JUTA

Disaster Medicine

Editors: Lee Wallis
and Wayne Smith

About the Authors

Editors

Lee A Wallis
MBChB, MD, DIMC Dip Sport Med, FRCSEd(A&E), FCEM FCEM(SA)
Professor and Head: Division of Emergency Medicine
University of Cape Town and Stellenbosch University

Wayne P Smith
MBChB, EMDM, FCEM(SA)
Head: Disaster Medicine
A Division of Emergency Medicine
University of Cape Town and Stellenbosch University

Associate editors

Theo J Ligthelm
Colonel
MPA, B Soc Sc (Hon), Dip Adv Nurse, Dip H Ed, Cert AEA, Cert Aviation Nursing
Senior Staff Officer Strategy and Planning
Office of the Surgeon General
South African Military Health Service

Petra Brysiewicz
PhD, M Curationis, B Arts, B Soc Sc
Senior Lecturer and Nurse Educator
School of Nursing
University of KwaZulu-Natal

Timothy C Hardcastle
MBChB, MMed, FCS(SA)
Head of Clinical Unit: Trauma Surgery
Inkosi Albert Luthuli Central Hospital Durban

Contributors

Karen I Barnes
MBChB, MMed
Professor: Division of Clinical Pharmacology
Department of Medicine
University of Cape Town

Kathryn Chu
MD, MPH
Surgical Advisor
Médicins Sans Frontières
Cape Town

3.2 Planning

Planning for major incidents includes coordinating which areas of the facility will be utilised, aligning all the appropriate resources to address the incident, and coordinating the functions through effective command to ensure that the hospital functions optimally. During major incidents, difficulties mostly arise from failure to coordinate resources, not a lack of resources.

A written, detailed Major Incident Plan is, however, not the same as being prepared – only practice makes perfect. Therefore the effectiveness of the planning needs to be assessed regularly to ensure readiness. Reviewing a bad weekend is perhaps worth as much as practising an artificial scenario.

Area allocation

No hospital is designed to manage major incidents. Internally, any or all of the human resources, equipment or infrastructure may be compromised during a major incident (e.g. strikes of healthcare personnel, power supply failure, fire etc.). Externally, extraordinary measures often need to be taken to deal with the numbers, complexity or type of patients presenting as a result of the incident. This all requires detailed and comprehensive planning to enable a healthcare facility to be ready to manage a major incident.

Globally, common problem areas identified in managing major incidents by hospitals include communication and power failures, water shortage and contamination, physical damage, hazardous material exposure, unorganised evacuations and resource allocation shortages. To deal with these situations, a hospital has to rapidly expand and reorganise its capabilities to meet the requirements of the situation. At present, there is little evidence on how to plan for these expansions – only frameworks and experience. Analysing local experience may be of value and more productive.

Area allocations are inseparably linked to staffing, equipment and infrastructure. The term 'surge' deals with the expansion measures to accommodate a sudden influx of patients.

- *Surge capacity* reflects the ability of a healthcare system's ability to rapidly expand normal services to meet the increased demand for qualified personnel, medical care and public health, in the event of a major incident.

- *Facility-based surge capacity* refers to the actions taken at the healthcare facility that allow for the augmentation of services within the structure of the facility.
- *Area allocation* refers to all the activities performed to rapidly provide added space, staffed and equipped to deal with patient requirements, to the best possible degree, and to receive and allocate those mobilised to deal with the threat, so that the transition from normal to extraordinary activities proceed to the best benefit of patients in hospital, and those presenting.

The hospital needs to plan where it proposes to receive patients and expand to (decanting, reserve space), with whom (personnel), how (operational plan), with what (resources) and when (time). Before mobilising reserve space, existing facilities need to be utilised optimally, since these are equipped, staffed and trained to deal with a rapid increase in workload.

To reach surge capacity, hospitals must identify which areas will be utilised to address which functions.

Creating space: decanting

Decanting is the process whereby suitable patients are moved to lower levels of care appropriate to the situation to clear space for new casualties. In constrained health systems, slang terms such as 'finding beds', 'clearing casualty' or 'finding movers' describe the activities encompassed in the term 'surge'. These informal systems need to be recognised and refined, as they are usually successful in creating capacity.

The best area in which to manage major incidents is the existing emergency centre: it is familiar, equipped and purpose-designed. Clearing this area for new (decanting) and potentially unstable patients and utilising alternative space for minor patients is hugely valuable in managing space.

