychological Emergencies Assessment Tool

Table 9-2. Mental Health Challenges and Risks for Patients During a Disaster

Patient Challenges	Patient Care Preparedness Efforts	Patient Response Recommendations	Patient Recovery Strategies	Suggested Tools and Literature
<ul style="list-style-type: none"> ■ Mental health risks associated with ICU admission (isolation, fear, organic disease processes) 	<ul style="list-style-type: none"> ■ Ensure that the hospital emergency operations plan includes placement of mental health response, with appropriately trained staff, into incident management and response. 	<ul style="list-style-type: none"> ■ Implement triage tools to identify those who need secondary assessment for mental health issues. 	<ul style="list-style-type: none"> ■ Integrate HICS mental health operations with specific tactics for the ICU setting. ■ Train all staff in very basic Psychological First Aid. The Listen, Protect and Connect model is recommended. 	<ul style="list-style-type: none"> ■ California Emergency Medical Services Authority Web site¹⁰ ■ Listen, Protect and Connect model¹¹ ■ Psychological First Aid¹²
<ul style="list-style-type: none"> ■ Standards of care 	<ul style="list-style-type: none"> ■ Create a mechanism for transparent demonstration of resource allocation schema to patients, when possible. 	<ul style="list-style-type: none"> ■ Utilize the risk communication plan in order to convey issues related to decision making in a resource-poor environment. ■ Practice crisis standards of care protocols in mandatory disaster exercises. 	<ul style="list-style-type: none"> ■ Augment the HICS mental health plan to incorporate management of reactions to crisis standards of care into operational plans. ■ Augment resources for provision of coping strategies for management of traumatic loss. 	
<ul style="list-style-type: none"> ■ Fewer professional resources available to support mental health needs 	<ul style="list-style-type: none"> ■ Train additional staff to render psychological support to patients. 	<ul style="list-style-type: none"> ■ Allow family to provide patient care support, when possible. 	<ul style="list-style-type: none"> ■ Rationally allocate limited mental health, social services, and spiritual care providers based on evidence-based triage. ■ Local and state disaster mental health plans ■ Consider use of the electronic database ESAR-VHP for this purpose. 	<ul style="list-style-type: none"> ■ LAC EMS Agency PsySTART Mental Health Triage System¹³ ■ Terrorism and Disaster Center. University of Oklahoma Health Sciences Center¹⁴ ■ Integration of Mental and Behavioral Health in Federal Disaster Preparedness, Response, and Recovery¹⁵ ■ IOM Crisis standards of care report.³

Abbreviations: HICS, hospital incident command system; ESAR-VHP, Emergency System for Advance Registration of Volunteer Health Professionals; LAC EMS, Los Angeles County Emergency Medical Services; IOM, Institute of Medicine

Table 9-3. Mental Health Challenges and Risks for Families During a Disaster

Family Challenges	Family Preparedness Efforts	Family Response Recommendations	Family Recovery Strategies	Suggested Tools and Literature
<ul style="list-style-type: none"> ■ Standards of care 	<ul style="list-style-type: none"> ■ Create mechanism for transparent demonstration of resource allocation schema to patients' families. ■ Explain ethical rationale for decision making, including those leading to the removal of life-sustaining care, and transition to palliative care model. 	<ul style="list-style-type: none"> ■ Allow family to engage in patient care efforts, when possible. ■ Encourage family participation in discussions related to transparent decision-making processes regarding allocation of scarce resources. ■ Provide a mechanism for reconsideration of allocation decisions prompted by family members, in conjunction with an existing scarce resource allocation plan. 	<ul style="list-style-type: none"> ■ Psychosocial support staff trained in expected reactions to crisis standards of care ■ Evidence-based or manual interventions for family members coping with crisis standards of care ■ Development of web-based interventions focused on traumatic loss of loved ones in crisis standards of care ■ Develop referral procedures for mental health follow-up, specifically for patients, staff, and family members who experienced the traumatic loss of loved ones following a disaster 	<ul style="list-style-type: none"> ■ TF-CBT Web. A web-based learning course for trauma-focused cognitive-behavioral therapy.¹⁶
<ul style="list-style-type: none"> ■ Patient tracking and location of family 	<ul style="list-style-type: none"> ■ Develop a patient-tracking database, in conjunction with EMS, public health, and emergency management authorities. 	<ul style="list-style-type: none"> ■ Encourage use of patient-tracking database to coordinate location of family members. ■ Site-based stand-up of Family Assistance Center model to include section on locating family members 	<ul style="list-style-type: none"> ■ Learn about various methods to locate loved ones during disasters, including the American Red Cross domestic Safe and Well program. 	<ul style="list-style-type: none"> ■ Recommendations for a National Mass Patient and Evacuee Movement, Regulating, and Tracking System¹⁷ ■ American Red Cross Safe and Well Web site¹⁸

Table 9-3. Mental Health Challenges and Risks for Families During a Disaster (continued)

Family Challenges	Family Preparedness Efforts	Family Response Recommendations	Family Recovery Strategies	Suggested Tools and Literature
<ul style="list-style-type: none"> ■ Fewer professional resources available to support mental health needs 	<ul style="list-style-type: none"> ■ Provide family members with resources to render psychological support. ■ Staff trained in PFA provide basic PFA as part of duties. ■ Understand sensitivities related to expected death rituals, including funerals, which may be disrupted due to a disaster. 	<ul style="list-style-type: none"> ■ Require that both HICS mental health components (mental health and employee health and well-being unit leader) address the surge needs of family members. ■ Specific ICU operational planning and strategies. May include use of mental health triage and rationing to those with the greatest need if there are limited mental health resources. ■ Utilize combination of mental health professionals and nontraditional providers to deliver basic support. 	<ul style="list-style-type: none"> ■ Ensure that the disaster mental health needs of local hospitals (especially the mental health follow-up needs of the ICU) are included as part of public mental health systems and response plans for large events. ■ Encourage integration with community recovery strategies, including faith-based efforts. 	<ul style="list-style-type: none"> ■ HICS mental health operational components ■ Draft PsySTART Hospital Mental Health Unit Triage function position

Abbreviations: EMS, emergency medical services; PFA, Psychological First Aid; HICS, hospital incident command system; PsySTART, Psychological Simple Triage and Rapid Treatment



SECTION VI. SUMMARY

- The potential for long-term mental health sequelae related to disaster events necessitates placement of added emphasis on planning for and responding to staff, patient, and family behavioral health needs. This will help secure “mission assurance” to meet patients’ needs and to support staff.
- Staff, patients, and family will all grapple with the ethical and moral choices related to fairness in resource allocation during large disaster events, and

the implications of shifting towards crisis standards of care may result in unprecedented stress on patients, families, and ICU staff.

- Successful disaster response must include efforts to ensure proactive management of the mental health consequences of disaster, which ultimately contributes to hospital and community resiliency.
- While physicians and nurses may mistakenly be prioritized, it is important to note that *all* members of the hospital community must be attended to, as it takes all members of the hospital staff to ensure continued, successful functioning of the hospital ICU.



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CHAPTER TEN

PEDIATRIC CONSIDERATIONS: WHAT IS NEEDED IN MY ICU TO CARE FOR THESE CASUALTIES?



SECTION I. PURPOSE OF THIS CHAPTER

- Recognize that the physiology of children renders them more susceptible to injury.
- Outline the critical issues that need to be included when creating a hospital disaster response plan for children.
- Discuss the developmental processes specific for different types of hospitals and their appropriate response in the disaster plan.
- Address critical issues and potential errors in a disaster plan for children that should be considered during plan development.



SECTION II. KEY POINTS

- Each type of hospital must have a preplanned and designated disaster plan for children.
- Space, equipment, and personnel for treating children must be preplanned prior to a disaster.
- Specialized pediatric disaster training and preparedness must be implemented at all levels.
- These disaster plans will depend on the space capacity and capabilities of the personnel who will manage the children.
- The hospital-specific disaster plan for children must integrate with local, regional, and national disaster plans.

You should use this chapter as a:

- Guide for developing your hospital disaster response plan for children
- Template for community and regional hospital disaster plans for children
- Guide for triage and transport of children based on illness acuity



SECTION III. FIRST THINGS FIRST

*What are the unique considerations in disaster planning for children?
What must you include in your ICU disaster response plan?*



Box 10-1. General Concepts: Special Considerations in Pediatric Disaster Planning

- Space** Identify appropriate space for safely managing the needs of injured children.
- Staff** Personnel must be adequately trained to manage pediatric crises and be prepared for just-in-time training.
- Stuff** Children require size-specific supplies and medication dosing.
- Triage** Design triage protocols to reconcile the imbalance between under- and over-triaging.

- **Space.** Depending on the nature of the disaster, identification of appropriate space for safely managing the needs of injured children is vital. This may be done in the hospital, school, church, community center, or other locations where the children can be reunified with family members or kept safe and under adult supervision until reunification occurs.
- **Staff.** Adequately training personnel to manage pediatric crises involves simulation-based training in established protocols and deliberate practice in advance of the disaster. This must happen at every level, including hospitals with little or no pediatric support. Staff also needs to be prepared for delivering and receiving just-in-time training, where management is directed via telemedicine (phone, web, etc) from the referral center as the crisis is unfolding.
- **Stuff.** Children are not small adults; they require size-specific supplies and medication dosing for even simple life-saving interventions (eg, airway and intravenous access). Emergency departments and the Strategic National Stockpile are inadequately stocked with pediatric equipment, contributing to the vulnerability of children in mass casualty. Identifying, anticipating, and addressing these needs during the preplanning stage is essential.

- **Triage.** Pediatric-specific triage protocols are designed to address the imbalance between under-triaging (resulting from poor comprehension of pediatric physiology) and over-triaging (resulting from the emotional burden associated with the care of critically ill children). Prehospital preparedness in triaging children is suboptimal. Utilization of accepted pediatric triage protocols like JumpSTART is desired, but may not be possible. The vast majority of emergency departments lack the necessary pediatric equipment and supplies to adequately manage pediatric emergencies. We expect our emergency services to serve as the first line of defense and response during disaster, rendering our children extremely vulnerable when injured. Pediatric-specific training and preparedness cannot be over-emphasized.



SECTION IV. VITAL CONCEPTS

What are the special needs in disaster planning for children?

- Special consideration needs to be given to children in disaster planning because of the unique vulnerabilities of children. According to Nance and colleagues, there are only 170 pediatric trauma centers in the United States.¹ They estimate that 17.4 million US children would not have access to a pediatric trauma center within 60 minutes.
- Children require highly specialized medical and psychiatric care, age- and weight-specific equipment and medication dosing, and dedicated triage protocols. Given the unique and extensive vulnerabilities in the pediatric population, mass casualty would likely result in a disproportionate number of injured children, and our response systems may be easily overwhelmed.
- Medical materiel (supplies, pharmaceuticals) to support the needs of children are likely absent from many or most nonpediatric ICUs, but may be required following a disaster. Is there a prudent approach to determining what to stock, what to have available on short notice, etc?
- ICU staff may require additional education and training to provide effective pediatric casualty management.

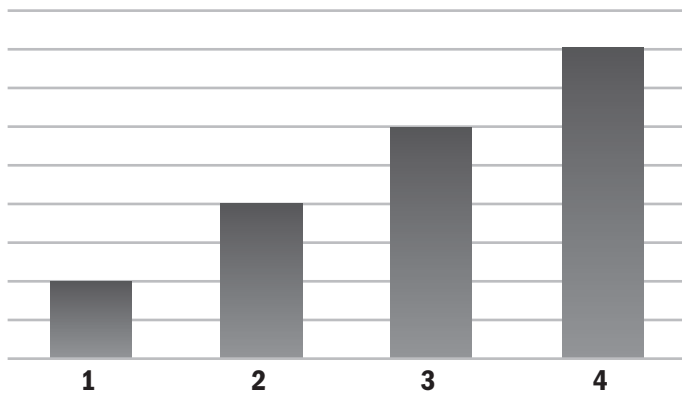


Box 10-2. Action Items: Essential Components to Creating a Disaster Plan for Children

1. Identify hospital (community, state, and national) resources (personnel and equipment) specific to the needs of children
2. Preplan disaster referral schematics to allow the most critical patients access to the most highly trained pediatric professionals
3. Be flexible enough to allow for tiered care of children utilizing highly trained and experienced pediatric caregivers who will supervise less experienced caregivers at every level of care.
4. Appreciate the distinctive physiology of the developing child (children are not small adults), and their social, emotional, and psychological needs.
5. Incorporate these unique pediatric requirements in disaster preparedness training.

How do we optimize response to children in a disaster?

- In order to optimize response to children during disaster, local, regional, and national resources available to provide care must first be considered.
- Hospitals can be placed into categories based on their ability to respond to pediatric illnesses and injuries as well as their ability to manage pediatric complexity. This classification schema will assist you when developing an ICU disaster response plan that appropriately addresses important pediatric considerations. Consider the depiction of this categorization in **Figure 10-1**.

Figure 10-1. Hospital Category by Level of Pediatric Care

1, primary care hospital; 2, primary care hospital with pediatricians; 3, secondary care hospital; 4, tertiary (or quaternary) care hospital

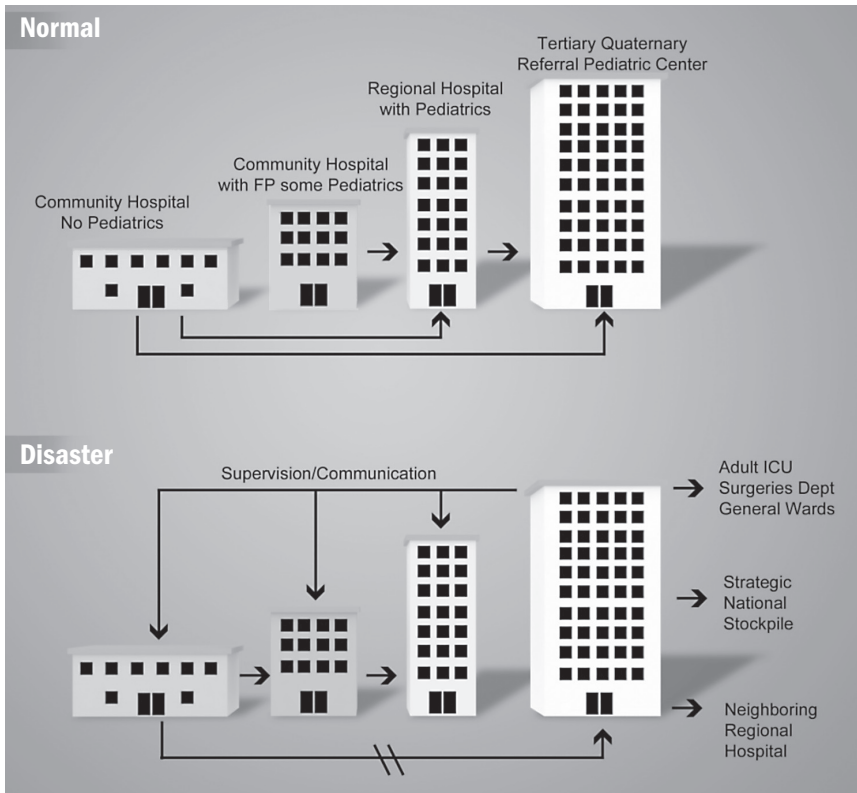
- **Primary care hospital.** Community hospital without pediatricians; pediatric patients are initially managed in the emergency department and then transferred elsewhere.
- **Primary care hospital with pediatricians.** Community hospital with pediatricians, but without pediatric-specific inpatient wards, ICU, or surgical specialists and emergency care; noncomplex pediatric patients are admitted locally.
- **Secondary care hospital.** Hospital with pediatricians and pediatric inpatient ward, without pediatric ICU, surgical, or emergency specialization; noncomplex and some pediatric patients of intermediate complexity are admitted locally.
- **Tertiary (or quaternary) care hospital.** Children's hospital with pediatric emergency, surgical, and intensive care specialization.

How should I account for referral patterns related to triage and transport of children in our ICU disaster response plan?

The following casualty logistics, flow patterns, and provider care issues should be delineated in your ICU disaster response plan:

- Referral patterns are usually driven by pediatric specialization (**Figure 10-2**), using the same four categories described in **Figure 10-1**.

Figure 10-2. Pediatric Specialization Referral Patterns



- Triage must be handled in a prehospital setting and, ideally, is determined according to accepted and evidence-based algorithms that account for the unique physiologic differences between children and adults. Some algorithms are available (eg, JumpSTART), although at present these algorithms have not been rigorously studied.
- During disasters, these referral patterns and triage protocols can be affected in a variety of ways (**Figure 10-2**).
 - First, it may be necessary for community hospitals with fewer pediatric resources to care for ill children of higher acuity when receiving hospitals and/or transferring hospitals are overwhelmed, when transport (ground and/or air) is disrupted, or when communication (phone, telemedicine) is interrupted.
 - Ideally, care and referral patterns will follow a pyramid scheme where pediatric intensivists direct care of critically ill children through adult intensivists and acutely ill children through pediatricians.

- Pediatricians will direct the care of less acutely ill children through family practitioners and emergency medicine specialists or some variation of this, where the most highly specialized pediatric care provider provides direction for the next level of pediatric specialization.
- These same considerations are also true for nursing care, respiratory care, and other allied health professionals. Ideally, all healthcare professionals who do not deal with pediatric issues/patients on a routine basis should be supervised by individuals who have the requisite experience.
- When the tertiary care system is overwhelmed, it may be necessary to utilize regional and national assistance, including neighboring states' resources and national support such as the Strategic National Stockpile (SNS) supplies. These changes in referral patterns impact implementation of effective pediatric disaster care protocols as well.

What are the unique physiologic considerations in children that render them more prone to injury during disaster?

An ICU disaster response plan should delineate staff and provider education requirements in order to care for children. The following systems-based issues should be reinforced with adult providers who will care for pediatric casualties following a disaster (**Box 10-3**).



Box 10-3. Disaster Tips: Physiologic Considerations Adult Providers Should Remember When Caring For Children During a Disaster

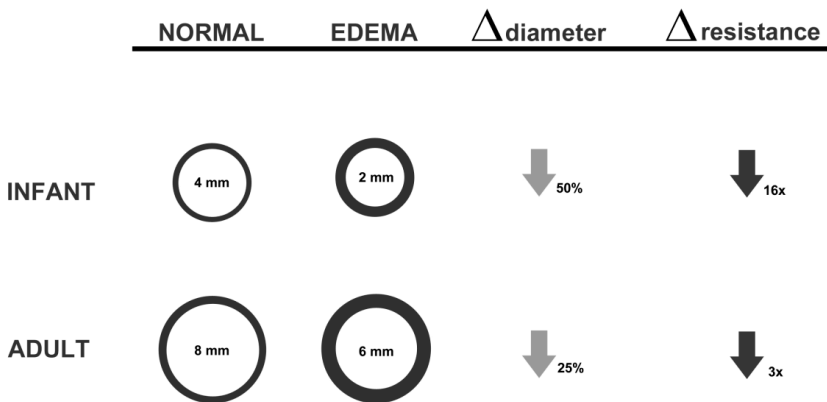
- **Respiratory considerations:** Children are more prone to chemical inhalation injury and have a greater propensity for alveolar hypoventilation and hypoxemia. Inhalation agents can have a direct effect on a child's airway resistance, and physiological differences make ventilation more difficult in children.
- **Cardiovascular considerations:** Children are at greater risk for shock after bleeding.
- **Neurological considerations:** Children have a higher risk for head injury and are more prone to nerve agents and seizures. Developmental immaturity complicates neurological assessment.

- **Skin and integumentary system considerations:** Children are more prone to injury from chemical and thermal burns, as well as hypothermia (in the field and during decontamination).
- **Musculoskeletal system considerations:** Children are at higher risk for internal injury because the spleen and liver are less well protected by the rib cage.
- **Psychological and mental health considerations:** Children are more vulnerable and less likely to protect themselves, recognize danger, and follow instructions.

■ Respiratory considerations

- Children are more prone to chemical inhalation injury, especially from chemicals that are heavier than air, such as chlorine and ammonia. This is because children are closer to the ground, have a more rapid respiratory rate, and have a smaller body surface that increases the metabolic effect of such agents.
- Inhalation agents that damage mucosa and cause airway inflammation have a direct effect on airway resistance through reduction of the diameter of the airways (**Figure 10-3**). The smaller the airway, the greater the resistance.

Figure 10-3. Airway Resistance in Children



- Children expend more energy in working to breathe and have higher oxygen demands per kilogram of body weight (elevated BMR), increasing their propensity for alveolar hypoventilation and hypoxemia.
- During resuscitation, ventilation is often more difficult in children secondary to the greater tongue-to-oropharynx ratio, increased flexibility of the trachea (hyperflexion/extension), and larger occipital shelf.
- Cardiovascular considerations
 - Children are at greater risk for shock after bleeding (secondary to a relatively smaller circulating blood volume than adults), and it is more difficult to diagnose shock in children given their unique physiologic responses to volume loss.
- Neurological considerations
 - Children are at higher risk for head injury secondary to poor neck muscle strength and an increase in head-to-body ratio compared to adults.
 - Developmental immaturity complicates neurological assessment for untrained caregivers. Children are also more susceptible to nerve agents (given their faster metabolic rates) and more prone to seizures than adults.
- Skin and integumentary system considerations
 - A child's skin is thinner and body surface area in relation to weight is greater than an adult. Hence, children are more prone to injury from chemical and thermal burns.
 - These same factors render children more susceptible to hypothermia both in the field and during decontamination procedures.
- Musculoskeletal system considerations
 - Children are at higher risk for injury to their internal organs and internal bleeding because the spleen and liver are less well protected by the rib cage than in adults.
- Psychological and mental health considerations
 - Children are also more vulnerable during disaster because they are less likely to be able to protect themselves, recognize danger, and follow directions.



SECTION V. BUILDING AND IMPLEMENTING THE PLAN



Box 10-4. Case Study: Primary Care Hospital

A school bus overturns and rolls down a ravine. One child dies, three are critically injured, and 20 are less critically hurt. They are now en route to your primary care hospital.

- A *primary care hospital* is a community hospital without pediatricians. Pediatric patients are initially managed in the emergency department and then transferred elsewhere.
- In response to the scenario in **Box 10-4**, a disaster response plan for this type of hospital would include three levels of triage:
 - First level of triage: Use adult resources within the community hospital.
 - Second level of triage: Use next level of community hospital with greater pediatric resources.
 - Third level of triage: Transport to tertiary pediatric centers within and outside of region.
- Predisaster considerations that should be included in your ICU disaster response plan:
 - Adequately train staff to manage initial pediatric issues (Advanced Pediatric Life Support/Pediatric Advanced Life Support).
 - Maintain necessary (adequate) equipment and define space needs—be ready for plan execution (this means practice and drills).
 - Maintain a close relationship with the nearest regional tertiary care hospital so assistance will be readily available (shortly following the beginning of the event).



Box 10-5. Case Study: Primary Care Hospital With Pediatricians

An aerosolized chemical weapon is released in a school. Victims are between 5 and 11 years of age. Two children die, five have respiratory compromise with shock, and 30 children are exposed with minimal symptoms.

- A *primary care hospital with pediatricians* is a community hospital with pediatricians, but without pediatric-specific inpatient wards, ICU, or surgical specialists and emergency care; noncomplex pediatric patients are admitted locally.
- In response to the scenario in **Box 10-5**, a triage plan for this type of hospital would include the following:
 - The five children with respiratory symptoms are the main priority.
 - Make arrangements to transport them to a regional tertiary center with pediatric-specific wards and an ICU. Utilize specialty transport teams.
 - Utilize transport teams from multiple regional hospitals, if necessary.
 - Triage exposure cases in the field and bring them to the emergency room for decontamination.
- Logistical and ICU disaster response considerations for this scenario should include:
 - **Space.** Space is needed to decontaminate the exposed, rewarm patients, and reunify children with family.
 - **Staff.** Pediatric ICU physician at tertiary hospital assists the emergency department physicians or the adult intensivists managing pediatric patients requiring mechanical ventilation. Nurses with pediatric training help nurses without pediatric training manage noncritically ill pediatric patients. Respiratory therapists with pediatric training will supervise those respiratory therapists who do not have pediatric training. This practice is similar for all other members of the multiprofessional team.
 - **Stuff.** Pediatric-specific equipment is needed to secure the airway on acute respiratory distress syndrome patients, as are ventilators capable of maintaining children until transport (eg, Viasys® 1200 versus hand ventilation)

**Box 10-6. Case Study: Secondary Care Hospital**

An F-5 tornado occurs. Roads are damaged, buildings are destroyed, the hospital is intact, airfields are satisfactory, and communications systems remain functional. There are a large number of injured children and adults; many are critically injured.

- A *secondary care hospital* is a hospital with pediatricians and a pediatric inpatient ward, without pediatric ICU, surgical, or emergency specialization; noncomplex and some pediatric patients of intermediate complexity are admitted locally.
- In response to the scenario in **Box 10-6**, a triage plan for this type of hospital would include the following:
 - Perform initial triage prehospital and offsite.
 - Identify appropriate locations in which to care for lower-acuity patients. These locations should be safe for patients and allow for easy reunification with family members.
 - As the surge of severely injured children overwhelms the pediatric-trained staff, pediatric-trained personnel should begin to supervise nonpediatric-trained personnel to care for a large number of patients. If available, utilize adult ICU space for the care of children, with a pediatric intensivist available by phone or through telemedicine to supervise adult intensivists.
 - Transport infrastructure will be taxed, so make appropriate triage decisions to offload the patients most likely to survive to regional centers and neighboring states.
 - National and regional disaster response (government) resources are activated.
 - **All of this requires preplanning *before* a disaster occurs. Use your hazard vulnerability analysis to guide these efforts.**



Box 10-7. Case Study: Tertiary (or Quaternary) Care Hospital

An earthquake occurs involving a large geographical area; hundreds of children are injured. Many are seriously or critically injured.

- A *tertiary (or quaternary) care hospital* is a children's hospital with pediatric emergency, surgical, and intensive care specialization.
- In response to the scenario in **Box 10-7**, a triage plan for this type of hospital would include the following:
 - No amount of planning will prepare a hospital(s) for this scenario.
 - Utilizing your disaster plan, move lower-acuity patients to available (safely monitored) care space – this may not be at the hospital.
 - Increase acuity of all remaining units to manage a large influx of critically ill children.
 - National and regional disaster response (government) resources are activated.
 - Ensure the safety of hospital workers and their families.



SECTION VI. SUMMARY

- The pediatric population deserves special consideration in disaster planning.
- The unique physical and psychological vulnerabilities of children render them extremely high risk during crises, and pediatric-specific surge capacity and capability are critical.
- Methodical planning will allow you to identify surge capacity necessities, including pediatric-specific facilities and equipment.
- When addressing surge capability (the number of trained personnel able to actually respond to pediatric emergencies), one cannot overemphasize the need for training and simulation in pediatric triage and emergency care.
- Finally, all disasters are local. The implications of this perspective are paramount when planning for a catastrophe. At the local level, personnel need to be prepared through training, pediatric equipment needs to be available, and alternate referral patterns need to be identified.

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**SUGGESTED READINGS**

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MacKenzie EJ, Hoyt DB, Sacra JC, et al. National inventory of hospital trauma centers. *JAMA.* 2003;289:1515-1522.

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APPENDIX ONE

DISASTER EDUCATION AND TRAINING RESOURCES

What is the purpose of a disaster training exercise for your ICU?

- To test your ICU disaster response plan for completeness and functionality
- To ensure that all decision makers meet certain criteria to test the completeness and functionality of your ICU disaster response plan
- To assess and measure the following general elements during the exercise:
 - Adequacy
 - Feasibility
 - Acceptability
 - Completeness
 - Compliance with guidelines and doctrine

What should be assessed during an ICU disaster response exercise?

1. Logistics

- Surge capacity
- Critical care infrastructure
 - Increase ICU beds to include monitored, procedural, and recovery areas
 - Have contingency plans for ventilator use
 - Develop a phased staffing plan
 - Apply critical care physicians' expert opinion in emergency triage
 - Prioritize tests and support services

2. Communication

- Within ICU
- Collaboration with interface units
 - Develop a hospital-based incident command system with clearly defined goals
 - Develop a standard operating procedure for communication and coordination between the ICU and other departments

- Define clear roles for personnel
- Create standard practices for patient transfer

3. Staffing capacity

- Availability of trained staff is the rate-limiting factor in most surge situations
- A current roster of trained individuals, and possible emergency training of additional personnel, should be developed
- Only clinical staff should provide patient care
- Staff should be prepared to provide care outside of their usual scope of practice

4. Essential equipment

- Availability of essential medical equipment and pharmaceuticals should be ensured
- Key personnel in each department should recognize potential scenarios requiring this equipment
- If resources are scarce, guidelines for triage of these resources should be outlined

5. Protection of hospital staff and patients

- Infection control and occupational health policies should be implemented
- Formal education on personal protective equipment (PPE) should be given

6. Critical care triage

- ICU services should be restricted to patients most likely to benefit
- Usual treatments might be impossible to administer
- Strict criteria for withholding ICU care should be developed
- These criteria might need to be altered with changing situations

What are some examples of appropriate disaster exercise scenarios that we could use in our ICU?

Table A1-1 includes examples of disaster scenarios that have a direct impact on ICU function. You should stage exercises based on threat priorities identified in your hazard vulnerability analysis.

Table A1-1. Disaster Scenarios Requiring Critical Care

Scenario	Time/Duration of Critical Illness	Expected Number of Critically Ill	Specific Critical Care Requirements
<i>Natural Mass Casualty</i> - Earthquake - Tornado - Hurricane	Immediate and days to months/variable	Few to thousands	- Crush injury - Blunt and penetrating trauma - Dehydration - Acute renal failure - Loss of ICU infrastructure (usually non-functional) - Loss of care access/ impact of chronic critical illness demands
<i>Man-made Mass Casualty</i> - Factory explosion - Fire in a densely inhabited building	Immediate/days to weeks	Usually in the hundreds	- Hemothorax - Pneumothorax - Acute respiratory distress syndrome - Hemorrhagic shock - Burns
<i>Pandemic Infections</i> - Pandemic influenza (H5N1, H1N1) - Severe acute respiratory syndrome	Days to weeks/weeks to months	Up to thousands	- Acute respiratory distress syndrome - Secondary bacterial infections
<i>Chemical Agents/Weapons Vesicants/Pulmonary Irritants</i> - Train derailment with hazardous materials - Tractor-trailer accident involving ammonia spill - Chemical factory explosion	Hours/days to weeks	Up to thousands	- Acute respiratory distress syndrome - Airway injury (pulmonary irritants) - Severe burns (vesicants)
<i>Chemical Agents/Weapons Nerve Agents</i> - Train derailment with hazardous materials - Tractor-trailer accident involving ammonia spill - Chemical factory explosion	Immediate/hours	Up to thousands	- Bronchospasm - Bronchorrhea - Flaccid paralysis
<i>Biological Weapons</i> - Bioterrorism - Disease outbreak (non-influenza)	Hours to days (based on incubation period)/days to weeks	Up to many thousands	- Acute respiratory distress syndrome (plague, tularemia) - Ventilatory failure (botulism)
<i>Radiological Weapons</i> - Nuclear explosions (power plant) - Dirty bombs	Immediate to months to years/years	Up to many thousands	- Acute radiation syndrome - Acute respiratory distress syndrome - ICU care needs similar to conventional blast injury

Are there other ways to accomplish a more targeted or directed ICU disaster response assessment?

We don't always have time for these exercises, and a full-scale exercise can be disruptive to normal (everyday) patient care activities. However, table-top exercises are integral and very useful adjuncts that allow directed assessment of specific ICU performance attributes during a disaster. These can be used to assess the following:

- Probability of an event or response following an event
- Functionality and accuracy of your hazard vulnerability analysis
- Assessment of critical care and hospital surge capacity
- Practice communication with regional and federal emergency organizations

Table A1-2 includes some examples of appropriate table-top exercises for your ICU.

