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Emergency department surge capacity: Recommendations of the Australasian Surge Strategy Working Group

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Abstract

Background

For more than a decade emergency medicine organizations have produced guidelines, training and leadership for disaster management. However to date, there have been limited guidelines for emergency physicians needing to provide a rapid response to a surge in demand. The aim of this study is to identify strategies which may guide surge management in the Emergency Department.

Method

A working group of individuals experienced in disaster medicine from the Australasian College for Emergency Medicine Disaster Medicine Subcommittee (the Australasian Surge Strategy Working Group) was established to undertake this work. The Working Group used a modified Delphi technique to examine response actions in surge situations. The Working Group identified underlying assumptions from epidemiological and empirical understanding and then identified remedial strategies from literature and from personal experience and collated these within domains of space, staff, supplies, and system operation.

Findings

These recommendations detail 22 potential actions available to an emergency physician working in the context of surge. The Working Group also provides detailed guidance on surge
recognition, triage, patient flow through the emergency department and clinical goals and practices.

**Discussion**

These strategies provide guidance to emergency physicians confronting the challenges of a surge in demand. The paper also identifies areas that merit future research including the measurement of surge capacity, constraints to strategy implementation, validation of surge strategies and measurement of strategy impacts on throughput, cost, and quality of care.

**Key words:** emergency medicine; disaster management; surge capacity
Emergency department surge capacity: Recommendations of the Australasian Surge Strategy Working Group

Background

By the early 1990s, the World Health Organization, hospital associations, and other health bodies began to promulgate disaster management guidelines for hospitals. Since 1995 emergency medicine specialty societies have contributed to this effort and Emergency Medicine concerns are now common in the literature. However difficulties encountered in assessing the impact on Emergency Medicine have led to international calls for the development of standardised tools. Guidance on pre-hospital management of mass casualties has been incorporated into standardised training curricula for over a decade in the United Kingdom and more recently in the United States. In Australasia, a strategic plan for disaster medicine was published by emergency physicians in 2003 with recommendations to develop standards on supply, equipment, and nomenclature relating to disasters.

Critical to the management of mass casualties in Emergency Departments (EDs) is the ability to rapidly expand capacity to accommodate a sudden increase in demand. Surge capacity has been defined and considered for selected hazards with various models developed to predict the hazard-specific case load and guidelines have been published on selected aspects of hospital capacity and selected hazards. A conceptual framework has emerged in the emergency medicine literature. Generic recommendations have been published in relation to department staffing and hospital beds. Altered standards of clinical care under disaster conditions have
also been considered.\textsuperscript{21} By 2006, a Science of Surge conference in the US, sponsored by Academic Emergency Medicine and the National Center for the Study of Preparedness and Catastrophic Event Response, differentiated between daily and extraordinary surge requirements and made further calls for the setting of benchmarks to trigger surge actions.\textsuperscript{22,23} The American Medical Association and the American Public Health Association produced a consensus report from a leadership summit with eight generic recommendations on health system surge capacity. The report ultimately called for establishment of common terminology and definitions and appealed to authoritative groups such as the Institute of Medicine to address health system surge capability.\textsuperscript{24}

However emergency medicine at present lacks agreed strategies for tactical management of volume overload. A concise, authoritative, and practical set of management strategies is required and such strategies become increasingly important in health systems which run at, or near, full capacity with access block, overcrowding, inpatient boarding, fully occupied beds, and ambulance diversion common.

The Australasian Surge Strategy Working Group (Working Group) was convened with the express purpose of producing a set of practical, scalable response strategies for emergency physicians confronted with sudden excess demand arising from either a single mass casualty incident (MCI) or from the overwhelming demand of a “bad day”. This paper offers recommendations for clinical management of these situations as well as for future research.
**Working Group Methods**

The Working Group consists of Australasian emergency physicians drawn from the Australasian College for Emergency Medicine (ACEM) Disaster Management Subcommittee. While each of the members has extensive experience in disaster medicine, they come from diverse clinical, management, and academic backgrounds, with professional practice experience in academic, non-academic, urban and rural hospitals.

