Optimizing Resource Utilization in Disasters

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Dallas, TX


FIRE
L.A. COUNTY
FIRE

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Emergence of a Novel Swine-Origin Influenza A (H1N1) Virus in Humans

Novel Swine-Origin Influenza A (H1N1) Virus Investigation Team*

CORE DISASTER FORMULARY[12]

Instruments/Equipment
BP cuffs and manometers
Stethoscopes
Oxygen saturation monitor
ECG monitor
Thermometers – tympanic and oral
Batteries-AA, AAA, D, C

Needles/Syringes
10cc Needless Syringes
60cc Needless Syringes
3cc 23G1" Safety Syringes
3cc 22G11/2" Safety Syringes
TB / Insulin Syringes
Blunt Plastic Cannula
Luer Lock Cannula
18G 11/2" Safety Needles
20G 1: Safety Needles
Sharps Container
IV Start Catheter (20,18,16,14ga)
Butterfly 23GA and 25GA
25G 1.5" needles for injections

ED / Surgical Supplies
Scalpels plastic with attached #11 blade
Suture Sets / Trays
Extra suture material
Irrigation sets (zerowet, canyon system, etc)
Thoracostomy Tray
Peritoneal Lavage Tray
Chest Tubes (12, 24, 28, 36)
Chest Drainage Set
Sterile Towels and sheets
Sterile Basins (small / large)
Skin Stapler
Consider additional stocking of surgical trays (lap, amputation, major procedure, thoracic, etc.) by OR/central supply
Consider eye irrigation sets (Morgan lens), epistaxis supplies, Raney clips.

Irrigation Solutions
Normal Saline or sterile water

IV Access/Supplies
IV Start Kits / supplies
Micro Drip Tubing
Adult Drip Tubing
Blood Admin. Tubing
Disposable IV Pressure Bag
IV pump tubing
Arterial Line Tubing (if capable)
Central vein catheter kit
IO access – EZ IO, FAST, BIG, etc.

IV Solutions
NS 1000cc
Consider LR 1000cc for burns
Long Arm Board
Short Arm Board
Stopcock

Dressings
Vaseline-impregnated dressings (consider large number of 5x7 adaptic dressings for burns)
2x2 sponges sterile
ABD Pads
4X4 Dressings / Sponges sterile
Self Adhering Dressing (tegaderm)
4" Roller gauze / Kerlix
Sterile Cotton Applicators
2" Porous First Aid Tape
3" foam tape
Adhesive Bandages
1" Paper Tape / Optipore tape
Bacitracin ointment (consider large amount for burn dressings)
Eye patches and shields

Linen
Disposable Sheets
Disposable Pillows
Disposable Pillow Covers

GU
Foley catheters and urometers
Urine multistix

Hand Hygiene
Providine/Iodine Scrub Brushes
PCMX Scrub Brushes (1 box per 100 casualties)
Chlorhexidine scrub
Alcohol-based hand gels

Patient Personal Care Supplies
Simple face mask
Bath Basin
Emesis basin / bag
Facial Tissues
Bedpan
Urinal
Belonging Bag
Regular Soap
Disposable / other gowns
Paper / cloth towels
Dental care supplies

Musculoskeletal
Bandage Scissors
Slings (medium and large)
Cervical collars (small and medium)
Knee Immobilizers
Ankle Immobilizers
Crutches
Splints:
Fiberglass pre-padded 3,4,5 inch
Plaster impregnated 4,5 inch rolls
Plaster 5x35 inch sheets
Roller bandages 3 and 6 inch (ACE)
Webril / other cast/splint padding
Triangular bandages

Respiratory System Supplies
Bag-valve-mask devices
Oral Airways (3,4,6)
Oxygen Cannulas
Oxygen Masks
Neb sets
Yankauer Suction Tips
Connecting Tubing O2 and suction
Suction Kit/Cup 14FX22
ET tubes 6, 7, 7.5 and holders / twill
Cook over needle cath for chest decompression / needle ventilation
Cricothyrotomy tray and pre-cut 6.0 ET tube, consider Shiley 4-6.
End-tidal CO2 detector
Esophageal detection device
Gum bougie
Back-up for intubation – ILMA, etc.

