

roles of his/her colleagues. Making action cards of their own words promoted active participation of members. As a result, the existing manual was revised and updated. The hospital could respond adequately to an earthquake with a magnitude of 5.4.

**Conclusions:** A workshop for disaster preparedness that utilized action cards was practical and useful to introduce a disaster response system to non-specialists in disaster medicine. **Keywords:** earthquake; Japan; preparedness; university hospital; workshop

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### Creation of Surge Capacity by Early Discharge of Hospitalized Patients at Low Risk for Untoward Events

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**Introduction:** Hospitals in the US are expected to function without external aid for up to 96 hours during a disaster. However, there is concern that there is insufficient capacity in hospitals to absorb large numbers of acute casualties. We wanted to determine the potential for creation of inpatient bed surge capacity from the early discharge (reverse triage) of hospital inpatients at low risk of untoward events for duration of 96 hours.

**Methods:** In a health system with three capacity-constrained hospitals representative of US facilities (academic, teaching affiliate, community), a variety (n = 50) of inpatient units were canvassed prospectively in rotation using a blocked randomized design over 19 weeks. Intensive care units, nurseries, and pediatric units were excluded. Assuming a disaster occurred on the day of enrollment, patients who did not require any (previously defined) critical intervention (CI) over four days were deemed suitable for early discharge.

**Results:** Of 3,491 patients, 44% did not require any CI, and were suitable for early discharge. Accounting for additional routine patient discharges and the full utilization of staffed and unstaffed licensed beds, Gross Surge Capacity was estimated at 77%, 95%, 103%, for the three hospitals. When factoring likely continuance of non-victim emergency admissions, the net surge capacity available for disaster victims was estimated at 66%, 71%, 81%, respectively. Reverse triage comprised the majority (50%, 55%, 59%) of surge beds. Most realized capacity was available within 24–48 hours.

**Conclusions:** Hospital surge capacity for standard inpatient beds maybe greater than previously believed. Reverse triage, if appropriately harnessed, can be major contributor to surge capacity.

**Keywords:** capacity building; disasters; early discharge; hospitals; capacity building; surge capacity  
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### Improvised Oxygen Supply System for Pandemic and Disaster Use

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**Introduction:** A pandemic influenza outbreak will greatly strain the surge capability of medical system worldwide. The availability of oxygen will be a lifesaving medical intervention. Little capability exists for oxygen delivery to patients in non-standard hospital beds. The volume of oxygen clinically used is staggering. A hospital H tank of oxygen only will last for one hour supplying 25 patients with oxygen at 4 liters per minute (lpm). There is a great need to develop methods of surge capacity for oxygen.

**Methods:** A large Dewar of liquid oxygen was used to supply an oxygen distribution system made of commonly available, inexpensive materials. This system was tested in various configurations and the practical limits of this supply system were established.

**Results:** The system can be designed and built easily. The materials are readily available and large metropolitan areas can support many such systems. It will power multiple ventilators at a constant pressure without malfunction. A ward delivery system supplying 30 beds at up to 6 lpm each can be assembled safely. The construction methods and safety issues will be described.

**Conclusions:** A practical method of supplying oxygen for use during a pandemic can be assembled easily. This will be lifesaving in the event of a serious outbreak of respiratory illness. **Keywords:** disaster; emergency health; oxygen; oxygen supply system; pandemic

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### Augmentation of Hospital Emergency Department Surge Capacity: Recommendations of the Australasian Surge Strategy Working Group

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**Introduction:** Emergency medicine has produced guidelines, training, and leadership for disaster response management for more than a decade. To date, there have been limited guidelines published for emergency physicians needing to provide a rapid response to a surge in demand.

**Methods:** Using epidemiologically and empirically derived practice assumptions, the Australasian Surge Strategy Working Group developed its recommendations for clinical surge management.

**Results:** These recommendations detail 22 specific actions potentially available to any emergency physician working in the context of surge. The strategies have been compiled according to the domains of space, staff, supplies, and system operation. Underlying these actions, the Working Group provides detailed guidance on surge recognition, patient flow through the emergency department, clinical goals and patient care practices during surge, and triage in surge.

**Conclusions:** Issues that merit future focused research include: (1) the measurement of surge capacity; (2) situational constraints to strategy implementation; (3) validation of surge strategies in combination; and (4) measurement of strategy impacts on throughput, cost, and quality of care.

**Keywords:** Australasian Surge Strategy Working Group; emergency department; hospital; preparedness; surge capacity

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### Creating Hospital Surge Capacity: Hospital Emergency Support Functions and Re-Allocation of Resources

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**Introduction:** Hospitals in the United States have been tasked by federal funding mandates and accreditation agencies to plan for accommodating large numbers of patients by increasing their in-house bed surge capacity. No clear means have been established to determine staff suitably to care for this increased patient load. To date, plans nationwide have identified volunteerism and emergency credentialing systems as possible solutions to the staffing issue. However, no evidence has been shown that this approach will address the staffing needs in a large-scale surge incident appropriately. The purpose of the Hospital Emergency Support Functions (HESF) Project is to identify staff capabilities and capacity available throughout the hospital that might be reassigned to both clinical and non-clinical services during an event.

**Methods:** Adapting the Delphi method, a mono-variable exploration technique for technology forecasting, a panel of experts that included hospital clinical directors, decision-makers and emergency managers was selected to participate in a consensus process.

**Results:** Hospital clinical functions pivotal to surge capacity were reviewed. Resources supporting non-critical hospital functions may be diverted to meet surge demands as defined by the HESFs. Provisions may also be made for just in time and cross training of employees, healthcare providers and volunteers to expand the workforce available to support the critical HESFs.

**Conclusions:** Identification of HESFs, staff training and reassignment of resources may help close gaps in meeting

surge demands. This approach is generalizable, adherent to state/federal/provincial mandates, and is intended for utilization and customization for emergency management planning.

**Keywords:** capacity building; hospitals; Hospital Emergency Support Functions; patient load; preparedness; resources

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### Consensus and Tools Needed for Evaluation of Emergency Management Capabilities

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**Objective:** The objective of this study was to determine whether a core set of healthcare emergency management capabilities and a comprehensive and rigorous approach to their evaluation exists.

**Methods:** The healthcare emergency management capabilities and evaluation approaches used by the Veterans Health Administration, The Joint Commission, the Institute of Medicine Metropolitan Medical Response System Committee, the Department of Homeland Security, and the Department of Health and Human Services were compared. Tools used to measure hospital performance based on written plans or exercises also were reviewed to determine their utility.

**Results:** Despite differences in the conceptualization of healthcare emergency management, there is considerable overlap regarding major capabilities and capability-specific elements among the agencies. At least three out of the five agencies identified occupant safety, continuity of operations, medical surge, communication, management of volunteers, management of resources, and support to external entities as major capabilities. Most often, the differences among agencies were related to whether a capability should be a major one or a capability-specific element (e.g., decontamination). All of the agencies rely on multiple indicators and data sources to evaluate emergency management capabilities. However, few performance-based tools have been developed to evaluate the quality of healthcare emergency management capabilities and none have been tested adequately for their reliability and validity.

**Conclusions:** Consensus on a healthcare emergency management framework must be reached so that efforts can be focused on improving the ability to rigorously evaluate and improve hospital emergency management capabilities for disasters.

**Keywords:** capacity building; emergency management; evaluation; preparedness; tool

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### Field Hospital and Clinics in Disaster Response: A Red Cross Model

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Health Emergency Response Units (ERUs) were pioneered >12 years ago by the Geneva-based International