

# Boston Surge Model™

*an interactive, collaborative approach to wicked problems*

A different approach to the issue of  
“crisis (or alterations in) standards of care”

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# Literature Review and Trends

# Health Care Facility and Community Strategies for Patient Care Surge Capacity

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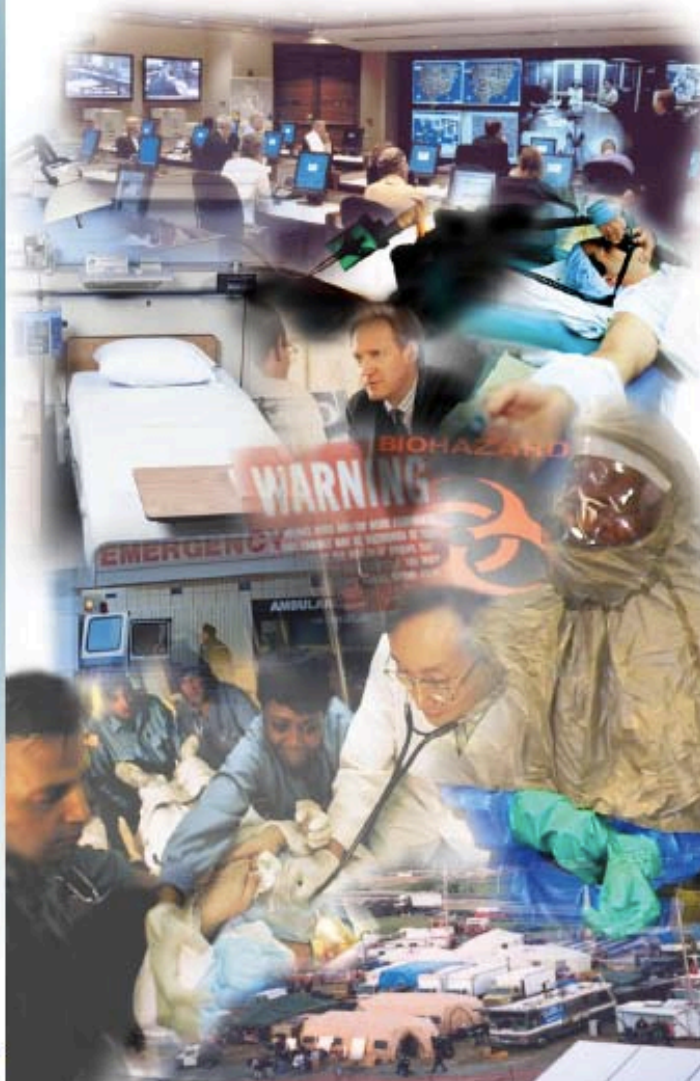
Recent terrorist and epidemic events have underscored the potential for disasters to generate large numbers of casualties. Few surplus resources to accommodate these casualties exist in our current health care system. Plans for “surge capacity” must thus be made to accommodate a large number of patients. Surge planning should allow activation of multiple levels of capacity from the health care facility level to the federal level. Plans should be scalable and flexible to cope with the many types and varied timelines of disasters. Incident management systems and cooperative planning processes will facilitate maximal use of available resources. However, resource limitations may require implementation of triage strategies. Facility-based or “surge in place” solutions maximize health care facility capacity for patients during a disaster. When these resources are exceeded, community-based solutions, including the establishment of off-site hospital facilities, may be implemented. Selection criteria, logistics, and staffing of off-site care facilities is complex, and sample solutions from the United States, including use of local convention centers, prepackaged trailers, and state mental health and detention facilities, are reviewed. Proper pre-event planning and mechanisms for resource coordination are critical to the success of a response.

[*Ann Emerg Med.* 2004;44:253-261.]

- 1. Difficulty meshing private hospitals with public needs**
- 2. alternate care centers**
- 3. Tiered approach**

## Medical Surge Capacity and Capability:

### A Management System for Integrating Medical and Health Resources During Large-Scale Emergencies



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Of particular note is Joseph A. Barbera, MD, a board-certified emergency physician and Co-Director of the Institute for Crisis, Disaster and Risk Management at The George Washington University. Dr. Barbera served as the co-principal investigator for this project.