Miscellaneous
Sterile Lubricant
Alcohol Wipes
Povodine/Iodine swabs and bottle
Hydrogen Peroxide
Tongue Depressors
Garbage bags
Blood Glucose Testing Supplies
Waterproof Markers
Body bags (10 per 100 patients)
Blank Labels/Tags
Bottled Drinking Water
Monitoring electrodes
Sat probes
Restraints – wrist, waist
Flashlights

Common Medications
Cefazolin, quinolones, other antibiotics
Morphine, hydromorphone, fentanyl
Local anesthetic (lido, bupivicaine)
Benzodiazepines
Paralytics
Sedatives – propofol, etomidate, etc.
dT booster

Sample Medical/Surgical and PPE Supplies by Disaster Type & Category of Hospital Emergency Services[1]

Hospital Category:	Trauma	Biologic	Chemical	Radiologic	Pediatric
Level 1	ACS verified Level 1 Trauma Center provides definitive care to all trauma patients. Possible planning goal: 200 patients require care, 60 admits, 30 to intensive care. (Not required as part of trauma designation).	Able to triage and hospitalize all classes of infectious patients with augmentation plans during epidemic. Possible planning goal: admit/cohort 60 patients with airborne precautions, 30 to intensive care	Maintains PPE for personnel, able to decon >50 pts / h 24/7 and provide antidote for nerve agents affecting up to 500 persons Planning goal: 500 persons (plan supplemental assist for above this number)	G-M counters and safety equipment (badges, etc) available to trained in-house staff 24/7, RSO or health physicist consultation available 24/7. Planning goal: 250 persons screen and decontaminate as needed.	Provides definitive care for pediatric trauma. Appropriate size and quantity of supplies to care for pediatric patients including decontamination operations. Possible planning goal: up to 20 critical and 100 minor injured pediatric patients.

TRAUMA Note: The following stock items are not requirements for trauma designation. See attached guidance on stock items and following notes/items:

- Triage tags, numbered or otherwise able to track victims
- Rapid assessment sheets for walking wounded (consider separate sheet for critical care)
- Consider additional burn supplies (e.g.: burn sheets, specialized dressings – see metro burn plan for ideas of supplies – inpatient and outpatient).
- Assure adequate bag-valve and endotracheal tubes to provide for anticipated numbers of victims that may require temporary hand ventilation (e.g.: consider 20-30 bag/valves for Level 1, etc).
- May wish to consider 3-5d supply (based on usual use) of those supplies on formulary lists (see final pages) applicable to your institution

BIOLOGIC

- Adequate supplies of N95 and barrier precautions to protect ED / other clinic staff and staff to care for cohorted / isolated patients hospitalized for 72h. Assume masks may be used for 1/4 shift, barrier gowns and gloves disposed of unless working in cohort care area. May wish to plan longer protection duration in case of pandemic.
- Surgical masks for patients – flexible with elastic ear loops best.
- Supplies to fit-test additional employees if rapid N95 protection for all staff required.
- Doxycycline sufficient to prophylax all hospital employees and patients either in-house or available from regional cache for at least 72h.
- Consider additional antibiotics, antivirals, suspension preparations, etc. including pediatric considerations.

OTHER

- Redundant communications: satellite phone, radio equipment for both internal and external needs (eg: amateur radio), etc, ensuring communications with regional partners.
- Vests, clipboards, portable radios, and other HICS equipment
- EOC equipment including computer access, fax, additional phone lines, phones, etc.
- Transport ventilators and portable monitors may be considered but are not a priority of grant funding. Available equipment from crash carts, etc. should be inventoried and used during a disaster.
- HICS or other NIMS compliant incident management system in place.

CHEMICAL

- Stock atropine and 2PAM adequate to care for 500 victims (2g/pt 2PAM and 5mg/pt atropine) either crystalline (have compounding protocols available), stock liquid, or as Mark 1 kits.
- Stock sodium thiosulfate adequate for 12.5g/pt for at least 100 victims either stock or crystalline.
- Five treatment courses of hydroxycobalamin for cyanide poisoning.
- Increase stocks of morphine or other narcotics (at least 1 week usual use as par level), benzodiazepines, paralytics (72h supply)
- Consider additional supplies of topical ocular anesthetics, oral narcotics, albuterol, atrovent inhalers/nebs.
- Stock bag-valve devices (15% of total victim number) in addition to usual supplies (see above trauma guidelines).
- Stock additional 7.5 and 7.0 endotracheal tubes (15% of total victim number), consider additional pediatric tubes.
- Stock additional oxygen tubing and masks as per trauma.
- Chemical PPE 15-20 sets and trained staff 24/7 with augmentation from call-in or outside support within 20 minutes (operations level). (Breathe-easy PAPR with FR57 canister, Tyvek SL or Tychem F suit, booties and gloves, taped seams).
- Decontamination facilities sufficient for 50 pts per hour and associated supplies (e.g.: towels, belongings bags, gowns, etc). (at least 5 shower stations at 1 person / 6 minutes)