Typically, 10% to 20% of a hospital's operating bed capacity can be mobilised within a few hours using strategies including expedited disposition of patients, clearing the emergency centre of ambulatory patients, transferring patient to other facilities and other alternative measures. Up to an additional 10% of bed capacity can be mobilised by converting the hospital's existing 'flat space' (such as hallways, lobbies and conference rooms) into emergency bed space.

Principles of decanting

The aim of decanting is to provide space and infrastructure where nursing staff can care for patients. At worst, medical practitioners can assess patients with the minimum facilities, but the nursing staff require space and equipment to render long-term care.

Time to decant patients is essential to successfully managing major incidents. Expanded roles need to be practised regularly. Practising these roles during normal workloads expands skills and tests systems.

All activities of patient care need expanded space for major incidents. Each hospital area must be designated, and each must practise a routine role and an expanded role.

Unidirectional flow through the hospital speeds the care process. Every patient contact needs to be the final for that purpose (e.g. assessment, treatment, medication, pick-up and out).

Counselling and comforting uninjured survivors is much increased during major incidents, and large areas need to be allocated for this.

Obstructions to creating space

Typical obstructions to decanting patients include:

- Shortage of low-level resources, sucking in high-level resources to do the job: for example, lack of cleaners to turn around beds, lack of porters etc. All of these distract caregivers from their primary task.
- Conversion of treatment areas into storage or office space, making it impossible to revert to treatment space.
- Inefficient or unavailable inter-hospital transport during a major incident, leaving the identified patients stuck in the higher-level facilities
- Learned ignorance – an apparent inability to cope with new or expanded responsibility.

To reach the surge capacity, decanting must be properly planned.

Allocating space

Table 3.1 summarises the activities for which space must be allocated.

Table 3.1: Area requirements during a major incident

Action	Requirements	Possible area
Routing and Parking	Unidirectional flow One entrance, many points of dispersal Single point (control, direction)	
Traffic Control Point	Clear routing or route maps handed out Pre-prepared route markers are positioned	
Ambulance Route and Patient Route (including private vehicles carrying patients)	Clearly indicated Lead to drop-off point and triage area Additional planning may be required to address larger vehicles used in a major incidents, such as major incident buses	Existing patient routes to emergency areas

➲

Action	Requirements	Possible area
Helicopter Route	Civil Aviation Authority requirements Additional planning may be required to accommodate large military helicopters (often mobilised in a major incident) Easy transport to triage area	Existing or an adequate size and approved space to accommodate large helicopters
Drop-off Zone Separate areas for: 1. Patients (casualties) arriving by various means of transport	Good lighting Crowd control Firm surface for austere weather conditions Access to Triage Area	Ambulance stop Parking area
2. Walking patients often arriving by mass transport such as buses	Easy walking via triage to Priority 3: Green treatment area	Entrance lobby Any area close to P3 area
3. Uninjured survivors (worried, well)	Easy walking distance Closest to reconciliation area	Administrative entrance Public visitors' entrance Visitors' area, recreation hall or large area for information
Media	Secure route to avoid media straying into sensitive areas Closest to press venue	Press liaison area, lecture room, chapel or other suitable area
Additional Staff – Hospital	Security-controlled entrance to confirm staff status	Own working area
Additional Staff – External Backup and Volunteers	Security-controlled entrance to additional staff registration venue Rapid integration Rapid orientation	Training centre, information desk, human resource management offices
Command	Space for coordination, conferences Existing and alternative communications Direct contact with emergency room, theatre, ICU, press Secure access	Existing management suites or boardroom
Tactical Command	Mobile Alternative communications	Centered in emergency centres ➲

Action	Requirements	Possible area
Triage Area	Immediate proximity to drop-off points First patient contact with hospital Covered Space Adequate lighting and emergency lighting Same floor level as drop-off-point and Priority 1: Red treatment area Unidirectional flow	Ambulance drop-off point, entrance lobby
Priority 1 Treatment Area (Red Area)	Space Equipped to resuscitate (medical gas, suction, oxygen in all bays etc.) Advanced resuscitation equipment in all bays (airway, breathing, circulation) Pre-packed emergency trolleys to provide additional capability	Existing emergency centre (P1 and P2 areas)
Priority 2 Treatment Areas (Yellow Area)	Oxygen, suction, medical gas Equipped to assess Pre-packed mobile trolleys	Emergency centre Existing P3 areas
Priority 3 Treatment Areas (Green Area)	Oxygen Clinical assessment Minor treatment (dressings, suturing) Dressing and suture packs Emergency crash-cart for patients who may collapse (mis-triaged)	Outpatient department, physiotherapy department, patient ward if no other space available
Theatre	Existing theatres usually sufficient once elective lists cancelled	Existing theatre(s) If inadequate, consider labour wards
Radiology	Transferring patients on and off radiology tables is the single biggest delaying factor Requesting non-essential radiology shifts the major incident from the scene to the radiology department Unidirectional flow	Increase throughput by providing teams to transfer patients Essential radiology only