Anthony G. Macintyre, MD, a board-certified emergency physician and Associate Professor with the Department of Emergency Medicine at The George Washington University, also played a prominent role. Dr. Macintyre served as the co-principal investigator for this project.

# **Altered Standards of Care in Mass Casualty Events**

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**...”it is critically important to identify, plan, and prepare for making the necessary adjustments in current health and medical care standards to ensure that the care provided in response to a mass casualty event results in as many lives being saved as possible.”**

**“Changes in the usual standards of health and medical care in the affected locality or region will be required to achieve the goal of saving the most lives in a mass casualty event. Rather than doing everything possible to save every life, it will be necessary to allocate scarce resources in a different manner to save as many lives as possible.”**

**“Protocols for triage need to be flexible enough to change as the size of a mass casualty event grows.”**

- The authority to activate or sanction the use of altered standards of care under certain conditions.**
- Legal issues related to liability, licensing, and intergovernmental or regional mutual aid agreements.**
- Financial issues related to reimbursement and other ways of covering medical care costs.**
- Issues related to effective communication with the public.**
- Issues related to populations with special needs.**
- Issues related to transportation of patients.**

# Augmentation of hospital critical care capacity after bioterrorist attacks or epidemics: Recommendations of the Working Group on Emergency Mass Critical Care

Lewis Rubinson, MD, PhD; Jennifer B. Nuzzo, SM; Daniel S. Talmor, MD; MPH; Tara O'Toole, MD, MPH; Bradley R. Kramer, BS; Thomas V. Inglesby, MD: for the Working Group on Emergency Mass Critical Care

The Working Group on Emergency Mass Critical Care was convened by the Center for Biosecurity of the University of Pittsburgh Medical Center and the Society of Critical Care Medicine to provide recommendations to hospital and clinical leaders regarding the delivery of critical care services in the wake of a bioterrorist attack resulting in hundreds or thousands of critically ill patients. In these conditions, traditional hospital and clinical care

standards in general, and critical care standards in particular, likely could no longer be maintained, and clinical guidelines for U.S. hospitals facing these situations have not been developed. The Working Group offers recommendations for this situation. (Crit Care Med 2005; 33:E●●●–E●●●)

**KEY WORDS:** bioterrorism; mass casualty medical care; disaster medicine; surge capacity

**“If there are limited hospital resources and many critically ill patients in need, triage decisions regarding the provision of critical care should be guided by the principle of seeking to help the greatest number of people survive the crisis. This would include patients already receiving ICU care who are not casualties of an attack.”**

***Planning assumptions regarding the current critical care medicine response capacity for bioterrorism:***

- 1. Future bioterrorist attacks may be covert and could result in hundreds, thousands, or more critically ill victims.**
- 2. Critical care will play a key role in decreasing morbidity and mortality rates after a bioterrorist attack.**
- 3. Mass critical care could not be provided without substantial planning and new approaches to providing critical care.**
- 4. A hospital would have limited ability to divert or transfer patients to other hospitals in the aftermath of a bioterrorist attack.**
- 5. Currently deployable medical teams of the federal government would have a limited role in increasing a hospital's immediate ability to provide critical care to large numbers of victims of a bioterrorist attack.**
- 6. Hospitals may need to depend on nonfederal sources or reserves of medications and equipment necessary to provide critical care for the first 48 hrs following discovery of a bioterrorist attack.**

# Concept of Operations for Triage of Mechanical Ventilation in an Epidemic

John L. Hick, MD, Daniel T. O'Laughlin, MD

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### Abstract

The recent outbreak of severe acute respiratory syndrome and the growing potential of an influenza pandemic force us to consider the fact that despite great advances in critical care medicine, we lack the capacity to provide intensive care to the large number of patients that may be generated in an epidemic or multisite bioterrorism event. Because many epidemic and bioterrorist agent illnesses involve respiratory failure, mechanical ventilation is a frequently required intervention but one that is in limited supply. In advance of such an event, we must develop triage criteria that depend on clinical indicators of survivability and resource utilization to allocate scarce health care resources to those who are most likely to benefit. These criteria must be tiered, flexible, and implemented regionally, rather than institutionally, with the backing of public health agencies and relief of liability. This report provides a sample concept of operations for triage of mechanical ventilation in epidemic situations and discusses some of the ethical principles and pitfalls of such systems.