RADIATION

- 3-4 G-M counters similar to Ludlum Model 3 with pancake probe and mR/h scale
- Radiation dosimeter badges for all staff involved in assessment and decontamination.
- Consider other forms of dosimetry
- Consider passive screening devices at entryways of high-risk facilities (contact Mark Lappe at HCMC interested in more info).
- KI tabs or SSKI to treat 500 victims for at least 24h (2x 130mg tab qd or several qtt SSKI adults).

PEDIATRICS (In addition to usual emergency supplies – see attached)

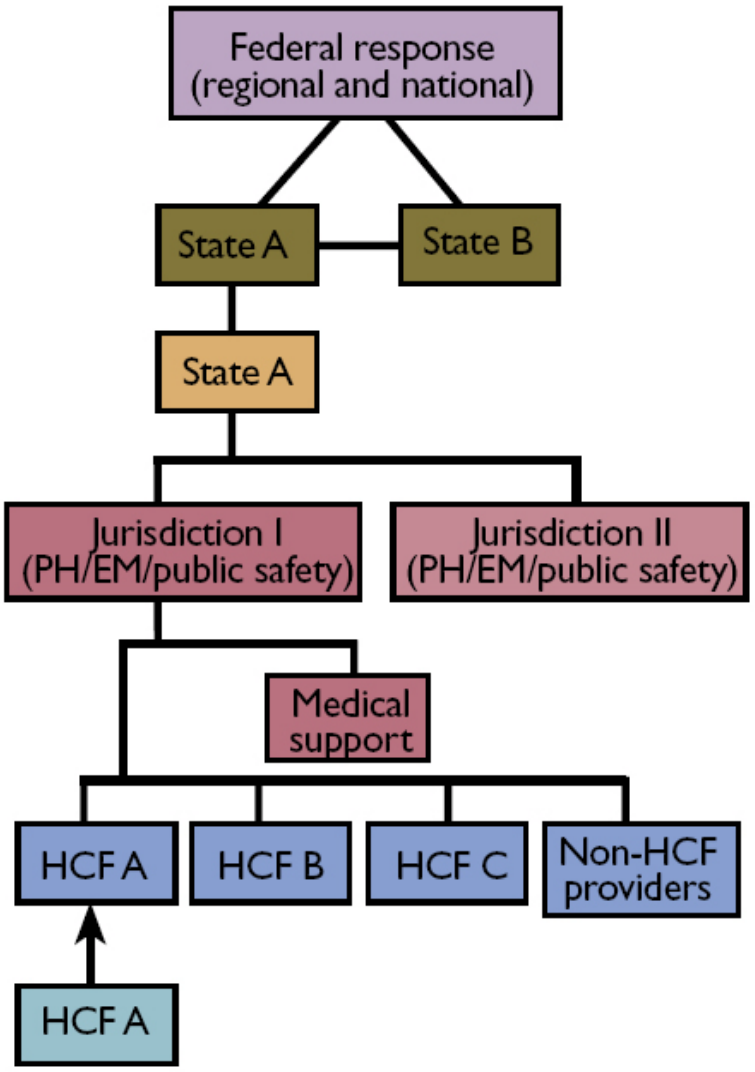
- Pediatric-appropriate fiberoptic scope
- Infant scale
- Gastrostomy tubes 12,14,16F
- Newborn warmer / warming device
- IV fluid warmer
- Pediatric bag-valve device (10-20)
- Pediatric IO needles (10)
- Supplemental pediatric endotracheal tubes and laryngoscope blades

How to do the greatest good…

- Implement incident management and surge capacity plans
- Anticipate resource shortfalls
- Solve the imbalance:
  - Bring in resources
  - Transfer patients
  - Triage resources
- Get help…