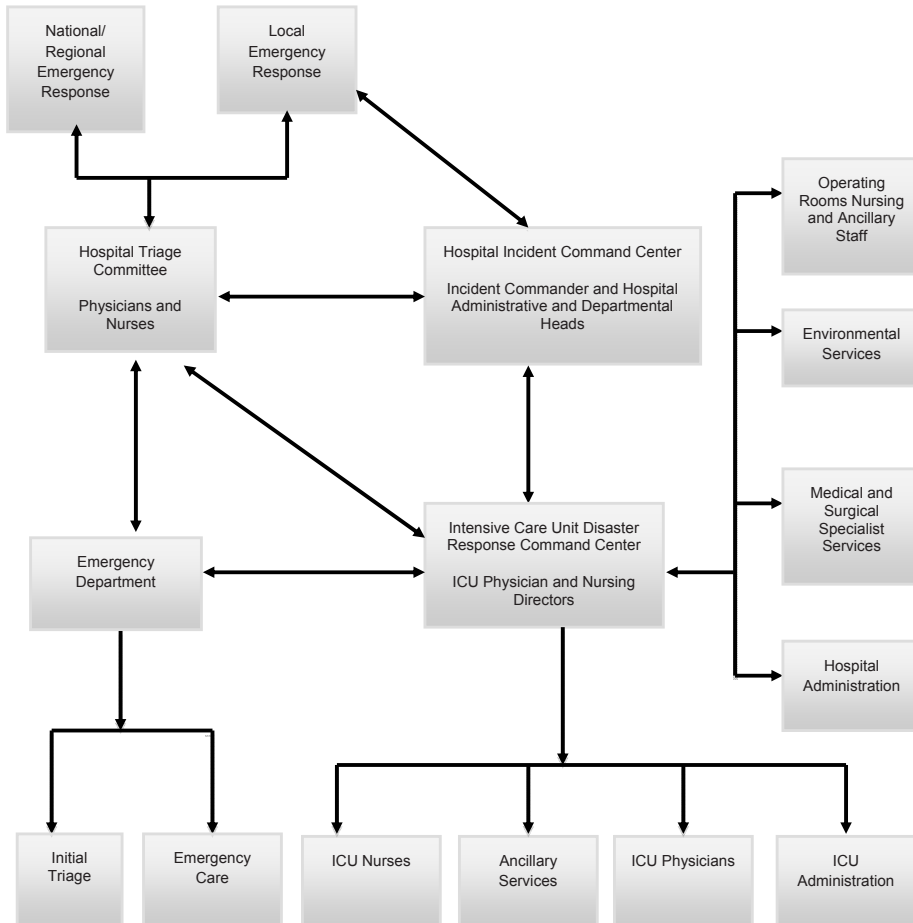
Table A1-2. ICU Disaster Response Table-Top Exercises

Scenario	Impact Analysis	Identification of Risk Reduction Measures	Response Strategy
Catastrophic natural disasters	Large patient population expected after major disaster	- Destruction of existing infrastructure	- Makeshift critical care centers - Triage of patients
Pandemic infections	Large patient population over a prolonged period	- Protracted course of disease - Potential for multiple waves - Effective infection control practices and use of PPE	- Effective coordination with national and local emergency units for medical equipment and expertise
Man-made mass casualty events - conventional	Small patient population, but existing infrastructure might be damaged	- Assess the need for an immediate surge in critical care capacity after the event	- Effective triage and early intervention for reversible injuries
Radiological/chemical attacks	Large patient population	- Immediate effect can be devastating - Affected area not easily accessible	- Use of PPE and specific expertise needed

Abbreviation: PPE, personal protective equipment

What are the “big picture” concepts that our ICU staff must know and understand?

Figure A1-1. Staffing Patterns Including Clinical and Non-Clinical Personnel



What are some examples of additional clinical training that might be needed to help our ICU staff perform optimally during a disaster?

There will need to be a certain degree of cross-training. During a disaster, some ICU staff may be expected to perform tasks that are outside of their normal job descriptions. For example, most/all ICU staff should be facile with the following disaster-specific equipment and procedures:

- Medical equipment
 - Mechanical ventilators
 - Noninvasive ventilators
 - Oxygen and other medical gases
 - Monitors: blood pressure, heart rate, electrocardiography
 - Intravenous pumps
 - Nebulizers
 - Suction machines
 - Pulse oximeters
 - Ambu bags
 - Endotracheal tubes
 - Catheters: intravenous (central and peripheral), arterial
- Pharmaceutical agents
 - Antiviral drugs (specifically neuraminidase inhibitors)
 - Antibiotics
 - Vasoactive drugs
 - Bronchodilators
 - Sedatives
 - Analgesics
 - Neuromuscular blocking agents
 - Steroids
 - Fluids for resuscitation
- Personal protective equipment
 - Masks: N95, surgical
 - Respirators: N95, powered air-purifying respirators
 - Full-face shields, goggles
 - Gloves and gowns: sterile and non-sterile
 - Filters, including high-efficiency particulate air

- Other general procedures (examples)
 - Placement of peripheral intravenous and arterial catheters
 - Respiratory hygiene procedures
 - Wound and skin care
- Other potential equipment requirements
 - Extracorporeal membrane oxygenation
 - Pumpless extracorporeal lung assist
 - High-frequency oscillatory ventilation
 - Nitric oxide

What are general principles that should be taught to ICU providers for procedures during disaster situations?

- Perform procedures at the bedside whenever possible.
- Ensure adequate training of the hospital personnel in PPE and its use in high-risk procedures.
- Develop and teach protocols for high-risk procedures.
- Determine criteria for cancelling elective procedures; ensure consistency through staff education.
- Use of noninvasive positive-pressure ventilation should be limited in disaster situations due to infectious risks (aerosol generation).
 - COROLLARY #1: Aerosol-generating procedures carry a high risk of dissemination of infection.
 - COROLLARY #2: Caregivers and hospital staff must wear appropriate PPE while managing these patients.
- Safe respiratory equipment, such as filters and closed suctioning circuits, should be provided.

Are there additional training resources specific to critical care regarding ICU disaster response?

Table A1-3. Training Resources for ICU Disaster Response

Course Name	Course Description	Link to Resource
Fundamental Disaster Management	A standardized course offered by the Society of Critical Care Medicine to prepare critical care professionals for care in disaster situations.	http://www.sccm.org/FCCS_and_Training_Courses/FDM/Pages/default.aspx
Federal Emergency Management Agency/ Emergency Management Institute/National Incident Management System	Independent study courses. Multiple lectures are detailed below: IS-100.HCb - Introduction to the Incident Command System (ICS 100) for Healthcare/Hospitals (no prerequisites) IS-200.HCa - Applying ICS to Healthcare Organizations (prerequisite IS-100.HCb) IS-700.a - NIMS: An Introduction (no prerequisites) IS-242.a - Effective Communication (no prerequisites) IS-139 - Exercise Design (no prerequisites)	http://training.fema.gov http://training.fema.gov/EMIWeb/IS/is100HCb.asp http://training.fema.gov/EMIWeb/IS/is200HCa.asp http://training.fema.gov/emiweb/is/is700a.asp http://training.fema.gov/EMIWeb/IS/is242a.asp http://training.fema.gov/EMIWeb/IS/is139.asp
Center for Domestic Preparedness	An all-hazards training center, offering training on chemical, biological, radiological, nuclear, and explosive weapons.	http://cdp.dhs.gov/
Homeland Security Exercise and Evaluation Program	A performance-based program providing standardized policy and methodology for designing, developing, conducting, and evaluating exercises.	https://hseep.dhs.gov
Harvard University toolkits for preparedness exercises	Toolkits summarize the federal guidance on preparedness exercises and make this information readily accessible to local health departments.	http://www.hsph.harvard.edu/hperlc/resources-and-toolkits/index.html

Table A1-3. Training Resources for ICU Disaster Response (continued)

Course Name	Course Description	Link to Resource
Agency for Healthcare Research and Quality/ Johns Hopkins University evaluation of hospital disaster drills	Evaluations can be used to identify strengths and weaknesses in hospital disaster drills. The results gained from evaluation can be applied to further training and drill planning.	http://archive.ahrq.gov/research/hospdrills/
Basic Disaster Life Support™	A course offered by the American Medical Association to improve care and coordinate disaster response by developing a common language among disciplines.	http://www.ndlsf.org/common/content.asp?PAGE=347
Advanced Disaster Life Support®	An advanced practicum offered by the American Medical Association that focuses on mass casualty decontamination, use of personal protective equipment, and essential skills for a mass casualty incident.	http://www.ndlsf.org/common/content.asp?PAGE=348
Terrorism, Preparedness, and Public Health: An Introduction	A course offered by the Center for Public Health Preparedness at the University at Albany. It provides public health workers and community partners with key fundamental concepts related to public health emergency preparedness.	http://www.ualbanycph.org/learning/registration/tab.cfm?course=terrorism&s=Overview
Radiation Emergency Medicine through Radiation Emergency Assistance Center/Training Site (REAC/TS)	A course for practitioners who may need to provide emergency medical care during a radiological or nuclear incident.	https://orise.orau.gov/reacts/capabilities/continuing-medical-education/radiation-emergency-medicine.aspx
Medical Management of Chemical and Biological Casualties Course	A course by the U.S. Army Medical Research Institute of Infectious Diseases and the U.S. Army Medical Research Institute of Chemical Defense to prepare medical professionals to effectively manage casualties of chemical and biological agent exposure.	https://ccc.apgea.army.mil/courses/in_house/brochureMCBC.htm This course is offered onsite in Fort Detrick and Aberdeen Proving Ground, Maryland. Some material is available via CD-ROM.

APPENDIX TWO

ADDITIONAL RESOURCES AND WEBSITES



DISASTER MANAGEMENT COURSES: ONSITE

- Society of Critical Care Medicine: Fundamental Disaster Management
http://www.sccm.org/FCCS_and_Training_Courses/FDM/Pages/default.aspx
- National Disaster Life Support Foundation
<http://www.ndlsf.org/common/content.asp?PAGE=137>
 - Basic Disaster Life Support
 - Advanced Disaster Life Support
 - Core Disaster Life Support
 - Decon Disaster Life Support
- New York State Office of Emergency Management
<http://www.dhse.ny.gov/oem/disaster-prep/>
- American College of Surgeons: Disaster Management and Emergency Preparedness Course
<http://www.facs.org/trauma/disaster/index.html>
- Center for Domestic Preparedness (FEMA)
<http://cdp.dhs.gov/>



ONLINE DISASTER MANAGEMENT TRAINING

- IS-100.HCb Introduction to the Incident Command System for Healthcare/Hospitals
<http://training.fema.gov/EMIWeb/IS/is100HCb.asp>
- IS-200.HCa Applying ICS to Healthcare Organizations
<http://training.fema.gov/EMIWeb/IS/is200HCa.asp>
- INMED Disaster Management Self-Paced Course
http://inmed.us/self-paced_courses/disaster_medicine_management/details.asp
- Los Angeles County Health Services, EMS Training Index
<http://ems.dhs.lacounty.gov/Disaster/DisasterTrainingIndex.htm>



RESOURCES FOR SPECIFIC HAZARDS

- CDC Agency for Toxic Substances Disease Registry
<http://www.atsdr.cdc.gov/hazmat-emergency-preparedness.html#bookmark06>



SPECIAL POPULATIONS

- U.S. Department of Health & Human Resources: Special Populations: Emergency and Disaster Preparedness
<http://sis.nlm.nih.gov/outreach/specialpopulationsanddisasters.html#a1>
- Disability Preparedness Resource Center
<http://www.disabilitypreparedness.gov/>
- Pediatrics
 - Federal Emergency Management Agency: Readiness for Kids
<http://www.fema.gov/kids/>
 - American Academy of Pediatrics: Emergency Preparedness for Children with Special Health Care Needs
<http://www.aap.org/advocacy/emergprep.htm>
 - American Academy of Pediatrics: Children and Disasters
<http://www.aap.org/disasters/index.cfm>
 - New York City Department of Health and Mental Hygiene: Pediatric Disaster Toolkit
<http://www.nyc.gov/html/doh/html/bhpp/bhpp-focus-ped-toolkit.shtml>
 - Emergency Medical Services for Children
<http://www.childrensnational.org/EMSC/DisasterPreparedness/>
- Psychological Support
 - Meredith LS, Eisenman DP, Tanielian T, et al. Prioritizing “psychological” consequences for disaster preparedness and response: a framework for addressing the emotional, behavioral, and cognitive effects of patient surge in large-scale disasters. *Disaster Med Public Health Prep.* 2011;5:73-80.
 - Meredith LS, Zazzali JL, Shields S, et al. Psychological effects of patient surge in large-scale emergencies: a quality improvement tool for hospital and clinic capacity planning and response. *Prehosp Disaster Med.* 2010;25:107-114.
 - Schreiber M, Koenig KL, Schultz C, et al. PsySTART Rapid Disaster Mental Health Triage System: performance during a full scale terrorism exercise in Los Angeles County hospitals. *Acad Emerg Med.* 2011;18:S26.



INTERNATIONAL RESOURCES

- Prevention Web
<http://www.preventionweb.net/english/>
- Asian Disaster Preparedness Center
<http://www.adpc.net/2011/>
- Center for International Disaster Information
<http://www.cidi.org/>
- United Nations International Strategy for Disaster Reduction
<http://www.unisdr.org/>
- National Institute of Disaster Management, Government of India
<http://www.nidm.net/>
- International Disaster Medicine Training Centre, Zagazig University Hospitals, Zagazig, Egypt
<http://www.idmtc.org/>



JOURNALS

- *Disasters*
<http://www.wiley.com/bw/journal.asp?ref=0361-3666>
- *Journal of Disaster Research*
<http://www.fujipress.jp/JDR/>
- *American Journal of Disaster Medicine*
<http://www.pnpco.com/pn03000.html>
- *International Journal of Mass Emergencies and Disasters*
<http://www.ijmed.org/>
- *Disaster Prevention and Management: An International Journal*
<http://www.emeraldinsight.com/products/journals/journals.htm?id=dpm>
- *Prehospital and Disaster Medicine*
<http://pdm.medicine.wisc.edu/>
- *The Internet Journal of Rescue and Disaster Medicine*
<http://www.ispub.com/journal/the-internet-journal-of-rescue-and-disaster-medicine/>
- *Disaster Medicine and Public Health Preparedness*
<http://www.dmphp.org/>

- *Australasian Journal of Disaster and Trauma Studies*
<http://www.massey.ac.nz/~trauma/>

APPENDIX **THREE**

CLINICAL STRATEGIES DURING DISASTER RESPONSE

Can you provide some examples of how to define clinical strategies to be employed during a disaster?

This is a GREAT question. As pointed out elsewhere, it is imperative that your clinical disaster response be consistent with what your ICU personnel do every day. This helps to avoid confusion, chaos, and an ineffective response. Follow these rules:

- 1.** As much as possible, an everyday job description should mirror a disaster job description.
- 2.** What vary are the THRESHOLDS, TRIGGERS, and TRIAGE protocols.
- 3.** Be consistent when applying rule #2!

With permission from the Minnesota Department of Health (www.health.state.mn.us/oep/healthcare), we have provided selected examples of clinical protocols designed for both hospital (inpatient) and ICU disaster responses:

- Patient Care Strategies for Scarce Resource Situations (pages 156-167)
- Renal Replacement Therapy Regional Resource Card (pages 168-170)
- Pandemic Incident Command Considerations for Healthcare Facilities by Event Stage (pages 171-172)

These protocols are available in the public domain. They are clearly written, deliberately simple in format, and provide all responders with a well-defined clinical rule set. This approach and these protocols can be adapted for your ICU.

PATIENT CARE STRATEGIES FOR SCARCE RESOURCE SITUATIONS **Summary Card** **MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM**

<p>Potential trigger events:</p> <ul style="list-style-type: none"> -Mass Casualty Incident (MCI) -Infrastructure damage/loss -Pandemic/Epidemic 	<ul style="list-style-type: none"> -Supplier shortage -Recall/contamination of product -Isolation of facility due to access problems (flooding, etc)
<p>How to use this card set:</p> <ol style="list-style-type: none"> 1. Recognize or anticipate resource shortfall 2. Implement appropriate incident management system and plans; assign subject matter experts (technical specialists) to problem 3. Determine degree of shortfall, expected demand, and duration; assess ability to obtain needed resources via local, regional, or national vendors or partners 4. Find category of resources on index 5. Refer to specific recommendations on card 6. Decide which strategies to implement and/or develop additional strategies appropriate for the facility and situation 7. Assure consistent regional approach by informing public health authorities and other facilities if contingency or crisis strategies exist for re-supply or patient transfer; activate regional scarce resource coordination plans as appropriate 8. Review strategies every operational period or as availability (supply/demand) changes 	

Core strategies to be employed (generally in order of preference) during, or in anticipation of a scarce resource situation are:

Prepare – pre-event actions taken to minimize resource scarcity (e.g., stockpiling of medications)

Substitute – use an essentially equivalent device, drug, or personnel for one that would usually be available (e.g., morphine for fentanyl)

Adapt – use a device, drug, or personnel that are not equivalent but that will provide sufficient care (e.g., anesthesia machine for mechanical ventilation)

Conserve – use less of a resource by lowering dosage or changing utilization practices (e.g., minimizing use of oxygen driven nebulizers to conserve oxygen)

Re-use – re-use (after appropriate disinfection / sterilization) items that would normally be single-use items

Re-allocate – restrict or prioritize use of resources to those patients with a better prognosis or greater need

Capacity Definitions:

Conventional capacity – The spaces, staff, and supplies used are consistent with daily practices within the institution. These spaces and practices are used during a major mass casualty incident that triggers activation of the facility emergency operations plan.

Contingency capacity – The spaces, staff, and supplies used are not consistent with daily practices; but provide care to a standard that is functionally equivalent to usual patient care practices. These spaces or practices may be used temporarily during a major mass casualty incident or on a more sustained basis during a disaster (when the demands of the incident exceed community resources).

Crisis capacity – Adaptive spaces, staff, and supplies are not consistent with usual standards of care, but provide *sufficiency* of care in the setting of a catastrophic disaster (i.e., provide the best possible care to patients given the circumstances and resources available). Crisis capacity activation constitutes a significant adjustment to standards of care (Hick et al, 2009).

This card set is designed to facilitate a structured approach to resource shortfalls at a healthcare facility. It is a decision support tool and assumes that incident management is implemented and that key personnel are familiar with ethical frameworks and processes that underlie these decisions (for more information see Institute of Medicine 2009 Guidance for Establishing Crisis Standards of Care for Use in Disaster Situations: A Letter Report- <http://www.nap.edu/catalog/12749.html> and the Minnesota Pandemic Ethics Project - <http://www.health.state.mn.us/divs/idepc/ethics/>).

Each facility will have to determine the most appropriate steps to take to address specific shortages. Pre-event familiarization with the contents of this card set is recommended to aid with event preparedness and anticipation of specific resource shortfalls. The cards do not provide comprehensive guidance, addressing only basic common categories of medical care. Facility personnel may determine additional coping mechanisms for the specific situation in addition to those outlined on these cards.

The content of this card set was developed by the Minnesota Department of Health (MDH) Science Advisory Team in conjunction with many subject matter experts whose input is greatly appreciated. This guidance does not represent the policy of MDH. Facilities and personnel implementing these strategies in crisis situations should assure communication of this to their healthcare and public health partners to assure the invocation of appropriate legal and regulatory protections in accord with State and Federal laws. This guidance may be updated or changed during an incident by the Science Advisory Team and MDH. The weblinks and resources listed are examples, and may not be the best sources of information available. Their listing does not imply endorsement by MDH.

CLINICAL STRATEGIES DURING DISASTER RESPONSE

MINNESOTA HEALTHCARE SYSTEM
PREPAREDNESS PROGRAM

OXYGEN
STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis												
<p>Inhaled Medications</p> <ul style="list-style-type: none"> Restrict the use of Small Volume Nebulizers when inhaler substitutes are available. Restrict continuous nebulization therapy. Minimize frequency through medication substitution that results in fewer treatments (6h-12h instead of 4h-6h applications). 	Substitute & Conserve															
<p>High-Flow Applications</p> <ul style="list-style-type: none"> Restrict the use of high-flow cannula systems as these can demand 12 to 40 LPM flows. Restrict the use of simple and partial rebreathing masks to 10 LPM maximum. Restrict use of Gas Injection Nebulizers as they generally require oxygen flows between 10 LPM and 75 LPM. Eliminate the use of oxygen-powered, venturi suction systems as they may consume 15 to 50 LPM. 	Conserve															
<p>Air-Oxygen Blenders</p> <ul style="list-style-type: none"> Eliminate the low-flow reference bleed occurring with any low-flow metered oxygen blender use. This can amount to an additional 12 LPM. Reserve air-oxygen blender use for mechanical ventilators using high-flow non-metered outlets. (These do not utilize reference bleeds). Disconnect blenders when not in use. 	Conserve															
<p>Oxygen Conservation Devices</p> <ul style="list-style-type: none"> Use reservoir cannulas at 1/2 the flow setting of standard cannulas. Replace simple and partial rebreather mask use with reservoir cannulas at flowrates of 6-10 LPM. 	Substitute & Adapt															
<p>Oxygen Concentrators if Electrical Power Is Present</p> <ul style="list-style-type: none"> Use hospital-based or independent home medical equipment supplier oxygen concentrators if available to provide low-flow cannula oxygen for patients and preserve the primary oxygen supply for more critical applications. 	Substitute & Conserve															
<p>Monitor, Use and Revise Clinical Targets</p> <ul style="list-style-type: none"> Employ oxygen titration protocols to optimize flow or % to match targets for SPO2 or PaO2. Minimize overall oxygen use by optimization of flow. Discontinue oxygen at earliest possible time. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Starting Example</th> <th>Initiate O2</th> <th>O2 Target</th> </tr> </thead> <tbody> <tr> <td>Normal Lung Adults</td> <td>SPO2 <90%</td> <td>SPO2 90%</td> </tr> <tr> <td>Infants & Peds</td> <td>SPO2 <90%</td> <td>SPO2 90-95%</td> </tr> <tr> <td>Severe COPD History</td> <td>SPO2 <85%</td> <td>SPO2 90%</td> </tr> </tbody> </table> <p>Note: Targets may be adjusted further downward depending on resources available, the patient's clinical presentation, or measured PaO2 determination.</p>	Starting Example	Initiate O2	O2 Target	Normal Lung Adults	SPO2 <90%	SPO2 90%	Infants & Peds	SPO2 <90%	SPO2 90-95%	Severe COPD History	SPO2 <85%	SPO2 90%	Conserve			
Starting Example	Initiate O2	O2 Target														
Normal Lung Adults	SPO2 <90%	SPO2 90%														
Infants & Peds	SPO2 <90%	SPO2 90-95%														
Severe COPD History	SPO2 <85%	SPO2 90%														
<p>Expendable Oxygen Appliances</p> <ul style="list-style-type: none"> Use terminal sterilization or high-level disinfection procedures for oxygen appliances, small & large-bore tubing, and ventilator circuits. Bleach concentrations of 1:10, high-level chemical disinfection, or irradiation may be suitable. Ethylene oxide gas sterilization is optimal, but requires a 12-hour aeration cycle to prevent ethylene chlorohydrin formation with polyvinyl chloride plastics. 	Re-use															
<p>Oxygen Re-Allocation</p> <ul style="list-style-type: none"> Prioritize patients for oxygen administration during severe resource limitations. 	Re-Allocate															

MINNESOTA HEALTHCARE SYSTEM
PREPAREDNESS PROGRAM

STAFFING
STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
<p>Staff and Supply Planning</p> <ul style="list-style-type: none"> Assure facility has process and supporting policies for disaster credentialing and privileging - including degree of supervision required, clinical scope of practice, mentoring and orientation, and verification of credentials Encourage employee preparedness planning (www.ready.gov and other resources). Cache adequate personal protective equipment (PPE) and support supplies. Educate staff on institutional disaster response. Educate staff on community, regional and state disaster plans and resources. Develop facility plans addressing staff's family / pets or staff shelter needs. 	<p><i>Prepare</i></p>			
<p>Focus Staff Time on Core Clinical Duties</p> <ul style="list-style-type: none"> Minimize meetings and relieve administrative responsibilities not related to event. Reduce documentation requirements. Cohort patients to conserve PPE and reduce staff PPE donning/doffing time and frequency. Restrict elective appointments and procedures. 	<p><i>Conserve</i></p>			
<p>Use Supplemental Staff</p> <ul style="list-style-type: none"> Bring in equally trained staff (burn or critical care nurses, Disaster Medical Assistance Team [DMAT], other health system or Federal sources). Equally trained staff from administrative positions (nurse managers). 	<p><i>Substitute</i></p>			
<ul style="list-style-type: none"> Adjust personnel work schedules (longer but less frequent shifts, etc.) if this will not result in skill / PPE compliance deterioration. Use family members/lay volunteers to provide basic patient hygiene and feeding – releasing staff for other duties. 	<p><i>Adapt</i></p>			
<p>Focus Staff Expertise on Core Clinical Needs</p> <ul style="list-style-type: none"> Personnel with specific critical skills (ventilator, burn management) should concentrate on those skills; specify job duties that can be safely performed by other medical professionals. Have specialty staff oversee larger numbers of less-specialized staff and patients (for example, a critical care nurse oversees the intensive care issues of 9 patients while 3 medical/surgical nurses provide basic nursing care to 3 patients each). Limit use of laboratory, radiographic, and other studies, to allow staff reassignment and resource conservation. Reduce availability of non-critical laboratory, radiographic, and other studies. 	<p><i>Conserve</i></p>			
<p>Use Alternative Personnel to Minimize Changes to Standard of Care</p> <ul style="list-style-type: none"> Use less trained personnel with appropriate mentoring and just-in-time education (e.g., healthcare trainees or other health careworkers, Minnesota Responds Medical Reserve Corps, retirees). Use less trained personnel to take over portions of skilled staff workload for which they have been trained. Provide just-in-time training for specific skills. Cancel most sub-specialty appointments, endoscopies, etc. and divert staff to emergency duties including in-hospital or assisting public health at external clinics/screening/dispensing sites. 	<p><i>Adapt</i></p>			

MINNESOTA HEALTHCARE SYSTEM
PREPAREDNESS PROGRAM

NUTRITIONAL SUPPORT
STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
<p>Food</p> <ul style="list-style-type: none"> Maintain hospital supply of inexpensive, simple to prepare, long-shelf life foodstuffs as contingency for at least 96 hours without resupply, with additional supplies according to hazard vulnerability analysis (e.g., grains, beans, powdered milk, powdered protein products, pasta, and rice). Access existing or devise new emergency/disaster menu plans. Maintain hospital supply of at least 30 days of enteral and parenteral nutrition components and consider additional supplies based on institution-specific needs. Review vendor agreements and their contingencies for delivery and production, including alternate vendors. Note: A 30-day supply based on usual use may be significantly shortened by the demand of a disaster. 	Prepare			
<p>Water</p> <ul style="list-style-type: none"> Stock bottled water sufficient for drinking needs for at least 96 hours if feasible (for staff, patients and family/visitors), or assure access to drinking water apart from usual supply. Potential water sources include food and beverage distributors. Ensure there is a mechanism in place to verify tap water is safe to drink. Infants: assure adequate stocks of formula and encourage breastfeeding. 	Prepare			
<p>Staff/Family</p> <ul style="list-style-type: none"> Plan to feed additional staff, patients, and family members of staff/patients in select situations (ice storm as an example of a short-term incident, an epidemic as an example of a long-term incident). 	Prepare			
<p>Planning</p> <ul style="list-style-type: none"> Work with stakeholders to encourage home users of enteral and parenteral nutrition to have contingency plans and alternate delivery options. Home users of enteral nutrition typically receive delivery of 30 days supply and home users of parenteral nutrition typically receive a weekly supply. Anticipate receiving supply requests from home users during periods of shortage. Work with vendors regarding their plans for continuity of services and delivery. Identify alternate sources of food supplies for the facility should prime vendors be unavailable (including restaurants – which may be closed during epidemics). Consider additional food supplies at hospitals that do not have food service management accounts. Determine if policy on family provision of food to patients is in place, and what modifications might be needed or permitted in a disaster. 	Prepare			
<ul style="list-style-type: none"> Liberalize diets and provide basic nutrients orally, if possible. Total parenteral nutrition (TPN) use should be limited and prioritized for neonatal and critically ill patients. 	Substitute			
<ul style="list-style-type: none"> Non-clinical personnel serve meals and may assist preparation. Follow or modify current facility guidelines for family donation of meals to patients. Anticipate and have a plan for the receipt of food donations. If donated food is accepted, it should be non-perishable, prepackaged, and in single serving portions. 	Adapt			
<ul style="list-style-type: none"> Collaborate with pharmacy and nutrition services to identify patients appropriate to receive parenteral nutrition support vs. enteral nutrition. Access premixed TPN/PPN solutions from vendor if unable to compound. Refer to Centers for Disease Control (CDC) Fact Sheets and American Society for Parenteral and Enteral Nutrition (ASPEN) Guidelines. Substitute oral supplements for enteral nutrition products if needed. Eliminate or modify special diets temporarily. Use blenderized food and fluids for enteral feedings rather than enteral nutrition products if shortages occur. Examples: <ol style="list-style-type: none"> The Oley Foundation: Making Your Own Food for Tube Feeding. http://www.oley.org/inline/TubeFeeding.html#makingyour%20own Klein, Marsha Dunn, and Suzanne Evans Morris. Homemade Blended Formula Handbook. Tucson: Mealtime Notions LLC, 2007. 	Substitute & Adapt			
	Adapt			

MINNESOTA HEALTHCARE SYSTEM
PREPAREDNESS PROGRAM

**MEDICATION ADMINISTRATION
STRATEGIES FOR SCARCE RESOURCE SITUATIONS**

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
<p>Cache / Increase Supply Levels</p> <ul style="list-style-type: none"> Patients should have at least 30 days supply of home medications and obtain 90 day supply if pandemic, epidemic, or evacuation is imminent. Examine formulary to determine commonly-used medications and classes that will be in immediate / high demand. Increase supply levels or cache critical medications - particularly for low-cost items and analgesics. Key examples include: <ul style="list-style-type: none"> Analgesia <ul style="list-style-type: none"> morphine, other narcotic and non-narcotic (non-steroidals, acetaminophen) class - injectable and oral (narcotic conversion tool at http://www.globalrph.com/narcoticonv.htm) Sedation <ul style="list-style-type: none"> particularly benzodiazepine (lorazepam, midazolam, diazepam) injectables Anti-infective <ul style="list-style-type: none"> narrow and broad spectrum antibiotics for pneumonia, skin infections, open fractures, sepsis (e.g.: cephalosporins, quinolones, tetracyclines, macrolides, aminoglycosides, clindamycin, etc.), select antivirals Pulmonary <ul style="list-style-type: none"> metered dose inhalers (albuterol, inhaled steroids), oral steroids (dexamethasone, prednisone) Behavioral Health <ul style="list-style-type: none"> haloperidol, other injectable and oral anti-psychotics, common anti-depressants, anxiolytics Other <ul style="list-style-type: none"> sodium bicarbonate, paralytics, induction agents (etomidate, propofol), proparacaine/tetracaine, atropine, pralidoxime, epinephrine, local anesthetics, antiemetics, insulin, common oral anti-hypertensive and diabetes medications 	<p>Prepare</p>			
<p>Use Equivalent Medications</p> <ul style="list-style-type: none"> Obtain medications from alternate supply sources (pharmaceutical representatives, pharmacy caches). <ul style="list-style-type: none"> Pulmonary <ul style="list-style-type: none"> Metered dose inhalers instead of nebulized medications Analgesia/ Sedation <ul style="list-style-type: none"> Consider lorazepam for propofol substitution (and other agents in short supply) ICU analgesia/sedation drips Morphine 4-10mg IV load then 2mg/h and titrate / re-bolus as needed usual 3-20mg/h; lorazepam 2-8mg or midazolam 1-5mg IV load then 2-8mg/h drip Anti-infective <ul style="list-style-type: none"> Examples: cephalosporins, gentamicin, clindamycin substitute for unavailable broad-spectrum antibiotic Target therapy as soon as possible based upon organism identified. Other <ul style="list-style-type: none"> Beta blockers, diuretics, calcium channel blockers, ace inhibitors, anti-depressants, anti-infectives 	<p>Substitute</p>			
<p>Reduce Use During High Demand</p> <ul style="list-style-type: none"> Restrict use of certain classes if limited stocks likely to run out (restrict use of prophylactic / empiric antibiotics after low risk wounds, etc.). Decrease dose; consider using smaller doses of medications in high demand / likely to run out (reduce doses of medications allowing blood pressure or glucose to run higher to ensure supply of medications adequate for anticipated duration of shortage). Allow use of personal medications (inhalers, oral medications) in hospital. Do without - consider impact if medications not taken during shortage (statins, etc.). 	<p>Conserve</p>			
	<p>Conserve</p>			

**MINNESOTA HEALTHCARE SYSTEM
PREPAREDNESS PROGRAM**

**MEDICATION ADMINISTRATION
STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)**

	Strategy	Conventional	Contingency	Crisis
<p>RECOMMENDATIONS</p> <p>Modify Medication Administration</p> <ul style="list-style-type: none"> • Emphasize oral, nasogastric, subcutaneous routes of medication administration. • Administer medications by gravity drip rather than IV pump if needed. • <i>IV drip rate calculation - drops / minute = amount to be infused x drip set / time (minutes) (drip set = qfts / mL - 60, 10, etc.).</i> • Rule of 6: pt wgt (kg) x 6 = mg drug to add to 100ml fluid = 1mcg / kg / min for each 1 mL / hour <p>NOTE: For examples, see http://www.gaems.net/download/drugcalc.pdf</p> <ul style="list-style-type: none"> • Consider use of select medications beyond expiration date.* • Consider use of veterinary medications when alternative treatments are not available.* <p>Restrict Allocation of Select Medications</p> <ul style="list-style-type: none"> • Allocate limited stocks of medications with consideration of regional/state guidance and available epidemiological information (e.g.: anti-viral medications such as oseltamivir) • Allocate limited stock to support other re-allocation decisions (ventilator use, etc.). 	Adapt			
	Adapt			
	Re-Allocate			
	Re-Allocate			

*Legal protection such as Food and Drug Administration approval or waiver required.