ACADEMIC EMERGENCY MEDICINE 2006; ■:■ ■-■ ■ © 2006 by the Society for Academic Emergency Medicine

- 1. Guidelines developed in advance**
- 2. State DOH driven**
- 3. State Declaration of Emergency initiates the process**
- 4. Two independent groups review**
- 5. State DOH presents to Governor**
- 6. Governor issues Emergency Order**
- 7. Ongoing review process**

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## Table 2

### Suggested Guideline Development Group Members

Department of Health commissioner or designee

Department of Health state epidemiologist

Department of Health Emergency Response/Office of Emergency Preparedness

Infectious disease physicians (2)\*

Critical care physicians (2)\*

Emergency physicians (2)\*

Family practice physician

Pediatric infectious disease physician

Pediatric critical care physician

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\* Should include the chapter representative or designee from the state specialty society.

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### Table 3

#### Suggested Guideline Review Group Members

Additional members in the categories noted under  
guideline development group

Respiratory therapists

Ethicists

State Attorney General and governor's legal counsel

State hospital association

State medical association

State nursing association

Hospital administrators, urban and rural

Local public health

Public safety and emergency management

Emergency medical services

Lay public members

Faith-based community members

Special interest groups: pediatrics, mental health, physical  
impairments groups

Political positions: select mayors, county commissioners,  
council members

## Three Tiers of Criteria

Tier 1: Do not offer AND withdraw ventilatory support for patients with any one of the following:

1. Respiratory failure requiring intubation *with* persistent hypotension (systolic blood pressure <90 mm Hg for adults) unresponsive to adequate fluid resuscitation after 6–12 hours of therapy *and* signs of additional end-organ dysfunction (e.g., oliguria, mental status changes, cardiac ischemia)
2. Failure to respond to mechanical ventilation (no improvement in oxygenation or lung compliance) and antibiotics after 72 hours of treatment for a bacterial pathogen (timeline may be modified based on organism-specific data)
3. Laboratory or clinical evidence of  $\geq 4$  organ systems failing
  - a. Pulmonary (adult respiratory distress syndrome, ventilatory failure, refractory hypoxemia)
  - b. Cardiovascular (left ventricular dysfunction, hypotension, new ischemia)
  - c. Renal (hyperkalemia, diminished urine output despite adequate fluid resuscitation, increasing creatinine level)
  - d. Hepatic (transaminase greater than two times normal upper limit, increasing bilirubin or ammonia levels)
  - e. Neurologic (altered mental status not related to volume status, metabolic, or hypoxic source, stroke)
  - f. Hematologic (clinical or laboratory evidence of disseminated intravascular coagulation)

Tier 2: Do not offer AND withdraw ventilatory support from patients with respiratory failure requiring intubation with the following conditions (in addition to those in tier 1):

Patients with pre-existing system compromise or failure including:

1. Known congestive heart failure with ejection fraction <25% (or persistent ischemia unresponsive to therapy and pulmonary edema)
2. Acute renal failure requiring hemodialysis (related to illness)
3. Severe chronic lung disease including pulmonary fibrosis, cystic fibrosis, obstructive or restrictive diseases requiring continuous home oxygen use before onset of acute illness
4. Acquired immunodeficiency syndrome (AIDS), other immunodeficiency syndromes at stage of disease susceptible to opportunistic pathogens (e.g., CD4 <200 for AIDS) with respiratory failure requiring intubation
5. Active malignancy with poor potential for survival (e.g., metastatic malignancy, pancreatic cancer)
6. Cirrhosis with ascites, history of variceal bleeding, fixed coagulopathy, or encephalopathy
7. Acute hepatic failure with hyperammonemia
8. Irreversible neurologic impairment that makes patient dependent for personal cares (e.g., severe stroke, congenital syndrome, persistent vegetative state)