Tiered System

Figure 1-2. MSCC Management Organization Strategy



Federal response (support to State and locals) — TIER 6

Interstate regional coordination (management coordination and mutual support) — TIER 5

State response and coordination of intrastate jurisdictions (management coordination and support to jurisdictions) — TIER 4

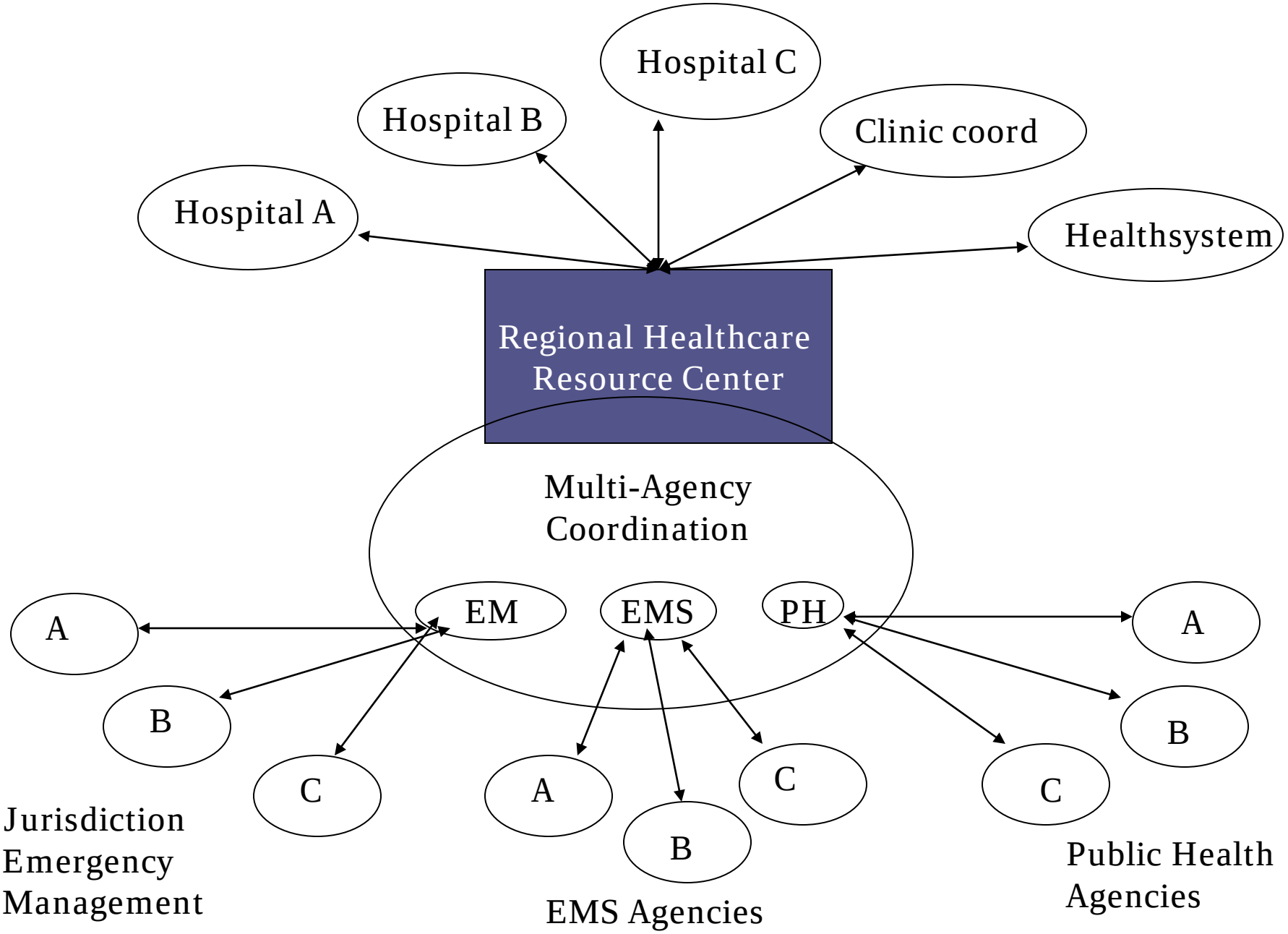
Jurisdiction incident management (medical IMS and emergency support—EOC) — TIER 3