HEMODYNAMIC SUPPORT AND IV FLUIDS STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
<p>Cache Additional Intravenous (IV) Cannulas, Tubing, Fluids, Medications, and Administration Supplies</p> <p>Use Scheduled Dosing and Drip Dosing When Possible</p> <ul style="list-style-type: none"> Reserve IV pump use for critical medications such as sedatives and hemodynamic support. 	<p>Prepare</p> <p>Conserve</p>			
<p>Minimize Invasive Monitoring</p> <ul style="list-style-type: none"> Substitute other assessments (e.g., clinical signs, ultrasound) of central venous pressure (CVP). When required, assess CVP intermittently via manual methods using bedside saline manometer or transducer moved between multiple patients as needed, or by height of blood column in CVP line held vertically while patient supine. 	Conserve			
<p>Emphasize Oral Hydration Instead of IV Hydration When Possible</p> <p>Utilize appropriate oral rehydration solution</p> <ul style="list-style-type: none"> Oral rehydration solution: 1 liter water (5 cups) + 1 tsp salt + 8 tsp sugar, add flavor (e.g., ½ cup orange juice, other) as needed. Rehydration for moderate dehydration 50-100mL / kg over 2-4 hours <p>Pediatric hydration</p> <p>Pediatric maintenance fluids:</p> <ul style="list-style-type: none"> 4 mL/kg/h for first 10kg of body weight (40 mL/h for 1st 10 kg) 2 mL/kg/h for second 10kg of body weight (20 mL/h for 2nd 10kg = 60 mL/h for 20kg child) 1 mL/kg/h for each kg over 20kg (example - 40 kg child = 60 mL/h plus 20 mL/h = 80 mL/h) <p>Supplement for each diarrhea or emesis</p>	Substitute			
<p>NOTE: Clinical (urine output, etc.) and laboratory (BUN, urine specific gravity) assessments and electrolyte correction are key components of fluid therapy and are not specifically addressed by these recommendations.</p> <p>NOTE: For further information and examples, see http://rehydrate.org, http://www.bt.cdc.gov/disasters/hurricanes/pdf/dguidelines.pdf and http://www.ped.med.utah.edu/cal/howto/intravenousFluidOrders.PDF.</p>				
<p>Provide Nasogastric Hydration Instead of IV Hydration When Practical</p> <ul style="list-style-type: none"> Patients with impediments to oral hydration may be successfully hydrated and maintained with nasogastric (NG) tubes. For fluid support, 8-12F (pediatric: infant 3-5F, < 2yrs 5F) tubes are better tolerated than standard size tubes. 	Substitute			
<p>Substitute Epinephrine for Other Vasopressor Agents</p> <ul style="list-style-type: none"> For hemodynamically unstable patients who are adequately volume-resuscitated, consider adding 6mg epinephrine (6mL of 1:1000) to 1000mL NS on minib drip tubing and titrate to target blood pressure. Epinephrine 1:1000 (1mg/mL) multi-dose vials available for drip use. 	Substitute			
<p>Re-use CVP, NG, and Other Supplies After Appropriate Sterilization / Disinfection</p> <ul style="list-style-type: none"> Cleaning for all devices should precede high-level disinfection or sterilization. High-level disinfection for at least twenty minutes for devices in contact with body surfaces (including mucous membranes)glutaraldehyde, hydrogen peroxide 6%, or bleach (5.25%) diluted 1:20 (2500 ppm) are acceptable solutions. NOTE: chlorine levels reduced if stored in polyethylene containers - double the bleach concentration to compensate). Sterilize devices in contact with bloodstream (e.g., ethylene oxide sterilization for CVP catheters). 	Re-use		(disinfection - NG, etc)	(sterilization - central line, etc)

**HEMODYNAMIC SUPPORT AND IV FLUIDS
STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)**

**MINNESOTA HEALTHCARE SYSTEM
PREPAREDNESS PROGRAM**

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
<p>Intraosseous / Subcutaneous (Hypodermoclysis) Replacement Fluids</p> <ul style="list-style-type: none"> • Consider as an option when alternative routes of fluid administration are impossible/unavailable • Intraosseous before percutaneous <p>Intraosseous</p> <ul style="list-style-type: none"> • Intraosseous infusion is not generally recommended for hydration purposes, but may be used until alternative routes are available. Intraosseous infusion requires pump or pressure bag. Rate of fluid delivery is often limited by pain of pressure within the marrow cavity. This may be reduced by pre-medication with lidocaine 0.5mg/kg slow IV push. <p>Hypodermoclysis</p> <ul style="list-style-type: none"> • Cannot correct more than moderate dehydration via this technique. • Many medications cannot be administered subcutaneously. • Common infusion sites: pectoral chest, abdomen, thighs, upper arms. • Common fluids: normal saline (NS), D5NS, D5 1/2 NS (Can add up to 20-40 mEq potassium if needed.) • Insert 21/24-gauge needle into subcutaneous tissue at a 45 degree angle, adjust drip rate to 1-2 mL per minute. (May use 2 sites simultaneously if needed.) • Maximal volume about 3 liters / day; requires site rotation. • Local swelling can be reduced with massage to area. • Hyaluronidase 150 units / liter facilitates fluid absorption but not required; may not decrease occurrence of local edema. 	<p>Substitute</p>			
<p>Consider Use of Veterinary and Other Alternative Sources for Intravenous Fluids and Administration Sets</p>	<p>Adapt</p>			

MECHANICAL VENTILATION / EXTERNAL OXYGENATION STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis																																										
<p>Increase Hospital Stocks of Ventilators and Ventilator Circuits; ECMO or bypass circuits</p>	Prepare																																													
<p>Access Alternative Sources for Ventilators / specialized equipment</p> <ul style="list-style-type: none"> Obtain specialized equipment from vendors, healthcare partners, regional, state, or Federal stockpiles via usual emergency management processes and provide just-in-time training and quick reference materials for obtained equipment. 	Substitute																																													
<p>Decrease Demand for Ventilators</p> <ul style="list-style-type: none"> Increase threshold for intubation / ventilation. Decrease elective procedures that require post-operative intubation. Decrease elective procedures that utilize anesthesia machines. Use non-invasive ventilatory support when possible. 	Conserve																																													
<p>Re-use Ventilator Circuits</p> <ul style="list-style-type: none"> Appropriate cleaning must precede sterilization. If using gas (ethylene oxide) sterilization, allow full 12 hour aeration cycle to avoid accumulation of toxic byproducts on surface. Use irradiation or other techniques as appropriate. 	Re-use																																													
<p>Use Alternative Respiratory Support Technologies</p> <ul style="list-style-type: none"> Use transport ventilators with appropriate alarms - especially for stable patients without complex ventilation requirements. Use anesthesia machines for mechanical ventilation as appropriate / capable. Use bi-level (BiPAP) equipment to provide mechanical ventilation. Consider bag-valve ventilation as temporary measure while awaiting definitive solution / equipment (as appropriate to situation - extremely labor intensive and may consume large amounts of oxygen). 	Adapt																																													
<p>Assign Limited Ventilators to Patients Most Likely to Benefit if No Other Options Are Available</p> <p>STEP ONE: assess patient acuity using SOFA (see next page+) scoring table and/or other parameters appropriate to the situation (agent-specific prognostic indicators, modifications based on agent involved).</p>																																														
<table border="1"> <thead> <tr> <th>ORGAN SYSTEM</th> <th>SCORE = 0</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>RESPIRATORY PaO2 / FIO2</td> <td>> 400</td> <td>≤ 400</td> <td>≤ 300</td> <td>≤ 200 with resp. support</td> <td>≤ 100 with resp. support</td> </tr> <tr> <td>HEMATOLOGIC Platelets</td> <td>> 150</td> <td>≤ 150</td> <td>≤ 100</td> <td>≤ 50</td> <td>≤ 20</td> </tr> <tr> <td>HEPATIC Bilirubin (mg / dl)</td> <td>< 1.2</td> <td>1.2 - 1.9</td> <td>2.0 - 5.9</td> <td>6 - 11.9</td> <td>≥ 12</td> </tr> <tr> <td>CARDIOVASCULAR Hypotension</td> <td>None</td> <td>Mean Arterial Pressure < 70 mmHg</td> <td>Dopamine ≤ 5 or any Dobutamine</td> <td>Dopamine > 5 or Epi < 0.1 or Nor-Epi ≤ 0.1</td> <td>Dopamine > 15 or Epi > 0.1 or Nor-Epi > 0.1</td> </tr> <tr> <td>CENTRAL NERVOUS SYSTEM Glasgow Coma Score</td> <td>15</td> <td>13 - 14</td> <td>10 - 12</td> <td>6 - 9</td> <td>< 6</td> </tr> <tr> <td>RENAL Creatinine</td> <td>< 1.2</td> <td>1.2 - 1.9</td> <td>2.0 - 3.4</td> <td>3.5 - 4.9</td> <td>≥ 5.0</td> </tr> </tbody> </table>	ORGAN SYSTEM	SCORE = 0	1	2	3	4	RESPIRATORY PaO2 / FIO2	> 400	≤ 400	≤ 300	≤ 200 with resp. support	≤ 100 with resp. support	HEMATOLOGIC Platelets	> 150	≤ 150	≤ 100	≤ 50	≤ 20	HEPATIC Bilirubin (mg / dl)	< 1.2	1.2 - 1.9	2.0 - 5.9	6 - 11.9	≥ 12	CARDIOVASCULAR Hypotension	None	Mean Arterial Pressure < 70 mmHg	Dopamine ≤ 5 or any Dobutamine	Dopamine > 5 or Epi < 0.1 or Nor-Epi ≤ 0.1	Dopamine > 15 or Epi > 0.1 or Nor-Epi > 0.1	CENTRAL NERVOUS SYSTEM Glasgow Coma Score	15	13 - 14	10 - 12	6 - 9	< 6	RENAL Creatinine	< 1.2	1.2 - 1.9	2.0 - 3.4	3.5 - 4.9	≥ 5.0	Re-allocate			
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MECHANICAL VENTILATION / EXTERNAL OXYGENATION MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)

RECOMMENDATIONS		Strategy	Crisis
<p>STEP TWO: Compared to other patient(s) requiring and awaiting external ventilation / oxygenation, does this patient have significant differences in prognosis or resource utilization in one or more categories below that would justify re-allocation of the ventilator / unit? Factors listed in relative order of importance/weight. Injury/epidemiologic factors may have the highest predictive value in some cases and may also affect the predictive ability of the SOFA score.</p>			
Criteria	<p>Patient keeps resource</p> <p>Low potential for death (SOFA score ≤ 7)</p> <p>Good prognosis based upon epidemiology of specific disease/injury.</p> <p>No severe underlying disease.^b</p> <p>Short duration – flash pulmonary edema, chest trauma, other conditions anticipating < 3 days on ventilator</p> <p>Improving ventilatory parameters over time^c</p>	<p>Intermediate potential for death (SOFA score 8-11)</p> <p>Indeterminate / intermediate prognosis based upon epidemiology of specific disease / injury</p> <p>Severe underlying disease with poor long-term prognosis and/or ongoing resource demand (e.g., home oxygen dependent, dialysis dependent) and unlikely to survive more than 1-2 years.</p> <p>Moderate duration – e.g., pneumonia in healthy patient (estimate 3-7 days on ventilator)</p> <p>Stable ventilatory parameters over time</p>	<p>Resource re-allocated</p> <p>High potential for death (SOFA score ≥ 12)</p> <p>Poor prognosis based upon epidemiology of specific disease / injury (e.g; pandemic influenza)</p> <p>Severe underlying disease with poor short-term (<1 year) prognosis</p> <p>Long duration – e.g., ARDS, particularly in setting of preexisting lung disease (estimate > 7 days on ventilator)</p> <p>Worsening ventilatory parameters over time</p>
1. Organ system function ^a			
2. Duration of benefit / prognosis			
3. Duration of need			
4. Response to mechanical ventilation			
<p>^a The Sequential Organ Failure Assessment (SOFA) score is the currently preferred assessment tool but other predictive models may be used depending on the situation / epidemiology. Note: SOFA scores were not designed to forecast mortality, and thus single or a few point difference between patients may not represent a substantial difference in mortality, but larger differences and trends can be extremely helpful in determining resource assignment.</p> <p>^b Examples of underlying diseases that predict poor short-term survival include (but are not limited to):</p> <ol style="list-style-type: none"> 1. Congestive heart failure with ejection fraction < 25% (or persistent ischemia unresponsive to therapy or non-reversible ischemia with pulmonary edema) 2. Severe chronic lung disease including pulmonary fibrosis, cystic fibrosis, obstructive or restrictive diseases requiring continuous home oxygen use prior to onset of acute illness 3. Central nervous system, solid organ, or hematopoietic malignancy with poor prognosis for recovery 4. Cirrhosis with ascites; history of variceal bleeding, fixed coagulopathy or encephalopathy 5. Acute hepatic failure with hyperammonemia <p>^c Changes in Oxygenation index over time may provide comparative data, though of uncertain prognostic significance. OI = MAMP x FIO2 / PaO2 where: OI = oxygenation index, MAMP= Mean Airway Pressure, FIO2 = inspired oxygen concentration, PaO2 = arterial oxygen pressure (May be estimated from oxygen dissociation curve if blood gas unavailable).</p>			
<p>STEP THREE: Re-allocate ventilator / resource only if patient presenting with respiratory failure has significantly better chance of survival/benefit as compared to patient currently receiving ventilation. Follow additional regional and state/federal guidance and institutional processes for scarce resource situations.</p>			

MINNESOTA HEALTHCARE SYSTEM
PREPAREDNESS PROGRAM

BLOOD PRODUCTS
STRATEGIES FOR SCARCE RESOURCE SITUATIONS

Category	RECOMMENDATIONS	Healthcare Facility	Blood Center	Strategy	Conventional	Contingency	Crisis		
All Blood Products	<ul style="list-style-type: none"> • Increase donations if required, and consider local increase in frozen reserves • Increase O positive levels • Consider maintaining a frozen blood reserve if severe shortage • Increase recruitment for specific product needs • Consider adjustments to donor HGB/HCT eligibility • Relax travel deferrals for possible malaria and BSE (bovine spongiform encephalitis)* • Use cell-saver and auto-transfusion to degree possible • Limit O negative use to women of child-bearing age • Use O positive in emergent transfusion in males or non-child bearing females to conserve O negative • Change donations from whole blood to 2x RBC apheresis collection if specific shortage of PRBCs • More aggressive crystalloid resuscitation prior to transfusion in shortage situations (blood substitutes may play future role) • Long-term shortage, collect autologous blood pre-operatively and consider cross-over transfusion • Enforce lower hemoglobin triggers for transfusion (for example, HGB 7) • Consider limiting high-consumption elective surgeries (select cardiac, orthopedic, etc) • Consider use of erythropoietin (EPO) for chronic anemia in appropriate patients • Further limit PRBC use, if needed; to active bleeding states, consider subsequent restrictions including transfusion only for end-organ damage, then to shock states only • Consider Minimum Qualifications for Survival (MQS) limits on use of PRBCs (for example, only initiate for patients that will require < 6 units PRBCs and/or consider stopping transfusion when > 6 units utilized). Specific MQS limits should reflect available resources at facility. • Reduce or waive usual 56 day inter-donation period* based upon pre-donation hemoglobin • Reduce weight restrictions for 2x RBC apheresis donations according to instruments used and medical director guidance* 		√	Prepare					
				√	Adapt				
				√	Prepare				
				√	Re-use				
				√	Conserve				
					√	Adapt			
				√	Conserve				
				√	Conserve				
				√	Conserve				
				√	Adapt				
Packed Red Blood Cells		√		Re-allocate					
		√		Re-allocate					
Fresh Frozen Plasma			√	Adapt					
			√	Adapt					
			√	Substitute					
		√	Conserve						
		√	Conserve						
			√	Adapt					

*FDA approval/variance required via American Association of Blood Banks (AABB)

BLOOD PRODUCTS
MINNESOTA HEALTHCARE SYSTEM
STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)
PREPAREDNESS PROGRAM

Category	RECOMMENDATIONS	Healthcare Facility	Blood Center	Strategy	Conventional	Contingency	Crisis	
Platelets	<ul style="list-style-type: none"> • Though not true substitute, consider use of desmopressin (DDAVP) to stimulate improved platelet performance in renal and hepatic failure patients • May use leukoreduced whole blood pooled platelets (and, if required, consider non-leukoreduced whole blood pooled platelets) • Convert less needed ABO Whole Blood to Apheresis • Transfuse platelets only for active bleeding, further restrict to life-threatening bleeding if required by situation • No prophylactic use of platelets • Accept female platelet donors without HLA antibody screen • Accept female donors for pooled and stored platelets • Apply for variance of 7 day outdate requirement* • Consider a 24 hr hold until the culture is obtained and immediate release for both Pool and Apheresis • Obtain FDA variance to allow new Pool and Store sites to ship across state lines* • Reduce pool sizes to platelets from 3 whole blood donations 	√		Substitute				
			√	Adapt	Leukoreduced		Non-leukoreduced	
			√	Adapt				
			√	Conserve				
			√	Conserve				
			√	Adapt				
			√	Adapt				
			√	Adapt				
			√	Adapt				
			√	Adapt				

*FDA approval/variance required via American Association of Blood Banks (AABB)

RENAL REPLACEMENT THERAPY REGIONAL RESOURCE CARD

Resource cards are intended to provide incident-specific tactics and planning information to supplement the general strategy cards. They are organized according to the CO-S-TR framework of incident response planning – http://www.dmphp.org/cgi/content/full/2/Supplement_1/551.

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

Category	RESOURCE and RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Command, Control, Communication, Coordination	<p>General Preparedness Information Compared to other critical care interventions, hemodialysis offers equipment availability, expansion capacity, and care coordination that greatly reduces the risk of contingency and crisis care, at least in our geographic area. Disaster dialysis challenges generally result from:</p> <ol style="list-style-type: none"> 1. Lack of clean water sources (each hemodialysis requires about 160 liters ultra-clean water) 2. Relocation of dialysis-dependent patients to a new area (evacuation of nursing homes, flood zones, etc.) 3. Increase in patients requiring dialysis (crush syndrome, unusual infections) <p>Outpatient</p> <ul style="list-style-type: none"> • Primary providers are DaVita and Fresenius – both have extensive contingency plans to increase capacity and relocate patients (including toll-free numbers to access dialysis services) • Renal Network 11 (multi-state renal planning, quality, and emergency preparedness) has database of all dialysis patients in the state/region and assists coordination activities (http://www.esrdnet11.org/resources/disaster_prep_resources.asp) <p>Inpatient</p> <ul style="list-style-type: none"> • Most facilities lease inpatient services via contract with above or other agencies; some have own nurses and program – plans should account for contingency use of alternate services / leasing services <p>Patient preparedness</p> <ul style="list-style-type: none"> • Patients should have a disaster plan – including specific foods set aside for up to 72h. Note that shelters are unlikely to have foods conducive to renal dietary needs (low sodium, etc.) • Personal planning guidance is available at: http://www.kidney.org/atoz/pdf/disaster_preparedness.pdf <p>Shortage of Renal Replacement Therapy (RRT) Resources</p> <ul style="list-style-type: none"> • Affected facility should contact involved/affected dialysis provider companies and organizations as expert consultants' (MDH OEP and the Renal Network 11 website maintain contact information) 	Prepare			
Space	<p>Relocated Patients Requiring Outpatient Dialysis</p> <ul style="list-style-type: none"> • Contact usual outpatient provider network to schedule at new facility – refer patients to 'hotlines' as needed <p>Excess Patients Requiring Dialysis</p> <ul style="list-style-type: none"> • Transfer patients to other facilities capable of providing dialysis • Consider moving patients to facilities with in-house water purification if water quality is an issue for multiple inpatients requiring dialysis • Consider moving other inpatient or outpatient dialysis staff and equipment to facilities requiring increased dialysis capacity 	Substitute			
		Adapt			

RENAL REPLACEMENT THERAPY REGIONAL RESOURCE CARD (cont.)

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

Category	RESOURCE and RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
	<p>Water Supply</p> <ul style="list-style-type: none"> Quantify water-purifying machines available for bedside dialysis machines Identify facilities providing high-volume services purify their own water and pipe to specific rooms in the dialysis unit, intensive care, etc. Identify water-purifying and dialysis machines to be obtained through lease agreements <p>Water Contamination</p> <ul style="list-style-type: none"> Consider alternate sources of water Consider transferring stable inpatients to outpatient dialysis centers for dialysis treatments and vice versa Consider use of MN National Guard water reserves and purification equipment – but must assure adequate purity for dialysis (potable is NOT sufficiently clean) <p>Power Outage or Shortage</p> <ul style="list-style-type: none"> Consider transferring stable inpatients to outpatient dialysis centers for dialysis treatments and vice versa Consider transferring inpatients to other hospitals Consider transfer of outpatients to other facilities for care until issue resolved <p>Dialysis Catheters, Machines, Reverse Osmosis Machines, and/or Other Supply Shortages Note: Dialysis catheters and tubing are inexpensive, relatively interchangeable, and supplied by several manufacturers</p> <ul style="list-style-type: none"> Stock adequate dialysis tubing sets and venous access catheters (Quinton, etc.) for at least one month's usual use Identify provider network and other sources of supplies and machines Transfer machines/supplies between outpatient centers and hospitals, or between hospitals 	Prepare			
Supplies		Prepare Substitute Adapt			
	<p>Dialysis Staff Shortages²</p> <ul style="list-style-type: none"> Non-dialysis nursing staff to take on "routine" elements of dialysis nursing (e.g., taking VS, monitoring respiratory and hemodynamic status, etc.) Dialysis nursing staff to supervise non-dialysis nursing staff providing some dialysis functions Outpatient dialysis techs may be used to supervise dialysis runs if provider deficit is critical issue (would be unlikely aside from potentially in pandemic or other situation affecting staff) <p>Community Planning</p> <ul style="list-style-type: none"> Medical needs of re-located renal failure patients are substantial; planning on community level should incorporate their medication and dietary needs during evacuation and sheltering activities. <p>Insufficient Resources Available For All Patients Requiring Dialysis</p> <ul style="list-style-type: none"> Change dialysis from "scheduled" to "as needed" based on clinical and laboratory findings (particularly hyperkalemia and impairment of respiration) – parameters may change based on demand for resources Conceivable (but extraordinary, given outpatient dialysis machine resources) situations may occur where resources are insufficient to the point that some patients may not be able to receive dialysis (for example, pandemic when demand nationwide exceeds available resources) – access to dialysis should be considered as part of critical care intervention prioritization (see Mechanical Ventilation Strategies for Scarce Resource Situations) 	Prepare Substitute Substitute Adapt			
Staff		Prepare Substitute			
Special		Prepare			
Triage		Conserve Re-allocate			

MINNESOTA HEALTHCARE SYSTEM
PREPAREDNESS PROGRAM

RENAL REPLACEMENT THERAPY
REGIONAL RESOURCE CARD (cont.)

Category	RESOURCE and RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Treatment	<p>Crush Syndrome</p> <ul style="list-style-type: none"> Initiate IV hydration and acidosis prevention protocols "in the field" for crush injuries to prevent/treat rhabdomyolysis in hospital settings <p>Mode of Dialysis</p> <ul style="list-style-type: none"> Restrict to hemodialysis only for inpatient care (avoid continuous renal replacement therapy(CRRT) and peritoneal dialysis (PD) due to duration of machine use (CRRT) and supply issues (PD)) <p>Increased Demand on Resources</p> <ul style="list-style-type: none"> Shorten duration of dialysis for patients that are more likely to tolerate it safely Patients to utilize their home "kits" of medication (Kayexalate) and follow dietary plans to help increase time between treatments, if necessary 	Conserve			
		Substitute			
		Conserve			
Transportation	<p>Transportation Interruptions</p> <ul style="list-style-type: none"> Dialysis patients may require alternate transportation to assure ongoing access to dialysis treatment. Chronic patients should coordinate with their service providers / dialysis clinics first for transportation and other assistance during service/transportation interruptions. Emergency management and/or the health and medical sector may have to supplement contingency transportation to dialysis during ice storms or other interruptions to transportation. 	Prepare Adapt			

¹The major national dialysis corporations have extensive experience contending with disasters; their input during any anticipated or actual incident is imperative to optimize the best patient care in Minnesota.

² See Staffing in the Core Clinical Strategies for Scarce Resource Situations card set.

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

PANDEMIC INCIDENT COMMAND CONSIDERATIONS FOR HEALTHCARE FACILITIES BY EVENT STAGE

GREEN *Pre-pandemic period; no current pandemic activity but moderate to high potential exists*

Administration/Planning

- Encourage employees to have personal emergency plans in place, including emergency day-care arrangements and family communications.
- Establish and maintain key personnel emergency notification list.
- Conduct Continuity of Operations Planning (COOP) for pandemic situations.
- Write pandemic annex to all-hazards emergency response plan.
- Develop security plans for buildings, including plans for augmenting staff and ingress/egress control.
- Stockpile personal protective equipment and create contingencies for when supplies run low.
- Plan for surge capacity, including accommodating patients in non-traditional areas both on-site and off-site.
- Formulate regional plans for capacity, including alternate care sites, through collaboration with local public health agencies and including inpatient and outpatient sectors.
- Discuss contingencies for scarce resource situations at facility and regional levels; include ethics committee members, administration, and medical staff on facility Clinical Care Committee that will determine which services may be offered during a pandemic. (See Institute of Medicine 2009 Guidance for Establishing Crisis Standards of Care for Use in Disaster Situations: A Letter Report- <http://www.nap.edu/catalog/12749.html>).

Operations

- Emphasize good infection control practices. • Encourage annual influenza vaccination for all staff. • Determine options for telephone screening and the use of flu centers with state and local public health departments and other stakeholders in the jurisdiction.

Pre-Training/Education (Pre-Event)

- Encourage personal preparedness planning using www.ready.gov information.
- Provide pandemic education to employees and fit-test personnel, and/or have ability to provide just-in-time fit testing for N95 or other appropriate respirators.
- Promote Cover Your Cough Campaign.
- Conduct exercises to practice pandemic responses; stress long-term response and incident action planning cycles consistent with Hospital Incident Command System (HICS) and National Incident Management System (NIMS).

BLUE *Pandemic has begun; no cases in Minnesota*

In addition to the previously listed measures, the following steps may be taken:

Administration/Planning

- Cancel or deny employee travel/leave.
- Conduct education about staff protections and expectations.
- Activate Clinical Care Committee to determine when and how to change services provided (e.g., canceling elective surgeries/appointments) based on the severity and expected arrival time of the pandemic.
- Determine triggers to move from blue level to yellow level.
- Track financial impact (direct and indirect), and staff time carefully for reimbursement or billing use.

Communications

- Communicate plans and expectations to clinical and business units, as well as to patients and families.
- Coordinate staff and public messages with community and regional leaders and partners.

Operations

- Partially activate Hospital Command Center; begin daily action planning cycle and information updates.
- Screen patients and visitors prior to building entry; assign infectious or suspect cases to appropriate care areas with appropriate PPE and respiratory hygiene.
- Separate suspect cases in emergency departments (ED) and clinics; provide masks to all suspect cases and post signage for patients regarding respiratory hygiene.
- Staff to wear personal protective equipment (PPE) when treating suspect cases.
- Follow MDH case definitions and protocols.
- Review elective procedures and cancel if patient recovery will be impacted by pandemic.
- Assess supplies and vendor inventory; place orders as needed; communicate with partner agencies about supply needs.
- Provide prescriptions; encourage patients to have 90 days of usual prescription medications on hand.

Training/Education (Pre-Event)

- Conduct just-in-time education for employees, including fit-testing, when required. Work with public health agencies and hospitals to craft public messages about symptoms and when (and when not) to come to hospital/clinics.

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

PANDEMIC INCIDENT COMMAND CONSIDERATIONS FOR HEALTHCARE FACILITIES BY EVENT STAGE (cont.)

YELLOW *Sporadic community cases of pandemic influenza have been confirmed but are few in number*

In addition to the previously listed measures, the following steps may be taken:

Administration/Planning

- Clinical Care Committee determines, on daily basis, if any modifications in facility services are necessary.
- Conduct appropriate case-finding and reporting.
- Open staff housing areas, as needed; open auxiliary rest, clinical care, and family areas, as needed.
- Begin limiting non-urgent surgeries and procedures, if required.
- Implement access controls and institute visitor and family member policies according to institutional procedures.
- Determine need for expanded outpatient operations and triggers for activating.

Communications

- Communicate on a daily basis among hospitals and agencies (e.g., through conference calls).
- Conduct employee and public information campaigns; update daily.

Operations

- Isolate or cohort cases in ED, clinics, and in-patient units.
- Determine whether staff wear PPE for all patient encounters in addition to suspect cases.

ORANGE *Widespread community cases*

In addition to the previously listed measures, the following steps may be taken:

Administration/Planning

- Clinical Care Committee, on a daily basis, determines the administrative and clinical changes needed to cope with demand for resources.
- Triage team may be appointed to decide which patients receive certain therapies (e.g., ventilators), based on prognosis.
- Conduct bed management to move beds and patients with authority of administration.
- Set up Multi-Agency Coordination (MAC) with public health agencies, other hospitals, and EMS; determine when to open on-site and/or off-site alternate care sites, if needed and as staffing and resources are available.
- Increase outpatient and ED capacity and throughput according to pre-established plans.