Tier 3: Specific protocols to be agreed upon by guideline development committee. Possibilities include:

1. Restriction of treatment based on disease-specific epidemiology and survival data for patient subgroups (may include age-based criteria)
2. Expansion of preexisting disease classes that will not be offered ventilatory support
3. Applying Sequential Organ Failure Assessment scoring to the triage process and establishing a cutoff score above which mechanical ventilation will not be offered

# CHEST<sup>®</sup>

Official publication of the American College of Chest Physicians

## **Summary of Suggestions From the Task Force for Mass Critical Care Summit, January 26-27, 2007**

Asha Devereaux, Michael D. Christian, Jeffrey R. Dichter, James A. Geiling and Lewis Rubinson

***Suggestion 2.1: Every hospital with an ICU should plan and prepare to provide EMCC and should do so in coordination with regional hospital planning efforts.***

***Suggestion 2.2: Hospitals with ICUs should plan and prepare to provide EMCC every day of the response for a total critically ill patient census at least triple usual ICU capacity.***

***Suggestion 2.3: Hospitals should prepare to deliver EMCC for 10 days without sufficient external assistance.***

***Suggestion 2.4: EMCC should include, when applicable, the following:***

- (1) mechanical ventilation,**
- (2) IV fluid resuscitation,**
- (3) vasopressor administration,**
- (4) antidote or antimicrobial administration for specific diseases,**
- (5) sedation and analgesia,**
- (6) select practices to reduce adverse consequences of critical illness and critical care delivery, and**
- (7) optimal therapeutics and interventions, such as renal replacement therapy and nutrition for patients unable to take food by mouth, if warranted by hospital or regional preference.**

***Suggestion 2.5: All communities should develop a graded response plan for events across the spectrum from multiple casualty to catastrophic critical care events***

***Suggestion 4.1: All hospitals must operate uniformly and cooperate in order to successfully implement a triage process when resources are scarce and/or unavailable.***

***Suggestion 4.2: All attempts should be made by the health-care facility to acquire scarce critical care resources or infrastructure, or to transfer patients to other health-care facilities that have the appropriate ability to provide care. Critical care will be rationed only after all efforts at augmentation have been exceeded.***

***Suggestion 4.3D: Rationing should apply equally to withholding and withdrawing life-sustaining treatments based on the principle that withholding and withdrawing care are ethically equivalent.***

***Suggestion 4.5: The Task Force suggests a systematic, retrospective review of the decisions of the triage team by a review committee.***

***Suggestion 4.6: Palliative care is a required component of mass critical care.***

***Suggestion 4.8: Providers should be legally protected for providing care during the allocation of scarce resources in mass critical care when following accepted protocols***

# **Crisis Standards of Care**

## **SUMMARY OF A WORKSHOP SERIES**

**Clare Stroud, Bruce M. Altevogt, Lori Nadig, and  
Matthew Hougan, *Rapporteurs***

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**BOX 1**  
**Louisiana Pandemic Influenza Clinical Forum Priorities**

- Researching existing data/resources
  - Planning/collaborating with other states
  - Identifying key partners/organizations
  - Identifying standards to be addressed
  - Identifying the scope of clinical practice
  - Developing “triggers” to activate
  - Developing an algorithm for allocation of limited resources
  - Funding to develop protocols
  - Guidance and support from federal authorities
-

## **BOX 2**

### **Who Should Participate in Planning for Crisis Standards of Care? A Partial List**

- Physicians
- Physician assistants
- Nurses
- Nurse practitioners
- EMTs/paramedics and dispatchers
- Pharmacists
- Hospital administrators
- State and local public health officials
- Emergency management
- Fire departments
- Police departments
- Ethicists
- Lawyers
- Morticians
- Funeral directors
- Citizens
- Elected officials
- Media
- Bloggers
- Teachers
- Large local employers
- Faith-based organizations
- Civic organizations
- Academia
- Charities and nonprofits
- Government
- Insurance companies
- Reinsurance companies
- Hospitals and hospital associations
- Nursing facilities
- Health system alliances
- Veterans Affairs hospitals
- Department of Defense facilities
- Community health centers
- Urgent care facilities
- Hospice and palliative care facilities
- Long-term care facilities
- Home health organizations
- Dialysis centers
- Hospital licensing agencies
- Regulatory agencies

## BOX 3

### Continuum of Conventional, Contingency, and Crisis Capacity

**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 maintain or have minimal impact on 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) (Hick et al., 2009).