The Working Group undertook a modified Delphi technique to examine response actions in surge situations. Core issues were explored in the biomedical literature using Medline from 1966 to 2007 using terms ‘disaster’, ‘surge’, and ‘surge capacity’. Members of the Group independently identified operational assumptions which underpinned emergency medicine surge situations, and their response actions. These actions were compiled within the domains of “space, staffing, supplies and health system”. The overall strategy was collated into a draft written framework and collectively reviewed in February 2008. Unsettled issues led to further independent electronic review and framework revision until consensus emerged. All Working Group members supported the final recommendations.
Planning and Operational Assumptions

In developing its strategies the Working Group identified and agreed on a number of assumptions, both epidemiological and operational, which underlie the approach to the management of major incidents.

Epidemiological Assumptions

- Natural and transportation hazards are the most likely cause of disasters.\(^{26}\)
- Daily variations in demand, without a single event, are the most likely cause of surge in EDs.\(^{27}\)
- In the event of terrorist attacks, explosions using conventional weapons remain the most common cause\(^{28}\) with one third of patients deemed critical, and two thirds of patients treated and released from an ED.\(^{29}\)
- Hazard-specific death rates will be low as even bomb blasts have been found to inflict a fatality rate of less than 5% on its victims.\(^{28}\) Hence, almost all disaster-affected persons must be considered as potential survivors.
- Events may attract department visitors (media, VIPs, hospital staff, concerned families etc) far in excess of patients generated by the events.\(^{30}\)
- The majority of patients will be ambulatory.\(^{31}\) More specifically:
  - The vast majority of casualties in a disaster will leave the scene spontaneously.\(^{32}\) These patients are typically not triaged, treated, or transported by an EMS system and they commonly arrive at the nearest hospital before the most injured patients.\(^{33}\)
• Major events may yield patients with psychiatric symptoms far in excess of patients with organic symptoms.\textsuperscript{34} For example in the Tokyo Sarin gas attack, the ratio of psychiatric to organically ill patients was 4:1.

Operational Assumptions

• EDs operate at full capacity at almost all times.\textsuperscript{31,35,36,37}

• There will be little or no advance warning.\textsuperscript{28,32} There will be limited options for patient diversion and limited ability to transfer patients to another facility.

• As most patients presenting as part of the surge following an incident will not have been transported by Emergency Medical Services (EMS), they may have had no triage, decontamination or treatment provided before arrival.\textsuperscript{28}

• Approximately 50-80\% of the acute mass casualties in a disaster will arrive at the closest medical facilities generally within 90 minutes following an event.\textsuperscript{16} Other hospitals outside the area may receive few if any casualties.\textsuperscript{33}

• ED lockdown is not considered an option during surge.

• All attempts will be made to maintain normal standards of care.

• External deployable medical teams are not an immediately available response option for an affected hospital.\textsuperscript{31}
Findings

Findings of the Working Group are presented as an ED response framework in Tables 1 and 2. Table 1 identifies actions to be considered before the surge (pre-event). Table 2 lists actions to be considered during the surge (event). The tables prioritise actions within categories of space, staffing, supplies, and systems. Key actions that differ markedly from routine work practices are considered in detail in the discussion. Actions in **bold type** apply particularly to the management of surge associated with a busy day unrelated to an MCI and are collectively considered at the end of the discussion.

Discussion

The Working Group has identified several key principles which appear critical to the effective management of surge.

1. Recognizing Surge

Recognizing surge is the key to a prompt response. ED surge is a significant increase in the demands placed on an ED, given the normal capacity within which an ED can reasonably maintain standards of care. The surge may be reflected in rate of patient presentations, waiting times, patients queued and ambulance diversions. A discrete, sudden mass casualty event makes activation relatively straightforward; however, a surge may occur without such declaration or in the absence of a discrete event.
An understanding of the patterns of surge, including the previously listed epidemiological assumptions, is critical to its identification and evaluation. A hospital ED is more likely to be burdened by self-presenting patients and their families than by ambulance patients. Nevertheless, the numbers of available operating rooms (ORs) and critical care beds have been identified as major factors in determining a hospital’s capacity to care for critically injured casualties.29

2. Initiating action

While a ‘whole of system’ response is necessary, initial strategies, including early establishment of ED command and control must be initiated from the ED. The Working Group believes that reluctance to activate components of a disaster plan under conditions of daily surge is common and often inappropriate.

