

PANDEMIC RECOMMENDED ACTIONS FOR HEALTHCARE FACILITIES BY EVENT STAGE

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

GREEN

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

These listed measures may be taken:

Administration/Planning

- Establish and maintain emergency notification list of key personnel.
- Discuss at facility and regional level contingencies for scarce resource situations [see AHRQ document *Mass Medical Care with Scarce Resources* at www.ahrq.gov/research/mce/1, including involvement of ethics committee members, administration, and medical staff on a facility Clinical Care Committee that will determine which services may be offered during a pandemic.
- Conduct Continuity of Operations Planning (COOP) for pandemic situations—assume schools may be out and staff may need housing during pandemic.
- Write pandemic annex to all-hazards emergency response plan.
- Develop security plans for buildings including augmentation of 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.
- Contact local public health agencies and area hospitals to formulate regional plans for capacity, including alternate care sites, as determined by regional needs.
- Encourage employees to have personal emergency plans in place, including emergency day-care arrangements and family communications.

Operations

- Stress good infection control practices
- ### Pre-Training/Education (Pre-Event)
- Encourage personal preparedness planning using www.codeready.org 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, as appropriate.
- Conduct education about staff protections and expectations.
- Activate clinical care committee to examine situation and 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 this level to yellow level and further adaptive strategies when this occurs.
- Track financial impact (direct and indirect) and staff time carefully for reimbursement.

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 the Hospital Command Center; begin daily action planning cycle and information updates.
- Have staff wear personal protective equipment (PPE) when treating suspect cases and place in isolation room, per infection control recommendations.
- Separate suspect cases in emergency departments (ED) and clinics; follow MDH case definitions and protocols. Provide masks to all suspect cases and post signage for patients regarding respiratory hygiene.
- 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.
- Screen patients and visitors prior to building entry, assigning infectious or suspect cases to appropriate care areas with appropriate PPE and respiratory hygiene.

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.

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

- Have Clinical Care Committee determine (on daily basis) which (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.
- Implement access controls and institute visitor and family member policies according to institutional procedures.

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

- Have Clinical Care Committee determine each day the administrative and clinical changes needed to cope with demand for resources; this may include appointment of triage team 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, as needed and as staffing and resources are available.

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 healthcare 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
- Update the 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

- Work with area hospitals, clinics, and public health to open alternate care sites when possible to reduce burden on hospitals, based on clinical situations and ethical standards.
- Concentrate critical care in hospitals; work with homecare and public health to assure appropriate homecare instructions given.

PATIENT CARE STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

Summary Table

RESOURCE	STRATEGY*	TACTIC
Oxygen	CONSERVE	Use minimum liter flow to keep O ₂ saturation > target (85-95% depending on situation). Use O ₂ conserving cannulas (Oxymizer™). No oxygen driven nebs. Eliminate or reduce equipment with high O ₂ consumption.
	RE-USE	Appropriately disinfect and re-use cannulas, masks, and tubing.
	RE-ALLOCATE	May have to base therapy on triage decision tool similar to ventilator allocation.
Medication Administration	SUBSTITUTE	Use alternative inexpensive medications (morphine, lorazepam, doxycycline) that are easily stockpiled prior to the event.
	ADAPT	Use morphine and benzodiazepines for sedation drips when possible, run drips via gravity rather than IV pumps if needed; Administer more medications via subcutaneous or intramuscular route than intravenous.
	CONSERVE	Give adjunctive non-steroidal and other analgesics / medications including orally when possible.
	RE-ALLOCATE	Last resort – palliative care demands adequate pain control / sedation – focus should be on stockpiling inexpensive options in advance of event.
Hemodynamic Support and IV Fluids	SUBSTITUTE	Use alternative vasopressor agents such as epinephrine (inexpensive).
	ADAPT	May have higher threshold to initiate vasopressors; may use gravity drips (e.g., 1mg epinephrine in 100cc NS) instead of infusion pumps. Consider nasogastric fluid replacement rather than IV.
	CONSERVE	Minimize invasive monitoring.
	RE-USE	Consider reusing central venous catheters, other tubes and catheters with appropriate sterilization/disinfection.
Mechanical Ventilation	ADAPT	Use of anesthesia machines, BiPAP, short-term manual ventilation and other strategies.
	CONSERVE	Adjust threshold for intubation; decrease elective surgeries to free up ventilators / anesthesia machines.
	RE-USE	Re-use of ventilator circuits after appropriate sterilization / disinfection.
	RE-ALLOCATE	Last resort, allocating ventilators to patients who can most benefit / will use least resources - must be according to pre-planned process using decision support tool and expert clinical judgment.
Nutrition	ADAPT	Have family or ancillary staff provide meals. Simpler meals, fewer choices for those that can take oral intake. Tube feedings in preference to total parenteral nutrition. May delay feedings longer than usual.
	CONSERVE	See above.
	RE-USE	May need to re-use nasogastric and other feeding equipment with appropriate disinfection.
Staffing	SUBSTITUTE	Outside, equally-qualified staff brought in to institution via compact agreements or other mechanism (DMAT, Medical Reserve Corps, other local/regional/state/federal sources). Use family or non-professional staff to provide basic patient cares (non-clinical).
	ADAPT	Less qualified staff from sources as above or volunteers provide basic patient care with critical care nursing and physician staff monitoring larger numbers of patients. Just-in-time training and orientation to job duties. Change shift duration. Use family or non-professional staff to provide some clinical care with training / in-service.
	CONSERVE	Reduce administrative demands (teaching and administration, documentation, etc.).