## BOX 4

### Stages of Care in North Dakota's Plan

#### STAGE 1: SMALL OUTCOME IMPACT

- Tighter admission criteria
- Early discharge
- Eliminate comfort-care nursing
- Increase shift length
- Small increases in patient-to-provider ratio
- Eliminate dietary preference
- Limited post-mortem care
- Hospital access restriction
- Cohorting

#### STAGE II: MODERATE OUTCOME IMPACT

- Acute care remains at nursing homes
- Limitations in services, diagnostics
- Limited expansion of privileges
- Moderate increase in patient-to-provider ratio
- Provider recruitment (e.g., retired)
- Increased care by family members
- Decreased frequency of vital signs
- Changes in palliative care
- Changes in charting

### STAGE III: SEVERE OUTCOME IMPACT

- Marked expansion in privileges
- Large increase in patient-to-provider ratio
- Use of volunteers for some patient care
- Family administration of medications
- Palliative threshold increase (low survival conditions)
- No cardiopulmonary resuscitation
- Clinical judgment replaces diagnostics
- Changes in informed consent requirements
- Minimal charting

## BOX 5

### Exclusion Criteria Prompting Possible Reallocation of Life-Saving Interventions

#### **Sequential Organ Failure Assessment (SOFA) score criteria:**

patients excluded from critical care if risk of hospital mortality > 80%

- A. SOFA > 15
- B. SOFA > 5 for >5 d, and with flat or rising trend
- C. > 6 organ failures

#### **Severe, chronic disease with a short life expectancy**

- A. Severe trauma
- B. Severe burns on patient with any two of the following:
  - i. Age > 60 yr
  - ii. > 40% of total body surface area affected
  - iii. Inhalational injury
- C. Cardiac arrest
  - i. Unwitnessed cardiac arrest
  - ii. Witnessed cardiac arrest, not responsive to electrical therapy (defibrillation or pacing)
  - iii. Recurrent cardiac arrest
- D. Severe baseline cognitive impairment

- E. Advanced untreatable neuromuscular disease
- F. Metastatic malignant disease
- G. Advanced and irreversible neurologic event or condition
- H. End-stage organ failure (for details, see Devereaux et al., 2008)
- I. Age > 85 yr (see Lieberman et al., 2009)
- J. Elective palliative surgery

SOURCE: IOM (2009) (adapted from Devereaux et al., 2008).

# **Guidance for Establishing Crisis Standards of Care for Use in Disaster Situations**

## **A Letter Report**

**Committee on Guidance for Establishing Standards of  
Care for Use in Disaster Situations**

**Board on Health Sciences Policy**

**Bruce M. Altevogt, Clare Stroud, Sarah L. Hanson,  
Dan Hanfling, and Lawrence O. Gostin, *Editors***

**“in an important ethical sense, entering a crisis standards of care mode is not optional—it is a forced choice, based on the emerging situation. Under such circumstances, failing to make substantive adjustments to care operations i.e., not to adopt crisis standards of care, is very likely to result in greater death, injury, or illness.”**

**...”health care professionals are always obligated to provide the best care they reasonably can under given circumstances.”**

**...”need to develop all protocols around the same key elements and components to ensure coordination, consistency, and fair allocation of scarce resources during a disaster.”**

**...”an urgent and clear need for a single national guidance for states with crisis standards of care that can be generalized to all crisis events and is not specific to a certain event.”**

## **“Crisis Standards of Care” Recommendations:**

### **Key elements:**

- **A strong ethical grounding**
- **Integrated and ongoing community and provider engagement, education, and communication;**
- **Assurances regarding legal authority and environment;**
- **Clear indicators, triggers, and lines of responsibility**
- **Evidence-based clinical processes and operations**
- **Consistency**

# Clarity of Language

## rationing

- rational distribution of limited resources

## standards of care

- Platonic concept – immutable
- legal vs. medical
- confusion with “standards of practice”

## rules of engagement (ROE)

- a tiered, adaptive protocol in effect when triggered

## operational healthcare system

- elements of healthcare, public health, medicine and nursing in management collaboration

**“alterations in standards of care” or  
“crisis standards of care”**



**DROE (disaster rules of engagement)**

**“alterations in standards of care”**  
**“crisis standards of care”**



**CROE (catastrophic rules of engagement)**

# Questions for those who would change ROEs

- WHO?
- WHAT?
- WHERE?
- WHEN?
- HOW?