3. Maintaining Patient Flow

There is a need to ensure unidirectional flow through the system and to avoid all bottlenecks.38 If patient flow is maintained, the occupancy of physical areas is reduced, which may increase the efficiency of any potential response.

4. Setting clinical goals

Notification of a surge in demand should prompt immediate changes in work practices of the staff. At issue is not that they work faster or harder than normal but that they work to a different
goal. In these circumstances the clinical goal shifts from individual patient satisfaction to doing ‘the most for the most’. This does not obligate a change in the standard of care but does imply a change in the standard of service; standard of care versus sufficiency of care. Error! Bookmark not defined.19,39 These changes are listed in Table 3 for which a notional rank order is proposed. Senior staff members have the responsibility of articulating these practice changes to their junior staff and delegating appropriate tasks. Changes in the standard of care occurring through depletion of critical supplies or exhaustion of staff are beyond the scope of this paper.

5. **Advance Triage by Surge Team**

Triage is fundamental to efficient and effective management of multiple patients. Routine triage may be maladapted to ED needs in times of surge. Passive reception of patients at triage denies the ED the opportunity to control patient flow before it converges on the waiting room, invites contamination of the premises from patients with transported hazards and delays initial clinical decision-making. Loss of crowd control in surge has been known to swamp a hospital within minutes.40

Triage and security are the lynchpins of the initial management of surge in the ED. Triage and security protect the ED from chaos and contamination and should also facilitate clinical care. In that context, triage and security must co-locate and work as a surge team. This may be as simple as one security officer and one triage nurse creating a surge team, or the team may enlarge with administrative and clinical staff.

The principal responsibilities of the surge team are to:
1. Ensure the work environment stays safe from contamination.

2. Deflect non-clinical visitors to an appropriate non-ED destination.

3. Divert ambulatory patients (“walking wounded”) to a designated reception area.

To these ends, the surge team must pre-position itself ahead of the customary triage location.

- With the anticipated arrival of fewer than 10 additional patients the surge team pre-positions itself at the entrance to the waiting room.

- If the waiting room is overloaded or triage anticipates an imminent arrival of 10 or more additional patients, the surge team pre-positions itself at the vehicle/ambulance entrance on the street.

- If a patient load far in excess of 10 patients is anticipated, then the surge team should consider curbside triage and close the street to through traffic.

The ability to do this depends on the design and location of the ED. Patients may be directed to a decontamination area, the designated ambulatory reception area or to the routine triage desk. Senior clinicians (doctors or triage nurses) best perform this role and most naturally project the gravitas needed for crowd control.

This model may appear resource-intensive, especially to small departments. However the need for these pre-positioned staff is generally short-lived and the consequences of mismanagement are chaos and/or contamination of the department. The Working Group believes that advanced triage is critical to the effective management of surges in demand in the ED. This is particularly so when multiple civilian vehicles converge on the ED or when mass transport of minor casualties to hospital has occurred.
The value of this approach was exemplified in the London bombings where critical mortality was reduced by repeated effective triage, implementation of a hospital wide damage control philosophy, minimal clinical investigations and rapid transfer to definitive care.\textsuperscript{41}

Diversion of stable, ambulatory patients to an appropriate treatment area is a key task which contributes to both efficient patient care and crowd control. This concept is well recognized in basic disaster training\textsuperscript{12} but is uncommonly applied in ED settings. The Working Group believes that the near simultaneous arrival of more than 10 ambulatory patients should prompt consideration of diversion to an in-ED “fast track” area or to an extra-ED ambulatory treatment area. To facilitate the movement of these “green” triage patients, we recommend five cm (2 inch) wide green adhesive tape be placed on the hospital floor to mark the path from the ED triage area to the ambulatory reception area. One dedicated hospital escort should shuttle along this intra-hospital path assisting with patient movement.

Triage within the ED should also be enhanced. Early investigations and early selection of patients suitable for transfer to the operating room (OR) and intensive care unit (ICU) aids faster patient transit and preservation of both ED space and staff capacity. It also allows critically ill patients to spend minimal time in the ED and to access definitive care earlier.

6. **Clinical Work Practices**

Emergency physicians typically focus on finding the pathology but the demands of surge force the ED to find the 'unmade' decision. Surge in demand should prompt clinical rounds of the ED
in order to expose ‘unmade’ decisions. In a small ED, this is easily organized, but in the large ED taking all clinicians from their clinical duties to attend may be counter-productive and different approaches may be necessary. Senior staff should regularly review patients under their care to ensure that timely decisions are made.