Communications

- Update hospital employees and the public regularly on what services the hospital is offering. When should patients come to the hospital? What can they do at home?

Operations

- Fully activate Hospital Command Center with action-planning cycles for next operational period.
- Mask all patients and visitors presenting to facility; staff wear PPE continuously to prevent exposure.
- Triage use of ED, clinic, and in-patient resources as required (e.g., what conditions will be evaluated in the ED? What surgeries will be done today?)

RED *Overwhelming number of local cases beyond capacity of health care system*

In addition to the previously listed measures, the following steps may be taken:

Administration/Planning

- Triage team appointed by Clinical Care Committee makes medical allocation decisions. Clinical Care Committee continues to make daily decisions about which hospital services can be maintained. Cohorting of patients no longer possible – emphasis on respiratory hygiene and masks, based on clinical situations and ethical standards.

Communications

- Staff, patient, and patient / provider family behavioral health and security issues become critical – assure support and safety.

Operations

- Update hospital employees and the public regularly on what services the hospital is offering. When should patients come to the hospital? What can they do at home?
- Concentrate critical care in hospitals; work with homecare and public health to assure appropriate homecare instructions given.
- Open alternate care sites working with area hospitals, clinics, and public health, to reduce burden on hospitals, based on clinical situations and ethical standards.

APPENDIX FOUR

DEVELOPING AN ICU SUPPLY AND OTHER TEMPLATES FOR DISASTER RESPONSE

Is the supply inventory for disaster response different than what we use every day in our ICU?

No, the supply inventory should be similar to what you use every day. The difference is in quantity. For example, the volume of use of antiviral drugs would be significantly greater during a pandemic outbreak than during usual circumstances. However, there are some differences of consequence.

What must I do regarding inventory management for ICU disaster response? How detailed does this inventory need to be?

You do need to develop inventory lists for your ICU as part of your planning processes. This is work for your ICU preparedness committee to complete. How detailed you make these lists depends on your institution. Use your hazard vulnerability analysis to guide the development of these lists as well.

To facilitate your inventory development efforts, this appendix offers several examples of lists. Please note: These are not intended to be comprehensive or exhaustive, but they will get you started on the processes.

What about pharmaceutical supplies? How do we arrange these, and how much detail is needed?

Table A4-1 provides an example of an effective means to accomplish pharmaceutical supply inventory for your ICU disaster response planning. The suggestions below do not account for the patient's home medications (eg, agents for high cholesterol, high blood pressure, and hypothyroidism) or therapies applied in the emergency department. Please do not focus exclusively on the precise drugs and doses listed here. These may vary for your institution. Instead, pay attention to the following:

- Terms like *organ system* and *clinical indications* are used as categories for the various drugs.
- *Assumptions* refers to unique circumstances that influence drug selection and dosing during a disaster.
- *Estimated dose/day* requires that you consider things like the impact of decreased staffing on drug dosing, etc.
- *Estimated stock supply* often yields surprising results – “Wow, that’s A LOT of drugs.” This, in turn, leads to very important discussions among your committee members about what drugs are stockpiled and how much, versus those drugs that can be obtained from other sources, etc.

Table A4-1. Pharmacy Inventory and Supply

	Assumptions	Selected Agents (Dose)	Estimated Dose/Day for 1 Patient [dose/h x 24 h]	Estimated Stock Supply for 30-d Pandemic for 10 Beds [dose/day x 30 d x 10 patients]
NEUROLOGY	<p>100% of mechanically ventilated patients require analgesia and sedation.</p> <ul style="list-style-type: none"> - First choice: morphine plus midazolam: 80% - Second choice: fentanyl plus midazolam: 20% - Sedation weaning (over 3-5 days): 50% may require oral clonazepam plus risperidone - Estimate 25% could use adjunctive agents such as acetaminophen with/without codeine. 	Morphine IV (1-10 mg/h)	240 mg	57,600 mg
		Midazolam IV or lorazepam (1-20 mg/h)	240 mg	57,600 mg
		Fentanyl IV (150 µg/h)	3,600 µg	216,000 µg
		Clonazepam PO (0.5 mg q8h)	1.5 mg	450 mg
		Acetaminophen (regular) PO with codeine PO (1-2 tablets q4h)	12 tablets	720 tablets
		Acetaminophen PR (1 supp q4h)	6 supp	180 supp
	<p>Up to 60% of ventilated patients are reported to experience agitation/delirium.</p> <ul style="list-style-type: none"> - First choice: IV haloperidol: 60% - Second choice: PO atypical anti-psychotic (eg, risperidone): 40% 	Haloperidol IV (agitation) (5 mg q4h)	30 mg	3,240 mg
		Risperidone NG (0.5-1 mg q6h)	4 mg	288 mg
	<p>5% of ventilated patients require chemical paralysis.</p> <p>During a pandemic, predict greater utilization: 10% (as per H1N1 publications).</p> <p>Pancuronium (can be used as either infusion or bolus dosing, adjusting dose for renal dysfunction): 100%</p>	Pancuronium IV (1-5 mg q1-4h)	30 mg	900 mg
	<p>Management of generalized tonic-clonic, complex partial seizures; (assume average wt = 80 kg)</p> <p>Benzodiazepines can also be used. <10% may have seizures.</p>	Phenytoin (Loading dose: 15-20 mg/kg; maintenance dose: 5 mg/kg/day)	400 mg (1,600 mg loading dose)	12,000 mg (16,000 mg loading dose)

DEVELOPING AN ICU SUPPLY
AND OTHER TEMPLATES FOR DISASTER RESPONSE

Table A4-1. Pharmacy Inventory and Supply (continued)

	Assumptions	Selected Agents (Dose)	Estimated Dose/Day for 1 Patient [dose/h x 24 h]	Estimated Stock Supply for 30-d Pandemic for 10 Beds [dose/day x 30 d x 10 patients]
CARDIOVASCULAR	<p>Vasopressors</p> <p>75% require vasopressor support for 3-5 days. – Norepinephrine: 90% – Dopamine: 10%</p> <p>25% with multiorgan failure may have cardiac dysfunction/failure.</p> <p>Currently, we do not recommend corticosteroids for septic shock.</p>	Norepinephrine IV (0.1-2 µg/kg/min)	250 mg	50,625 mg
		Dopamine IV (1-20 µg/kg/min)	2,500 mg	56,250 mg
		Dobutamine IV (5-10 µg/kg/min)	1,150 mg	86,250 mg
CARDIOVASCULAR	<p>Arrhythmias</p> <p>10% have atrial fibrillation – Amiodarone: 90% – Metoprolol IV: 10%</p>	Amiodarone IV (900 mg/24 h)	900 mg	27,000 mg
		Metoprolol IV (2.5-5 mg IV q4-8h)	30 mg	90 mg
PULMONARY	<p>Bronchodilation</p> <p>75% of mechanically ventilated patients require bronchodilators. During pandemic (H1N1, SARS), 100% required bronchodilation.</p> <p>10% are admitted on a corticosteroid puffer during winter months.</p>	Ipratropium 20 µg MDI (8 puff q4h + q1h prn)	1 inhaler	225 inhalers
		Salbutamol 100 µg MDI (8 puff q4h + q1h prn)	1 inhaler	225 inhalers
		Fluticasone 125 µg MDI (4 puff q12h)	<1 inhaler	30 puffers
PULMONARY	<p>Ventilation</p> <p>100% mechanically ventilated patients receive chlorhexidine oral rinse</p>	Chlorhexidine 0.12% PO (10 mL q6h)	40 mL	12,000 mL (15 bottles)
GASTROINTESTINAL	<p>General</p> <p>Nearly 100% require GI stress prophylaxis if on mechanical ventilation for >48 h. – Ranitidine IV/PO: 90% – Lansoprazole PO/SL: 10%</p> <p>Limit PPI use to minimize risk of VAP and <i>Clostridium difficile</i> infections.</p>	Ranitidine IV (50 mg q8h)	3 vials	450 vials
		Ranitidine NG (150 mg q12h)	2 tablets	240 tablets
		Lansoprazole NG (30 mg daily)	1 tablet	30 tablets

Table A4-1. Pharmacy Inventory and Supply (continued)

	Assumptions	Selected Agents (Dose)	Estimated Dose/Day for 1 Patient [dose/h x 24 h]	Estimated Stock Supply for 30-d Pandemic for 10 Beds [dose/day x 30 d x 10 patients]
GASTROINTESTINAL	Glycemic Control 50% have hyperglycemia, will not use tight glycemic infusion protocol; associated high workload and maybe ↑ staff without training. - Sliding scale insulin; checks every 4 hours: 50% - Use of Lantus® insulin as a long-term glucose stabilizer for pts with stable hyperglycemia (minimizes need for Accu-Chek® monitors and improves workflow)	Insulin R	50 units	7,500 units
		Lantus® insulin	25 units	3,750 units
NEPHROLOGY	Diuresis 25% require diuresis	Furosemide IV (80 mg/day)	80 mg	6,000 mg
		Bumetanide IV (5-10 mg/day)	5-10 mg	or 750 mg
	Electrolyte Replacement 100% need electrolyte replacement daily.	Potassium chloride IV (80 mEq/day)	2 bags	600 bags
		Magnesium sulfate IV (4 g/day)	2 bags	600 bags
	Sodium phosphate (30 mmol/day)	2 bags	600 bags	
	Calcium gluconate IV (4 g/day)	4 vials	1,200 vials	
HEMATOLOGY	VTE Prophylaxis 100% require DVT prophylaxis. 25% may have indications for LMWH.	Heparin SC PFS (5000 units q12h)	2 syringes	480 syringes
		Enoxaparin SC PFS (40 mg q24h)	1 syringe	60 syringes
	Treatment Anticoagulation 10% with atrial fibrillation or DVT/PE require treatment anticoagulation.	Heparin IV (nomogram)	2 bags	60 bags
		Enoxaparin SC (1.5 mg/kg/day)		

DEVELOPING AN ICU SUPPLY
AND OTHER TEMPLATES FOR DISASTER RESPONSE

Table A4-1. Pharmacy Inventory and Supply (continued)

		Assumptions	Selected Agents (Dose)	Estimated Dose/Day for 1 Patient [dose/h x 24 h]	Estimated Stock Supply for 30-d Pandemic for 10 Beds [dose/day x 30 d x 10 patients]
Community-Acquired Pneumonia		100% with respiratory symptoms/ pneumonia are empirically covered for CAP.	Ceftriaxone IV (1 g q24h)	(First 3 days) 30 g	(Beyond first 3 days) 1,200 g
		100% covered with combination therapy during the first 3 days – Moxifloxacin – Azithromycin plus ceftriaxone or vancomycin	Moxifloxacin IV (400 mg q24h) Azithromycin IV (500 mg q24h)	30 bags 30 vials	1,200 bags 1,200 vials
Bacterial Co-Infections		Estimate 50% require treatment of bacterial co-infection that requires treatment beyond 3 days of initial treatment (need 4 more days) – Cefazolin/cloxacillin: MSSA – Vancomycin: penicillin allergy/ MRSA/co-infection	Cefazolin IV (2 g q8h) Cloxacillin IV (2 g q6h) Vancomycin IV (1 g q12h)	6 g 8 g 2 g	900 g 1,200 g 300 g
		5% VAP rate >50% require treatment of general septic shock with broad-spectrum antibiotics for 7 days – Pip/tazo: VAP/sepsis – Meropenem or cefepime: VAP/ sepsis/ESBL	Pip/tazo IV (4.5 g q8h) Meropenem IV (1 g q8h) Cefepime IV (1g q12h)	3 vials 3 vials 2 vials	360 vials 90 vials 60 vials
	<10% require antifungal coverage – Fluconazole – Caspofungin	Fluconazole IV (400 mg q24h) Caspofungin IV (50 mg q24h)	2 bottles 1 vial	60 bottles 30 vials	
	2% require treatment of antibiotic associated diarrhea (<i>C. difficile</i>).	Metronidazole PO (500 mg q8h)	3 tablets	90 tablets	

Table A4-1. Pharmacy Inventory and Supply (continued)

	Assumptions	Selected Agents (Dose)	Estimated Dose/Day for 1 Patient [dose/h x 24 h]	Estimated Stock Supply for 30-d Pandemic for 10 Beds [dose/day x 30 d x 10 patients]	
ANTIDOTES	Viral	100% with respiratory symptoms/ pneumonia are empirically covered for influenza for at least 5 days . Not all patients in the ICU will have respiratory symptoms/pneumonia but better to overestimate.	Oseltamivir PO (75 mg q12h)	2 capsules 600 capsules	
	Bacillus anthracis	For treatment of anthrax (inhalational/GI/oropharyngeal): – Doxycycline plus ciprofloxacin for 60 days	Doxycycline IV/PO (100 mg q12h) Ciprofloxacin (400 mg IV q12h)	– 120,000 mg (600 vials) 480,000 mg (1200 bags)	
	Yersinia pestis	For treatment of plague: – Doxycycline for 7 days	Doxycycline PO (100 mg q12h)	– 1,400 mg (14 tablets)	
	Vibrio cholerae	For treatment of cholera: – Doxycycline for 1 dose	Doxycycline PO (300 mg x 1 dose)	300 mg (2 tablets)	90,000 mg (300 tablets)
	Variola	For treatment of smallpox: – Smallpox vaccine x 1 dose – Revaccination recommended every 3 years	Smallpox vaccine SC (single drop of suspension)	1 vaccine	300 vaccines
	Nausea	Dimenhydrinate for nausea	Dimenhydrinate PO/IV (50 mg q4h)	300 mg	90,000 mg (1,800 tablets) (1,800 vials)
OTHER	Whenever possible, home medications should be brought into the hospital during a disaster.	–	–	–	

Abbreviations: PO, by mouth; PR, per rectum; supp, suppository; NG, nasogastric; wt, weight; SARS, severe acute respiratory syndrome; MDI, metered-dose inhaler; prn, as needed; GI, gastrointestinal; SL, sublingual; PPI, proton pump inhibitor; VAP, ventilator-associated pneumonia; pt, patient; DVT, deep vein thrombosis; LMWH, low-molecular-weight heparin; SC, subcutaneous; PFS, prefilled syringe; PE, pulmonary embolism; CAP, community-acquired pneumonia; MSSA, methicillin-susceptible *Staphylococcus aureus*; MRSA, methicillin-resistant *Staphylococcus aureus*; Pip/tazo, piperacillin-tazobactam; ESBL, extended spectrum β -lactamase

DEVELOPING AN ICU SUPPLY
AND OTHER TEMPLATES FOR DISASTER RESPONSE

Are there other lists (plans) that we need to develop for our ICU?

The list in **Table A4-2** outlines personal protective equipment, along with a variety of other general use equipment and supplies that may be needed in your ICU. Again, the emphasis is not on each individual item – think about the “big picture.” This list outlines a process for your ICU disaster response committee to undertake. What might the final deliverable product look like?

Table A4-2. Medical and Non-Medical Supplies and Equipment

Resource	Type	@ Site A	@ Site B	@ Site C	Total Available
HT50® transport ventilators	Respiratory				
3M Air-Mate™ PAPR disposable hoods	Infection Control				
3M Air-Mate™ PAPR units	Infection Control				
3M Bioconversion filter kit	Infection Control				
Portable negative pressure unit	Infection Control				
Mintie Tech. ECU2 Bundle	Infection Control				
Mintie Tech. IcoRoom	Infection Control				
Clamp light	Light				
4-foot, portable fluorescent light fixtures	Light				
Halogen flood lights with stand	Light				
Emergency light tower	Light				
Duct tape (100 ft/roll)	Miscellaneous				
Box fan	Miscellaneous				
Extension cord (various lengths)	Power				
2-kW portable generator	Power				
5.5-kW portable generator	Power				
10-kW portable generator	Power				
5-gallon gas cans	Power				
Power strip with 6-ft cord	Power				
7x14-ft power and light equipment trailer	Power				
N95 respirators, standard (20/box)	PPE				
N95 respirators, small (20/box)	PPE				
Exam gloves (nitrile) - L (100/box)	PPE				
Exam gloves (nitrile) - M (100/box)	PPE				
Exam gloves (nitrile) - S (100/box)	PPE				
STAT Paq Case (6 boxes of 10/case)	PPE				
Gown Kits - Youth (25/box)	PPE				
Gown Kits - Adult (25/box)	PPE				
Medical surge cots (10 per cart)	Surge				
Linen kits for cots	Surge				
Dry-It™ Disposable Towels (100/roll)	Surge				
Biohazard bags and holder (20 bags/box)	Surge				
Germicidal disposable wipe (50/box)	Surge				
Postmortem kit - pediatric (10/box)	Surge				

Table A4-2. Medical and Non-Medical Supplies and Equipment (continued)

Resource	Type	@ Site A	@ Site B	@ Site C	Total Available
Male urinals (25/box)	Surge				
Mylar blankets (25/box)	Surge				
Staff scrubs - M (25/box)	Surge				
Staff scrubs - XXXL (25/box)	Surge				
Disposable blood pressure cuff covers (10/box)	Surge				
Lab coats - M (10/box)	Surge				
Lab coats - XL (10/box)	Surge				
Patient lifters (10/box)	Surge				
Sharps disposal container (each)	Surge				
IV pole (each)	Surge				
Privacy curtain (each)	Surge				
Hand truck - medium duty	Surge				
Emergency generator fuel (hours)	Company_____				
Water (gallons of potable on site)	Company_____				
Food (days of meals at current census)	TBD				
<i>Medical gas</i>					
- Bulk oxygen (days)	Company_____				
- Nitrogen (H cylinders)	Company_____				
- Nitrous oxide (H cylinders)	Company_____				
- CO ₂ (H cylinders)	Company_____				
<i>Medications</i>					
- Doxycycline 100-mg capsules	Antidotes				
- Atropine 2-mg injection auto-inject	ChemPack				
- Pralidoxime 600-mg injection auto-inject	ChemPack				
- Atropine 1-mg injection auto-inject	ChemPack				
- Atropine 0.5-mg injection auto-inject	ChemPack				
Diazepam 5 mg/mL injection auto-inject	ChemPack				
- Atropine 4 mg/mL 20-mL vials	ChemPack				
Pralidoxime 1-g 20-mL vials	ChemPack				
- Diazepam 5 mg/mL 10-mL vials	ChemPack				
- SWFI 20-mL vials	ChemPack				
<i>Other medical supplies</i>					
- Type	TBD				
- Type	TBD				
- Type	TBD				
- Type	TBD				
- Type	TBD				
Other ()	TBD				
Command center phones	Communications				
Command center downtime phones	Communications				
SouthernLINC radio (base unit - state-wide)	Communications				
SouthernLINC radio					

DEVELOPING AN ICU SUPPLY
AND OTHER TEMPLATES FOR DISASTER RESPONSE

Table A4-2. Medical and Non-Medical Supplies and Equipment (continued)

Resource	Type	@ Site A	@ Site B	@ Site C	Total Available
800-MHz radio (local police and fire com)	Communications				
Doff-It® kits	Decon				
Level-C suits	Decon				
Rubber overboots	Decon				
Rubber overgloves	Decon				
3M Breathe Easy™ PAPR	Decon				
55-gallon plastic wastewater barrels	Decon				
3M PAPR filter FR-57 (6 pack)	Decon				
3M PAPR battery charger	Decon				
Backboard for decon	Decon				
Privacy shelter (yellow 8x10 tent)	Decon				
Portable decon shower (blue 12x12 tent)	Decon				
Decon equipment trailer, 7x14 tandem axle	Decon				
Pelican case, black, field medical supplies	DMAT				
Pelican case, yellow, field medical supplies	DMAT				
Pelican case, green, field medical supplies	DMAT				
Pelican case, blue, field medical supplies	DMAT				
Pelican case, gray, field medical supplies	DMAT				
Stryker emergency medical services stretcher	DMAT				

Abbreviations: PAPR, powered air-purifying respirator; PPE, personal protective equipment; SWFI, sterile water for injection; TBD, to be determined; Decon, decontamination; DMAT, disaster medical assistance team

What about medical gas management? How much is needed, and how is this calculated/estimated?

Medical gas management is also very important. **Table A4-3** provides a planning template for determining what you need (medical gas delivery devices) and how much (volume, liters) gas might be required. Several considerations are crucial in your planning:

- Electrical outage, hurricanes, tornadoes, or other weather-related events?
- Sudden influx of O₂-dependent patients (severe acute respiratory syndrome, avian flu, H1N1 flu, etc)?
- Failure of centrally piped medical oxygen system?
- Failure of centrally piped medical vacuum system?

Table A4-3. Respiratory Equipment and Supplies

Device	Gas Source	Power Source (compressed gas, electricity or battery, both)	# Available or Potential Re-purpose	Outside Resources (unaffected, hospital, rentals, SNS)
Noninvasive positive-pressure ventilators (CPAP or BiPAP)				
Conventional mechanical ventilators (assess in all areas of hospital: ICU, PACU, catheter lab, MRI, etc)				
High-frequency oscillatory ventilators				
Transport ventilators				
Other portable ventilators				
Anesthesia machines				
Negative pressure ventilators				
Respiratory Equipment				
Equipment	# Days Supply on Hand		Other Resources (unaffected hospital, rentals, SNS)	
Self-inflating bags				
Anesthesia bags				
Endotracheal tubes (evaluate capacity for adults and children)				
Wall suction				
Portable suction				
Masks (evaluate capacity for adults and children)				
Laryngeal mask airways (evaluate capacity for adults and children)				
Ventilator circuits				
Assess Risk of Gas Shortage				
Gas Source	# Hours/Days Supply on Hand		Other Resources (unaffected hospital, rentals, SNS)	
Bulk liquid gas				
Piped gases				
E-cylinders				
Power failure				
Cylinders – continuous flow				
Cylinders – conserving flow				

Table A4-3. Respiratory Equipment and Supplies (continued)

Gas Conservation
<ul style="list-style-type: none"> - No routine or precautionary O₂ - Wean oxygen as quickly as tolerated. - Revise clinical target parameters: accept lower O₂ saturation than typical, such as 85-88%. - Use O₂-conserving cannulas such as Oximizer®. - Decrease or eliminate O₂-driven nebulizers. - Minimize frequency of nebulized treatments or convert to MDI medications. - Restrict continuous nebulization therapy. - Restrict or eliminate the use of high-flow cannula systems. - Restrict the use of simple and partial rebreathing masks. - Eliminate or reduce use of ventilators with high oxygen consumption. - Create "mini manifolds" to sustain local supplies to critical areas. Utilizing K- or H-cylinders equipped with 50 psi regulators and extension hoses, the lines are connected to the wall outlets in the unit needing supply. The zone valve is then closed, isolating the unit from the failed main line. Using two or more cylinders to create a manifold, you can run a critical area for an extended period of time. - Avoid low-flow use of air-oxygen blenders. Reserve air-oxygen blender use for mechanical ventilators that use high-flow non-metered outlets. (These do not utilize reference bleeds.) - Disconnect blenders when not in use. - Bag with air. - Eliminate the use of oxygen-powered Venturi suction systems as they may consume 15-50 L/min. - Substitute available oxygen concentrators if electrical power is present to supplement low-flow cannulas.
Extreme Situations
<ul style="list-style-type: none"> - Disinfect and reuse cannulas, tubing, circuits, and masks. - Allocate ventilators. - Adjust threshold for airway intervention and respiratory support.

Abbreviations: SNS, Strategic National Stockpile; CPAP, continuous positive airway pressure; BiPAP, bilevel positive airway pressure; PACU, post-anesthesia care unit; MRI, magnetic resonance imaging; MDI, metered-dose inhaler; psi, pounds per square inch

APPENDIX FIVE

SCENARIO-BASED PANDEMIC PLANNING TEMPLATES

Reproduced with permission from the Mayo Clinic.

Should we plan for ICU staffing and potential absenteeism during a disaster? Are there scenario-based planning templates for this?

The answer is “yes.” The most important example is a pandemic outbreak. A pandemic is most likely to impact your personnel staffing and apply constraints to your daily ICU/hospital workload. Following are the H1N1 planning templates and scenario that were used at the Mayo Clinic in Rochester, Minnesota during 2009. Please notice:

- The use of a defined scenario establishes a rules-based approach to planning, ensures that all departments and clinical work areas are similarly focused, and clearly defines assumptions for all planners to follow.
- This approach leads planners to answer specific questions (eg, given the calculated absenteeism for your department, what will you continue to do and what will you cease to do?). This ensures that all departments and work areas are consistent in their approach to planning.
- Defining the pandemic in 1-week increments also ensures consistency.
- Once each department/work area completes this template-based approach, all responses can be synthesized into a single, unified institutional pandemic response plan.
- Valid assumptions regarding care needs (which treatments, how many, how much, by whom?) should be generated. To do this in preparation for an influenza outbreak, the hospital courses of 30 randomly selected flu patients admitted to Saint Marys Hospital at the Mayo Clinic during 2008 were reviewed and quantified.
- A pandemic of moderate severity can be used for planning purposes, which the Mayo Clinic employed for its scenario. (A severe pandemic can generate numbers so high that it might become demoralizing.)



PANDEMIC SCENARIO ASSUMPTIONS

The pandemic scenario used for the Mayo Clinic plan is based on Centers for Disease Control and Prevention (CDC) predictions. The scenario assumes that the pandemic has arrived in Minnesota after working its way across the country. The scenario emphasizes that once the first patient arrives, the rest will follow, and pushes Mayo staff to implement the plan sooner rather than later. If the impact of the pandemic is not as predicted (ie,

more or less aggressive/severe), dealing with the actual situation compels Mayo staff to use this plan as the basis for “flexing” their response up or down. Therefore, it is important to have institutional and departmental decision-making processes in place and plans for departmental responses that allow the plan to respond to the actual demands of the pandemic.

The predicted number of Mayo staff and dependents newly sick each week is based on the number of employed staff members as well as their dependents. These numbers are then weekly “plugged in” to the incidence rate from the CDC pandemic moderate influenza prediction model (ie, FluSurge). The scenario also assumes no benefit from vaccine or antiviral prophylaxis. It also assumes that all newly sick, 50% of staff with ill dependents, and 25% of those sick in the previous week will be absent and includes the historical standard of a 2.5% absenteeism rate for Mayo multiprofessional staff.



MAYO CLINIC PANDEMIC INFLUENZA PLANNING TEMPLATES

Instructions for Preparation of Department/Functional Area Pandemic Response

Please use the information contained in this document to develop a plan for how your department would meet the demands of patient care in the face of increased absenteeism to the levels described in the scenario. A number of points to consider may be helpful as you develop your plan.

- If you already have a robust pandemic response plan that will guide your department through a pandemic event such as the one described here, GOOD FOR YOU! Simply send your plan to the pandemic task force and you are done!
- Depending on the speed with which the pandemic arrives, we may have our normal patient population present in the hospitals and outpatient practice. If the pandemic moves across the country slowly it may be that our referral patients, regionally and nationally, will not be traveling due to the pandemic, in which case we may have reduced census. You should plan for the worst case: the hospitals are at their normal census levels.
- Over the course of the pandemic wave elective surgeries will be canceled and normal referral patient populations will be severely limited. Staff members who normally care for these types of patients will be available to care for other patient populations. Other patient populations will continue to seek normal (non-pandemic) care. Cardiology will continue to see local/regional urgent patients. Trauma will continue. Local and regional patients will continue to need care for non-pandemic medical reasons. Babies will continue to be born. There will continue to be a need for urgent care of cancer patients. Dialysis will be ongoing.

Careful thought about the patient populations your department serves will be important as you figure out how to get your work done with fewer staff and any increase in service needed for pandemic patients.

- When making your plan, it is important to establish a decision-making structure that can withstand leadership absences. Who will make decisions concerning department operations when the leadership is sick?
- In the scenario presented, can you cover the work with normal staffing, or are you going to need more people? What surge capacity do you have? Can you convert part-time people to full-time staff? Do you need a trigger point at which you would implement mandatory overtime?
- Is there some work you might stop doing and redirect the effort to work required by the pandemic situation?
- Do you anticipate any shortages of supplies or equipment?
- Do you anticipate any difficulty accessing services from other departments?



WEEK 1 MODERATE FLU PANDEMIC

Table A5-1. Planning Template for Week 1 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	Generalized care	ICU	Mechanical ventilation	Deaths
1,500	85	162	3.1%	750	15	13	2	1	4

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-2**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-2. Formula to Calculate Week 1 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.031	=			-		=	

Institutional Assumptions and Plan – Mayo Clinic

1. Hospital incident command system (HICS) activated.
 - Hospital Practice Committee meets twice daily to triage resources for duration of pandemic.
 - Surgical Committee meets daily to triage surgical resources for duration of pandemic.

- Outpatient Practice Committee meets daily to triage outpatient resources for duration of pandemic.
2. To the extent possible, hospitalized patients will be located at Saint Marys Hospital (SMH).
 - First admissions will be scattered to isolation rooms and the medical ICU.
 3. Flow of outpatients and hospital admissions controlled.
 - Upon first case, all Mayo entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout pandemic.
 - Centralized control of admissions from the Mayo Health System and regional hospitals with the goal of keeping as many patients as possible in local hospitals.
 - Off-site fever clinics established and staffed by Mayo personnel.
 4. Elective patient volume reduced to allow room for pandemic patients.
 - As required, prescheduled patients will be contacted by supervising service to postpone or cancel their appointments.

Department-specific info here:

Department-specific questions here:



WEEK 2 MODERATE FLU PANDEMIC – MAYO CLINIC

Table A5-3. Planning Template for Week 2 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	General care	ICU	Mechanical ventilation	Deaths
7,500	426	811	5.5%	2,250	45	39	6	3	11

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-4**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-4. Formula to Calculate Week 2 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.055	=			-		=	

Institutional Assumptions and Plan

1. HICS activated
2. To the extent possible, hospitalized patients will be located at SMH.
 - Pandemic patients will be cohorted in Domitilla and MB6B/G.
 - Patients will be triaged off medical ICU and Domitilla to make room for pandemic patients.
 - Pediatric pandemic patients will occupy Fr 3B/C and eventually Fr 2B/C as needed.
3. Flow of outpatients and hospital admissions controlled.
 - Upon first case, all Mayo entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout pandemic.
 - Control of admissions from Mayo Health System and regional hospitals centralized with goal of keeping as many patients as possible in local hospitals.
 - Entrance to Domitilla will be restricted as floors are converted to pandemic floors.
 - Off-site fever clinics established and staffed by Mayo personnel.
4. Elective patient volume reduced to allow room for pandemic patients.
 - As required, prescheduled patients will be contacted by supervising service to postpone or cancel their appointments.
 - Elective surgical volume reduced.
 - Surgical staff reassigned as needed.



WEEK 3 MODERATE FLU PANDEMIC – MAYO CLINIC

Table A5-5. Planning Template for Week 3 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	General care	ICU	Mechanical ventilation	Deaths
21,000	1,193	2,270	11.1%	7,125	143	124	19	10	34

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-6**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-6. Formula to Calculate Week 3 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.111	=			-		=	

Institutional Assumptions and Plan

1. HICS activated

2. To the extent possible, hospitalized patients will be located at SMH.

- Pandemic patients cohorted.
 - o Medical ICU completely pandemic unit, beginning to make space in MB7 and 8D/E for pandemic patients.
 - All services share remaining ICUs for non-pandemic patients.
 - o Domitilla building is entirely pandemic patient care.
 - As required, patients will be doubled in all rooms.
 - o As required, altered standards of care will be in place throughout SMH.
 - Details on altered standards of care under development
 - o Ei 92 converted to medicine unit.
 - o Pediatric pandemic patients occupy Fr 3B/C and Fr 2B/C; if capacity is overwhelmed, pediatric pandemic patients will be cohorted on Dom 3.