# Who?

- **By Whom** can care be delivered under DROE? CROE?

- ★ med students, nursing students?  
- see Project Xtreme

- ★ family members?

 Supply  
Demand

# Who? What?

- **What level of care** will be available and **To Whom** under DROE? CROE?
- **What conditions will be treated?**
  - consider a multi-level, community-based triage and distribution system
  - defined expectant criteria

Supply

 Demand

# Where?

*Where can care be delivered?*

- ACCs Alternate Care Centers?
- neighborhood health centers?

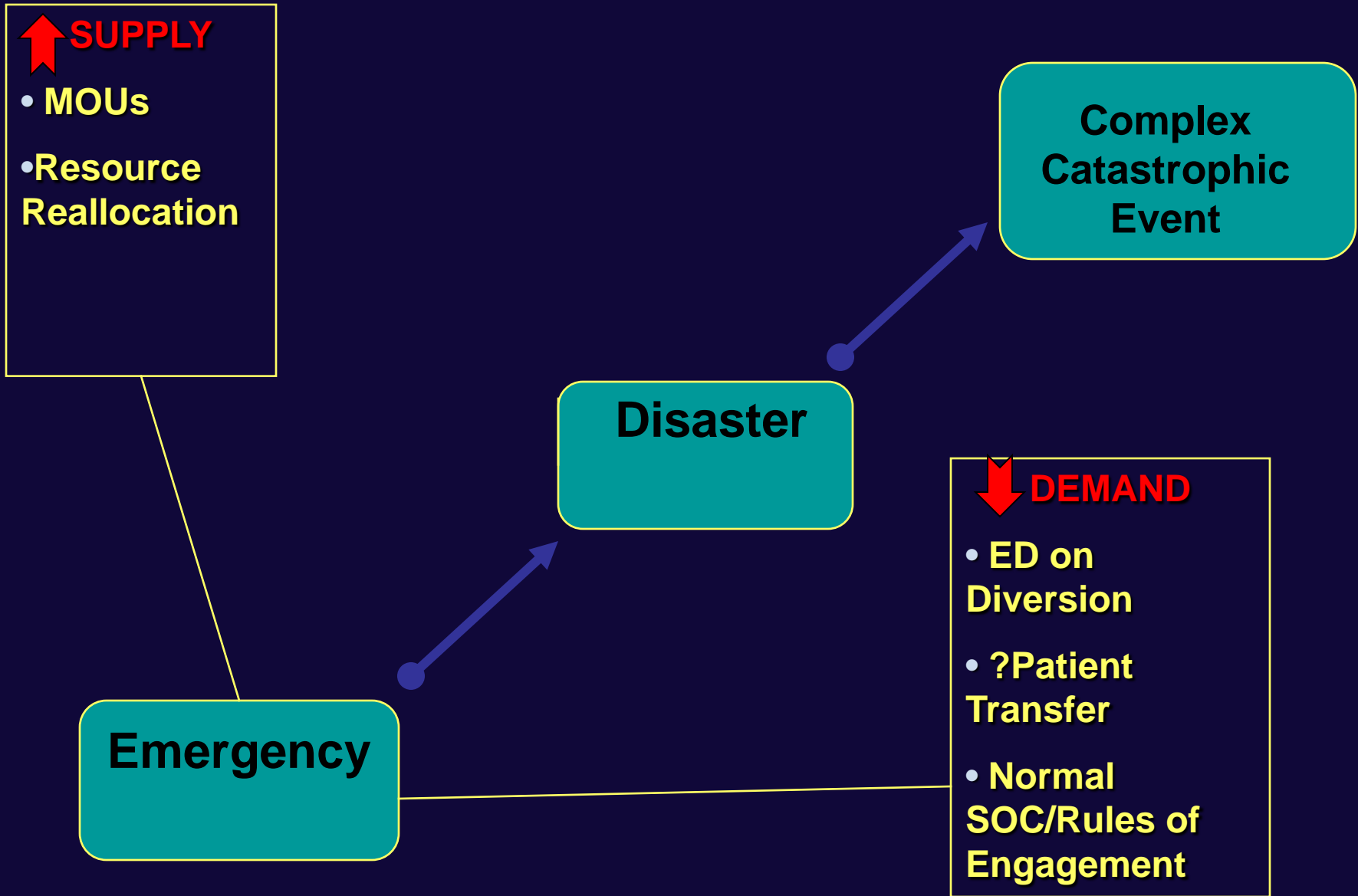
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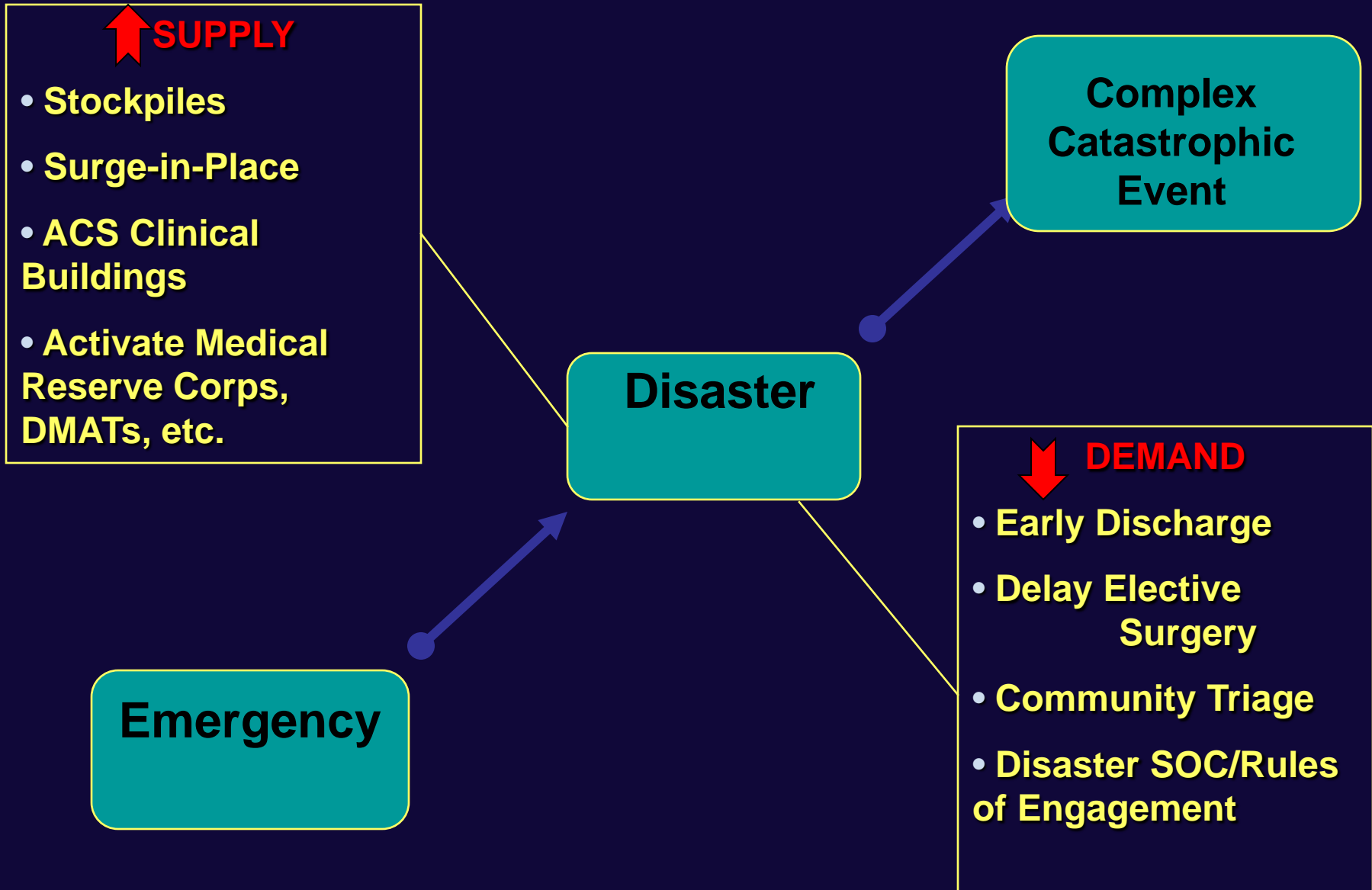
# When?