Healthcare "coalition" (info sharing; cooperative planning; mutual aid) — TIER 2

Healthcare asset management (EMP+EOP using incident management) — TIER 1

EMP = Emergency Management Program
EOP = Emergency Operations Plan
PH = Public Health
EM = Emergency Management

MSCC, Barbera and Macintyre


Hospital C
Hospital B
Clinic coord
Hospital A
Healthsystem
Regional Healthcare Resource Center
Multi-Agency Coordination
EM
EMS
PH
A
B
C
A
B
C
A
B
C
Jurisdiction Emergency Management
EMS Agencies
Public Health Agencies

Hospital Operational Issues

- Process for planning vs. process for response
- Response conops:
  - IMS recognizes situation
  - Clinical care committee
  - Triage plan
  - Informational issues
  - Resource requests
  - Personnel management

Continuum of Disaster Care

Incident demand/resource imbalance increases →
Risk of morbidity/mortality to patient increases →
← Recovery

	Conventional	Contingency	Crisis
Space	Usual patient care space fully utilized	Patient care areas repurposed (PACU, monitored units for ICU-level care)	Facility damaged/unsafe or nonpatient care areas (classrooms, etc) used for patient care
Staff	Usual staff called in and utilized	Staff extension (brief deferrals of nonemergent service, supervision of broader group of patients, change in responsibilities, documentation, etc)	Trained staff unavailable or unable to adequately care for volume of patients even with extension techniques
Supplies	Cached and usual supplies used	Conservation, adaptation, and substitution of supplies with occasional reuse of select supplies	Critical supplies lacking possible reallocation of life-sustaining resources
Standard of care	Usual care	Functionally equivalent care	Crisis standards of care

Usual operating conditions

Indicator: potential for crisis standards[2]

Trigger: crisis standards of care[3]