*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

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 - take a resource from one patient and giving it to a patient with a better prognosis or greater need

MDH/OEP/MHSPP/Patient Care Strategies/12-07/Revised 6-08

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OXYGEN USE STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

	POTENTIAL TRIGGER EVENTS	STRATEGY*	RECOMMENDATIONS													
Oxygen Administration	INTERNAL DISRUPTION OF HOSPITAL MEDICAL GAS SYSTEMS	SUBSTITUTE	1. Oxygen Conservation Devices <ul style="list-style-type: none"> Use Oxymizer™ type cannulas at 1/2 the flow setting of standard cannulas. Replace simple & partial rebreather mask use with Oxymizer™ cannulas at flowrates of 6-10 LPM. 													
	INTERNAL SURGE TO HOSPITAL CAPACITY	SUBSTITUTE & CONSERVE	2. Inhaled Medications <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 result in fewer treatments (6h-12h instead of 4h-6h applications). 													
Hemodynamic Support and IV	EXTERNAL NOTIFICATION BY GAS SUPPLIER OF DELAYS OR SHORTAGES	CONSERVE	3. Oxygen Concentrators if Electrical Power Is Present <ul style="list-style-type: none"> Use hospital-based or independent home medical equipment supplier oxygen concentrators if available; use to supplement low-flow cannula use, and preserve the primary oxygen supply for more critical applications. 													
	EXTERNAL NOTIFICATION BY THE MINNESOTA DEPARTMENT OF HEALTH	CONSERVE	4. Monitor Use and Revise Clinical Targets <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"> <thead> <tr> <th>Starting Example</th> <th>Initiate O₂</th> <th>O₂ Target</th> <th>Note:</th> </tr> </thead> <tbody> <tr> <td>Normal Lung Adults</td> <td>SPO₂ <89%</td> <td>SPO₂ 90%</td> <td rowspan="3">Targets may be adjusted further downward depending on resources available, the patient's clinical presentation, or measured PaO₂ determination.</td> </tr> <tr> <td>Infants & Peds</td> <td>SPO₂ <90%</td> <td>SPO₂ 91-94%</td> </tr> <tr> <td>COPD History</td> <td>SPO₂ <88%</td> <td>SPO₂ 90%</td> </tr> </tbody> </table>	Starting Example	Initiate O ₂	O ₂ Target	Note:	Normal Lung Adults	SPO ₂ <89%	SPO ₂ 90%	Targets may be adjusted further downward depending on resources available, the patient's clinical presentation, or measured PaO ₂ determination.	Infants & Peds	SPO ₂ <90%	SPO ₂ 91-94%	COPD History	SPO ₂ <88%
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Mechanical Ventilation			5. High-Flow Applications <ul style="list-style-type: none"> Restrict the use of high-flow adult cannula systems (Vapotherm™ type) 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. 													
			6. Air-Oxygen Blenders <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. 													
Nutrition		RE-USE	7. Expendable Oxygen Appliances <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 chlorhydrin formation with polyvinyl chloride plastics. 													
		RE-ALLOCATE	8. Oxygen Re-Allocation Implementation <ul style="list-style-type: none"> Prioritize patients for oxygen administration during severe resource limitations. 													

Oxygen
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*See Patient Care Strategies for Scarce Resource Situations for strategy definitions.

