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MINNESOTA DEPARTMENT OF HEALTH
OFFICE OF EMERGENCY PREPAREDNESS
www.health.state.mn.us/oep/healthcare

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PATIENT CARE
STRATEGIES FOR SCARCE RESOURCE SITUATIONS

Summary Card

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

Potential trigger events:	•Mass Casualty Incident (MCI) •Infrastructure damage/loss •Pandemic/Epidemic	•Supplier shortage •Recall/contamination of product •Isolation of facility due to access problems (flooding, etc)

How to use this card set:

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 resource 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 will continue beyond 24h and no regional options 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.

Version 2.0 December 2011

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OXYGEN

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Inhaled Medications • 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*			
High-Flow Applications • 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*			
Air-Oxygen Blenders • 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*			
Oxygen Conservation Devices • 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*			
Oxygen Concentrators if Electrical Power Is Present • 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*			
Monitor Use and Revise Clinical Targets • 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. **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% **Note**: Targets may be adjusted further downward depending on resources available, the patient's clinical presentation, or measured PaO2 determination.	*Conserve*			
Expendable Oxygen Appliances • 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*			
Oxygen Re-Allocation • Prioritize patients for oxygen administration during severe resource limitations.	*Re-Allocate*			

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STAFFING

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Staff and Supply Planning • Assure facility has process and supporting policies for disaster credentialling 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.	*Prepare*			
Focus Staff *Time* on Core Clinical Duties • 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.	*Conserve*			
Use Supplemental Staff • 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).	*Substitute*			
• 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.	*Adapt*			
Focus Staff *Expertise* on Core Clinical Needs • 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.	*Conserve*			
Use Alternative Personnel to Minimize Changes to Standard of Care • 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.	*Adapt*			

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NUTRITIONAL SUPPORT

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Food • 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*			
Water • 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*			
Staff/Family • 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*			
Planning • 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*			
• 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*			
• 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*			
• 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.	*Substitute & Adapt*			
• Eliminate or modify special diets temporarily. • Use blenderized food and fluids for enteral feedings rather than enteral nutrition products if shortages occur. Examples: 1. The Oley Foundation: Making Your Own Food for Tube Feeding, http://www.oley.org/lifeline/TubetalkSO07.html#Making%20your%20own 2. Klein, Marsha Dunn, and Suzanne Evans Morris. Homemade Blended Formula Handbook. Tucson: Mealtime Notions LLC, 2007.	*Adapt*			

MEDICATION ADMINISTRATION

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Cache / Increase Supply Levels • 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: **Analgesia** • morphine, other narcotic and non-narcotic (non-steroidals, acetaminephen) class - injectable and oral (narcotic conversion tool at http://www.globalrph.com/narcoticonv.htm) **Sedation** • particularly benzodiazepine (lorazepam, midazolam, diazepam) injectables **Anti-infective** • narrow and broad spectrum antibiotics for pneumonia, skin infections, open fractures, sepsis (e.g.: cephalosporins, quinolones, tetracyclines, macrolides, aminoglycosides, clindamycin, etc.), select antivirals **Pulmonary** • metered dose inhalers (albuterol, inhaled steroids), oral steroids (dexamethasone, prednisone) **Behavioral Health** • haloperidol, other injectable and oral anti-psychotics, common anti-depressants, anxiolytics **Other** • sodium bicarbonate, paralytics, induction agents (etomidate, propofol), proparacaine/tetracaine, atropine, pralidoxime, epinephrine, local anesthetics, antiemetics, insulin, common oral anti-hypertensive and diabetes medications	*Prepare*			
Use Equivalent Medications • Obtain medications from alternate supply sources (pharmaceutical representatives, pharmacy caches). **Pulmonary** • Metered dose inhalers instead of nebulized medications **Analgesia/ Sedation** • 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** • Examples: cephalosporins, gentamicin, clindamycin substitute for unavailable broad-spectrum antibiotic • Target therapy as soon as possible based upon organism identified. **Other** • Beta blockers, diuretics, calcium channel blockers, ace inhibitors, anti-depressants, anti-infectives	*Substitute* *Substitute*			
Reduce Use During High Demand • 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.	*Conserve*			
• Do without - consider impact if medications not taken during shortage (statins, etc.).	*Conserve*			