3. Flow of outpatients and hospital admissions controlled.

- Upon first case, all Mayo entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout the pandemic.
- Control of admissions from Mayo Health System and regional hospitals centralized with goal of keeping as many patients as possible in local hospitals.
- Entrance to Domitilla will be restricted as floors are converted to pandemic floors.
- Off-site fever clinics established and staffed by Mayo personnel.

4. Elective patient volume reduced to allow room for pandemic patients.

- As required, prescheduled patients will be contacted by supervising service to postpone or cancel their appointments.
- Elective surgical volume reduced.
 - o Surgical staff reassigned as needed.



WEEK 4 MODERATE FLU PANDEMIC – MAYO CLINIC

Table A5-7. Planning Template for Week 4 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	General care	ICU	Mechanical ventilation	Deaths
45,000	2,556	4,863	21.5%	16,500	330	285	45	22	78

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-8**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-8. Formula to Calculate Week 4 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.215	=			-		=	

Institutional Assumptions and Plan

1. HICS activated

2. To the extent possible, hospitalized patients will be located at SMH.

- Pandemic patients cohorted.
 - MB6B/G, MB7D/E, MB8D/E all pandemic ICUs.
 - All services share remaining ICUs for non-pandemic patients.
 - Domitilla building is entirely pandemic patient care.
 - As required, patients will be doubled in all rooms.
 - As required, altered standards of care will be in place throughout SMH.
 - Details on altered standards of care under development.
 - Ei 92 converted to medicine unit.
 - Pediatric pandemic patients occupy Fr 3B/C and Fr 2B/C; if capacity overwhelmed, pediatric pandemic patients will be cohorted on Dom 3.

3. Flow of outpatients and hospital admissions controlled.

- Upon first case, all Mayo entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout the pandemic.
- Control of admissions from Mayo Health System and regional hospitals centralized with goal of keeping as many patients as possible in local hospitals.

- Entrance to Domitilla will be restricted as floors are converted to pandemic floors.
- Off-site fever clinics established and staffed by Mayo personnel.

4. Elective patient volume reduced to allow room for pandemic patients.

- As required, prescheduled patients will be contacted by supervising service to postpone or cancel their appointments.
- Elective surgical volume reduced.
 - o Surgical staff reassigned as needed.



WEEK 5 MODERATE FLU PANDEMIC – MAYO CLINIC

Table A5-9. Planning Template for Week 5 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	General care	ICU	Mechanical ventilation	Deaths
45,000	2,556	4,863	22.5%	22,500	450	389	61	30	106

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-10**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-10. Formula to Calculate Week 5 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.225	=			-		=	

Institutional Assumptions and Plan

1. HICS activated

2. To the extent possible, hospitalized patients will be located at SMH.

- Pandemic patients cohorted.
 - o MB6B/G, MB7D/E, MB8D/E all pandemic ICUs.
 - o All services share remaining ICUs for non-pandemic patients.
 - o Domitilla building is entirely pandemic patient care.
 - As required, patients will be doubled in all rooms.

- As required, altered standards of care will be in place throughout SMH.
 - Details on altered standards of care under development.
 - Ei 92 converted to medicine unit.
 - Pediatric pandemic patients occupy Fr 3B/C and Fr 2B/C; if capacity overwhelmed, pediatric pandemic patients will be cohorted on Dom 3.
- 3. Flow of outpatients and hospital admissions controlled.**
- Upon first case, all Mayo entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout the pandemic.
 - Control of admissions from Mayo Health System and regional hospitals centralized with goal of keeping as many patients as possible in local hospitals.
 - Entrance to Domitilla will be restricted as floors are converted to pandemic floors.
 - Off-site fever clinics established and staffed by Mayo personnel.
- 4. Elective patient volume reduced to allow room for pandemic patients.**
- As required, prescheduled patients will be contacted by supervising service to postpone or cancel their appointments.
 - Elective surgical volume reduced.
 - Surgical staff reassigned as needed.



WEEK 6 MODERATE FLU PANDEMIC – MAYO CLINIC

Table A5-11. Planning Template for Week 6 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	General care	ICU	Mechanical ventilation	Deaths
21,000	1,193	2,270	13%	16,500	330	285	45	22	78

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-12**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-12. Formula to Calculate Week 6 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.13	=			-		=	

Institutional Assumptions and Plan

1. HICS activated

2. To the extent possible, hospitalized patients will be located at SMH.

- Pandemic patients cohorted.
 - MB6B/G, MB7D/E, MB8D/E all pandemic ICUs; begin returning ICUs to normal function as possible.
 - All services share remaining ICUs for non-pandemic patients.
 - Domitilla building is entirely pandemic patient care.
 - As required, patients will be doubled in all rooms; begin to return rooms to standard occupancy.
 - As required, altered standards of care will be in place throughout SMH.
 - Details on altered standards of care under development.
 - Ei 92 converted to medicine unit.
 - Pediatric pandemic patients occupy Fr 3B/C and Fr 2B/C; if capacity overwhelmed, pediatric pandemic patients will be cohorted on Dom 3.

3. Flow of outpatients and hospital admissions controlled.

- Upon first case, all Mayo entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout the pandemic.
- Control of admissions from Mayo Health System and regional hospitals centralized with goal of keeping as many patients as possible in local hospitals.
- Entrance to Domitilla will be restricted as floors are converted to pandemic floors.
- Off-site fever clinics established and staffed by Mayo personnel.

4. Elective patient volume reduced to allow room for pandemic patients.

- As required, prescheduled patients will be contacted by supervising service to postpone or cancel their appointments.
- Elective surgical volume reduced.
 - Surgical staff reassigned as needed.



WEEK 7 MODERATE FLU PANDEMIC – MAYO CLINIC

Table A5-13. Planning Template for Week 7 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	General care	ICU	Mechanical ventilation	Deaths
7,500	426	811	6.5%	7,125	143	124	19	10	34

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-14**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-14. Formula to Calculate Week 7 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.065	=			-		=	

Institutional Assumptions and Plan

1. HICS activated

2. To the extent possible, hospitalized patients will be located at SMH.

- Pandemic patients cohorted.
 - MB6B/G, MB7D/E, MB8D/E all pandemic ICUs.
 - Begin returning ICUs to normal function as possible. MB6B/G remains a pandemic ICU.
 - All services share remaining ICUs for non-pandemic patients.
 - Domitilla building is entirely pandemic patient care.
 - As required, patients will be doubled in all rooms; begin to return rooms to standard occupancy.
 - As required, altered standards of care will be in place throughout SMH.
 - Institutional decisions to remove altered standards of care made as soon as possible.
 - Ei 92 converted to medicine unit.
 - Pediatric pandemic patients occupy Fr 3B/C and Fr 2B/C; if capacity overwhelmed, pediatric pandemic patients will be cohorted on Dom 3.

3. Flow of outpatients and hospital admissions controlled.

- Upon first case, all Mayo entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout the pandemic.
- Control of admissions from Mayo Health System and regional hospitals centralized with goal of keeping as many patients as possible in local hospitals.
- Entrance to Domitilla will be restricted as floors are converted to pandemic floors.
- Off-site fever clinics established and staffed by Mayo personnel.

4. Elective patient volume reduced to allow room for pandemic patients.

- Rescheduling patients for elective surgery begins.
- Elective surgical volume reduced.
 - o Closed surgical capacity re-opened as possible.



WEEK 8 MODERATE FLU PANDEMIC – MAYO CLINIC

Table A5-15. Planning Template for Week 8 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	General care	ICU	Mechanical ventilation	Deaths
1,500	85	162	3.5%	2,250	45	39	6	3	11

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-16**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-16. Formula to Calculate Week 8 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.035	=			-		=	

Institutional Assumptions and Plan

1. HICS activated

2. To the extent possible, hospitalized patients will be located at SMH.

- Pandemic patients cohorted.
 - o MB6B/G, MB7D/E, MB8D/E all pandemic ICUs.

- ICUs returned to normal function as possible. MB6B/G remains a pandemic ICU.
 - All services share remaining ICUs for non-pandemic patients.
 - Domitilla building is entirely pandemic patient care.
 - As required, patients will be doubled in all rooms; begin to return rooms to standard occupancy.
 - Return to normal standards of care.
 - Ei 92 returns to Orthopedics.
 - Pediatric pandemic patients occupy Fr 3B/C and Fr 2b, Fr 2C returns to Colorectal.
- 3. Flow of outpatients and hospital admissions controlled.**
- Upon first case, all Mayo entrances will be controlled with patient/staff/visitor screening. This will remain in place throughout the pandemic.
 - Control of admissions from Mayo Health System and regional hospitals centralized with goal of keeping as many patients as possible in local hospitals.
 - Entrance to Domitilla will be restricted as floors are converted to pandemic floors.
 - Off-site fever clinics established and staffed by Mayo personnel.
- 4. Elective patient volume reduced to allow room for pandemic patients.**
- Rescheduling patients for elective surgery begins.
 - Elective surgical volume reduced.
 - Closed surgical capacity re-opened as possible.



WEEK 9 MODERATE FLU PANDEMIC – MAYO CLINIC

Table A5-17. Planning Template for Week 9 Moderate Flu Pandemic

Regional patients newly sick	Mayo staff newly sick	Mayo dependents newly sick	Potential Mayo absenteeism ^a	Seeking outpatient care	Hospitalized	General care	ICU	Mechanical ventilation	Deaths
0	0	0	2.6%	750	15	13	2	1	4

^aTo calculate the absence rates for your department for this week, use the formula in **Table A5-18**. For the purposes of this calculation, the figure used should be numbers of individuals, not full-time employees.

Table A5-18. Formula to Calculate Week 9 Departmental Absence Rates

Total department staff	X	Absentee rate	=	Total staff absent	Total department staff	-	Staff absent	=	Staff available
	X	0.026	=			-		=	

APPENDIX SIX

COMMUNICATION TEMPLATES

A series of communication templates are provided here for your use. These do not have to be “high tech” or electronic. Handwritten or word processing files should be sufficient.

Table A6-1. Critical Care Personnel Recall Roster Template

Name		Phone Numbers				Work Address	Home Address				Email Address		Essential	Position
Last	First	Work	Home	Cellular	Pager	Work Location	Street	City	Zip	State	Work	Home	Y (Yes) N (No)	

Function of Key Personnel

- Initiate disaster procedures for their service/unit/department.
- Notify other personnel to report for duty as needs arise.

Table A6-2. Disaster Recall List Survey

DEPARTMENT: _____ DATE: _____ TIME: _____

Instructions: List all department staff members and responses received. Forward this list to the command center.

Name	Position	Response (coming in, not home, message left, etc)	Expected Arrival Time (in military time)

Notification Instructions

- Notify each of the key personnel listed on the master list.
- Notify alternate personnel as listed if:
 - The primary person cannot be reached.
 - The primary person requests the alternate be notified.

Note: The switchboard, administration, and nursing office have a master list of names/telephone numbers for each department. It is the responsibility of every department head to ensure that the list is kept up to date.

Method of Communication: Personnel are required to wear their identification cards as per facility policy.

Notification Telephone List: Duties

EXTERNAL DISASTER

Policy: In a disaster the CHC will have a system to announce the disaster and appropriately notify the staff.

Purpose: To ensure command will activate disaster notification and staff notification in a disaster.

Procedure:

(References to “Code Orange” are used as example only. Check with your local/state hospital emergency groups to determine their code color standards.)

1. The incident commander will call the switchboard to announce “CODE ORANGE – EXTERNAL” or “EXTERNAL CODE ORANGE.”
2. Switchboard is to announce “CODE ORANGE – EXTERNAL” or “EXTERNAL CODE ORANGE” with the location via the overhead paging system and over the pocket pagers of the emergency management team.

Emergency Management Team Responds to Command Post

- CEO
 - Nursing administrator
 - Medical director
 - Director of security
 - Plant operations director
 - Chairman of the emergency management committee
 - IT staff
3. Switchboard is to initiate the appropriate call list for external disasters.
 4. Communications will dispatch an operator to the command post to cover the “Information Phone.”
 5. If the situation is cleared, the switchboard will be notified by the administrator in charge and an operator will announce “CODE ORANGE – EXTERNAL – CLEAR.”

Table A6-3. Situational Briefing Tool with Universal Communication Format: SBAR

<p>Situation Why am I calling?</p>	<p>What's now happening? What is the situation? Urgent issues?</p>	<ul style="list-style-type: none"> ■ Urgent concerns and immediate needs up front ■ Agency name and unit number ■ Trauma destination decision or high risk ■ ETA to trauma center, patient's age and gender
<p>Background What will the provider need to know?</p>	<p>What has happened? What happened up to this point? Past history?</p>	<ul style="list-style-type: none"> ■ Mechanism of injury/injuries sustained ■ Chief complaint, major injuries, level of consciousness ■ Basic scene information
<p>Assessment What is the patient's current status?</p>	<p>What may happen? How is the patient now? Stable/unstable?</p>	<ul style="list-style-type: none"> ■ Primary survey and pertinent positives ■ Report abnormal values, vital signs, altered level of consciousness
<p>Response/ Recommendation What is needed from the healthcare provider?</p>	<p>What should happen? What field care was performed? Was it effective?</p>	<ul style="list-style-type: none"> ■ Treatments and patient's response ■ Restate concerns ■ Respond to questions ■ Request consultation or handoff

SBAR, an evidenced-based communication model developed in the military, is widely used in many industries, including aviation and healthcare, to make sure the right information gets to the right people in the shortest timeframe. It is currently the communication standard of care in many emergency departments in the United States because it has been so effective in improving communication among all types of healthcare providers.

- These guidelines outline the priority information that must be related to the recipient during patient care handoff so that information critical to patient care is not missed.
- The format emphasizes primary urgent concerns and empowers the healthcare provider to advocate for the patient.
- These guidelines are to be used in a flexible manner that meets the needs of the situation encountered.

Before calling the healthcare provider, follow these steps (as appropriate):

- Assess the patient personally before calling.
- Discuss the situation with the ward nurse.
- Review the chart for appropriate licensed independent provider to call.
- Know the admitting diagnosis and date of admission.
- Read the most recent progress notes.
- Have available the following when speaking with the LIP:
 - Patient's chart
 - List of current medications, allergies, IV fluids, and most recent labs
 - Most recent vital signs
 - When reporting lab results: provide the date and time test was done and results of previous tests for comparison
 - Code status

APPENDIX SEVEN

RUSH UNIVERSITY MEDICAL CENTER COMMUNICATION PROTOCOLS FOR NURSING PERSONNEL

Rush University Medical Center has graciously granted permission to include this policy document. It outlines the following:

- Policy and communications expectations for supervisors and nursing staff following a disaster event
- Protocols for response
- A self-assessment survey for staff members that helps to quantitate their ability to report for duty immediately following a disaster event



NURSING DIVISION UNIT PHONES TREES FOR DISASTER RESPONSE GUIDELINES

Purpose: To ensure a positive staffing response to surge plan needs by keeping unit staff phone trees current through the utilization of staff self-assessments and the One-Staff database

General Guidelines

1. All Nursing Division units will have their clinical staff complete a *Staff Self-Assessment for a Prioritized Phone Tree Survey*. (See **Figures A7-1** and **A7-2** at the end of this appendix.)
2. Completed surveys will be given to each department's controller for data entry into the One-Staff database.
3. Upon completion of data entry, the surveys are returned to unit leadership to be placed in employee's file.
4. The *Staff Self-Assessment for a Prioritized Phone Tree Survey* will be added to each unit's specific orientation checklist. All new employees will complete the survey during unit orientation.
5. Controllers will update the One-Staff database with all staff change notices.
6. Unit leadership should review the information on the phone tree for accuracy with each employee annually, during employee evaluations. Please notify the controllers of any changes needed.
7. The controllers will print a unit-prioritized phone tree for each unit director as requested, and minimally on a quarterly basis as follows: during the first week of the months of January, April, July, and October.

8. A copy of all unit phone trees will be kept in a binder in the Nursing Division's Director of Operations Office in _____.
9. A copy of the prioritized phone tree must be readily available to all unit charge nurses. Unit directors will ensure all unit leaders have copies for their residences and copies in their offices.

Phone tree reports are created for each of the clinical departments in the One-Staff database.

The names are as follows:

XXX LEVELS (Med-Surg)

XXX LEVELS (ACC)

XXX LEVELS (W&C)

XXX LEVELS (Psy)

XXX LEVELS (JRB)

XXX LEVELS (PeriOplnt)

Figure A7-1. Communication with Clinical Staff to Obtain Phone Tree Information

Dear _____ Staff Member:

The Division of Nursing has worked on a program for ensuring staffing during serious health emergencies. We have developed an innovative tiered call-in system for emergencies. We believe that if we collaborate with staff that we can ensure staff accountability for responding to emergency calls. We think such a system will work because it respects staffs' personal and professional commitments. This will provide Rush Medical Center with excellent staff responses to emergencies and employees with a personal sense of excellence and effectiveness.

Serious health emergencies (an influx of patients to a hospital or emergency room) pose a challenge to healthcare workers. Their obligations to their professional vows and to their employer compel them to respond to a request for emergency aid. At the same time, many people have a variety of compelling personal obligations as well, which may make an immediate response difficult.

We trust our staff to fairly and accurately assess the amount of time it would probably take them to be able to respond to a call-in for a serious health emergency or mass casualty event. We can use the staff self-assessment to prioritize our call-in tree.

The ability to prioritize our call-ins should make a more efficient process, and using the staff's self-designations should make it more effective. Such a system also might ensure our ability to have adequate staff if the emergency were to persist for 2 or 3 days.

Please fill out the attached form and return it to your unit director by _____ . Your cooperation with this project is greatly appreciated. If you have questions, feel free to contact your unit director or the project coordinator.

RUSH UNIVERSITY MEDICAL CENTER
COMMUNICATION PROTOCOLS FOR NURSING PERSONNEL

Figure A7-2. Staff Self-Assessment for a Prioritized Phone Tree Survey

Please complete the following data.

Name:	Contact numbers in order of preference	Please circle type of contact number.
Address:	1. () -	Cell, Home, Pager, Other
City:	2. () -	Cell, Home, Pager, Other
State: Zip:	3. () -	Cell, Home, Pager, Other
Position: Shift:	ICE: (in case of an emergency)	Cell, Home, Pager, Other
ACLS Certified: Yes No	PALS Certified:	Yes No

Please answer the following questions.

<p>In what amount of time could you be available to respond to a Code Triage II or serious health emergency? Please circle one choice.</p> <p style="text-align: center;"> <input type="radio"/> Less than 2 hours <input type="radio"/> 2-4 hours <input type="radio"/> 5-7 hours <input type="radio"/> 8-12 hours <input type="radio"/> 13-24 hours <input type="radio"/> 25-48 hours <input type="radio"/> More than 48 hours </p>			
<p>What personal issues would you need to address before coming to work in an emergency? Circle all that apply below.</p> <p style="text-align: center;"> <input type="checkbox"/> Child care <input type="checkbox"/> Dependent adult care <input type="checkbox"/> Pet care <input type="checkbox"/> Transportation </p>			
<p>What is your primary mode of transportation to work?</p> <p>What is your secondary mode of transportation to work?</p> <p>What is the distance in miles that you travel to come to work? _____ miles</p>	<p>Is public transportation available to you?</p> <p>Circle one. Yes No</p> <p>If yes above, what modes of public transportation are available? Circle all that apply.</p> <p style="text-align: center;"> <input type="checkbox"/> Walk <input type="checkbox"/> Bicycle <input type="checkbox"/> Bus <input type="checkbox"/> El train <input type="checkbox"/> Metra train <input type="checkbox"/> Cab </p>		
<p>Based on your ability to respond to a call-in for additional staffing in response to a Code Triage II emergency, please select a prioritization category.</p> <p style="text-align: center;"> Circle one choice below. a. Level I: I could respond within 4 hours. b. Level II: I could respond within 24 hours. c. Level III: I could respond in 48 hours or more. </p>			

Return completed survey to your supervisor.

APPENDIX EIGHT

ICU LESSONS FROM A MASS CASUALTY INCIDENT

The views expressed in this chapter are those of the author and do not necessarily reflect official policy of the U.S. Government or the Department of Veterans Affairs.

On September 11, 2001, terrorists crashed American Airlines Flight #77 into the Pentagon at 9:37 AM, causing 189 deaths. The initial organized medical response to this event was conducted by the Pentagon's own health facility, the 200-person DiLorenzo Tricare Health Clinic, which successfully executed its response in large part due to its predisaster preparations. Although the response came in a prehospital setting, the processes and lessons learned serve as a template for ICU leaders' disaster preparations.



EVENT: SEPTEMBER 11 ATTACK ON THE U.S. PENTAGON

Preparation

Disasters, or mass casualty incidents (MCIs), are multiagency events more complex than simply the medical component. The burgeoning disaster medicine literature can guide ICU disaster planners during their planning process, as was done at the Pentagon.

A *hazard vulnerability analysis* (HVA) critically attempts to look at the most probable disasters facing an organization. If a transportation accident is likely, then the impact on an ICU would be minimal — a short surge. However, a mass-inhalational accident would have a profound effect. For the Pentagon, terrorist bombings and transportation accidents due to the proximity of major roads and the Ronald Reagan Washington National Airport appeared to be the most likely events.

With this HVA, a review of applicable literature, and lessons learned previously, the DiLorenzo Tricare Health Clinic embarked on a defined series of preparations, actions which translate well to ICUs:

- **Emphasis by leader.** The organization knew this was a leadership priority.
- **Timeline.** Objectives were developed and a defined timeline was established.
- **Normal processes.** The clinic looked at normal emergency response efforts and developed refinements for an MCI.
- **Equipment.** Missing or damaged equipment was replaced. New equipment was added based on the HVA, including backpacks for medics' equipment and triage tags. Coordination with the local, responding emergency medical services (EMS) involved communications procedures and identifying gear, such as blue vests for medical personnel.

- **Training.** Individuals received training on traumatic injuries, building maneuvers, communications, and other individual skills. The clinic underwent a leader-blinded tabletop exercise with a compressed series of events delivered in sequence via slide presentation, along with simulated radio traffic. This exercise, held on May 24, 2001, simulated the crash of a commercial aircraft into the west side of the Pentagon.

Like the Pentagon's clinic, ICUs need to work within an organizational framework. Knowing the chain of command translates directly into both an effective disaster response capability and improved patient care. At the Pentagon, important contacts and interactions with building leadership and the local EMS directly benefited communications, response, and recovery operations on 9/11. ICUs also must accomplish this interaction, ie, moving from day-to-day organizational structure into the facility's disaster organization, such as the hospital incident command system.

Response

The disaster on 9/11 was a no-notice, sudden impact event. While the news had begun to spread about the New York City attacks, no definite warning was issued. Medics with prepackaged emergency backpacks deployed to the scene and established casualty collection points. Because the threat of another inbound aircraft existed, community response was delayed; thus, evacuation of casualties used private vehicles. Casualties had a variety of predicted traumatic injuries, though the prevalence of burns and eye injuries was not expected. Getting oxygen to patients was difficult. Also challenging was the large number of stressed, worried well patients. Finally, with a progressively increasing need for security, access for medical personnel was guaranteed only because of the blue EMS vests purchased during preparations.

The previously recognized need for radios helped maintain communication with clinic leaders as they moved around the scene. With cell towers overwhelmed, backup radios, pagers, and land-lines proved invaluable. The use of runners carrying messages was especially effective. Communication with senior leaders was simplified by a prearranged series of reports or conversations, thereby allowing ongoing rescue efforts without random interruptions.

Finally, with so many agencies and groups involved, recognition of the command relationships became increasingly challenging. In spite of a large military response, the local Arlington Fire Department and EMS took charge, highlighting the importance of the relationships the clinic had established.

Recovery

Often under-recognized are the energies needed to reestablish organizational operations. Key is caring for the responders – their physical and mental health and

that of their families. Important human resources actions must also occur, such as documentation of injuries, illnesses, or toxic exposures, as well as acknowledgment via appropriate service awards. Equipment must be refurbished or replaced and supplies reordered, all with detailed accounting to facilitate the eventual requests for reimbursement.

Media interviews and requests are best managed with the assistance of trained public affairs spokespersons. The principles of risk communication are important in meeting the needs of the public and media, as well as the organization's people and their families.

The pace of recovery can be slowed because of personnel fatigue, missing supplies, and damaged or compromised treatment space. At the Pentagon, as in ICUs, rapid return to "normalcy" took priority because of ongoing patient care demands. The DiLorenzo Tricare Health Clinic opened for disaster-related and routine appointments on 9/12. Fortunately, with a robust recovery plan, the clinic was prepared for the events surrounding the anthrax release in Washington, DC, 1 month later.



RELEVANCE TO CRITICAL CARE AND LESSONS LEARNED

Preparation

1. ICU personnel must integrate into the facility's and region's interagency disaster planning.
2. Normal hospital and ICU organizational structures may change during a disaster (hospital incident command system).
3. Redundant communications should be planned to aid response efforts.
4. The literature of disaster medicine aids planning.

Response

1. Communication between the scene and the hospital is usually fragmented.
2. Following a sudden impact disaster, the least injured arrive first by their own means; patients with more severe injuries arrive by ambulance later, but usually within 3 hours.
3. Schedules should be adjusted early, sending some providers home during the event to return refreshed later, prepared for sustained operations.
4. The media and VIPs will arrive; the ICU should be secured to prevent voyeurs.

Recovery

1. The well-being of the ICU staff and their families should be heeded.
2. Damaged equipment must be refurbished and supplies restocked.
3. The aftermath lasts longer than the response.
4. The lessons learned and other information should be gathered to share with the academic community.



SUGGESTED READINGS

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APPENDIX NINE

LONG-TERM ICU AND HEALTHCARE LESSONS LEARNED FROM THE 2003 SARS PANDEMIC



SUMMARY: TORONTO SEVERE ACUTE RESPIRATORY SYNDROME (SARS) OUTBREAK

In late 2002 and early 2003, a novel virus, the severe adult respiratory syndrome (SARS)-associated coronavirus, was spreading throughout China's Guangdong province.^{1,2} Despite thousands of cases of illness and hundreds of deaths, the world remained virtually unaware of the situation until February 21, 2003, when one physician flew from China to Hong Kong for a family event, checked into the Hotel Metropole, and brought SARS to the rest of the world. Eleven individuals from that same hotel then boarded planes and flew to six countries, initiating chains of transmission that would ultimately result in thousands of cases of illness and hundreds of deaths worldwide, including the transmissions within Hong Kong.

On February 23, 2003, an elderly couple staying at the Hotel Metropole returned to Toronto. The wife (Toronto's index case) subsequently fell ill and died at home on March 5. Her 43-year-old son also became ill and was admitted to the hospital for treatment of possible tuberculosis. This hospitalization initiated the spread of SARS within Toronto's hospital system and, to a limited degree, to the public; all but three of the subsequent 225 cases of SARS in Toronto can be traced back to the index case.³ Despite this, not until March 13 was the first case of SARS diagnosed in Toronto, and significant public health control measures to contain the outbreak were not instituted for another 10 days.

Even after the cluster of cases was identified and clinically recognized to be SARS based upon the symptoms and epidemiologic links, virtually nothing was known about the illness other than people became critically ill and many died. No one knew the mode of transmission, incubation period, agent causing the illness, or any possible treatments. Faced with this uncertainty, the fear among both the public and healthcare workers (HCWs) was significant. This was further compounded by the fact that, given the extensive unrecognized chains of transmission, cases seemed to pop up everywhere across the healthcare system in Toronto, with 58% (11 of 19) of hospitals ultimately experiencing intrafacility SARS transmissions. Adding to the fear was the fact that, in some situations, transmission occurred despite the use of personal protective equipment (PPE).^{4,5} To contain the outbreak, extensive control measures were deployed, including severely restricting entry to all hospitals; screening for symptoms in all persons entering a hospital; suspending all patient transfers between hospitals; suspending all nonessential services at affected hospitals; restricting staff movement between hospitals; requiring airborne PPE for all patient care in any healthcare setting; requiring N95 masks to be worn at all times in a hospital; use of enhanced PPE for high-risk aerosolizing procedures; social distancing

measures within hospitals; curtailing mass gatherings; and quarantining 23,103 case contacts.

On May 11, 2003, the SARS outbreak was declared over by the provincial government and, on May 14, the World Health Organization removed Toronto from the list of SARS-affected areas, given the absence of reported new cases for two incubation periods. Despite the seemingly successful resolution of the outbreak in Toronto, a new cluster of SARS cases was identified on May 23, traced back to an acute care hospital in Toronto in which a chain of transmission had gone unrecognized.⁶ This led to a second phase of the outbreak, with an additional 77 cases added to the 148 cases from the first wave. This second wave was primarily restricted to healthcare settings and quickly halted following reinstatement of control measures.

The SARS experience of Toronto can be contrasted with that of Vancouver. On March 6, 2003, a couple who had stayed at the Hotel Metropole simultaneously with the Hong Kong index patient returned to Vancouver. Both had symptoms of SARS⁷ and went directly from the airport to their physician. The wife only had a mild illness and was sent home; the husband was sent to the emergency department, where he was placed in airborne isolation within 15 minutes of arrival. Subsequently he deteriorated and required admission to the intensive care unit, where he eventually recovered fully from his disease as did his wife. None of the 148 HCWs who were in contact with the husband ever developed SARS, and no secondary transmissions were documented from these two cases. The primary difference between the events in Toronto and Vancouver is that the British Columbia Centres for Disease Control, based on data from external sources reporting a cluster of atypical pneumonia, issued a notice to all healthcare facilities on February 20 urging enhanced vigilance and isolation for atypical cases of severe pneumonia in persons returning from China. Therefore, the hospital in Vancouver was on the watch for potential cases.



RELEVANCE TO TODAY AND CLINICAL TEACHING POINTS

The experience with SARS resulted in many lessons learned across the spectrum of healthcare, from the individual patient or critical care HCW through to public health and governments. The Toronto SARS outbreak led to a complete reorganization of the provision of critical care and public health across the province of Ontario, as well as changing how patients move between hospitals. Internationally, SARS was the trigger for revision and significant strengthening of the International Health Regulations.^{8,9}

The most direct impact in critical care units was on the HCWs caring for patients in ICUs. SARS was a major eye-opening event for HCWs, hospital administrators, government, and the public, reminding us that healthcare delivery carries a real risk of harm, be it physical or psychological. For the first time in modern Western

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medical systems, a significant number of HCWs lost their lives as a result of an infection they acquired while treating patients. The loss of colleagues, and working in an environment with many uncertainties, contributed to a significant psychological impact on many of the HCWs caring for patients with SARS.¹⁰⁻¹² Over the decades following the 1918 pandemics and World Wars, healthcare came to be viewed as a “safe” profession, free of significant risks such as those commonly assumed for police, fire, or emergency medical personnel. The realization of these risks has important implications for preparedness planning and highlights issues such as HCWs’ duty to care and the potential impact of absenteeism during bioevent disasters.¹³⁻¹⁷ Despite these negative effects, the Toronto experience also showed people’s capacity to carry on in the face of adversity and to care for their fellow humans.

A critical aspect of any future response to an infectious disaster will be the need to mitigate the risks to HCWs and the impact of fear, so as to maintain a sufficient workforce. One approach to structuring protection for HCWs during a bioevent disaster is to use the occupational health framework of rings of protection: PPE, environmental engineering, administrative controls, and quality control.⁵ During the SARS outbreak, it quickly became apparent that when facing a novel infectious disease, it is essential to assume potential airborne transmission and use appropriate PPE, with enhanced PPE for high-risk procedures. Failure to do this will result in illness in HCWs, which increases fear among their colleagues. Another lesson learned was that provision of PPE supplies alone is insufficient to effectively protect HCWs. Staff also require training on the proper use of PPE and initiating processes such as “buddy checking” to prevent lapses when HCWs are stressed or fatigued. SARS also reminds us that PPE should be viewed as the last, not the first or only, line of defense. Engineering controls to establish large negative pressure environments with high air exchange are an essential component in controlling an outbreak. Building appropriate environments, or the ability to easily modify existing areas to become isolation units, requires consideration during facility design, advanced planning, and engagement of nonclinical staff, such as engineers.¹⁸ Finally, staff require policies and procedures (administrative controls) to guide their response during outbreaks, such as “protected code blue,” screening patients for febrile respiratory illnesses, and plans by the institution to support employees during the crisis.