MEDICATION UTILIZATION STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

<p>Oxygen</p> <p>Medication Administration</p> <p>Hemodynamic Support and IV</p> <p>Mechanical Ventilation</p> <p>Nutrition</p> <p>Staffing</p>	POTENTIAL TRIGGER EVENTS	STRATEGY*	RECOMMENDATIONS												
	MASS CASUALTY EVENT	PREPARE	<p>1. Cache / Increase Supply Levels for Common Medications</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 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. <p>Key classes include:</p> <table border="1"> <tr> <td>Analgesia</td> <td>morphine, other narcotic and non-narcotic (non-steroidals, acetaminophen) class - injectable and oral (narcotic conversion tool at http://www.globalrph.com/narcoticonv.htm)</td> </tr> <tr> <td>Sedation</td> <td>particularly benzodiazepine (lorazepam, midazolam, diazepam) injectables</td> </tr> <tr> <td>Anti-infectives</td> <td>narrow and broad spectrum antibiotics for pneumonia, skin infections, open fracture care, sepsis (cephalosporins, fluoroquinolones, doxycycline, gentamicin, clindamycin, metronidazole), select antivirals</td> </tr> <tr> <td>Pulmonary</td> <td>metered dose inhalers (albuterol, inhaled steroids), oral steroids (dexamethasone, prednisone)</td> </tr> <tr> <td>Behavioral Health</td> <td>haloperidol, other injectable and oral anti-psychotics, common anti-depressants, anxiolytics</td> </tr> <tr> <td>Other</td> <td>sodium bicarbonate, paralytics, induction agents (etomidate, propofol), proparacaine/tetracaine, atropine, pralidoxime, epinephrine, local anesthetics, antiemetics, insulin, common oral anti-hypertensive and diabetes medications</td> </tr> </table>	Analgesia	morphine, other narcotic and non-narcotic (non-steroidals, acetaminophen) class - injectable and oral (narcotic conversion tool at http://www.globalrph.com/narcoticonv.htm)	Sedation	particularly benzodiazepine (lorazepam, midazolam, diazepam) injectables	Anti-infectives	narrow and broad spectrum antibiotics for pneumonia, skin infections, open fracture care, sepsis (cephalosporins, fluoroquinolones, doxycycline, gentamicin, clindamycin, metronidazole), 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
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	INFRASTRUCTURE DAMAGE OR LOSS														
	INTERRUPTION IN SUPPLY CHAIN														
	PANDEMIC INFLUENZA OR OTHER EPIDEMIC	CONSERVE	<p>2. 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.). 												

Medication Administration

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*See Patient Care Strategies for Scarce Resource Situations for strategy definitions.

MEDICATION UTILIZATION STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

Oxygen Medication Administration Hemodynamic Support and IV Mechanical Ventilation Nutrition Staffing	POTENTIAL TRIGGER EVENTS	STRATEGY*	RECOMMENDATIONS
	MASS CASUALTY EVENT	SUBSTITUTE	3. Use Equivalent Medications <ul style="list-style-type: none"> Obtain medications from alternate supply sources (pharmaceutical representatives, pharmacy caches).
	INFRASTRUCTURE DAMAGE OR LOSS		Analgesia/Sedation <ul style="list-style-type: none"> consider lorazepam for propofol substitution. 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 refractory agitation add haloperidol 5-10mg IV (may repeat q30min) then final dose scheduled q6h (5-20mg/dose usual)
	INTERRUPTION IN SUPPLY CHAIN		Anti-infective <ul style="list-style-type: none"> examples: cefazolin, gentamicin, clindamycin for broad-spectrum antibiotics Target therapy as soon as possible based upon organism identified.
	PANDEMIC INFLUENZA OR OTHER EPIDEMIC		Pulmonary <ul style="list-style-type: none"> metered dose inhalers instead of nebulized medications
		ADAPT	4. Modify Medication Administration <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: 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 Consider use of select medications beyond expiration date. Consider use of veterinary medications when alternative treatments are not available. NOTE: For further information and examples, see http://www.cityofsomerset.com/ems/IV%20Drug%20Calculations.pdf
		RE-ALLOCATE	5. Restrict Allocation of Select Medications <ul style="list-style-type: none"> Allocate limited stocks of anti-viral medications with consideration of regional/state guidance and available epidemiological information. Allocate limited stock to support other re-allocation decisions (ventilator use, etc.).

Medication Administration
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*See Patient Care Strategies for Scarce Resource Situations for strategy definitions.