Austere operating conditions

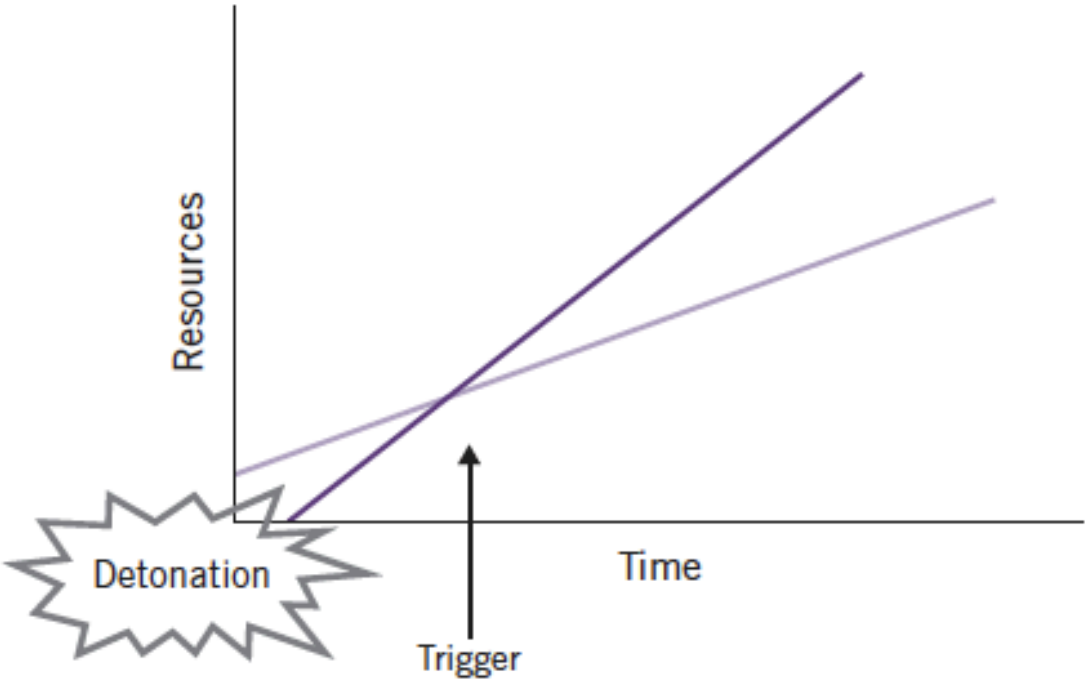
Strategies

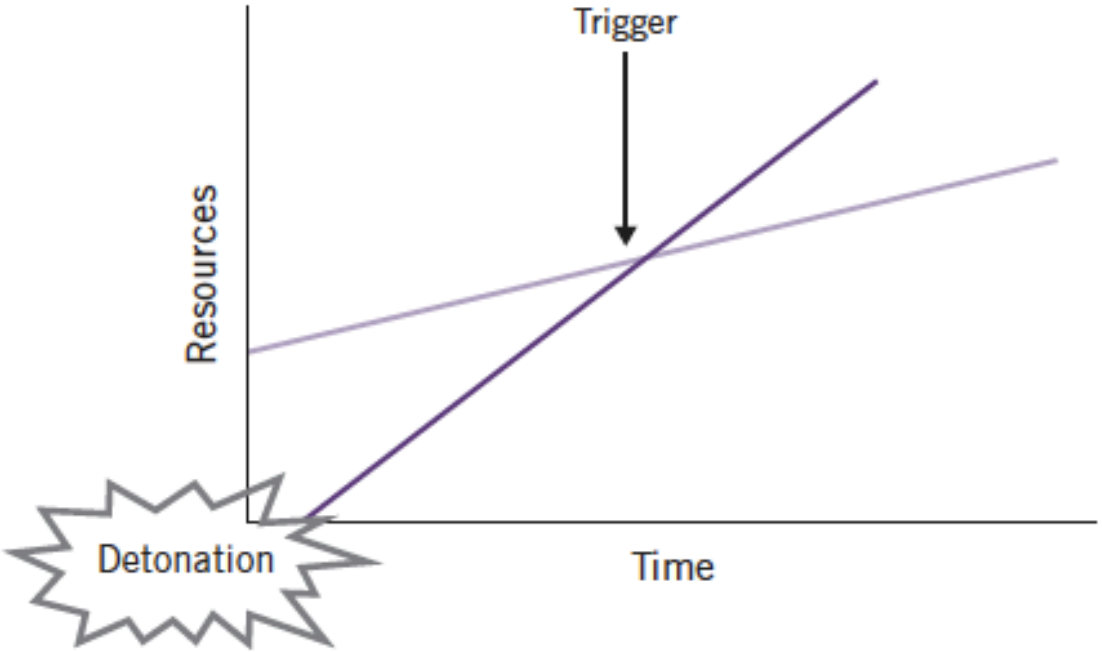
- Prepare
- Substitute
- Adapt
- Conserve
- Re-use
- Re-allocate

Supply Strategies

	Conventional	Contingency	Crisis
Prepare	Stockpiled supplies used		
Substitute	Equivalent medications used		
Conserve	Oxygen flow rates titrated	Oxygen only for saturations < 90%	Oxygen only for respiratory failure
Adapt		Anesthesia machine for mechanical ventilation	Bag-valve manual ventilation
Re-Use		Re-use NG tubes and ventilator circuits	Re-use invasive lines
Re-Allocate		Re-allocate oxygen saturation monitors, cardiac monitors from low-risk patients	Re-allocate ventilators

Prepare


Resources
Time
Detonation
Trigger


Trigger
Resources
Time
Detonation

Logged in as John Hick

Facilities | Regional Status | Alert Manager | Command Center | Resource Request | Reports