One group of patients merits particular attention - the non-disaster / pre-surge patients. These patients may be easily marginalized by the demands of an incoming surge and its associated drama. Some of these patients may harbour serious pathology but all of them call for clinical decision-making.

The Working Group recommends a senior physician review these patients in concert with a senior nurse. This senior physician should gather all the unseen patients’ records and proceed to the waiting patients. After a brief explanation he/she should identify the chief complaint, perform a focused inspection and order necessary studies. This may lead to immediate acceptance by an inpatient service — particularly for referred patients.

The Working Group recommends consideration of designated teams (1 to 2 staff) for specific ED tasks - resuscitation, cohort care, bedside procedures, fluid and medication review, etc. A patient who is seriously ill or injured may require the attention of a resuscitation team. A patient not seriously ill or injured may be managed in a designated area of the ED by one of the dedicated teams. Allocation of individuals to specific tasks such as analgesia has been shown to be effective. 42
The Working Group finds value in work practices which optimize information sharing in brief clinical encounters. Selected illustrative practices are listed in Table 4.

7. Departmental Work Practices

A schematic of an ED with loci of application of these strategies is presented in Figure 1. In addition, this figure provides several functional insights into the scope of oversight of the attending physician.

- The working area of the ED enlarges with surge. Staff and medical and crowd control must reach beyond the clinical treatment areas of the department. Reallocating resources specifically permits the department to pre-position key functions of security and triage.
- Arrows in the figure convey how hospital spaces outside the ED may receive decanted or diverted patients as part of a surge strategy. These ambulatory patients who appear well at triage may be escorted away from a chaotic waiting room and observed by appropriate staff pending detailed examination by a treating physician. Particular care needs to be taken however with detailed examination of ambulant patients following terrorist bombings.43
- The convergence of staff and equipment can impair free movement within the department and amplify problems of decontamination should breaches occur.

8. External and ancillary personnel

The Working Group notes that surge in the ED from an MCI is likely to last only several hours. With the exception of small EDs, the calling in of additional clinical staff is often too slow to impact on the immediate situation. Call in lists should be pre-prepared and updated regularly and
also include ‘rough call in time’ based on distance from hospital. Prior credentialing of external staff and volunteers should also be considered in this case.\textsuperscript{44} Use of unfamiliar staff is a potential source of confusion. Planning should include a ‘corral point’ for arriving staff and a buddy system which partners non-ED staff (medical, nursing, clerical) to work with existing ED staff or supervisor. Medical and nursing students are a source of additional workforce and may assist with minor interventions (IVs, pathology specimen delivery), message bearers, or scribes.\textsuperscript{43} Similarly, allied health staff are often neglected in surge planning but may be able to fill a variety of valuable roles.\textsuperscript{45}

9. Surge From Variations in Daily Demand

The most common surge confronting EDs is the overwhelming demand of a very busy day aggravated by access block. The resultant crowding has been shown to be associated with adverse patient outcomes.\textsuperscript{46,47,48} Selected actions in Tables 1 and 2 are bolded for their applicability to these situations in the ED. In effect, surge management on a busy day amounts to a simplification of the options available in an MCI. The key is forthright recognition of the problem and willingness to activate an appropriate response.

Some actions, such as ambulance bypass, are commonly undertaken. Other actions, such as clearing the department of admitted patients, may be precluded by access block and effectively may yield little in terms of new ED bed space. The Working Group focused on those particular work practices under the control of the emergency physician— independent of pre-hospital and in-hospital constraints.
Depending on local conditions various options may be most applicable in given circumstances. Not all options suggested in this paper may be available to all departments at all times. Nonetheless, the Working Group believes that an emergency physician with a ready list of options is best equipped to serve his/her patients.

**Future Steps**

The Working Group recognizes these recommendations are simply the start of what needs to be a long-term effort to validate and optimize surge management strategies in EDs. Surge management is but one aspect of disaster management and it will require the commitment of health and government leaders. The Working Group embraces the busy ED as a centre for hospital clinical excellence and an opportunity for clinical education and operations research. To those ends, particular areas meriting attention include:

- A more complete understanding of factors limiting ED surge capacity is needed to enable development of appropriate response strategies.