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MEDICATION ADMINISTRATION

STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)

RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Modify Medication Administration • Emphasize oral, nasogastric, subcutaneous routes of medication administration. • Administer medications by gravity drip rather than IV pump if needed: *IV drip rate calculation - drops / minute = amount to be infused x drip set / time (minutes) (drip set = qtts / mL - 60, 10, etc.).* • Rule of 6: pt wgt (kg) x 6 = mg drug to add to 100ml fluid = 1mcg / kg / min for each 1 mL / hour NOTE: For examples, see http://www.gaems.net/download/drugcalc.pdf	*Adapt*			
• Consider use of select medications beyond expiration date.* • Consider use of veterinary medications when alternative treatments are not available.*	*Adapt*			
Restrict Allocation of Select Medications • Allocate limited stocks of medications with consideration of regional/state guidance and available epidemiological information (e.g.: anti-viral medications such as olseltamivir)	*Re-Allocate*			
• Allocate limited stock to support other re-allocation decisions (ventilator use, etc.).	*Re-Allocate*			

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

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HEMODYNAMIC SUPPORT AND IV FLUIDS

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Cache Additional Intravenous (IV) Cannulas, Tubing, Fluids, Medications, and Administration Supplies	*Prepare*			
Use Scheduled Dosing and Drip Dosing When Possible • Reserve IV pump use for critical medications such as sedatives and hemodynamic support.	*Conserve*			
Minimize Invasive Monitoring • 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*			
Emphasize Oral Hydration Instead of IV Hydration When Possible Utilize appropriate oral rehydration solution: • 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 Pediatric hydration: Pediatric maintenance fluids: • 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) Supplement for each diarrhea or emesis 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. 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/cai/howto/IntravenousFluidOrders.PDF.	*Substitute*			
Provide Nasogastric Hydration Instead of IV Hydration When Practical • 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*			
Substitute Epinephrine for Other Vasopressor Agents • For hemodynamically unstable patients who are adequately volume-resuscitated, consider adding 6mg epinephrine (6mL of 1:1000) to 1000mL NS on minidrip tubing and titrate to target blood pressure. • Epinephrine 1:1000 (1mg/mL) multi-dose vials available for drip use.	*Substitute*			
Re-use CVP, NG, and Other Supplies After Appropriate Sterilization / Disinfection • 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)

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RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Intraosseous / Subcutaneous (Hypodermoclysis) Replacement Fluids • Consider as an option when alternative routes of fluid administration are impossible/unavailable • Intraosseous before percutaneous Intraosseous • 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. Hypodermoclysis • 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.	*Substitute*			
Consider Use of Veterinary and Other Alternative Sources for Intravenous Fluids and Administration Sets	*Adapt*			

MECHANICAL VENTILATION / EXTERNAL OXYGENATION

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

RECOMMENDATIONS	*Strategy*	*Conventional*	*Contingency*	*Crisis*
Increase Hospital Stocks of Ventilators and Ventilator Circuits, ECMO or bypass circuits	*Prepare*			
Access Alternative Sources for Ventilators / specialized equipment • 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*			
Decrease Demand for Ventilators • 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*			
Re-use Ventilator Circuits • 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*			
Use Alternative Respiratory Support Technologies • 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.	*Adapt*			
• 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).				
Assign Limited Ventilators to Patients Most Likely to Benefit if No Other Options Are Available ***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).	*Re-allocate*			

ORGAN SYSTEM	SCORE = 0	1	2	3	4
RESPIRATORY Pa02 / FI02	> 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

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MECHANICAL VENTILATION / EXTERNAL OXYGENATION

STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)