➲

Action	Requirements	Possible area
Pharmacy for Priority 3 Discharged Patients	Close to Priority 3 treatment area Pre-stocked Expanded as required	Existing outpatient pharmacy or a temporary capability
Pickup Points for: Discharged Patients and Uninjured Survivors	Traffic control point Unidirectional flow Space (much expanded)	Public parking area
Reuniting, Grieving and Counselling Including Comforting and Counselling Uninjured Survivors	Vastly expanded space as holding area Privacy for counselling Basic hospitality Furnishing and comfort with adequate ablution facilities	Outpatients department, recreation hall or ancillary health departments (for example, occupational therapy)
Staff Rest and Recovery	Privacy and comfort Facility for counselling and debriefing Familiarity Basic hygiene (toilet, shower, sleep)	Staff restaurant Departmental offices/ sleepover Nurses home
Decanting	Traffic control Covered loading space Proximity to wards Away from emergency room and ambulance entrance	Service entrance/exit
Mortuary	Overflow can usually be accommodated for up to 24 hours in existing air-conditioning space Existing cold storage in vicinity May need to accommodate body identification capability and access to relatives	Existing Expand to use existing floor space Ensure capacity for expanded air-conditioning area or cooler areas such as cold storage space or cooler trucks
Major incident Storeroom	Pre-determined stock Specialist items such as triage tags and additional spine boards Provide stock to cover period from activation until standard stores can provide stock Stock rotated to prevent expiry	Emergency stock room
Priority 4 Patients	Privacy Access to family Access to counselling	Low care ward

➲

Action	Requirements	Possible area
Pharmacy	Man and expand emergency centre dispensary Restock critical areas Re-order stock, ensure reserve maintained	Pharmacy
Communications Capability	Backup not dependent on existing land lines, mobile networks Preferably dedicated broadband	Existing switchboard Mobile radios to key personnel
Media Briefing Area (free flow of information minimises snooping) Opportunity to build positive image	Space Connectivity Lighting Audio-visual Hospitality	Lecture facility

3.3 Command

Command is a function vested in an individual, whereby that individual will plan, organise, lead and control the organisational activities through, and with, others so that the desired result is achieved.

Commanders can and must work through, and with, other people (major incident committee, command group etc.), and accountability for the outcome is never to be delegated.

Components of a hospital incident command structure include:

- *Strategic command:* managing relations with higher levels of management (e.g. provincial authorities), referred to as *gold command*;
- *Operational command:* managing the incident within the hospital, referred to as *silver command*;
- *Tactical command:* managing areas within the hospital, referred to as *bronze command*.

Planning

Planning is the work managers do to predetermine a course of action. It includes establishing guidelines for planning, risk analysis, analysis of strengths, weakness, opportunities and threats, identifying key goals, developing a plan to achieve those goals, auditing and refining the plan.

Planning is not the product of individual effort; it follows on the structured efforts of all involved, preferably a major incident committee.

Countering false intimidator information

An active communication strategy must be planned to counter all information that may be used to intimidate workers. Intimidation is often focused on the healthcare professional's family or home. The moment information is picked up that, for example, 'Nurse X's house was burned down last night', the information must be actively followed up by management; if untrue, formal communication must be issued as soon as possible featuring Nurse X denying that her house was raised and even including pictures of her house. A single false message like this may result in a hospital's total staff staying away from work out of fear that their families will be targeted next by intimidators.

Measures to assist staff who are willing to work includes protection and countering false information as quickly as possible.

Establishing a volunteer support system

If there is a risk that a facility's human resource supply may be disrupted, active effort must be made to establish a volunteer support system to provide at least basic levels of care, such as feeding and housekeeping, during a disruption. This is critically important, especially for geriatric or psychiatric facilities and facilities for the disabled. Such a system needs time to build up and cannot be started during an incident. Useful approaches are to use existing community groups, such as women's organisations from churches and service clubs, and to link each group to a specific unit or ward of the facility. These groups can be invited over in advance to become involved in the ward, regularly visit the facility and assist with such tasks as reading to patients or doing shopping for basic necessities. During a disruption in the regular human resources, such a group could then fulfil essential support functions.