Patient management during SARS was significantly hindered by the lack of research and evidence to inform the best approach to what was initially an unknown agent. Despite the success of basic scientists to network and rapidly identify the causative organism,¹⁹⁻²³ it was not possible to conduct real-time clinical research during the outbreak to inform patient management. As a result, several empiric treatments were of no utility, and some may have been harmful.¹ There is a desperate need to

develop the capacity to perform rapid research, analyze the results, and disseminate them to effectively manage an outbreak of a novel infectious agent. During the 2009-2010 H1N1 pandemic, this need again went unmet, but efforts are underway to meet the challenge in the future.^{24,25}

In addition to lessons learned at the level of individual patients and HCWs, the SARS experience provided innumerable lessons at the system level. One of the first lessons was the impact of modern air travel; in the space of just over 1 week, SARS was transformed from an epidemic contained for several months in a remote Chinese province to a global pandemic. Therefore, local institutions must be aware of what is happening on the other side of the planet because tomorrow it could be in their ICU. Further, not only did SARS illustrate the degree of global travel, it also highlighted the immense degree of interconnectivity between local healthcare facilities caused by the movement of staff and patients between institutions.²⁶ Hospitals are not isolated islands but rather nodes in a complex web of a community's healthcare delivery network. This network concept was also highlighted by the need to establish coordination and communication between institutions to mount an effective response to SARS.^{14,27} Further, the interconnectivity of healthcare institutions revealed the vulnerability of their supply chains. Toronto hospitals participate in joint purchasing consortia to obtain bulk discounting for supplies. The purchasing organization operates on a just-in-time delivery model, minimizing costs such as warehousing. However, when an outbreak affects a broad region, this supply system falls apart because suddenly all hospitals look to a single common source for extra supplies. Thus, if these types of systems are to be used, stockpiling processes are essential. Finally, in attempts to manage and control the spread of SARS, the healthcare system shut down all nonessential care and severely restricted access to healthcare facilities. These actions had significant economic and other collateral consequences.²⁸⁻³¹

Although the SARS experience in Toronto and globally took a great human toll in lives lost or forever changed, it also taught valuable lessons about both the strengths and vulnerabilities of the current healthcare system. The final lesson we must not fail to learn is that preparing for and managing the outbreak are not the only aspects of a response. Recovery from the event is an often-overlooked and inadequately executed aspect that requires significant planning and resources. Failure to have an adequate recovery plan resulted in phase II of the Toronto outbreak. To use an analogy from firefighting, the healthcare system and public health failed to make sure that all the smoldering embers of the outbreak were extinguished before everyone packed up and went home. The result was that a smoldering chain of transmission ignited another large outbreak. The recovery phase of any disaster plan requires the same attention as earlier phases.

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**COMPLEX ICU ISSUES THAT ARISE DURING
AN INFLUENZA PANDEMIC****CASE STUDY: DESCRIPTION OF EVENTS**

A 33-year-old obese woman at 26 weeks of her first pregnancy presented to a local community hospital in June 2009 with dyspnea, abdominal cramps, and loose stools of 4 days' duration. She had fever, rhinorrhea, and dry cough. Her chest radiograph showed bilateral lower lobe infiltrates, and she was admitted. As she had little clinical response to intravenous fluids, antibiotics (ceftriaxone and azithromycin), and bronchodilators, she was transferred to a tertiary facility for close monitoring.

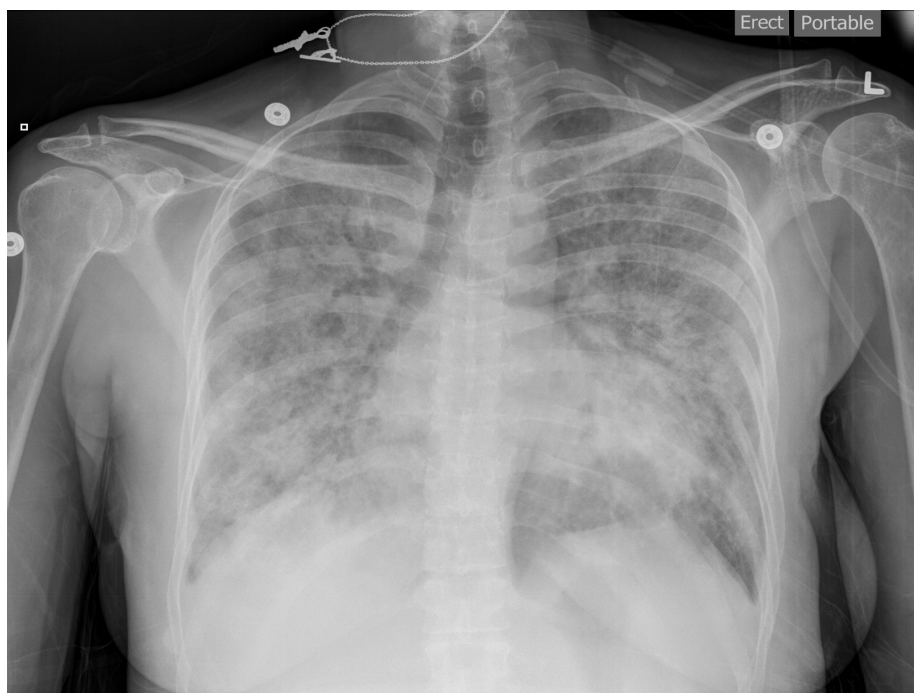
The patient had no known medical problems apart from obesity. Her prepregnancy body mass index was 45 kg/m². Her pregnancy had been largely unremarkable before this, although she had missed her prenatal appointments. She smoked half a pack of cigarettes for 10 years but stopped 1 year before her pregnancy. She had used marijuana several years ago but denied current use. She gave no significant history of travel but had spent a few days with her 4-year-old niece, who had an upper respiratory tract infection, 5 days prior to her own illness.

Within 12 hours of admission, she developed worsening dyspnea and marked hypoxemia. She was treated with noninvasive ventilation (NIV) for 7 hours but remained hypoxemic and in respiratory distress. She was transferred to the ICU, emergently intubated, and placed on mechanical ventilation.

Initial ICU Course

Her clinical findings were consistent with severe acute respiratory distress syndrome (ARDS): bilateral worsening interstitial lung infiltrates on radiograph (**Figure A10-1**), the partial pressure of arterial oxygen (Pao₂)/fraction of inspired oxygen (Fio₂) ratio was 80, and echocardiography demonstrated normal left heart function. Diagnostic data and laboratory findings are found in **Table A10-1**.

Continuous fetal monitoring was started, and the patient was evaluated by the obstetrics and gynecology service. No fetal distress was initially noted, but neonatal resuscitation equipment was placed at the bedside. Bedside fiberoptic bronchoscopy and bronchoalveolar lavage (BAL) were performed. A BAL sample was sent for bacterial, atypical organisms, and viral studies, including influenza A polymerase chain reaction (PCR).

Figure A10-1. Chest Radiograph**Table A10-1. Diagnostic Data and Laboratory Findings**

	On ICU Admission	28 h Post-ICU
Heart rate, beats/min	114	47
Blood pressure, mm Hg	109/60	75/40
Temperature, °C (°F)	38.7 (101.7)	40 (104)
pH	7.31	7.17
Pao ₂ /PaCo ₂ , mm Hg	81/39	43/58
Fi _o ₂ /PEEP	1.0/14	1.0/on APRV (P high 34 cm/H ₂ O, T high 4 sec)
White blood cell count, per mL	4.6 (52% lymphocytes, 4% bands)	11.2 (73% neutrophils, 9% bands)

Abbreviations: Fi_o₂, fraction of inspired oxygen; PEEP, positive end-expiratory pressure; APRV, airway pressure release ventilation; P, pressure; T, time

The patient was placed in droplet isolation after arrival to the ICU. Antibiotic coverage was broadened to include vancomycin, piperacillin/tazobactam, azithromycin, and oseltamivir (75 mg via nasogastric tube twice daily). PCR results from the nasopharyngeal swab obtained at admission were reported as negative for influenza A; however, antiviral treatment was continued.

Despite best efforts, arterial hypoxemia persisted. Arterial oxygen saturation (SpO_2) ranged from 85% to 90% despite an F_{iO_2} of 1.0 (100%) and positive end-expiratory pressure as high as 16 cm of H_2O . On conventional modes of mechanical ventilation – such as volume control, pressure-controlled ventilation, or pressure-regulated volume control – she had little improvement, and her respiratory mechanics were marked by elevated peak inspiratory and plateau pressures. She was heavily sedated with fentanyl and propofol infusions. The dose of fentanyl was as high as 300 μg /hour, while the propofol drip was increased to 4 mg/kg/h. Neuromuscular blockade was started with cisatracurium infusion.

Airway pressure release ventilation (APRV) was initiated 10 hours after ICU admission, at which time she responded with SpO_2 increasing 93% to 95%. Simultaneously, the patient was started on a furosemide drip at 10 mg/h.

Acute Cardiopulmonary Collapse

Approximately 28 hours after ICU transfer (day 2), the patient acutely deteriorated with the development of markedly bloody copious tracheobronchial secretions, worsening hypoxemia (SpO_2 68% to 77%), temperature 40°C (104°F), acidosis, and hypotension. Within a few minutes, she developed severe bradycardia, and acute fetal distress was noted.

Cardiopulmonary resuscitation (CPR) was initiated immediately. The patient received intravenous cardiac stimulants (epinephrine and atropine boluses), sodium bicarbonate, and bag-valve ventilation while the obstetrical team delivered the baby by emergency caesarean delivery. The baby underwent 4 minutes of CPR and was taken to the neonatal ICU.

The patient's endotracheal tube was filled with excessive amounts of hemorrhagic fluid, a significant impediment to effective ventilation. The endotracheal tube was replaced and bedside fiberoptic bronchoscopy resulted in the aspiration of a large amount of bloody respiratory secretions. Due to her tenuous state, extracorporeal membrane oxygenation (ECMO) was contemplated. As administrative and resource preparations for ECMO were being undertaken, inhaled nitric oxide (iNO) was started. The patient's condition began to stabilize. Over a few hours, her SpO_2 improved on APRV, returning to mid-90%.

Subsequent ICU Course

Over the next few days, a superimposed bacterial pneumonia with sepsis became apparent. Her admission BAL PCR was positive for influenza A (novel H1N1 swine variety), despite the early negative result on the nasopharyngeal swab. Bacterial respiratory cultures taken at the time of her marked respiratory deterioration (48 hours) grew methicillin-sensitive *Staphylococcus aureus*. She received oseltamivir for 5 days. Treatment of the *S. aureus* infection was continued for 10 days. Her condition worsened again at day 9, and oseltamivir was reinitiated for 5 additional days. She developed acute renal failure requiring temporary hemodialysis.

The patient stayed on mechanical ventilation for 19 days (APRV, 13 days; iNO, 11 days). She remained in the ICU for 26 days and in the hospital for 41 days before she was discharged to a rehabilitation facility.



EVALUATION OF CRITICAL CARE PROBLEMS ENCOUNTERED

- **Triage.** The patient's predominant gastrointestinal and mild respiratory symptoms initially indicated a moderate pre-test probability of influenza. However, when treatment for community-acquired pneumonia was started, the likelihood of an influenza diagnosis increased. Based on her chest radiograph and other features, would an early direct ICU transfer have been indicated? Similarly, the use of NIV for diffuse pneumonitis or bronchopneumonia-related respiratory failure has questionable success. Early recognition of NIV failure, ICU evaluation, and intubation can preempt the fulminant respiratory decline.
- **Resource availability and utilization.** Two distinct resource-related issues were encountered in this case. Mobilization of the obstetrics-gynecology team, fetal monitoring, and anticipatory placement of caesarean/neonatal resuscitative equipment in the ICU proved successful. On the other hand, attempts to assemble an ECMO team were marred by lack of organized ECMO team protocols.
- **Protection of healthcare workers (HCW).** It was clear that HCWs were exposed to the novel H1N1 variety of influenza A in at least three locations before ICU admission: the referring hospital's emergency department, medical ward, and the monitored high-acuity unit in the institution. Nurses, respiratory therapists, and physicians were tracked and notified. Prophylactic oseltamivir was provided for 13 nonimmunized HCWs. Prophylaxis was also provided to an additional 15 personnel involved in the CPR and caesarean delivery due to potential exposure to hemorrhagic respiratory secretions.
- **Patient flow.** As described earlier, early admission to the ICU with quicker resolution of acute illness and shorter length of stay are potential outcomes.

- **Ethical dilemmas.** Timing and selection of patients for salvage therapies like ECMO is extremely difficult in such instances. Pregnancy further complicates decision making, not only for ECMO but also for the use of benzodiazepines, antibiotics, neuromuscular blockers, and alternative modes of ventilation, with the potential of decreasing venous return compromising cardiac output.



CRITICAL CARE CONSEQUENCES

A case of severe, highly complicated, and potentially lethal, “fulminant” novel H1N1 influenza was encountered by the ICU team. Unconventional resuscitative efforts and emergency delivery of the fetus were undertaken by a multidisciplinary team effort. Intensivists, nurses, respiratory therapists, and obstetric and neonatology teams were involved in a complex coordinated endeavor. After this event, the following ICU actions were taken:

- Development of a triage and risk stratification algorithm for patients with community-acquired pneumonia and hypoxemia transferred from emergency departments and referring hospitals.
- Modification or development of guidelines for ARDS management, with particular emphasis on salvage maneuvers (ECMO, high-frequency oscillatory ventilation, iNO, prone positioning) and alternate modes of ventilation such as APRV.
- Continuing education programs for nursing, respiratory personnel, and physicians
- Immunization drive for HCWs
- Review of infection control policies (isolation practice, etc)
- Collection of epidemiologic data



LESSONS LEARNED

This case illustrates the intricacies of managing H1N1 influenza-associated severe ARDS. From triage to diagnosis, to management and salvage, the major lesson learned was that many unanswered questions about this condition remain. Some clinical and administrative gray areas were identified:

1. Negative nasopharyngeal swabs may miss highly suspect cases. Is there a role for more frequent testing and/or paired tracheal aspirate or BAL and nasopharyngeal testing?
2. Is there any role for NIV in diffuse pneumonitis? Should intubation be early and preemptive?

3. Hemorrhagic alveolitis and edema may be resistant to positive end-expiratory pressure, but are they sensitive to diuretics? Alternate advanced ventilator modes like APRV are probably needed sooner in the course of ARDS.
4. Criteria and risk stratification development for frequently needed salvage therapy (high-frequency oscillator ventilation, iNO, ECMO) are required. Associated issues relate to manpower and cost-effectiveness.
5. Massive sedative and neuromuscular blocking agent use can be required. Medication supply and availability must be ensured.
6. What is the dose and duration of antiviral therapy? The oseltamivir dose for severe pneumonitis has varied from 150 to 300 or 450 mg/day. Similarly, should the duration of therapy for severe cases be 5 or 10 days?
7. The presence or development of hemorrhagic pulmonary edema likely represents increased severity and may predict the need for salvage maneuvers.
8. Is there a role for steroids?
9. What are the risks to pregnancy?
10. What are potential resource limitations (eg, nursing, ventilator monitors, arterial lines, ICU space)? Initiation of the facility's disaster management procedure may be essential for multiple cases of severe infection.
11. Droplet or airborne isolation recommendations have not been evaluated or based on unstable ICU patients. In this subgroup, isolation practice issues – such as duration of isolation, use of personal protective equipment (negative pressure respirators), and vaccination of exposed HCW – are potential areas for further studies.



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APPENDIX ELEVEN

THE 2011 JAPAN EARTHQUAKE AND TSUNAMI: LESSONS LEARNED FROM THE LOSS OF MEDICAL INFRASTRUCTURE



SUMMARY: GREAT EAST JAPAN EARTHQUAKE AND TSUNAMI

On March 11, 2011, a magnitude 9.0 earthquake struck Japan along the Pacific coast. This unprecedented seismic activity devastated the northeastern region of the country. Approximately 30 minutes later, waves from the resulting tsunami reached the coast and washed away what lay in their paths. This was the most powerful earthquake recorded in the history of Japan. The scale of the damage created by the earthquake and tsunami was said to be the “biggest national emergency since the Second World War.”¹

Most of the damage was created by the tsunami waves, which reached as high as 133 feet,² devastating coastal cities and paralyzing their functions. The three Pacific coastal prefectures of Iwate, Miyagi, and Fukushima suffered most of the damage. As of January 10, 2012, the official number of dead or missing individuals in Japan had reached 19,000.³ Initial forensic reports stated that 90% of the casualties were from drowning.⁴

Healthcare in the cities along the Pacific coast was devastated. Minamisanrikucho (population 17,000) in Miyagi, for example, experienced some of the worst damage. The only hospital in the town (126 beds) became inoperable after the torrent of water flooded everything up to the fourth floor. Five of its six outpatient clinics were also destroyed.⁵ Communities along the coast also suffered varying degrees of damage, and all were in need of outside support as their healthcare resources were overwhelmed.

The disaster was complicated further when the safety mechanism at the nuclear power plant located in Fukushima failed to shut down the plant after the earthquake, leading to an uncontrollable elevation in its core temperature, a hydrogen explosion, and ultimately, a nuclear meltdown. As a consequence, people living within a 12.5-mile radius of the plant were forced to evacuate and leave everything behind, taking with them only concerns about radiation exposure.



RELEVANCE TO TODAY AND CLINICAL TEACHING POINTS

The mobilization of rescue healthcare professionals was executed quickly,⁶ with approximately 1,300 assembled within the first 24 hours⁵ and a larger number following soon after. A major goal of the early responders was to lower the number of preventable deaths after the initial event. This rapid medical response to the disaster was made possible by the lessons learned from previous domestic natural disasters, including the Kobe earthquake in 1995 (magnitude 7.2) that led to the development of disaster-response specialists.

The most medically vulnerable population from this disaster was, somewhat surprisingly, the ambulatory population. This differed from previous earthquake disasters in Japan (eg, the aforementioned Kobe earthquake), where patients with crush injuries and acute trauma were the most vulnerable population.⁷ This was largely due to the fact that the secondary destructive force of the tsunami took the lives of those individuals who could not be safely evacuated to an area outside the reach of the waves. Therefore, aside from the relatively few cases of aspiration pneumonitis, hypothermia, and trauma among survivors of the tsunami, the care of the ambulatory population with chronic illnesses became the primary goal for healthcare professionals.⁵

Medical professionals from various backgrounds joined the relief team to help meet the needs of the ambulatory population. Interdisciplinary teams of physicians, nurses, dentists, dental hygienists, physical/occupational therapists, social workers, psychologists, acupuncturists, massage therapists, and medical students were formed. The diversity of these healthcare professionals was necessary to address the array of medical needs.

Large earthquakes are always followed by a series of aftershocks. These aftershocks have often slowed the pace of rescue missions, as they have presented major threats to the safety of the people in the field. Since March 11, a total of 502 aftershocks measuring greater than magnitude 5.0 have occurred.⁸ Thus, the establishment of emergency evacuation plans and safety protocols was imperative for conducting an effective rescue mission.

The threat of shortages in medical supplies also became an issue during the acute phase. For example, concern grew about a levothyroxine shortage because the earthquake had directly affected the factory that produced 95% of the levothyroxine supply in Japan.⁴ This exemplified just how vulnerable pharmaceutical supplies can be when a large-scale disaster strikes a major factory.

Social networking sites played an important role in the rescue efforts in this disaster. Twitter and Facebook were powerful and valuable modes of communication, as these services allowed mass communication to take place at an extremely fast pace. Reports circulated of trapped survivors being rescued after “tweeting” their locations via their phones,⁹ and a number of medical consultations were made possible via Twitter.

This disaster hit a region of Japan that had been experiencing a chronic shortage of healthcare professionals for years. In fact, the Iwate prefecture ranks as having the largest shortage of health professionals in Japan, with the Fukushima and Miyagi prefectures not far behind.¹⁰ In addition, as in many other rural areas in Japan, the demographic makeup of the prefecture is older and thus lacked a younger population who could serve as a workforce to revive the community. These two

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variables are becoming the center of debate as the discussion continues on the reconstruction of the communities and their healthcare systems.

Lastly, psychiatric and emotional care was in high demand, both among the local people and volunteer relief workers. Medical volunteers working in forensic medicine were thought to be the highest at-risk group. Due to the large number of casualties, many physicians untrained in forensic medicine were involved in the identification of bodies and other forensic activities. This appears to have created extra emotional stress for these volunteers; thus, careful monitoring of their psychological states and emotional health has been conducted. This disaster reconfirmed the importance of emotional care for both local residents and responding volunteers.



LESSONS FOR CRITICAL CARE

- Japan is a developed nation that found its medical infrastructure completely wiped out and isolated. Future disaster planning must focus on rapid deployment of portable medical and critical care capabilities. Should community and state response teams be modeled after military response teams, or should the focus be on high-capability healthcare transport out of the affected region? Which is better, bringing resources into the area or transporting patients out?
- Has planning included a medical social structure or hierarchy to efficiently organize personnel and survivors? Medical leaders must be capable of organizing and rapidly mobilizing resources in a postdisaster environment.
- This disaster highlighted the need to prepare for multiple, simultaneous disasters. An evaluation of the surrounding environment and significant infrastructure (eg, factories, power plants, and chemical plants) that will likely be affected is an important step in disaster preparedness. Local responders and leaders need to look around for secondary disasters that may occur.
- Do communities have the ability to identify and obtain needed supplies of chronic medications during a crisis? Will plans be in place for the distribution of supplies from other areas?
- The ongoing level of support after the immediate disaster is a challenge for rebuilding critical care capabilities. Sustainable critical care capabilities will be needed after medical organizations, the military, and the media have started to leave.
- Both relief workers and the local population require protection from post-traumatic stress disorder and other sequelae. Systems to monitor the emotional and physical health of all involved must be in place.

- Is the knowledge available and are there resources to provide critical care outside of the hospital infrastructure?



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APPENDIX TWELVE

MOUNT SINAI HOSPITAL ICU DISASTER RESPONSE PLAN

Mount Sinai Hospital in Toronto, Ontario, Canada, has graciously granted permission to include a portion of its 2009 ICU disaster response plan.

This section, “Critical Care and Overflow Areas,” provides excellent insight into the organization and synthesis of all necessary elements into a cohesive plan. The plan is aligned with the findings of the hospital’s hazard vulnerability analysis.



CRITICAL CARE AND OVERFLOW AREAS

Pandemic Planning Assumptions

- There will be increased demands for critical care services in the acute phase of an influenza outbreak. The number of patients requiring ventilator support and intense monitoring from influenza and the consequences of influenza will also increase.
- The pandemic will have several waves and, consequently, critical care services and care models will need to be tailored to safely address clinical issues, patient volumes/capacity, and surge. Dedicated space will be required for the care of overflow critically ill patients to minimize the impact of the pandemic on normal ICU operations.
- Pregnant women are at increased risk for influenza-related complications. Processes for the assessment and care of these women is needed should critical care intervention be required.
- Temporary suspension or redesign of less-essential/deferrable patient care services will be required, allowing for reassignment of staff to critical care areas.



CRITICAL CARE SPACE AND CAPACITY

Physical space and capacity for patients requiring critical care will be as follows:

ICU Capacity (18th Level)

Maximum capacity in the ICU located on the 18th floor is 16 beds. Planning for a minimum of 115% critical care surge capacity (moderate surge) in all hospitals in the Toronto Central Local Health Integration Network is required due to anticipated system-wide increases in patient volume during a pandemic. At Mount Sinai, this represents 2 additional critical care beds, to equal a total census of 18. Mount Sinai Hospital is able to provide care for 150% of the normal ICU capacity (=8 additional beds or a total critical care census of 24). Should this level of surge be required, significant alterations in models of care and reduction in deferrable services will be needed to assist in staffing

critical care areas. Deferral of less-essential services will need to occur prior to reaching this census.

Activation of critical care surge/overflow area(s) will occur in a staged fashion. Several surge models have been discussed, and it is anticipated that should a surge to 150% be required, it will occur in the 8-bed coronary care unit (CCU) located on the 16th level. Should a surge beyond 150% be required, overflow into the post-anesthesia care unit (PACU) is planned with the possible addition of up to 12 critical care beds. This represents 225% (or 36 critical care beds) of the total normal critical care capacity. Possible surge scenarios/options are detailed in this appendix.

Expansion of Critical Care Space and Capacity

Satellite critical care areas will be developed to manage the anticipated increase in the volume of patients during a pandemic. To assist with staffing these areas, a reduction in deferrable medical and surgical services will occur and temporary bed or unit closure may be required. Decisions regarding service reduction, bed or unit closures in the medical-surgical areas, operating room (OR), and PACU to accommodate an influx of critically ill patients will be made in real time.

The need to expand the ICU into satellite critical care areas will be assessed daily at the ICU bed meeting held at 9 AM. During a pandemic, this bed meeting will expand to occur 7 days per week and additional meetings will be held as required.

The Critical Care Director/delegate, the Nursing Unit Administrator of the ICU, and the Nursing Unit Administrator/delegate of the unit(s) will receive critical care patients (ie, CCU and PACU); the ICU Team Leader/Resource Nurse, and the Patient Flow Coordinator/Nursing Clinical Manager (off-hours) will attend these meetings. Respiratory Therapy should also be included in ICU bed meetings when potential activation of overflow areas is anticipated. Respiratory Therapy will advise on equipment availability and respiratory therapist (RT) staffing levels required to care for ventilated patients in the overflow areas. Respiratory Therapy representation can include the Charge ICU RT and/or the RT Manager. Nursing leadership from areas affected by patient moves due to critical surge will also be included in the ICU bed meeting on an ad hoc basis (medicine/surgery/cardiology). The Senior Director of Acute and Chronic Medicine and the Senior Director of Surgery will be included in bed meeting discussions as required.

Based on recommendations from the ICU Team and bed meeting participants, a recommendation to open critical care overflow areas will be made to the Flu Management Executive Committee who will, in turn, make the final decision on expansion and subsequent processes for deferring related hospital activity.

The need to expand critical care areas will be a reflection of epidemic trends within the community and the volume of patients presenting to the hospital requiring critical care services (ie, via the emergency department, Code Blue within the hospital/at Princess Margaret Hospital [PMH], or by Criticall, a provincial ICU bed registry/placement service). Some of this data can be obtained from the Mount Sinai Hospital (MSH) Flu Dashboard. The Daily Bed Status and Staffing (EXCEL) Report that is completed daily by the Patient Flow Coordinator and the nursing clinical managers (on nights and off-hours) is an additional data source that may be used for decision making.

Critical Care Expansion Scenarios and Activity Triggers

Decisions to surge into alternate areas outside of the 16-bed ICU will be made in real time and will be based on available resources and patient needs. Three scenarios/options have been identified for critical care surge to 115% or higher. Activity triggers have been identified outlining timing for set-up/activation of overflow areas and alterations in patient care activities to manage critical care surge.

The ICU is able to manage a maximum capacity of 16 patients. Sixteen ventilated patients will be cared for in the current ICU area located on the 18th floor with the goal to have the most acutely ill patients cared for on this unit. It is recognized, however, that allocation of the sickest patient to this unit may not always be feasible. *Once the ICU reaches a census of 14 patients with increasing volumes of patients afflicted with influenza, the consequences of influenza, or suspected influenza, arrangements will be made for the set-up and conversion of the CCU (or PACU depending on scenario/option chosen) to an overflow critical care area. Once the ICU has reached full capacity (100%) and the volume of patients with influenza/influenza-like illness is increasing, triage of surgical cases requiring postoperative (level 3) critical care will begin.*

Scenario/Option 1: Surge Into the CCU With CCU Reallocation to Room 1629

Activation of the CCU as a critical care overflow area will occur in a staged fashion as a means of causing minimal disruption to services offered by the cardiology and surgical teams.

- **Stage 1.** Involves surge to 115% critical care capacity (or 2 additional beds). The CCU will remain on the 16th floor with its normal 6-bed census. The space will be shared by CCU and ICU staff. *Activity trigger: Once 1 critical care overflow bed is occupied in the CCU, conversion of room 1629 will begin. A reduction in surgical cases requiring level 2 care may need to occur.*

- **Stage 2.** Involves surge to 125% critical care capacity (or 4 beds). CCU will remain in its current location but census will decrease to 4 beds. CCU and ICU staff will share the space. *Activity trigger: Begin moving patients to room 1629.*
- **Stage 3.** For surge to 150% critical care capacity (with 4 additional beds opened to =8 critical care overflow beds, or 24 critical care beds across the organization). CCU patients (=census of 4) will be receiving care in alternate location in room 1629. Infection Control will need to be consulted regarding isolation requirements in this satellite location.

Scenario/Option 2: Surge Into the CCU With Reallocation of the CCU to a Medical Step-Down Unit (MSDU) Or Surgical Step-Down Unit (SSDU)

- **Stage 1.** Involves surge to 115% critical care capacity (or 2 additional beds). The CCU will remain on the 16th floor with its normal 6-bed census. The space will be shared by CCU and ICU staff. *Activity trigger: Once 1 critical care overflow bed is occupied in the CCU, conversion of the MSDU or SSDU will begin. A reduction in surgical cases requiring level 2 care will need to occur.*
- **Stage 2.** Involves surge to 125% critical care capacity (or 4 beds). The CCU will remain in its current location but census will decrease to 4 beds. CCU and ICU staff will share the space. *Activity Trigger: Patient move will begin to the MSDU or SSDU.*
- Note: Should the MSDU be used for overflow, MSDU patients will be cared for in shared space within the SSDU or in a satellite location, which will require activation on the 17th level. *Activity trigger: Set-up of a satellite MSDU may need to occur once conversion of this area is made to a CCU.*
- **Stage 3.** For a surge of 150% critical care capacity (or 8 beds), the current CCU will be reallocated to one of the step-down units (medical or surgical). Infection Control will need to be consulted regarding isolation requirements in this satellite location.

Note: For both scenarios/options 1 and 2, should surge beyond 150% be required, the PACU on the 5th level will be used as a second surge area. Should this level of surge be required, significant alterations in patient care delivery models will be required.

Scenario/Option 3: Surge to the PACU and Maintenance of 16 Level 2 Beds

As it is anticipated that there will continue to be demands for level 2 care throughout a pandemic, and as a means of reducing strain on the ICU, step-down unit beds will be preserved at their normal quota of 14 beds with the addition of 2 beds in the CCU (=8 in the CCU). This will allow for maximization of level 2 beds and will result in a total of 16 level 2 beds across the organization (MSDU=4 + SSDU=4 + CCU=8). Medical, surgical, and CCU patients will be mixed in these units if necessary.

Under such circumstances, critical care (level 3) surge will occur in the PACU to a maximum of 4 beds (=125% critical care surge) or a total of 20 level 3 beds across the organization. Whenever possible, to assist with appropriate staffing, 4 patients will be cohorted in the PACU. Level 3 patients will be transferred to level 2 beds or to a level 1 inpatient bed, as appropriate and when available. Triage and deferral of surgical services will be required and alterations in care delivery models will occur.

Set-up and commissioning of the critical care overflow area on the 16th level (CCU) and activation of the CCU in an alternate location (room 1629 or the MSDU/SSDU) is detailed in **Supplement A1** on page 254.