RECOMMENDATIONS				***Strategy***	***Crisis***
***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.				*Re-allocate*	
Criteria	Patient keeps resource		Resource re-allocated		
1. Organ system function[a]	Low potential for death (SOFA score ≤ 7)	Intermediate potential for death (SOFA score 8-11)	High potential for death (SOFA score ≥12)		
2. Duration of benefit / prognosis	Good prognosis based upon epidemiology of specific disease/ injury. No severe underlying disease.[b]	Indeterminate / intermediate prognosis based upon epidemiology of specific disease / injury 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.	Poor prognosis based upon epidemiology of specific disease / injury (e g; pandemic influenza) Severe underlying disease with poor short-term (e.g., <1 year) prognosis		
3. Duration of need	Short duration – flash pulmonary edema, chest trauma, other conditions anticipating < 3 days on ventilator	Moderate duration – e.g., pneumonia in healthy patient (estimate 3-7 days on ventilator)	Long duration – e.g., ARDS, particularly in setting of preexisting lung disease (estimate > 7 days on ventilator)		
4. Response to mechanical ventilation	Improving ventilatory parameters over time[c]	Stable ventilatory parameters over time	Worsening ventilatory parameters over time		
[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.					
[b] Examples of underlying diseases that predict poor short-term survival include (but are not limited to): 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					
[c] Changes in Oxygenation Index over time may provide comparative data, though of uncertain prognostic significance. OI = MAWP x FiO2 / PaO2 where: OI = oxygenation index, MAWP= Mean Airway Pressure, FiO2 = inspired oxygen concentration, PaO2 = arterial oxygen pressure (May be estimated from oxygen dissociation curve if blood gas unavailable.)					
***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.					

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BLOOD PRODUCTS

STRATEGIES FOR SCARCE RESOURCE SITUATIONS

Category	RECOMMENDATIONS	Healthcare Facility	Blood Center	Strategy	Conventional	Contingency	Crisis
All Blood Products	• 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		√	*Prepare*			
	• Consider adjustments to donor HGB/HCT eligibility		√	*Adapt*			
	• Relax travel deferrals for possible malaria and BSE (bovine spongiform encephalitis)*		√	*Prepare*			
Packed Red Blood Cells	• Use cell-saver and auto-transfusion to degree possible	√		*Re-use*			
	• 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	√		*Conserve*			
	• Change donations from whole blood to 2x RBC apheresis collection if specific shortage of PRBCs		√	*Adapt*			
	• More aggressive crystalloid resuscitation prior to transfusion in shortage situations (blood substitutes may play future role)	√		*Conserve*			
	• Long-term shortage, collect autologous blood pre-operatively and consider cross-over transfusion	√		*Conserve*			
	• Enforce lower hemoglobin triggers for transfusion (for example, HGB 7)	√		*Conserve*			
	• Consider limiting high-consumption elective surgeries (select cardiac, orthopedic, etc)	√		*Conserve*			
	• Consider use of erythropoietin (EPO) for chronic anemia in appropriate patients	√		*Adapt*			
	• 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	√		*Re-allocate*			
	• 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.	√		*Re-allocate*			
	• Reduce or waive usual 56 day inter-donation period* based upon pre-donation hemoglobin		√	*Adapt*			
	• Reduce weight restrictions for 2x RBC apheresis donations according to instruments used and medical director guidance*		√	*Adapt*			
Fresh Frozen Plasma	• Though not true substitute, consider use of fibrinolysis inhibitors or other modalities to reverse coagulopathic states (tranexamic acid, aminocaproic acid, activated coagulation factor use, or other appropriate therapies)	√		*Substitute*			
	• Consider reduction in red cell : FFP ratios in massive transfusion protocols in consultation with blood bank medical staff	√		*Conserve*			
	• No anticipatory use of FFP in hemorrhage without documented coagulopathy	√		*Conserve*			
	• Obtain FDA variance to exceed 24 collections per year for critical types*		√	*Adapt*			