In case of intimidation, volunteers must be very carefully screened and protected on arrival at the facility. Safe parking for private vehicles must be planned, as staff vehicles are an easy target for aggression and attempts to intimidate workers.

A special volunteer recruitment point must be established, with secure parking facilities. The administrative information required from volunteers must be planned in advance, including legal advice on the use of indemnity documents to be signed by all volunteers. Volunteers must also be provided with temporary identification, which is renewed on a daily basis.

Use of volunteers/temporary staff during an interruption in human resources requires proper planning and control to prevent intimidation.

4.4 Surge capacity

Surge capacity is defined as the additional capacity, both physical and human, that is available within a facility to address an influx of additional patients. This capacity is often used as the buffer between a compensated major incident and an uncompensated disaster.

The surge capacity forms an integral part of the disaster planning of the facility, both for internal and external disasters. Surge capacity will always depend on time available to activate and prepare such additional facilities. For planning purposes, surge capacity is grouped into facilities that can be made available immediately, within six hours of notification, within twelve hours of notification and within 24 hours of notification.

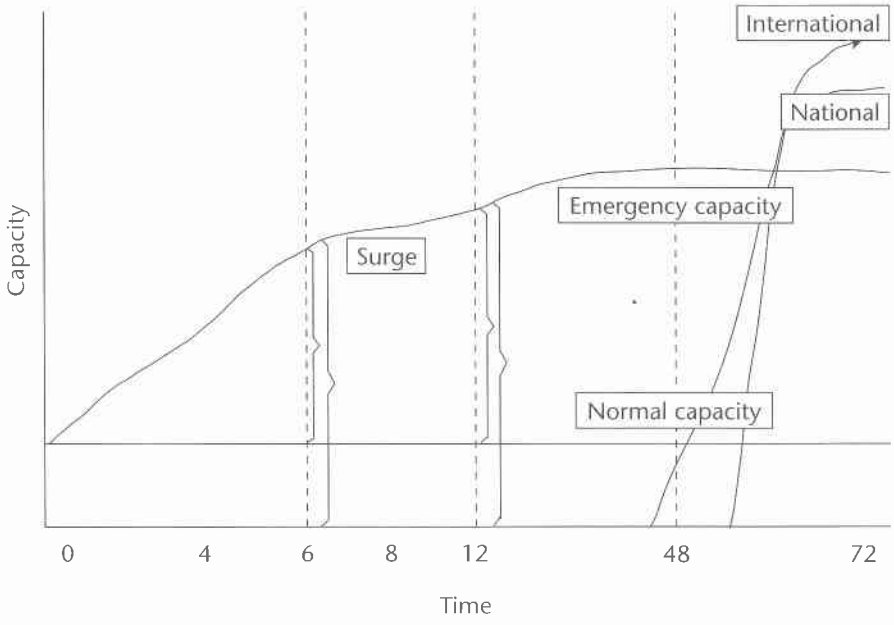


Figure 4.1: Surge capacity

The additional facilities that can be activated within a healthcare facility need to be determined in advance. It is necessary to accurately calculate the capability of a facility to accept additional patients, over and above the normal capability of the facility. To ensure that the information from different facilities can be compared in a central database per region, and even per country, a simple classification system is used, giving criteria for comparison. All facilities are classified into immediately available, can be made available within six hours, available within twelve hours and available after 24 hours.

Key point:

Surge capacity refers to the additional space that can be made available within a facility to provide space for increased needs and numbers.

Components of surge capacity

- *Space:* it is important to keep in mind that space is only one element of a surge capacity in a healthcare facility.
- *Staff:* the provision of staff to take care of the additional patients must be appreciated in detail. This may include volunteers that are available to the facility.

- *Equipment:* this is the third facet of surge capacity, and requires a detailed appreciation to ensure that acceptable levels of care can be provided for the additional patients. This includes catering capability and ablution facilities.

Key point: **Surge capacity consists of space, staff to provide care and equipment required.**

Limiting factors in surge capacity

Providing optimum care is not only dependent on space and resources, but also on making the resources available timeously for care. Therefore there are certain limitations to providing optimum levels of care.