PATIENT CARE PROCESSES

An influenza pandemic will be characterized by several waves or stages. The acute phase of an influenza outbreak will be marked by significant increases in patient volume and activity in the emergency department and critical care areas. The following processes will be put in place to manage patient care as patient activity/volume and staff illness increases in critical care areas.

Management of Surge

Once a pandemic has been declared and increases in the volume of critically ill patients approach maximum capacity, the ICU will implement the following measures to support the surge:

1. The sickest patients will be triaged to and cared for in the ICU on the 18th floor. It is recognized, however, that this may not always be possible. Multiple bed moves will not occur under pandemic conditions due to staffing limitations and patient status.
2. Deferral of some patient care activities will need to occur to support staffing and space requirements/expansion in critical care areas. According to the Toronto Central Local Health Integration Network, cancellation of elective scheduled procedures that require critical care (level 3) resources is an internal decision that is expected to be implemented when a hospital reaches 100-115% occupancy (September 2009).
3. Maintain medical step-down unit and/or surgical step-down unit for the care of level 2 patients. While de-escalation of deferrable surgical procedures will occur during a pandemic, Priority 1 surgical cases will continue and, due to patient complexity, may require this level of care. Level 2 patients from medical and surgical services may be cared for together in the step-down units.

4. Consider the need to cancel elective surgeries. The cancellation of elective (Priority C) surgery will be done as a means of freeing up Anesthesia, RTs, and nurses (RNs) for redeployment to the ICU and critical care overflow areas as required. The impact of OR cancellation is anticipated to be as follows:
 - At 100% capacity – Surgical cases requiring level 3 care will require triage and possible deferral.
 - At 115% to 150% capacity – Deferral of cases requiring postoperative level 2 care will be required (in particular, once 150% capacity is reached). Due to potential relocation of the CCU to the MSDU/SSDU and subsequent need for shared space in an alternate step-down unit, limitations in SSDU capacity will occur. Only Priority A surgical cases will be done. Urgent cases, if unable to be deferred due to patient risk, will be moved to Priority A (emergent) classification.
 - At 200% to 225% capacity – 8 beds in the PACU would be occupied. Emergent surgical cases will only be performed (Priority A) with the use of two operating suites (one for emergent cases and one for urgent cases). Patients will be recovered in a dedicated OR suite due to PACU occupation.
5. Consider clinical closures on medical-surgical units so staff from these areas can be redeployed as necessary to assist in the care of patients in overflow critical care areas.
6. Satellite critical care carts will be requested and made available in overflow area(s) as activated:
 - One line insertion cart will be available for an 8-bed unit and one for a 12-bed unit (**Supplement A2** on page 258).
 - One RT supply cart will be available for an 8-bed unit and one for a 12-bed unit (**Supplement A2** on page 258).
 - General supply carts will be available for an 8-bed and one for a 12-bed unit.
 - Additional supplies for the care of obstetric patients will be needed in the ICU and critical care overflow areas (vaginal delivery cart, emergency C/S cart, neonatal resuscitation equipment).

Patient Accommodation

As it is anticipated that patients with and without the flu will require critical care services, and due to difficulty in determining who may be incubating the illness, patients will *not* be cohorted according to flu versus non-flu in critical care areas. The ICU on the 18th floor and the CCU on the 16th floor consist of private rooms only,

and infection control will be obtained through the use of droplet-contact precautions. Staff caring for patients in either unit will be required to adhere to required isolation precautions as per Infection Control directives.

Should the PACU be required for critical care surge, social distancing will be used in the early stages of use of the area (a distance of 6 feet should be maintained). In later stages, as capacity increases, privacy curtains will be used to maintain social distance between beds and are to remain closed at the sides, while allowing a view of patient monitors. Pregnant patients with a fetus at a viable gestation should be cohorted in critical care areas whenever possible to share equipment and resources. However, multiple patient moves will not occur during a pandemic due to anticipated limitations in staff resources and infection control reasons. Equipment to support the care of this population and their fetuses will be required in all areas in which they are cared. **Supplement A3** on page 259 details communication and responsibility processes for off-service obstetric patients. Gestational viability will be determined based on Neonatology and other resource availability and as per directives from the Child Health Network.

Critical Care Rapid Response Team (ACCESS Team)

The ACCESS Team will continue to triage patients who might require critical care support and will provide stabilization services across the organization. This team will assist in providing patient stabilization services as per normal processes, write orders for care, and oversee the rapid transfer of patients to the ICU or overflow critical care areas. This team will use the same model used under normal conditions: one nurse, one physician, and an RT. Rapid transfer of emergency department patients to critical care will be a priority during the pandemic outbreak, and the ACCESS Team will support these processes as able.

The ACCESS Team will be maintained as long as possible throughout the pandemic to support patient care across the hospital and as long as staffing resources permit. The need to add a second ACCESS Team will be considered (should staffing allow) if there is a substantial increase in patient volume of those requiring critical care assessment and monitoring.

Critical Care Admission Criteria

The Critical Care Team will follow the provincial guidelines/criteria for admission to critical care, as well as criteria for the triage of ICU patients. Additional detail on admission/triage, discharge, and care modification during a pandemic can be found in **Supplement A4** on page 261.

Critical Care Support

Critical Care support will include ventilation, fluid resuscitation, invasive monitoring, and management of organ failure and complications from the flu. Clinical care will be consistent with practices used under normal circumstances to address patient needs and enhance clinical outcomes (**Supplement A4** on page 261).

Mechanical Ventilation Protocol - General Principles

- Usual pressure-limited protocols will be utilized.
- Noninvasive ventilation will be used when appropriate.
- High frequency oscillation will be used for influenza patients as available and as required.
- Airway pressure release ventilation may be in alternative ventilatory mode for those with extreme hypoxemia.
- Inhaled nitric oxide will not generally be available.

Critical Care Patient Triage

A process for the triage of critical care patients will be developed at the provincial level. Triage guidelines and processes will be implemented as directed by the province.

Triggers and Code Blue Services

An assessment of Code Blue services to and patient admission processes from PMH will occur in real time. At the height of pandemic, admission of patients from PMH will be based on clinical criteria outlined in **Supplement A4** on page 261. The ability to offer Code Blue services and critical care admission of PMH patients will depend on available staffing and resources. In October 2009, a leadership link was established between MSH and University Health Network (including Toronto General, Toronto Western, Princess Margaret, and Toronto Rehabilitation Institute). This group will assume leadership for decision making about critical care support that is able to be offered to PMH at the height of the pandemic. Code Blue service to MSH will be maintained throughout the pandemic.

Discharge Criteria

Discharge criteria in the critical care areas will be most dependent on ventilator requirements. Prior experience in patients with H1N1 (April-June 2009) showed that most patients recover quickly once weaned from the ventilator and are often able to be transferred directly to an inpatient unit.

The critical care discharge process is anticipated to occur as follows: once a patient comes off the ventilator, he/she will likely leave the critical area with the goal: a) to improve and recover, or b) to provide supportive palliation. Refer to OHPIP: http://www.health.gov.on.ca/english/providers/program/emu/pan_flu/ohpip2/ch_17a.pdf.

Palliative Care

Discontinuation of ventilator support, active biophysical monitoring, and transition to symptom management has been outlined by the MSH Palliative Care Team. Drug choices for patients under Palliative Care during an influenza pandemic is detailed in **Table A12-1**.

Table A12-1. Palliative Medication Options

Symptom/Patient Assumptions	Palliative Medication Options
Secretions (assuming 100% of patients)	1st choice in ~80% will be scopolamine 0.4 mg q4h prn 2nd choice or may need additional agent - glycopyrrolate 0.4 mg q4h prn
Pain + Dyspnea (assuming >80% of patients)	1st choice - morphine (~70% would use or tolerate this choice) 2-10 mg IV or SQ q4h standing and q30 min h prn 2nd choice - hydromorphone hydrochloride (~30% would require this) 0.5-2 mg q4h standing and q30 min prn Also would use BZP - lorazepam 1-4 mg s/l or IV q2-4h or if a drip required midazolam 1-5 mg/h
Sedation (assuming all patients)	1st choice - methotrimeprazine 5-25 mg SQ tid prn 2nd choice - BZP lorazepam 1-2 mg s/l or IV q4h prn or if drip required will use midazolam 1-5 mg/h
Delirium (assuming 50% of patients)	1st choice - haloperidol IV 0.5-5 mg or SQ q 2-4h prn or risperidone PO ~0.5 mg q6h
Nausea + Vomiting (assuming 50% of patients will have opioid-related N/V)	1st choice - haloperidol IV or SQ 0.5-5 mg q4h or metoclopramide IV or SQ 10 mg q6h

Abbreviations: q, every; prn, as needed; SQ, subcutaneous; BZP, benzodiazepine; s/l, sublingual; tid, three times a day; PO, by mouth; N/V, nausea/vomiting

All the drugs cited may be given by different dosing schedules, depending on need. They may be given as needed or by standing routine, they may be given subcutaneously or intravenously. Guidelines will be developed in the future to outline delivery methods and dosages. The chosen dose ranges have been developed for planning purposes. Once a patient is in palliative care, discussion with the Palliative Care Team is to occur as to how symptom management will be approached.

Staffing, Redeployment, and Patient Care Delivery Models

Redeployment in critical care areas will be a reflection of staff illness/absence and patient volumes. As the pandemic progresses, increases in patient acuity and volume will require expansion into satellite areas and will require the use of redeployed staff. In an outbreak situation, the ICU will follow Code Orange directives for initiating fan-out procedures to increase staffing as necessary. Advance planning to sustain increased staffing levels for the duration of the pandemic is required.

Staffing and patient care delivery models have been discussed for the critical care and overflow areas. The underlying principle for the care of ICU patients under pandemic conditions is that the less critical care/staffing resources available, the less patient care services will be able to be offered. A critical care skills inventory of staff across Mount Sinai Hospital has been developed and will be used as the basis for redeployment decisions to critical care areas. Staff skill sets, employment status, and prior critical care experience will be considered in decision making. Relevant collective agreements will also be considered. Non-clinical staff (including ward clerks, service assistants, porters, etc) will be obtained as required through the Staff Labour Pool (once activated) based on their specific skill set.

Staffing Preferences. A one-to-one ratio of patients to professional staff (either nursing or allied health) is preferred in critical care (level 3) areas. Alternate models of care will be implemented as shifts in available staff resources occur. Sources of redeployable staff to critical care and the overflow areas will depend on staff illness and absenteeism across clinical units. Staff will be redeployed to areas based on greatest need, with consideration of their skill set and past experience.

Under pandemic conditions, ICU staff will assume a leadership role in the coordination and management of critical care patient needs. The following principles will be used in the redeployment of staff to critical care areas:

1. ICU nurses will care for the patients who are the most ill. These patients will ideally be cared for in the ICU on the 18th level. When redeployment of staff to the ICU on the 18th floor occurs, staff will be assigned to assist with the care of patients with lower acuity/care requirements or to provide care that is within their scope.

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2. Nurses redeployed to work in the ICU or in one of the overflow units will be provided with an orientation (ie, including an overview of patient diagnoses/type, documentation requirements, care processes, equipment and supplies used, department and rest area layout, emergency procedures/exits, etc) before working there.
3. All staff redeployed to critical care areas will work in the buddy system, with the ICU nurse assuming primary responsibility and leadership for the nursing care needs of the patient. Tasks will be assigned to redeployed staff based on their skill sets.
4. Redeployment to the ICU will be done in advance whenever possible (ie, to provide staff with warning – preferably 24 hours – of the need to go to the ICU, rather than it being a last-minute decision). If on arrival to the ICU it is determined that redeployed staff are no longer needed, reassignment to home units will be done.

Critical Care Staffing Models

Critical care staffing models have been discussed. Based on a critical care skills inventory of all MSH nursing staff and RT skills needed for critical care, a preferred staffing model (at 150%) has been developed (Tables A12-2 through A12-5).

Table A12-2. Preferred RN/RT Staffing Scenario at 150% Capacity (ie, 16 ICU Beds + 8 Critical Care Beds on 16th Floor CCU)

Stage	Location	Patients	Patient Type	Leader	ICU RN	CCRT RN	PACU RN	Ward/CCU RN	MSDU RN	SSDU RN	Total	RRT
			Base staffing	1	14	1	2		2 (stay in MSDU)	2 (stay in SSDU)		3
100% capacity	ICU	8	ICU (most acute)	1	5			2 floor 1 CCU			8	1
		8	ICU (most acute)		4		1	2 floor 1 floor			8	1
150% capacity	CCU critical care overflow	8	Surge ICU	1	4	1	1	2 floor			8	1
	MSDU/ room 1629	4	Cardiac CCU		0			2 CCU 1 floor			3	
Total				1	13	1	2	11	2	2	27	3

Abbreviations: RN, nurse; RT, respiratory therapist; CCU, coronary care unit; CCRT, Critical Care Response Team; PACU, post-anesthesia care unit; MSDU, medical step-down unit; SSDU, surgical step-down unit; RRT, registered respiratory therapists

Assumptions at This Stage

- Deferrable patient care activities will occur (outpatient clinics and surgery).
- SSDU will remain open to support care of level 2 patients. Medical and surgical level 2 patients to be cared for/mixed in SDUs as required. Triage of surgical cases (especially those requiring level 2 care) will be required.
- MSDU or room 1629 to be converted to a 4-bed CCU.
- MSH Code Blue Services are in place. ACCESS Team (normal model) available to support patient care across MSH.
- Ideally, two RNs (from ICU) with one floor nurse can manage four critical care patients).

Table A12-3. MD Staffing at 150% Capacity (ie, 16 ICU Beds and 8 Critical Care Beds on 16th Floor CCU)

Stage	Location	Patients	Patient Type	House Staff	Support Medical Staff	House Staff Nights	Attendings
Baseline	ICU	8		1 ICU resident	Fellow	1 ICU resident on call and 1 resident backup 2nd call	ICU staff
				1 ICU resident			
				1 other resident			
150% Capacity	CCU	8		1 ICU resident	Fellow		
	Evaluation, stabilization, floating		1 ICU resident				
				1 ICU resident (post call)			

Abbreviations: MD, physician; CCU, coronary care unit

Source of Additional Residents

- Anesthesia
- Surgery
- Medical subspecialty

**Table A12-4. MD Staffing at 200% Capacity
(ie, 16 ICU Beds, 8 in CCU, and 8 in PACU)**

Stage	Location	Patients	Patient Type	House Staff	Support Medical Staff	House Staff Nights	Attendings
Baseline	ICU	8		1 ICU resident	Fellow Cardiology/ GIM with additional basic critical care training (such as FCCS or ACES)	2 residents and fellow backup	2 ICU staff: one clinical, one administrative/ triage
				1 ICU resident			
				1 other resident			
150% Capacity	CCU	8		1 ICU resident			
200% Capacity	PACU	8		1 ICU resident 1 other resident			
		Evaluation, stabilization, floating		1 anesthesia resident	Anesthesia staff		
				1 other resident (post call)			
				1 other resident (post call)			

Abbreviations: MD, physician; CCU, coronary care unit; PACU, post-anesthesia care unit; GIM, general internal medicine; FCCS, Fundamental Critical Care Support; ACES, Acute Critical Event Simulation Course

Source of Additional Residents

- Ear, Nose, and Throat
- Anesthesia
- Surgery

Table A12-5. MD Staffing at 225% Capacity (ie, 16 ICU beds, 8 in CCU, and 12 in PACU)

Stage	Location	Patients	Patient Type	House Staff	Support Medical Staff	House Staff Nights	Attendings
Baseline	ICU	8		1 ICU resident	Fellow Cardiology/ GIM with additional basic critical care training (such as FCCS or ACES)	2 residents and fellow/ staff in house	2 ICU staff: one clinical, one administrative
				1 ICU resident			
				1 other resident			
150% Capacity	CCU	8		1 ICU resident			
225% Capacity	PACU	12		1 ICU resident	Anesthesia staff		
				1 other resident			
		Evaluation, stabilization, floating		1 anesthesia resident	Fellow		
				1 other resident (post call)			
				1 other resident (post call)			

Abbreviations: MD, physician; CCU, coronary care unit; PACU, post-anesthesia care unit; GIM, general internal medicine; FCCS, Fundamental Critical Care Support; ACES, Acute Critical Event Simulation Course

Source of Additional Residents

- Ear, Nose, and Throat
- Anesthesia
- Surgery
- Medical Subspecialty



EQUIPMENT, SUPPLIES, AND RESOURCES REQUIRED

Planning Assumptions

- There will be an increased volume of patients arriving via the emergency department and Critical who require critical care support including ventilation. An increased number of obstetrical patients requiring critical care services is also anticipated under pandemic.
- Scarce resources will need to be allocated to provide maximum benefit to the greatest number of patients.

Communication Processes

As the pandemic escalates and there is noted increase in the volume of critically ill patients, leadership from critical care services, the PACU, and the CCU will:

1. Begin staff communication and planning process. Nursing Unit administrators/ leadership team will review pandemic plans in light of emerging information.
2. Liaise with Infection Control to review isolation requirements and personal protective equipment.
3. Staff team meetings to be held outlining pandemic-related processes (ie, sick calls, personal protective equipment, infection control protocols, modifications to units and shifts in patient care processes, redeployment, etc).
4. Initiate planning meetings regarding escalation of critical care capacity (when required).
5. Initiate discussion with Critical Care regarding planned process for patient management.
6. Patient/family letter to be developed in partnership with Public Relations detailing changes to admission and visitation processes (to be developed in real time based on Infection Control directives).
7. Daily interprofessional bed rounds to be coordinated as required (at least once per shift) to determine patient needs in overflow critical care areas.
8. Daily bed meeting to be held at 9 AM with additional meetings held as required (see the “Critical Care Space and Capacity” section in this appendix).
9. Ensure availability of adequate supplies (initially plan for 6-8 weeks of stock).
10. Ensure call system/crash cart functionality.
11. Mask fit – test list to be checked. Ensure adequate supply of personal protective equipment.

Supplies

Supply lists for critical care are based on normal daily ICU usage. Carts have been developed to manage an 8-bed satellite area in the CCU and a 12-bed satellite area in the PACU and have been reviewed by the Materials Management Manager, the Customer Service Coordinator (Central Dispatch), and approved by the ICU team. Supply carts will continue to be supplied by Central Dispatch as per normal processes. Twenty four- to 48-hour lead time is needed for initial set-up of satellite carts.

Pandemic-specific supply carts are onsite. Lists for specific patient care supplies (respiratory therapy and line insertion) have been developed and are outlined in **Supplement A5** on page 264.

Ventilators

The ICU currently has 20 available adult ventilators and 4 noninvasive ventilators with 2 additional ventilators available from the Ministry of Health Ontario emergency pool. Due to the anticipated increases in patient volume, additional ventilators will need to be secured for use in the emergency department and critical care overflow areas. Total MSH ventilator capacity using OR, transport, and noninvasive ventilators is 48; however, it is suggested based on information to date that noninvasive ventilators are likely unable to adequately ventilate this patient population. Caution needs to be exercised when considering the use of anesthesia gas machines for adult ventilation in an ICU setting due to the frequent monitoring and high maintenance required at the bedside (frequent soda lime exchanges, etc, may not be feasible). At this time, we caution against using any more than 25 ventilators as a realistic number (**Table A12-6**).

Several assumptions have been considered in the allocation of ventilators to critical care and overflow areas:

- Some anesthesia gas machines will need to remain in use in the OR for anesthesia purposes.
- Labor and Delivery currently has 2 anesthesia machines which, in light of complications from influenza in pregnant women, will not be able to be redeployed to critical care areas.
- Adult ventilators will continue to be needed for the care of critically ill patients in the emergency department. The emergency department will require use of the transport ventilator for movement of patients to critical care areas.
- Noninvasive ventilation ventilators have not been included in the ventilator calculations, assuming all patients will require support from adult ventilators.

Table A12-6. Ventilator Capacity and Allocation Under Pandemic

Unit/Area	Type and Number Currently Available	Critical Care Bed Allocation	Redeployment of Ventilators
ICU	Adult = 20 NIV = 4	16 beds	16 adult vents to be allocated to ICU on 18th floor
Critical Care Surge (CCU on the 16th level)	0	2 beds 4 beds 8 beds	2 adult vents to be allocated from ICU pool to overflow area in CCU 2 adult vents to be allocated from ICU pool (1 currently in existence; 1 on order) to overflow area in CCU 4 vents from MSH general ventilator pool
PACU	Adult = 1	8 beds 4 beds	1 adult vent to stay in PACU due to anesthesia needs + occurs
ED	Adult = 2 (one 760 plus one transport) NIV = 1	Increased volume	1 adult vent, 1 NIV, and 1 transport to stay in ED to manage patients with critical care needs
OR	Anesthesia = 15		Once OR de-escalated to Priority 1 cases/cancer cases: 4 anesthesia vents to stay in OR as standby for OR needs NOTE: 4 anesthesia vents to be redeployed to critical care overflow in the CCU; balance of 7 for use in PACU once surge occurs
L&D	Anesthesia = 2		2 anesthesia vents to stay in L&D due to anticipated flu complications NOTE: 2 anesthesia vents to move to ED as required – last case scenario HELP! To stay in NICU
EOPS	Anesthesia = 2		
NICU	Neonatal = 41		
Total Adult =	44 (+3)		
Total Neonatal =	41 plus 24 CPAP units		

Abbreviations: NIV, noninvasive ventilation; vents, ventilators; CCU, coronary care unit; MSH, Mount Sinai Hospital; PACU, post-anesthesia care unit; ED, emergency department; OR, operating room; L&D, Labor and Delivery; EOPS, Emergent Outpatient Services; NICU, neonatal intensive care unit

Information Technology

During the pandemic, there will be Information Technology needs in critical care areas which include updating policies and procedures and posting them online. This may involve online order sets for those admitted with the flu to critical care areas or medicine, and transfer orders from the critical care unit to the regular units.

Information sheets for family members of patients undergoing critical care may also be of value. Due to staffing limitations, there may be a need to provide web-based information to family members explaining what to expect when their loved one is in critical care.



MEDICATIONS

Critical Care medications are outlined in **Table A12-7**.

Table A12-7. ICU Prescription List

The following information is a summary of methodologies and assumptions used to estimate the Rx stock quantities that need to be available to manage mechanically ventilated ICU patients for a 4-week time block during an influenza pandemic.

Methods

A computerized literature search of 1) MEDLINE, 2) EMBASE, 3) International Pharmaceutical Abstracts, 4) the Cochrane Central Register of Controlled Trials and Science Citation Index databases, and 5) internet search engines Google and Google Scholar was undertaken between the time period 1950-September 2009. In anticipation of limited published resources, no exclusion criteria were specified for the search (ie, any controlled study, uncontrolled study, case series, or review paper would be reviewed). References in identified papers were manually reviewed for additional references not identified by the computerized search.

Results

- The systematic search did not identify any paper describing medication resource planning nor any paper providing guidance on the estimation of medication needed for mechanically ventilated ICU patients in the event of a pandemic. Identified papers only provided details on antiviral medications.

- An attempt to identify ANY reference providing information on resource or medication planning for ANY critical care disaster was undertaken (eg, bioterrorism). Again, identified papers only provided detail on stocking specific antidotes.
- The search was extended to contacting individuals who were thought to have experience in disaster planning: 1) North American Critical Care Pharmacy Network, 2) Department of National Defence – Pharmacy Division. Again, little was identified.
 - Therefore, the basic principles of critical care were applied to estimate essential drug therapies and potential quantities. Calculations were extrapolated from the current utilization of our 16-bed medical-surgical ICU and our drug consumption during the winter months when pneumonia and septic shock are common admission diagnoses.
 - **Table A12-8** summarizes the assumptions to calculate 4 weeks of supplies. For indications where multiple therapy options are available, the agent with the most favorable drug properties was selected (eg, kinetics, dynamics, dosing interval, dilution requirements, etc). Dosages used for calculations were based on mean published doses from gold standard references (Micromedix, AHFS, CPS). For agents that are weight based, a mean weight of 80 kg was used. The following calculations focus on Rx related specifically to critical care. No calculations have been made to estimate utilization of non-critical care drugs such as those consumed by patients at home (eg, antihypertensive, antidepressants, etc).

Abbreviations: AHFS, American Hospitals Formulary Systems; CPS, Compendium of Pharmaceutical Specialties

Table A12-8. Prescription List for Ventilated Patients During a Pandemic

Condition	Assumption or Comments	Agents of Choice & Suggested Dose	Estimated Dose/Day for 1 Pt	Estimated # of Pt/36 (max surge 36)	Estimated 30-Day Stock Supply (dose/day x # pt likely to require Rx x 30 days)
Neurology					
Sedation, Anxiety, Pain Control	<p>Based on our internal data >95% of MV pt require sedation + analgesia. Assumptions:</p> <ul style="list-style-type: none"> - All will require opioid for analgesia, benzodiazepine for sedation-anxiolysis. - 1st choice: morphine + midazolam - 2nd choice: fentanyl + midazolam - True allergy to midazolam essentially unheard of. - Based on I-CAN-SLEAP project, non-HFOV pt mean dose ~5 mg/h (1-10 mg/h range) - Based on HFOV residency project, HFOV pt mean dose 25 mg/h for morphine and midazolam equivalents - We will not upsurge supply of propofol, as our primary use is for neuro and these cases should not increase. 	<p>Group 1: Non-H1N1 pt will use average sedation.</p> <p>Midazolam 5 mg/h Morphine 5 mg/h Fentanyl 150 µg/h</p>	<p>120 mg 120 mg 3600 µg</p>	<p>18 14 4 (morphine intolerant)</p>	<p>64,800 mg midazolam 50,400 mg morphine 432,000 µg fentanyl</p>
		<p>Group 2: H1N1 ARDS pt will use above average sedation; estimate similar to HFOV use of sedation.</p> <p>Midazolam 25 mg/h Morphine 25 mg/h Fentanyl 500 µg/h</p>	<p>600 mg 600 mg 12,000 µg</p>	<p>18 14 4 (morphine intolerant)</p>	<p>324,000 mg midazolam 252,000 mg morphine 1,440,000 µg fentanyl</p>
Agitation, Delirium	<p>Published literature estimates 15-80% of MV pt are delirious. More recent literature suggests 60-80%. Based on our internal data, we use an antipsychotic in 40% of MV pt. Assumptions:</p> <ul style="list-style-type: none"> - Conservative estimate of 50% delirium - 50% of pt will be able to use NG/PO route - Tx options to be oral risperidone and IV haloperidol. 	<p>Haloperidol 5 mg IV q4h</p>	<p>30 mg (6 amps)</p>	<p>10</p>	<p>1,800 vials (1 mL x 5 mg/mL)</p>
		<p>Risperidone 0.5-1 mg NG/PO q6h</p>	<p>4-8 tablets 0.5 mg</p>	<p>10</p>	<p>1,200 tablets</p>
Chemical Paralysis	<p>Current practice is to limit NMBA use to pt with refractory vent status despite deep sedation. Published literature quotes use of 1-5%. Our I-CAN-SLEAP project = 6%. Assumptions:</p> <ul style="list-style-type: none"> - Use of NMBA to ↑ with H1N1; based on MSH experience and Winnipeg. - Conservative estimate of 25% will require NMBAs. At 225% surge (n=36), 50% will be H1N1 (n=18) 	<p>Pancuronium IV 1-5 mg/h</p>	<p>120 mg</p>	<p>9</p>	<p>32,400 mg (16,200 vials of 2 mg/mL)</p>

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<p>Chemical Paralysis (continued)</p>	<p>Of these, half will require NMBA (n=9) to control respiration despite deep sedation.</p> <ul style="list-style-type: none"> - Finally, we will not have the supply to support our current practice of pushing sedation to suppress respiratory drive. If SAS 1 and still oxygenation/ventilation issue will need to initiate paralysis. - Only Rx supply to be increased will be pancuronium as it offers option of continuous infusions and bolus dosing at reasonable costs. Usual stock supply of rocuronium, succinylcholine and cisatracurium to be maintained. 				
<p>Cardiovascular</p>					
<p>Vasopressors</p>	<ul style="list-style-type: none"> - Difficult to predict who will progress to requiring vasopressors. Based on available information, those with influenza who require ventilation may be at high risk of hemodynamic instability. Based on our trial data, 75% of pt require vasopressor support for 4-5 days. - Norepinephrine is generally the preferred agent (less AFib and other tachycardias). 90% will use norepinephrine. Remaining 10% will receive dopamine. - Cardiac dysfunction/failure estimated to occur in one-fourth of ICU pt with multiorgan failure. 	<p>Norepinephrine IV 0.1-2 µg/kg/min</p> <p>Dopamine IV 1-20 µg/kg/min</p> <p>Dobutamine IV 5-10 mg/kg/min</p>	<p>250 mg</p> <p>2,300 mg</p> <p>1,150 mg</p>	<p>25</p> <p>3</p> <p>9</p>	<p>187,500 mg</p> <p>207,000 mg</p> <p>310,500 mg</p>
<p>Arrhythmias</p>	<ul style="list-style-type: none"> - AFib: 9.8% prevalence of all ICU admissions (95% CI=8.3-11.3) - Assumption: Our primary agent is amiodarone and that would not change. 	<p>Amiodarone IV 900 mg/24 h</p>	<p>900 mg</p>	<p>4</p>	<p>108,000 mg</p>
<p>Pulmonary</p>					
<p>Bronchodilation</p>	<ul style="list-style-type: none"> - Based on current utilization >75% of mechanically ventilated pt require bronchodilators. - During a pandemic, will make assumption that 100% of these pt will require bronchodilators. - Estimated during winter months, flu season, COPD season 25% of pt would be admitted on a corticosteroid puffer. <p>Vent weaning - 100% will requires PO clonazepam + risperidone to wean off IV sedation</p>	<p>Ipratropium 20 µg MDI 8 puffs q4h + q1h prn</p> <p>Albuterol 100 µg MDI 8 puffs q4h + q1h prn</p> <p>Fluticasone 125 µg MDI 4 puffs q12h</p> <p>Clonazepam 0.5 mg tid PO 3-5 days</p> <p>Risperidone 0.5 mg tid PO 3-5 days</p>	<p>1 inhaler</p> <p>1 inhaler</p>	<p>36</p> <p>36</p>	<p>1,080 ipratropium inhalers</p> <p>1,080 albuterol inhalers</p> <p>~1 puffer/pt to last 15 days. Doubling current stock should be adequate.</p> <p>~1,000 tablets</p> <p>~1,000 tablets</p>

VAP Prevention	- All MV pt to receive chlorhexidine oral rinse.	Chlorhexidine 0.12% 10 mL qid	40 mL	36	43,200 mL (~50 bottles)
Gastrointestinal					
Stress Ulcer Prophylaxis	- 100% of pt requiring MV for >48 h are at risk of GI stress-related mucosal injury/ulceration.	Ranitidine IV 50 mg q8h	3 vials	17	1,530 vials
	- 90% can be managed with H2RA = ranitidine IV or PO (n=33 pt of those ~50% will require IV or n=14).	Ranitidine NG 150 mg q12h	2 tablets	16	960 tablets
	- 9% will require a PPI	Lansoprazole NG 30 mg daily	1 tablet	2	60 tablets
	- 1% ICU pt have an upper GI bleed and require a continuous PPI infusion. - Have limited PPI use to minimize risk of VAP and <i>C. difficile</i> infections.	Pantoprazole IV 8 mg/h	5 vials	1	150 vials
Glycemic Control	50% of pt have hyperglycemia in the ICU Assumptions: - Will not use insulin nomogram due to associated high workload. Will use sliding scales and q4h checks.	Insulin R	50 units	18	30 vials insulin R
		Insulin N	25 units	9	10 vials insulin N
GI Motility	- Use an estimate of 10% of ICU pt have slow GI motility (from critical illness, narcotics, etc). - Based on our HFOV experience, all require metoclopramide.	Metoclopramide 10 mg IV qid	4 vials	18	2,160 vials
Nephrology					
	- Unable to find published information to estimate the use of electrolytes in the ICU. - Based on previous work in our unit, utilization of electrolytes is ~100%, every day.	KCl IV bags 80 mEq/day	2 bags	36	2,160 KCl 40 mEq bags
		Magnesium sulfate IV 4 g/day	2 bags		2,160 mg 2g bags
		NaPhos IV 30 mmol/day	2 bags		2,160 NaPhos 15 mmol bags
		Calcium gluconate IV 4 g/day	4 vials		4,320 vials
Diuresis	- No information. Estimated 25% will require diuresis.	Furosemide IV 120 mg/day	1,080 mg	9	32,400 mg (~800 vials)
Hematology					
Prophylactic Anticoagulation	- 100% of ICU pt require DVT prophylaxis or Tx. Maybe 5% with contraindication to Rx.	Heparin 5,000 U SC BID	2 pfs	18	1,080 heparin pfs
		Enoxaparin 40 mg SC daily	1 pfs	18	540 enoxaparin pfs

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Treatment Anticoagulation	- Those with AFib or DVT/PE will require treatment anticoagulation. Use conservative estimate of 10%. Majority				
Infectious Disease					
CAP /H1N1	- 100% of pt with respiratory symptoms/pneumonia will be empirically covered for CAP as well as influenza. - All ICU pt to be covered with combination antiviral + antibacterial during first 3 days of admission. >3 days specimens/cultures should be available to tailor therapy.	Ceftriaxone 1 g IV/day Moxifloxacin 400 mg IV/day Azithromycin 500 mg IV/day (will use the European 3-day regimen for simplicity).	1 g 1 bag 1 vial	36 18 18	108 g (108 vials) 540 bags 540 vials
Co-Infections	- Bacterial co-infection ~50% that requires Tx beyond 3 days of initial Tx (need 4 more days). - Conservative estimate of 10% for VAP (4 pt) - Also need to provide antibiotic coverage for general septic shock (abdominal, etc). Use 50% of all ICU pt are on a broad-spectrum antibiotic for 7-10 days. - 10% may require antifungal coverage if PMH admissions - Antibiotic-associated diarrhea (<i>C. difficile</i>) 2% (based on ICU data from April 2008-July 2009)	Ceftriaxone 1 g IV q24h Moxifloxacin 400 mg IV q24h Cefazolin IV 2 g q8h Cloxacillin IV 2 g q6h Vancomycin IV 1 g q12h Septra (sulfamethoxazole and trimethoprim) IV 10 mL q12h Pip-tazo IV 4.5 g q8h Meropenem IV 1 g q8h Ciprofloxacin 400 mg IV q12h Caspofungin IV 50 mg daily Fluconazole 400 mg IV daily Metronidazole 500 mg NG TID	1 vial 1 bag 6 g 6g 2g 4 vials 3 vials 3 vials 2 bags 1 vial 2 bottles 3 tablets	6 6 3 2 3 3 15 5 5 3 2 2	720 vials ceftriaxone 180 bags moxifloxacin 540 g cefazolin 480 g cloxacillin 180 vials vancomycin 360 vials Septra (sulfamethoxazole and trimethoprim) 1,350 vials pip-tazo 450 vials meropenem 300 bags ciprofloxacin 90 vials caspofungin 120 bottles fluconazole 180 tablets metronidazole
Miscellaneous					
Regular routine meds for this cohort of 36 pt should be accounted for in the general hospital planning.					