HEMODYNAMIC SUPPORT AND IV FLUIDS USE STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

Oxygen	POTENTIAL TRIGGER EVENTS	STRATEGY*	RECOMMENDATIONS
Medication Administration	MASS CASUALTY EVENT	PREPARE	1. Cache Additional Intravenous (IV) Cannulas, Tubing, Fluids, Medications, and Administration Supplies
	INFRASTRUCTURE DAMAGE OR LOSS	CONSERVE	2. Use Scheduled Dosing and Drip Dosing When Possible <ul style="list-style-type: none"> Reserve IV pump use for critical medications such as sedatives and hemodynamic support.
Hemodynamic Support and IV	INTERRUPTION IN SUPPLY CHAIN	SUBSTITUTE	3. Minimize Invasive Monitoring <ul style="list-style-type: none"> Substitute other assessments 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.
	PANDEMIC INFLUENZA OR OTHER EPIDEMIC		4. Emphasize Oral Hydration Instead of IV Hydration When Possible <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., 1/2 cup orange juice, other) as needed. Rehydration for moderate dehydration 50-100mL / kg over 2-4 hours <p>Supplement for each diarrhea or emesis</p> <ul style="list-style-type: none"> Pediatric maintenance fluids: <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>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 and http://www.bt.cdc.gov/disasters/hurricanes/pdf/dguidelines.pdf.</p>
Mechanical Ventilation			5. Provide Nasogastric Hydration Instead of IV Hydration When Practical <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.
Nutrition			6. Provide Subcutaneous (Hypodermoclysis) Replacement Fluids if No Other Options Possible <ul style="list-style-type: none"> Disadvantages: 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>NOTE: Intraosseous infusion is not recommended; requires special equipment, training, and can be very painful during insertion/infusion.</p>

Hemodynamic Support and IV Fluids

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(continued on next page)

*See Patient Care Strategies for Scarce Resource Situations for strategy definitions.

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

Oxygen	POTENTIAL TRIGGER EVENTS	STRATEGY*	RECOMMENDATIONS
	MASS CASUALTY EVENT	SUBSTITUTE <i>(continued)</i>	7. Substitute Epinephrine for Other Vasopressor Agents <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 minidrip tubing and titrate to target blood pressure. Epinephrine 1:1000 (1mg/mL) multi-dose vials available for drip use.
Medication Administration	INFRASTRUCTURE DAMAGE OR LOSS	ADAPT	8. Consider Use of Veterinary and Other Alternative Sources for Intravenous Fluids and Administration Sets
Hemodynamic Support and IV	INTERRUPTION IN SUPPLY CHAIN	RE-USE	9. Re-use CVP, NG, and Other Supplies After Appropriate Sterilization / Disinfection <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). <ul style="list-style-type: none"> Sterilize devices in contact with bloodstream (ethylene oxide sterilization for CVP catheters).
Mechanical Ventilation	PANDEMIC INFLUENZA OR OTHER EPIDEMIC		
Nutrition			
Staffing	Hemodynamic Support and IV Fluids (page 2 of 2)		

*See Patient Care Strategies for Scarce Resource Situations for strategy definitions.

MECHANICAL VENTILATION STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

Oxygen
Medication Administration
Hemodynamic Support and IV
Mechanical Ventilation
Nutrition
Staffing

POTENTIAL TRIGGER EVENTS:	STRATEGY*	RECOMMENDATIONS																																									
<p>OTHER EVENT THAT OVERWHELMS VENTILATOR CAPACITY</p> <p>FACILITIES SHOULD <i>NOT</i> RE-ALLOCATE VENTILATORS UNLESS THIS IS A STATE AND REGIONALLY AGREED-UPON NECESSITY IN AN OVERWHELMING SITUATION WITHOUT POTENTIAL TO RECEIVE NEEDED RESOURCES OR EVACUATE PATIENTS TO AREAS WITH NECESSARY RESOURCES</p> <p>Mechanical Ventilation (page 1 of 2)</p>	PREPARE	<p>1. Increase Hospital Stocks of Ventilators and Ventilator Circuits</p>																																									
	SUBSTITUTE	<p>2. Access Alternative Sources for Ventilators</p> <ul style="list-style-type: none"> Obtain ventilators from vendors / healthcare partners / Federal stockpiles via usual emergency management processes. 																																									
	ADAPT	<p>3. 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. Use bi-level equipment to provide mechanical ventilation. Consider bag-valve ventilation as temporary measure while awaiting definitive solution (as appropriate to situation). 																																									
	CONSERVE	<p>4. 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. 																																									
	RE-USE	<p>5. Sterilize Ventilator Circuits After Cleaning.</p> <ul style="list-style-type: none"> If using gas (ethylene oxide) sterilization, allow full 12 hour aeration cycle to avoid toxic byproducts from accumulating on surface. Use Steris System®, irradiation, or other techniques as appropriate. 																																									
RE-ALLOCATE	<p>6. Assign Limited Ventilators to Patients Most Likely to Benefit if No Other Options Are Available (see text at left)</p> <p>STEP ONE: assess patient acuity using SOFA (see next page⁺) scoring table.</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 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 PaO ₂ / FIO ₂	> 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 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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(continued on next page)

*See Patient Care Strategies for Scarce Resource Situations for strategy definitions.