Trauma patients

For a trauma patient, the optimum care is in making competent surgical capabilities available. Therefore the surge capacity of a healthcare facility for trauma patients *is limited by the capacity of the surgical facilities*. The space and equipment available must therefore be balanced with the availability of surgical capacity.

Calculating available theatre capacity

Surgery needs to be done within optimum cut-off times for optimal prognosis. It must be emphasised that this is a planning concept to determine optimum care, and not an absolute. This concept is used extensively in military planning processes to determine requirements on the battlefield. The concept can, however, be used as a guideline for disaster surge capacity calculation. In uncompensated disaster situations – for example the 2004 tsunami situation in the Indian Ocean – these norms will be ideal but unlikely to be achieved.

The available number of theatres, or areas that can be used as theatres within a facility needs to be determined. Determine for what triage category the theatre is suitable – for example, certain theatres will be suitable for Priority 1 critical patient-type surgery, whereas other theatres are only suitable for minor Priority 3 patients.

The equipment and staffing for the number of theatres must be confirmed. This would include the availability of anaesthesia machines and gases for anaesthesia. The requisite number of staff must be determined to staff all the planned theatres, with sufficient replacement staff to allow for rest periods if at all possible.

Sterilisation turn-around times need to be confirmed. It is essential to ensure that basic instrumentation can be returned sterilised to the theatre within the time planned for surgery (see planning norm below). If instrumentation can't be returned within the planned time, an additional set of instruments must be available.

Operating time required per triage category for the facility must be estimated by the surgical team. This will differ from facility to facility depending on the skills of the team and the support systems available. As a guideline, military planning norms for trauma patients are as follows:

- *Priority 1:* 3 hours/patient;
- *Priority 2:* 2 hours/patient;
- *Priority 3:* 30 min/patient (if surgery is required).

Calculating surge capacity

To be able to compare the surge capacity of facilities to admit patients, a simple classification system is used. The space available is graded according to utilisation for the triage priorities.

Space is needed for the full pathway of patient care within the facility, starting with the following:

- reception and triage space;
- resuscitation and treatment space;
- bed/accommodation space for hospitalisation.

Reception and triage space

Planning norm: 5 min/patient;
Space required: 6 m^2/patient.

Additional requirements:

- emergency lighting.

Adequate infrastructure to receive patients:

- trolleys/gurneys;
- wheelchairs;
- floors at same level.

Note on reception capacity
Reception capacity: space available/m^2 ÷ 6 x (60min ÷ 5) = capacity/hour

Surge capacity resuscitation and treatment

Priority 1 – Space to resuscitate one Priority 1 patient prior to admission

Space required: 7 m^2/patient.

Additional requirements:

- emergency lighting;
- oxygen outlet (x 2);
- suction (x 1);
- power outlet (x 4);
- overhead IV hook (x 4).

Note on resuscitation capacity
Resuscitation capacity: (60 ÷ facility's throughput time) x *N* bays = capacity/hour Priority 1 patients
(Planning norm throughput time: 28 min/patient)

Priority 2 – Space to stabilise/treat one Priority 2 patient prior to admission

Space required: 5 m^2/patient.

Additional requirements:

- emergency lighting.

Direct access to:

- oxygen;
- suction;
- overhead IV hooks (x 2).

Note on emergency care capacity
Emergency care capacity: (60 ÷ facility's throughput time) x *N* spaces = capacity/hour Priority 2 patients
(Planning norm throughput time: 17 min/patient)

Priority 3 – Space to stabilise/treat one Priority 3 patient prior to admission or discharge

Space required: 5 m^2/patient.

Additional requirements:

- lighting;
- access to resuscitation equipment;
- consider utilising surge capacity space.

Note on treatment capacity
Treatment capacity: (60 ÷ facility's throughput time) x *N* areas = capacity/hour Priority 3 patients
(Planning norm throughput time: 10 min/patient)

Surge capacity space for hospitalisation (admission of patients)

Priority 1 – Space suitable to nurse a Priority 1 patient requiring ICU care

Space: 8 m^2;
Spacing: 2.5 m nose-to-nose (prefer 4 m).

Additional requirements:

- infusion hooks (x 4);
- oxygen outlet (x 2);
- medical air outlet (x 1);
- suction outlet (x 2);
- power supply (x 6) with 2 on back-up supply;
- emergency lighting.

Minimum equipment guidelines:

- ventilator (x 1);
- monitoring system (x 1).