- *When will these rules of engagement be triggered?*

# How?

- *How will these rules of engagement be implemented, monitored and transitioned back to everyday rules?*
- *Changes in provider:patient ratios?*
- *Extension of scope of practice?*
- *Changes in charting/documentation?*
- *Reuse of disposables?*





**↑ SUPPLY**

- Stockpiles/SNS
- ACS Clinical Buildings
- ACS Non-Clinical and Temporary Buildings
- Palliative Care Sites
- Activate Disaster Healthcare Volunteers.

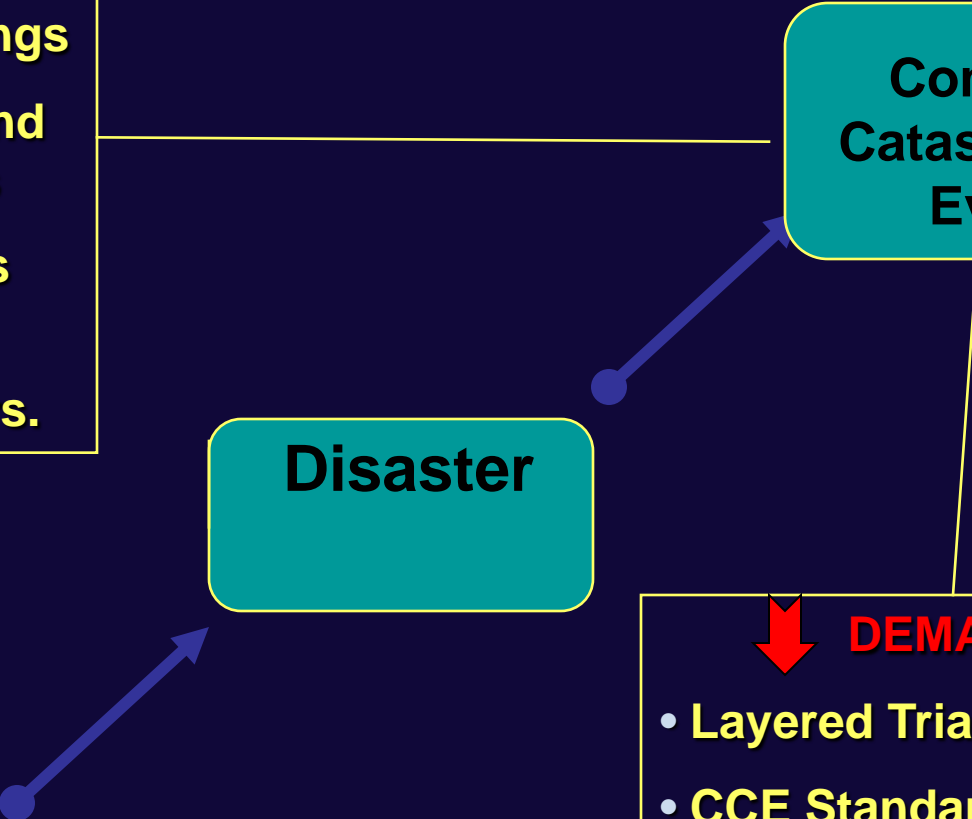
**Disaster**

**Complex Catastrophic Event**

**Emergency**

**↓ DEMAND**

- Layered Triage
- CCE Standards of Care/ Rules of Engagement
- “Expectant” Category





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