MECHANICAL VENTILATION STRATEGIES FOR SCARCE RESOURCE SITUATIONS (cont.)

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

Oxygen
Medication Administration
Hemodynamic Support and IV
Mechanical Ventilation
Nutrition
Staffing

POTENTIAL TRIGGER EVENTS

STRATEGY*

RECOMMENDATIONS

PANDEMIC INFLUENZA

RE-ALLOCATE

OTHER EVENT THAT OVERWHELMS VENTILATOR CAPACITY

FACILITIES SHOULD *NOT* RE-ALLOCATE VENTILATORS UNLESS THIS IS A STATE AND REGIONALLY AGREED-UPON NECESSITY IN AN OVERWHELMING SITUATION WITHOUT POTENTIAL TO RECEIVE NEEDED RESOURCES OR EVACUATE PATIENTS TO AREAS WITH NECESSARY RESOURCES

Mechanical Ventilation

(page 2 of 2)

STEP TWO: Compared to other patient(s) requiring and awaiting mechanical ventilation, 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? Factors listed are in order of importance / weight.

	Ventilator re-allocated	Patient keeps ventilator	
	High potential for death (SOFA score ≥ 12)	Intermediate potential for death (SOFA score 8-11)	Low potential for death (SOFA score ≤ 7)
1. Organ system function⁺			
2. Duration of benefit / prognosis	a. Poor prognosis based upon epidemiology of specific disease / injury (eg; pandemic influenza) b. Severe underlying disease with poor short-term (e.g., <1 year) prognosis ⁺⁺	a. Indeterminate / intermediate prognosis based upon epidemiology of specific disease / injury b. 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.	a. Good prognosis based upon epidemiology of specific disease / injury b. No severe underlying disease
3. Duration of need	Long duration – e.g., ARDS, particularly in setting of pre-existing lung disease (estimate > 7 days on ventilator)	Moderate duration – e.g., pneumonia in healthy patient (estimate 3-7 days on ventilator)	Short duration – flash pulmonary edema, chest trauma, other conditions anticipating < 3 days on ventilator
4. Response to mechanical ventilation	Worsening ventilatory parameters over time ⁺⁺⁺	Stable ventilatory parameters over time	Improving ventilatory parameters over time

⁺ 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.

⁺⁺ 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

⁺⁺⁺ 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 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.

*See Patient Care Strategies for Scarce Resource Situations for strategy definitions.

STAFFING STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

	POTENTIAL TRIGGER EVENTS	STRATEGY*	RECOMMENDATIONS
Oxygen	STAFF UNABLE TO REPORT	PREPARE	1. Staff and Supply Planning <ul style="list-style-type: none"> Encourage employee preparedness planning (www.codeready.org and other resources). Cache adequate personal protective equipment (PPE) and support supplies. Educate staff on institutional disaster response. Educate staff on community, regional, state disaster plans and resources. Develop facility plans addressing staff's family / pets or staff shelter needs.
Medication Administration	<ul style="list-style-type: none"> STAFF ILLNESS AT HOME WITH FAMILY UNABLE TO GET TO FACILITY 	SUBSTITUTE	2. Use Supplemental Staff <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)
Hemodynamic Support and IV	STAFFING LEVELS INADEQUATE FOR DEMANDS OF DISASTER	ADAPT	3. Use Alternative Personnel to Minimize Changes to Standard of Care <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 care workers, 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. 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.
Mechanical Ventilation		CONSERVE	4. Focus Staff Time on Core Clinical Duties <ul style="list-style-type: none"> Minimize meetings and relieve administrative responsibilities not related to event. Use personnel with specific critical skills (ventilator, burn management) to concentrate on those skills; define other job duties that can be safely performed by other medical professionals. Have specialty staff oversees 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). Reduce documentation requirements. 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. Cohort patients to conserve PPE and reduce staff PPE donning/doffing time and frequency. Restrict elective appointments and procedures.
Nutrition		RE-ALLOCATE	5. Divert Staff to Emergency Response <ul style="list-style-type: none"> 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.
Staffing	Staffing (page 1 of 1)		

*See Patient Care Strategies for Scarce Resource Situations for strategy definitions.