Abbreviations: Pt, patient(s); Rx, prescription; MV, mechanical ventilation; HFOV, high-frequency oscillatory ventilation; ARDS, acute respiratory distress syndrome; NG, nasogastric; PO, by mouth; Tx, treatment; NMBA, neuromuscular blocking agent; MSH, Mount Sinai Hospital; SAS, Sedation Assessment Score; AFib, atrial fibrillation; COPD, chronic obstructive pulmonary disorder; MID, metered-dose inhaler; tid, three times a day; VAP, ventilator-associated pneumonia; GI, gastrointestinal; PPI, proton pump inhibitor; *C. difficile*, *Clostridium difficile*; KCL, potassium chloride; NaPhos, sodium phosphate; DVT, deep vein thrombosis; SC, subcutaneous; BID, twice a day; pfs, prefilled syringe; PE, pulmonary embolism; CAP, community-acquired pneumonia; PMH, Princess Margaret Hospital; pip-tazo, piperacillin and tazobactam

Supplement A1. Commissioning of Critical Care Overflow Areas

Bed/Patient Allocation	Processes Required for Implementation/Triggers	Monitors	Ventilators	Service Considerations
Pandemic Phase: 1st phase usual ICU capacity (=16 beds or 100% capacity)				
<p>Use current ICU space to full capacity of 16 beds.</p> <p>Most acutely ill patients will be assigned to this unit.</p>	<p>Hold daily ICU bed meeting at 9 AM to determine ICU bed requests and need for activating overflow areas. Arrange additional ad hoc meetings as required.</p> <ul style="list-style-type: none"> - ICU MD - PFC/NCM - RT - ICU RN team leader - Nsg leadership <p>TRIGGER: Once the ICU reaches a census of 14 patients with increasing volumes of patients with ILI or consequences of influenza, begin to arrange set-up and conversion of 2 CCU rooms for overflow use.</p>	<ul style="list-style-type: none"> - Cardiac monitors in 2 closed rooms in CCU have been activated. Check modules for monitors. - Central telemetry monitor to remain in CCU; to be monitored by CCU staff. - Purchase 4 after-market monitors or secure use of 4 monitors from PACU. - Install network drops for TeleCentral Client software in room 1629. 	<p>Allocate 16 adult vents to ICU on 18th floor (already possess).</p> <p>Allocate 2 adult vents from ICU pool to overflow area in CCU.</p>	<ul style="list-style-type: none"> - Allocate service carts to CCU with required ICU supplies (24-hour notice required). - Check nurse call and emergency call to ensure it is in working order. - Admit critical care patients to CCU locations required (change to census). - Ensure adequate supply of IV pumps (add 4 pump channels from BioMedical Engineering pump pool). - Plan for movement of ICU-related meds to CCU cupboards. - Ensure availability of ICU-related patient forms (dedicated location for ICU nursing station within CCU station to be allocated).
Pandemic Phase: 2nd phase increase to 150% capacity (=24 beds) Open CCU to create 8-bed critical care overflow unit.				
<p>Activate and set up this unit in a 3-step/staged process:</p> <p>Step 1. Surge to 2 beds (115%)</p> <p>Step 2. Surge to 4 beds (125%)</p> <p>Step 3. Surge to 8 beds (150%)</p>	<p>Step 1. 115% surge or 2 critical care overflow beds opened with activation/set-up of 2 currently closed beds. CCU will remain at 6-bed census in normal location.</p> <p>TRIGGER: Once 1 critical care overflow bed is filled and ICU census (on the 18th floor) is 16, transition to room 1629 (1st choice) or MSDU (2nd choice). <i>The following section outlines the preparation that is to occur for both of these options.</i></p>	<ul style="list-style-type: none"> - Facilitate off-CCU monitoring of central telemetry with the TeleCentral Client software and reconfiguration of the software. The main TeleCentral Client software server/display will always remain on 16 in either CCU (phase 1, 2) or 16N (>phase 2). 	<p>Allocate 2 adult vents from ICU pool (1 currently in existence; 1 on order) to overflow area in CCU.</p>	<p>When cardiac patients are relocated, move the CCU crash cart with defibrillator to the new area. An additional manual defibrillator with pacing and AED capability will be required for the old CCU (ie, ICU overflow area). The cart itself can be redeployed from SPD.</p>

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<p>1st Choice Set-up/use of room 1629 for CCU patients</p>	<ul style="list-style-type: none"> - CCU census to be reduced to 4 patients. CCU patients remain in CCU with 4 critical care patients. - Clear room 1629 and prepare it for use by CCU patients. 	<ul style="list-style-type: none"> - Central telemetry monitor remains in CCU for surge of 4 patients. Monitored by CCU nurse. - Test TeleCentral Client software for room 1629 or use 16N Nurse Station for TeleCentral Client software monitoring. - Install 4 aftermarket monitors in room 1629. 		<p>For CCU patients (prior to movement to room 1629): Activate/Test:</p> <ul style="list-style-type: none"> - Phone (internal and external lines) for staff use - Computer (paper printer) - Label printers – reconfigure for proper printing location - Nurse call bell - Emergency bells - Admit CCU patients to new location in required (change to census). <p>For ICU surge patients in CCU:</p> <ul style="list-style-type: none"> - Admit CCU patients to new location in required (change to census). - Ensure adequate ICU supplies (24-hour notice required). - Move ICU-related meds to satellite cupboards (increased quota?). - Ensure adequate supply of IV pumps (send additional pumps from BioMedical Engineering pump pool). - Ensure availability of ICU-related patient forms (satellite ICU nursing station to be set up).
<p>2nd Choice Set-up/use of MSDU for CCU patients</p>	<ul style="list-style-type: none"> - Consider need for satellite MSDU or determine if MSDU should be allocated to SSDU (will require deferral of SSDU cases). - If satellite area to be created, reallocate medical step-down patients to 4-bed quad room in 1702 or 1738 prior to preparation for CCU move. 	<ul style="list-style-type: none"> - Central telemetry monitor remains in CCU for surge of 4 patients and is monitored by CCU nurses. - Set up test TeleCentral Client software in 17 SDU. - Prepare 4 aftermarket monitors for displaced SDU level 2 patients. 		<p>For MSDU patients (prior to CCU movement):</p> <ul style="list-style-type: none"> - Close room 1702 or 1728 with patients currently in rooms transferred or discharged as appropriate, or transfer to SSDU. - Admit MSDU patients to new location in required (change to census). - Ensure adequate MSDU supplies in satellite location (24-hour notice required). - Move MSDU-related meds to satellite cupboards/ area. - Ensure adequate supply IV pumps (send additional pumps from BioMedical Engineering pump pool). - Ensure availability of MSDU-related patient forms (set up satellite MSDU nursing station in new location).

				<p>Activate/Test:</p> <ul style="list-style-type: none"> - Computer (paper printer) - Label printers – reconfigure for proper printing location - Emergency bells <p>For CCU patients (prior to movement to MSDU):</p> <ul style="list-style-type: none"> - Admit CCU patients to new location in required (change to census). - Arrange for transport of CCU equipment and supplies. - Transport Code Blue cart to location outside of MSDU. <p>For ICU surge patients in CCU:</p> <ul style="list-style-type: none"> - As above (plan for surge to 8 patients in system) - Ensure adequate ICU supplies (24-hour notice required). - Move ICU-related meds to satellite cupboards (increased quota?). - Ensure adequate IV pumps (send additional pumps from BioMedical Engineering pump pool). - Move 2nd ICU rover cart to CCU.
	<p>Step 2. 125% surge or 2 additional critical care beds opened (=4) with 4 CCU patients sharing unit TRIGGER: Once 4 ICU patients are in CCU, central telemetry client to move to 1629 or MSDU.</p>	<p>Note: MSDU area has monitors suitable for CCU patients.</p>		<ul style="list-style-type: none"> - If applicable and MSDU used, transfer MSDU patients to 1728 or 1702. - Transfer 2 CCU patients once central monitoring station has been moved. 2 CCU patients in 1629/MSDU will be cared for by 2 CCU nurses (1 who will also monitor telemetry). - Transfer final 2 patients once telemetry station is functional and tested.
	<p>Step 3. 150% surge or 4 additional beds opened (=8) for critical care only. CCU (4 beds) patients now located in 1629 or MSDU.</p> <ul style="list-style-type: none"> - Priority A: surgical cases only, and cancer not requiring level 3 care. Code Orange has been activated. 	<ul style="list-style-type: none"> - Move CCU to room 1629 or MSDU (=4); relocate central telemetry client. - Relocate main TeleCentral Client software to 16 North (not for primary viewing). - If MSDU, monitor displaced level 2 patients with 4 aftermarket monitors. 	<p>Redeploy 4 vents to critical care overflow in the CCU from the general MSH ventilator pool.</p>	<ul style="list-style-type: none"> - Admit ICU patients to final 4 beds in the CCU.

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Pandemic Phase: 3rd phase increase to 200% capacity (=32 patients)				
<p>Open 8 critical care overflow beds in PACU.</p> <p>De-escalation of OR services will have occurred.</p> <p>Consider alternate PACU space – patients to be recovered in designated OR.</p>			<p>1 adult vent to stay in PACU due to anesthesia needs +7 anaesthetic vented to redeployed from OR once surge to 8 beds occurs.</p> <p>Additional IV pumps delivered from BioMedical Engineering pump pool.</p>	<p>Patients recovered in the OR by PACU and OR staff teams.</p>
Pandemic Phase: 4th phase increase to 225% capacity (=36 patients)				
<p>Open 4 additional critical care overflow beds in the PACU.</p>	<p>2 OR suites in operation only. 1 OR is used as a dedicated space for postoperative recovery of patients.</p>			

Abbreviations: MD, physician; PFC/NCM, Patient Flow Coordinator/Nursing Clinical Manager; RT, respiratory therapist; RN, registered nurse; Nsg, nursing; ILI, influenza-like illness; CCU, coronary care unit; PACU, post-anesthesia care unit; MSDU, medical step-down unit; AED, automated external defibrillator; SSDU, surgical step-down unit; SDU, step-down unit; OR, operating room

Supplement A2. 8- and 12-Bed Satellite ICU Line Insertion Carts^a

Location	8-Bed Cart Contents	12-Bed Cart Contents
Top	1 box of surgical masks 2 sterile dressing trays Sterile gloves in different sizes	2 boxes of surgical masks 4 sterile dressing trays Sterile gloves in different sizes
Drawer 1	20 Tegaderm™ dressings 10 Medipore™ rolls small and large 10 surgical blades 10 stitch cutters 1 box of alcohol wipes 20 small chlorhexidine swab sticks 24 large chlorhexidine swab sticks 5 Surgiseal™ curved and straight sutures	20 Tegaderm™ dressings 10 Medipore™ rolls small and large 10 surgical blades 10 stitch cutters 2 boxes of alcohol wipes 30 small chlorhexidine swab sticks 36 large chlorhexidine swab sticks 5 Surgiseal™ curved and straight sutures
Drawer 2	10 14-cm guidewire with casing 10 14-cm guidewire without casing 10 femoral arterial line kits 10 radial arterial line kits 20 20-gauge 1.16 inch Angiocaths™ (PINK) 20 4-way stopcocks 20 M/F Luer lock caps	20 14-cm guidewire with casing 10 14-cm guidewire without casing 10 femoral arterial line kits 15 radial arterial line kits 40 20-gauge 1.16 inch Angiocaths™ (PINK) 30 4-way stopcocks 40 M/F Luer lock caps
Drawer 3	4 sterile towels 4 sterile gowns 2 45-cm guidewire 2 68-cm guidewire 2 Arrow triple lumen central line kits 2 Cordis® kits Elastoplast® tape Large and small bandages	8 sterile towels 8 sterile gowns 4 45-cm guidewire 2 68-cm guidewire 4 Arrow triple lumen central line kits 4 Cordis® kits Elastoplast® tape Large and small bandages
RT Supplies		
Location	8-Bed Cart Contents	12-Bed Cart Contents
Top ETTs 7 - 50872 7.5 - 50873 8 - 50874	3 intubation kits - RT 5 Laerdal bags - 701009 Blue & white forms - RT ETTs 7, 7.5, & 8 (10 each) - see left 10 stylets -112160 10 face shields - 50151 Box batteries AA & C - 110365/ 110350 Magills & Mac 3 & 4 blades - RT 3 lidocaine spray - pharmacy	5 intubation kits 10 Laerdal bags Blue & white forms ETTs 7, 7.5, & 8 (10 each) 10 stylets 10 face shields 1 box batteries AA & C Magills & Mac 3 & 4 blades 3 lidocaine spray
Drawer 1	12 aerosol tubing - 59286 4 tracheostomy masks - 702001 6 aerosol masks - 113300 10 nasal prongs - 50615 10 oxygen tubing - 59238 5 O ₂ connectors - 59239 5 AeroChambers® - 112350 5 venti-masks - 50616	18 aerosol tubing 6 tracheostomy masks 10 aerosol masks 10 nasal prongs 10 oxygen tubing 5 O ₂ connectors 8 AeroChambers® 10 venti-masks

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Side Drawer 1	Cuff manometer - RT 8 PEEP valves - 11282 4 flow diverters - RT 10 CO ₂ detectors - 634420 10 filters (disposable) - 701665	Cuff manometer 10 PEEP valves 6 flow diverters 20 CO ₂ detectors 20 filters (disposable)
Drawer 2	10 ETT in-line suction - ICU 2 tracheostomy in-line suction - ICU 5 normal saline vials (boxes - ICU) 12 Spo ₂ probes - 112357	20 ETT in-line suction 4 tracheostomy in-line suction 10 normal saline vials (boxes) 20 Spo ₂ probes
Side Drawer 2	10 ETT tapes (pre-made) - 115710 12 tongue depressors - 50279 5 ETT bite blocks - RT 4 Dale® tracheostomy ties - RT	20 ETT tapes (pre-made) 24 tongue depressors 10 ETT bite blocks 10 Dale® tracheostomy ties
Drawer 3	10 pressure bags - 701310 10 stress relievers - 701998 10 CVP lines - 631180 Medication labels - pharmacy	20 pressure bags 20 stress relievers 20 CVP lines Medication labels
Side Drawer 3	5 oral airways #8 - 110030 5 oral airways #9 - 110035 5 oral airways #10 - 110404 5 nasal airways #6 - 112600 5 nasal airways #7 - 112605	10 oral airways #8 10 oral airways #9 10 oral airways #10 10 nasal airways #6 10 nasal airways #7
Drawer 4	10 ventilator circuits & filters - 701531 & RT 10 ventilator/NIV pots - 701530 & RT 5 temperature probes - RT 2 servo green lines with filters - RT 10 NIV/ventilator filters - 701665 & RT 10 NIV circuit & masks - 701667 & RT	15 ventilator circuits & filters 15 ventilator/NIV pots 10 temperature probes 2 servo green lines with filters 10 NIV/ventilator filters 10 NIV circuits & masks
Side Drawer 4	10 15-mm connectors - 632490 5 22-mm connectors- 702002 12 flexible tubing - RT 12 short white tubing - RT	20 15-mm connectors 5 22-mm connectors 20 flexible tubing 20 short white tubing

Abbreviations: M/F, male/female; RT, respiratory therapist; ETT, endotracheal tubes; PEEP, positive end-expiratory pressure; CVP, central venous pressure; NIV, noninvasive ventilation

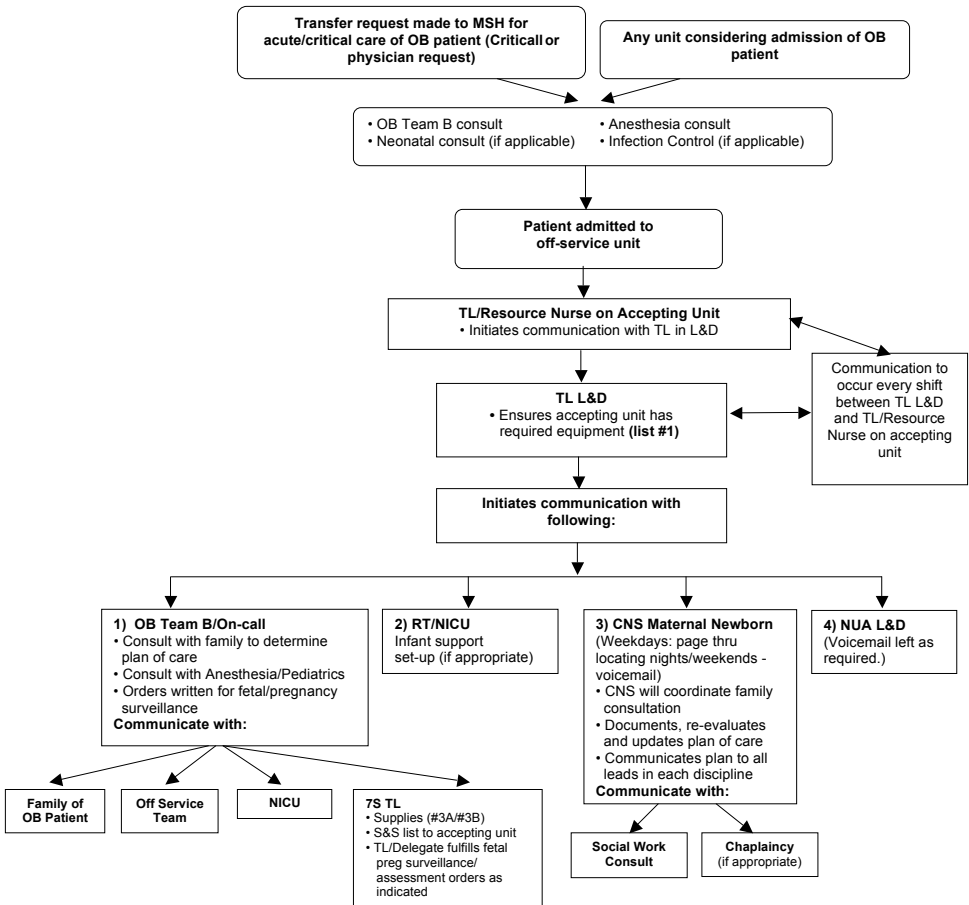
^aFor items are listed with an HLI barcode number and "RT," a backup pandemic supply of this item is available.

Supplement A3. Communication and Responsibility for Off-Service Obstetrical Patients

Discussion Points for Immediate Planning and Ongoing Reassessment

1. Need for and type of antenatal surveillance
2. Emergency delivery plan
 - Family priorities

- Anesthesia plan
 - Location of delivery
 - Infant resuscitation
 - Code status for mom/baby
3. Neonatal consult
 4. Anesthesia consult
 5. Need for equipment



Abbreviations: MSH, Mount Sinai Hospital; OB, obstetric; Critical, name of the provincial ICU bed registry service; TL, team leader; L&D, Labor and Delivery; RT, Respiratory Therapy; NICU, neonatal intensive care unit; CNS, clinical nurse specialist; NUA, nursing unit administrator; preg, pregnancy

Supplement A4. Modification of Usual ICU Admission Criteria and Usual Standards of Care

See also Ontario Health Plan for an Influenza Pandemic 2008, Chapter 17: http://www.health.gov.on.ca/english/providers/program/emu/pan_flu/pan_flu_plan.html

See also ACCP Guidelines. Definitive care for the critically ill during a disaster: http://www.chestjournal.org/content/vol133/5_suppl/

As the number of critically ill patients increase, scarce resources will need to be allocated to provide maximum benefit to the greatest number of patients. All patients will receive care, but when ICU resources become limited, high-intensity interventions will be limited and patients with a low likelihood of survival will receive predominantly comfort-oriented care.

This process will involve:

- 1) Limitation of ICU care to patients with respiratory or hemodynamic failure
- 2) Elimination of high workload interventions that have a minimal benefit
- 3) Reduction in the number of high-resource interventions (eg, those requiring transport)
- 4) Triage based on the likelihood of survival given the limited resources

This section describes a suggested stepwise approach to the implementation of altered standards of care. Criteria should apply to all patients (ie, those with influenza and with other causes of critical illness). The precise trigger point for each change will be determined by those in charge during a pandemic, based on evolving knowledge of the disease, resources, and patient load.

Critical Care Admission Criteria

The ICU's major benefit is in providing care for patients with respiratory failure or shock. For example:

- Hypoxic or hypercapnic respiratory failure
- Impending respiratory failure
- Inability to protect the airway
- Hypotension with evidence of organ dysfunction, refractory to fluid administration

Elimination of High Workload Interventions

The following interventions are presented in order of complexity, workload, and limited benefit in a pandemic situation, with the suggestion that they are discontinued in this order.

- 1) **Continuous renal replacement therapy.** Acute renal failure in the critically ill patient carries a very high mortality. Resources in this hospital are limited to 3 machines and workload is high.
- 2) **Inhaled nitric oxide.** Inhaled nitric oxide is used as salvage therapy for patients with intractable hypoxemia. Mortality rate in this population would be extremely high and no evidence exists to support its use in this situation. However, as patients with H1N1 pneumonitis develop severe hypoxemia, this may be a very valuable transient supportive intervention.
- 3) **High-frequency oscillation.** High-frequency oscillation as a salvage therapy is utilized at Mount Sinai, but there is little evidence for its use in this role. However, as patients with H1N1 pneumonitis develop severe hypoxemia, high-frequency oscillation may be a very valuable mode of respiratory support.
- 4) **Cardiac arrest management.** The prognosis for patients with cardiac arrest is poor and resource utilization is high. An exception may be patients with primary cardiac disease (eg, in the CCU).
- 5) **Massive blood product requirement.** Patients requiring massive blood transfusions or other blood product support have a poor prognosis, and blood products may be difficult to obtain under pandemic conditions.
- 6) **Limitations in inotrope dose.** Patients requiring high-dose infusions of inotropes (eg, $>1 \mu\text{g}/\text{kg}/\text{min}$ norepinephrine) have a poor prognosis.
- 7) **Total parenteral nutrition**

Critical Care Triage

Triage may occur prior to ICU admission or in patients occupying an ICU bed with limited hope of survival. Triage will occur under the direction of the Chief Medical Officer of Health for the Province of Ontario based on protocols issued by the MOHLTC. This will ensure that all patients are treated equally, preventing inequities between various hospitals. The triage protocol thresholds will vary based upon the balance between system demands and resource availability, with the goal of restricting treatment only to the degree necessary to address resource shortfalls.

Critical Care Exclusion Criteria

Resources will be focused on those patients with the best chance of long-term survival. Therefore patients with poor prognostic indicators, such as those listed below, will be excluded from ICU admission or ongoing ICU treatment:

1. Advanced underlying disease

Patients with the following underlying conditions presenting to the ICU with acute organ failure have a very high mortality rate, often following a prolonged and resource-intensive ICU course:

- Severe cardiac dysfunction (eg, grade 4 left ventricular function)
- Severe respiratory disease (eg, requiring ambulatory oxygen)
- Severe neurological compromise
- Active malignancy
- Advanced neuromuscular disease
- End-stage liver disease

2. Poor chance of survival despite ICU care

Patients with the following have a very high mortality rate, often following a prolonged and resource-intensive ICU course:

- Respiratory failure, shock, and renal failure
- Multiple organ failure (eg, SOFA [Sequential Organ Failure Assessment] score >11)
- Prolonged intractable hypoxemia
- Cardiac arrest survivors with neurological compromise

3. Triage based on SOFA score monitoring

This is described in detail in the Ontario Health Plan for an Influenza Pandemic 2008. SOFA score calculation requires: blood pressure, Glasgow Coma Scale, PaO₂, platelet count, bilirubin, creatinine. Four categories of patients are identified based on SOFA score at baseline and on improvement/deterioration at 48 h and 120 h:

- **Blue.** Will not benefit from ICU, requires comfort measures
- **Red.** Highest priority, needs life support but good chance of survival
- **Yellow.** Requires life support but may or may not benefit. Serial SOFA score may be of value
- **Green.** Does not require ICU, good prognosis

Supplement A5. Critical Care Nursing Inventory^a

Education	CCU	SSDU	PACU	MSDU	16N	17N/S	14 N/14S	12S	OR	11N/11S
Respiratory Assessment	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Establishing an Airway	Y	P	P	P	N	N	N	N	N	N
Mechanical Ventilators	N	N	Y	N	N	N	N	N	N	N
Weaning a Ventilated Patient	N	N	P	N	N	N	N	N	N	N
Drug Theory	Y	P	P	P	N	N	N	N	N	N
Interpretation										
12-Lead ECG	Y	N	N	N	Y	N	N	N	N	N
Cardiac Monitoring	Y	Y	P	Y	N	N	N	N	N	N
Advanced Hemodynamic Monitoring	Y	Y	P	N	N	N	N	N	N	N
Arterial Lines	Y	Y	Y	Y	N	N	N	N	N	N
Acid-Base Balance/ABG	Y	Y	Y	Y	N	N	N	N	N	N
CVG	Y	N	N	N	N	N	N	N	N	N
Sepsis	Y	P	P	P	N	N	N	N	N	N
Shock	Y	P	P	P	N	N	N	N	N	N
Pain Management and Sedation	Y	Y	Y	Y	N	N	N	N	N	N
ACLS	Y	N	N (many do)	N	N	N	N	N	N	N
AED	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Total = 15 criteria	14	7	6	6	3	2	2	2	1	2

Abbreviations: CCU, critical care unit; SSDU, surgical step-down unit; PACU, post-anesthesia care unit; MSDU, medical step-down unit; OR, operating room; ECG, electrocardiogram; ABG, arterial blood gas; CVG, central venous gas; ACLS, Advanced Cardiac Life Support; AED, automated external defibrillator
^aY indicates that nurses have this skill/education, P indicates that nurses have some level of this skill/education but require further knowledge, N indicates that nurses do not have the skill/education

As well as the skills above, RN skills include:

Peripheral IV access/monitoring, initiation of hemodynamic therapy, appropriate use of personal protective equipment, basic patient care, routine nursing skills (nasogastric tube placement, Foley catheter insertion)

As well as the skills above, ICU RN skills include:

- Assist Advanced Cardiac Life Support Team during initial assessment and stabilization of new ICU patients

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- Maintain and titrate hemodynamic therapy
- Monitor oxygen saturation and ventilator alarms
- Monitor arterial blood pressure and central venous pressure
- Administer bag-mask ventilation
- Perform electrocardiogram rhythm analysis
- Suction using in-line suction system
- Use IV pumps and/or drip titration of drugs
- Routine nursing skills (nasogastric tube placement, Foley catheter insertion)

Education	RT (Adult) 26 FT/ 2 PT	RT (Neonatal) 23 FT/ 2 PT	RT (OR) 6 FT
Respiratory Assessment	Y	Y	Y
Establishing an Airway	Y	Y	Y
Mechanical Ventilation	Y	Y	Y
Weaning Ventilated Patient	Y	Y	Y
Drug Therapy	Y	Y	Y
Interpretation of 12-Lead ECG	P	P	Y
Cardiac Monitoring	Y	Y	Y
Advanced Hemodynamic Monitoring	Y	Y	Y
Arterial lines	Y	Y	Y
Acid-Base Balance/ABG/MV	Y	Y	Y
Sepsis	Y	Y	Y
Shock	Y	Y	Y
Pain Management and Sedation	P	P	Y
ACLS (~50%)	P	P	P
AED (100%)	Y	Y	Y
Total = 15 criteria	12	12	14

Abbreviations: RT, respiratory therapist; FT, full time; PT, part time; OR, operating room; ECG, electrocardiogram; ABG, arterial blood gas; MV, mechanical ventilation; ACLS, Acute Cardiac Life Support; AED, automated external defibrillator

*Y indicates that RTs have this skill/education, P indicates that RTs have some level of this skill/education but require further knowledge, N indicates that RTs do not have the skill/education

As well as the skills above, RT skills include:

- Assisting Acute Cardiac Life Support Team during the initial assessment and stabilization of patients admitted to the ICU
- Management of unstable ICU patients/transportation of critically ill patients
- Taking patient histories/chest radiograph interpretation
- Conscious sedation (OR RT)/peripheral intravenous access (OR RT)
- Setup and monitoring of pulmonary arterial/central venous pressure lines/arterial line insertion
- Maintain/monitor/manage/test/clean mechanical ventilators
- Maintain/monitor/manage endotracheal and tracheostomy tubes
- Application/monitoring and assisting with open tracheotomies
- Tracheotomy assessment and reinsertion
- Thoracic suction/chest tube maintenance
- Oxygenation monitoring and equipment maintenance
- Oxygen administration equipment maintenance
- Difficult airway management
- Assisting with bronchoscopy and cleaning