- How much surge capacity a hospital or health system should be expected to produce *a priori* remains unclear. Surge capacity benchmarks have been described in terms of percentage of usual bed capacity in Israel,\(^{49}\) population ratio in the US\(^{50}\) and absolute numbers of patient beds in other settings. Improved measures of population risk, agreement on performance indicators and data transparency enabling assessment of preparedness, are all future landmarks in the science of surge.

- Operational research into the kinetics of patient flow merits future research. Researchers will likely adopt tools commonly used in lean systems such as bar coding, provider ID
card readers, and software enabling full department schematic display. Metrics of interest include patient volumes in areas of surge, elapsed times associated with the patient flow in Figure 1, as well as outcomes of care.

- The impact of surge on quality of care also needs more study. Pioneering work in Australasia clearly shows excess mortality in patients presenting during periods of high ED occupancy.\textsuperscript{47} While competence in medicine is case-related, volume overload in emergency medicine remains linked to patient outcomes. Surge strategies appear destined to become integral to the achievement of standards of care in overburdened health facilities. Clearer understanding of consequences of surge management will guide future efforts to refine the strategies.

The Working Group believes that the identification of ‘surge strategies’ for EDs can lead to quantifiable measures of disaster preparedness. This will facilitate measurement of progress by individual departments and allow comparison between departments, in pursuit of improved patient outcomes.

**Acknowledgements:**

The Working Group wishes to thank the staff of the ACEM for their support in coordinating the meetings of the group.
Table 1
Working Group Recommendations for Surge Management
Pre-Event Priority Actions

<table>
<thead>
<tr>
<th>SPACE</th>
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<tbody>
<tr>
<td>• Clear the ED of all admitted patients with cooperation of inpatient units as feasible and the hospital executive as needed.</td>
</tr>
<tr>
<td>• Identify intra-ED expansible areas—corridors, transit lounge, short stay, fast track—for care of stretcher and sitting patients who can be cohorted.</td>
</tr>
<tr>
<td>• Identify and set up an extra-ED diversion area for stable, ambulatory, non-emergency patients.</td>
</tr>
<tr>
<td>• Clear the waiting room of all patients fit for disposition to alternative providers.</td>
</tr>
<tr>
<td>• Send admitted patients to a pre determined holding area (e.g. outpatients, short stay unit) to allow immediate decant and have inpatient units pick patients up rather than ED staff perform transfer.</td>
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<tr>
<th>STAFFING</th>
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<tr>
<td>• Allocate roles and distribute appropriate job action cards.</td>
</tr>
<tr>
<td>• Determine meeting points for new staff to arrive and staff updates to occur.</td>
</tr>
<tr>
<td>• <strong>Decide if/how the ED must modify its staffing model.</strong></td>
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<tr>
<th>SUPPLIES &amp; EQUIPMENT</th>
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<tbody>
<tr>
<td>• Distribute pre-made “disaster” IDs, chart packs, X-ray and lab slips.</td>
</tr>
<tr>
<td>• Distribute tools for redundant communications—cell (mobile) phones, 2 way radios, white boards, runners.</td>
</tr>
<tr>
<td>• <strong>Call for extra trolleys and chairs so every patient has a place to lie or sit.</strong></td>
</tr>
<tr>
<td>• Call for extra portable suction, ventilators, monitors.</td>
</tr>
<tr>
<td>• Create at least one portable disaster trolley appropriate for each cohort area. Stock with items such as fluids, dressings, IVs, analgesia, antibiotics.</td>
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<tr>
<th>SYSTEM OPERATIONS (Flow)</th>
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<tbody>
<tr>
<td>• Notify EMS to arrange bypass of individual patients unrelated to the surge event.</td>
</tr>
<tr>
<td>• Co-locate triage and security staff to create triage-security surge team(s).</td>
</tr>
<tr>
<td>• Preposition a surge team to the waiting room entrance.</td>
</tr>
<tr>
<td>• <strong>Call rounds or make rounds to force clinical decision-making on remaining ED patients.</strong></td>
</tr>
<tr>
<td>• Announce surge induced goals of care and investigation and treatment processes.</td>
</tr>
<tr>
<td>• Place security at all entry and exit points to ensure access exclusively to patients and properly badged staff</td>
</tr>
<tr>
<td>• <strong>Announce intent to delegate extensively to free up the senior clinician(s) for decision-making purposes.</strong></td>
</tr>
<tr>
<td>• Bring in early use of disaster patient tracking system and have a dedicated staff member keep this updated.</td>
</tr>
<tr>
<td>• If recognized by the local system, invoke pre-established methods of utilizing alternative sites for patient disposition.</td>
</tr>
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Table 2
Working Group Recommendations for Surge Management
Event Priority Actions