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

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BLOOD PRODUCTS

STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)

Category	RECOMMENDATIONS	Healthcare Facility	Blood Center	Strategy	Conventional	Contingency	Crisis
Platelets	• Though not true substitute, consider use of desmopressin (DDAVP) to stimulate improved platelet performance in renal and hepatic failure patients	√		*Substitute*			
	• May use leukoreduced whole blood pooled platelets (and, if required, consider non-leukoreduced whole blood pooled platelets)		√	*Adapt*	Leukoreduced		Non-leukoreduced
	• Convert less needed ABO Whole Blood to Apheresis		√	*Adapt*			
	• Transfuse platelets only for active bleeding, further restrict to life-threatening bleeding if required by situation	√		*Conserve*			
	• No prophylactic use of platelets	√		*Conserve*			
	• Accept female platelet donors without HLA antibody screen		√	*Adapt*			
	• Accept female donors for pooled and stored platelets		√	*Adapt*			
	• Apply for variance of 7 day outdate requirement*		√	*Adapt*			
	• Consider a 24 hr hold until the culture is obtained and immediate release for both Pool and Apheresis		√	*Adapt*			
	• Obtain FDA variance to allow new Pool and Store sites to ship across state lines*		√	*Adapt*			
	• Reduce pool sizes to platelets from 3 whole blood donations		√	*Adapt*			

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

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RENAL REPLACEMENT THERAPY
REGIONAL RESOURCE CARD

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

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/S51.

Category	RESOURCE and RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Command, Control, Communication, Coordination	**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: 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) <u>Outpatient</u> • 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) <u>Inpatient</u> • 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 <u>Patient preparedness</u> • 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_prepardness.pdf	*Prepare*			
	Shortage of Renal Replacement Therapy (RRT) Resources • Affected facility should contact involved/affected dialysis provider companies and organizations as expert consultants[1] (MDH OEP and the Renal Network 11 website maintain contact information)				
Space	**Relocated Patients Requiring Outpatient Dialysis** • Contact usual outpatient provider network to schedule at new facility – refer patients to 'hotlines' as needed **Excess Patients Requiring Dialysis** • 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	*Substitute*			
	• Consider moving other inpatient or outpatient dialysis staff and equipment to facilities requiring increased dialysis capacity	*Adapt*			

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Category	RESOURCE and RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Supplies	**Water Supply** • 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	*Prepare*			
	Water Contamination • Consider alternate sources of water	*Prepare*			
	• Consider transferring stable inpatients to outpatient dialysis centers for dialysis treatments and vice versa	*Substitute*			
	• Consider use of MN National Guard water reserves and purification equipment – but must assure adequate purity for dialysis (potable is NOT sufficiently clean)	*Adapt*			
	Power Outage or Shortage • 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	*Substitute* *Adapt*			
	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				
	• 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	*Prepare*			
	• Transfer machines/supplies between outpatient centers and hospitals, or between hospitals	*Substitute*			
Staff	**Dialysis Staff Shortages**[2] • Non-dialysis nursing staff to take on "routine" elements of dialysis nursing (e.g., taking VS, monitoring respiratory and hemodynamic status, etc.)	*Substitute*			
	• 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)	*Adapt*			
Special	**Community Planning** • 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.	*Prepare*			
Triage	**Insufficient Resources Available For All Patients Requiring Dialysis** • 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	*Conserve*			
	• 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)	*Re-allocate*			

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Category	RESOURCE and RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Treatment	**Crush Syndrome** • Initiate IV hydration and acidosis prevention protocols "in the field" for crush injuries to prevent/treat rhabdomyolysis in hospital settings	*Conserve*			
	Mode of Dialysis • 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))	*Substitute*			
	Increased Demand on Resources • 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*			
Transportation	**Transportation Interruptions** • 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 stroms or other interruptions to transportation.	*Prepare* *Adapt*			

[1] The 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.

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