Requests for Resources

Region	Facility	Requested	Request Resource	Quantity	Actions Taken	Fulfillment	Active
West Metro	University of M..iversity Campus	10/24/2008 10:01	ventilator	11		0 of 11 fulfilled	✓
East Metro	United Hospital - St. Paul	10/24/2008 10:00	ventilator	6		0 of 6 fulfilled	✓
West Metro	Unity Hospital - Fridley	10/24/2008 09:59	ventilator	6		0 of 6 fulfilled	✓
West Metro	North Memorial Medical Center	10/24/2008 09:59	ventilator	13		0 of 13 fulfilled	✓
West Metro	Regency Hospita..- Golden Valley	10/24/2008 09:57	ventilator	4		0 of 4 fulfilled	✓
West Metro	Methodist Hospi.. St. Louis Park	10/24/2008 09:56	ventilator	11		0 of 11 fulfilled	✓
West Metro	Children's Hosp..l - Minneapolis	10/24/2008 09:56	ventilator	6		0 of 6 fulfilled	✓
West Metro	Mercy Hospital - Coon Rapids	10/24/2008 09:55	ventilator	8		0 of 8 fulfilled	✓
West Metro	Fairview Southd..ospital - Edina	10/24/2008 09:54	ventilator	6		0 of 6 fulfilled	✓
West Metro	Abbott Northwes..l - Minneapolis	10/24/2008 09:53	ventilator	10		0 of 10 fulfilled	✓
*Demo	*ImageTrend Hospital	09/08/2008 13:55	Ventilators	2		0 of 2 fulfilled	✓
*Demo	*ImageTrend Hospital	08/29/2008 13:25	Motorola Radio	25	Referred to all RHRC	20 of 25 fulfilled	✗
*Demo	*ImageTrend Hospital	08/29/2008 13:14	Cot	1		0 of 1 fulfilled	✓
*Demo	*ImageTrend Hospital	08/29/2008 13:13	Zoll Defibrillator	10		3 of 10 fulfilled	✓
*Demo	*ImageTrend Hospital	08/29/2008 12:56	Zoll Defibrillator	4		4 of 4 fulfilled	✓
*Demo	*ImageTrend Hospital	08/28/2008 13:58	Bandaids	500		500 of 500 fulfilled	✓
*Demo	*ImageTrend Hospital	08/28/2008 12:30	Beekers	10		0 of 10 fulfilled	✓
West Metro	Hennepin County Medical Center	08/28/2008 09:42	ventilators	10		4 of 10 fulfilled	✓
*Demo	*ImageTrend Hospital	08/28/2008 08:14	o negative	2		0 of 2 fulfilled	✓
*Demo	*ImageTrend Hospital	08/28/2008 08:07	Zoll Defibrillator	2		1 of 2 fulfilled	✓
*Demo	*ImageTrend Hospital	08/27/2008 17:34	Zoll Defibrillator	3	Acknowledged	2 of 3 fulfilled	✓

Records 1-21 of 21 | First | << | >> | Last

✓ = Active ✗ = Inactive

Request a Resource

Cardset

- Overview
- Oxygen
- Staffing
- Medications
- Hemodynamic support and IV fluids
- Ventilators and external oxygenation
- Nutritional support
- Blood products
- Resource cards – dialysis, burn

PATIENT CARE STRATEGIES FOR SCARCE RESOURCE SITUATIONS

Summary Card

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

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 resource shortfall
2. Implement appropriate incident management and assign subject matter experts (technical specialists) to problem
3. Determine degree of shortfall, expected demand, and duration
4. Find category of resource on index
5. Refer to specific recommendations on card
6. Decide which strategies to implement
7. If implementing contingency strategies over >24h or crisis strategies, assure that no regional options exist for re-supply or patient transfer and that public health authorities and other facilities aware of situation to assure consistent regional approach
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

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 give it to a patient 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). 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 policy of the 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.

MINNESOTA DEPARTMENT OF HEALTH
OFFICE OF EMERGENCY PREPAREDNESS
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TEL: 651.201.5700 / TDD: 651.215.8880

OXYGEN
STRATEGIES FOR SCARCE RESOURCE SITUATIONS

MINNESOTA HEALTHCARE SYSTEM PREPAREDNESS PROGRAM

	RECOMMENDATIONS	Strategy	Conventional	Contingency	Crisis
Oxygen	**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*			
	Oxygen Conservation Devices • Use Oxymizer™ type cannulas at 1/2 the flow setting of standard cannulas. • Replace simple and partial rebreather mask use with Oxymizer™ cannulas at flowrates of 6-10 LPM.	*Substitute*			
	Oxygen Concentrators if Electrical Power is Present • 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.	*Substitute & Conserve*			
	High-Flow Applications • 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.	*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*			
	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 <89% / SPO2 90% Infants & Pods: SPO2 <90% / SPO2 91-94% COPD History: SPO2 <88% / 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 Implementation • Prioritize patients for oxygen administration during severe resource limitations.	*Re-Allocate*			

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Key Issues

- Incident management / coordination framework
  - System ‘tuning’ to consistent level of care
- Identification of ‘at-risk’ resources
- Cache or plan for contingency/crisis strategies
- Request mechanisms (vendor, public, inter-agency)
- Prioritization mechanisms
- Vendor vs. governmental allocation