<table>
<thead>
<tr>
<th>SPACE</th>
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<tbody>
<tr>
<td>• Maximize cohort care and minimize one-on-one care.</td>
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<table>
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<tr>
<th>STAFF</th>
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<tbody>
<tr>
<td>• Request surgical and critical care liaison points in ED</td>
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<tr>
<td>• Engage non-clinical staff (e.g. medical students) as runners, scribes, and patient transporters.</td>
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<tr>
<th>SUPPLIES &amp; EQUIPMENT</th>
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<tbody>
<tr>
<td>• Have a team member dedicated to restocking supplies in main cohort areas allowing staff in these areas to maintain clinical roles.</td>
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<table>
<thead>
<tr>
<th>SYSTEM OPERATIONS (FLOW)</th>
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<tbody>
<tr>
<td>• Delegate extensively. Your job is to make decisions, not gather data.</td>
</tr>
<tr>
<td>• Make frequent rounds to geographic areas of cohort care.</td>
</tr>
<tr>
<td>• Pursue an appropriate disposition even without a clear diagnosis.</td>
</tr>
<tr>
<td>• Consider the use of Focused Abdominal Sonogram in Trauma(FAST) to assist early disposition</td>
</tr>
<tr>
<td>• Limit contrast studies. ED staff read films but insist on real time reporting of studies as driven by patient instability or provider uncertainty.</td>
</tr>
<tr>
<td>• Minimize return of patients to the ED. A patient sent out of the ED for a special study goes with a provisional diagnosis and a disposition plan.</td>
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Table 3

Working Group Recommendations for Patient Priorities in Surge Settings

<table>
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<tr>
<th>Patient Priority</th>
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<tbody>
<tr>
<td>1. Life threat</td>
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<td>2. Limb threat</td>
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<tr>
<td>3. Other urgent bedside procedures (analgesia, splinting, dressings, etc)</td>
</tr>
<tr>
<td>4. Disposition decision</td>
</tr>
<tr>
<td>5. Diagnosis decision</td>
</tr>
<tr>
<td>6. Patient comfort (access to stretcher, blankets, pillows, newspapers)</td>
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<tr>
<td>7. Visual and auditory privacy</td>
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Table 4

**Working Group Recommendations for Clinical Work Practices in Surge Settings**

<table>
<thead>
<tr>
<th>Recommendation</th>
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<tbody>
<tr>
<td>• Do not interrupt the expression of the chief complaint</td>
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<td>• Chart as you listen</td>
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<tr>
<td>• Order laboratory investigations necessary to make a disposition, not necessarily to make a diagnosis</td>
</tr>
<tr>
<td>• Limit imaging, particularly contrast imaging, as much as possible</td>
</tr>
<tr>
<td>• Put selected patients with a clear diagnosis and limited care needs (IV fluid, analgesia, antibiotics) under the care of a junior doctor</td>
</tr>
<tr>
<td>• Make a disposition plan with a key family member present to optimize understanding</td>
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Figure 1: Priorities in Surge Augmentation

BASELINE

SURGE / MCI
• Physical spaces/places are depicted with capitals
• Recommended priorities for the ED supervising consultant and senior colleagues are depicted in lower case.

CARE = patient care area/treatment cubicles and resuscitation areas
ROAD = Roadside
SURGE = surge areas (eg. Short stay unit, fast track area, corridor)
TRIAGE = triage area
Triage = advance triage
WAIT = waiting room
XRAY = radiology department
✈ = Re-deployed senior ED staff member
☆ = Security personnel
❑ = Extra trolleys/stretchers
❑ = Medical supplies and equipment
➡️ = Usual patient flow

Action ❖ = Action to reduce ED patient number/ workload
Reconfigure = Re-organise staff and cohort patients
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26


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