Priority 2 – Space suitable to nurse a Priority 2 patient

Space: 6 m^2;
Spacing: 1.5 m nose-to-nose (prefer 2 m).

Additional requirements:

- infusion hooks (x 2);
- access to oxygen and suction;
- ablution facilities;
- emergency lighting.

Priority 3 – Space suitable to nurse a Priority 3 patient

Space: 6 m^2;
Spacing: 1.5 m nose-to-nose;
Ablution facilities.

Additional requirements:

- basic emergency lighting.

Ablution facilities:

Showers/baths: 1/12 patients;
Urinals: 1/20 patients;
Toilet: 1/12 patients (maximum 1/20 patients);
Basins: 1/12 patients.

Linen:

1 rotation set/day/patient;
2 sets/bed.

Utilising this classification system, it is possible to calculate the surge capacity of a particular facility. Within each of the categories, the number of beds or treatment areas that can be made available immediately, after six hours, after twelve hours and after 24 hours (and even later) must be calculated. It is re-emphasised that the available space and minimum requirements must not be used in isolation to determine surge capacity. It must be linked to the availability of staff and equipment within fixed timelines to ensure optimum care. For trauma patients, the determining factor remains the availability of theatre/additional theatre facilities.

Calculating surge capacity provides management with a predetermined additional capacity to be able to address requirements in an external disaster, or in an internal disaster where certain facilities must be evacuated.

Key point: **Using predetermined criteria, the surge capacity of the healthcare facility can be calculated at various points in the treatment process. A mismatch between components needs special planning to optimise the surge capacity.**

External major incidents and the ICU

External major incidents occur on a regular basis, and these may require the institution of in-house hospital major incident plans, such as stopping elective surgical procedures, clearing post-anaesthetic care areas to increase intensive/critical care capacity and opening additional operation rooms to handle the expected surge of major emergency cases.

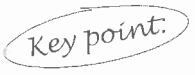
External major incidents may be traumatic in nature, although many will involve critically ill medical and paediatric patients. This is made worse during protracted incidents, such as natural disasters, which tax the in-hospital teams' abilities to adapt, as the hospital itself is stressed to capacity, due to the patient surge combined with the challenges already highlighted in the preceding section.

The team therefore needs to be prepared for the effects of external major incidents by means of the following:

- Knowledge of the local major incident plan, with a hospital coordination team who will direct the hospital response to this incident. Communication is the key to success.
- The ICU staff will fall under the nursing hierarchy in the scheme of command. They most often will be involved with the subsequent treatment phase when the type of incident involves many injured patients. This will involve application of strict triage criteria by the medical staff to decide when a critically ill patient

is offered an ICU bed. Often the standard of care normally provided will be reduced and the patients admitted will be those who are salvable, but with critically impaired organ systems.

- Action cards should be provided for the shift leaders of the ICU nursing staff to detail the extent of their actions during a major incident. Someone must coordinate the overall ICU nursing response with the reporting authority to the nursing service manager.
- ICU teams may be formed to undertake the inter-hospital transfers.
- Regular drills and table-top practices are essential for adequate preparation. The longest phase of the major incident is most likely to be the definitive care phase in the ICU, and this will delay the hospital recovery phase.
- Unlike the USA and Canada, developing countries do not have stockpiles of additional ventilators and other ICU equipment readily available. Knowledge of access to military resources and national resources may assist in alleviating the challenges of equipment shortage, such as the military deployable field hospital or the mobile hospital based in a train.



External major incidents may overwhelm the normal ICU capacity. Team-based care is essential.

Evacuation due to hazards

Evacuation of the ICU follows very similar principles to the evacuation of the operating suite, with similar command structures and triage decision processes to be followed.

Evacuation of an ICU will be most commonly due to fire, and next most likely due to an external threat. Planning for evacuation is essential.

Conclusion

Internal and external major incidents can affect the function of the ICU and may necessitate evacuation or alternative management strategies. Planning for an 'all hazards' approach will prevent an incident from becoming a disaster.

Other areas of special concern

Hospitals faced with internal and external major incidents are often found to have planned mainly for adult patients in the wards, thus leading to challenges when patients of other age groups are also involved. The need to move patients carefully and safely from the hospital beds or transportation gurneys to assembly areas, or for ward consolidation, is only one aspect in which an 'all hazards' approach is essential.

It is essential that hospitals build into the in-house plans special considerations for the very young, the very old and the patient who presents a community health risk or a psychiatric challenge. A plan with a good command and control, addressing safety issues and with adequate paths for communication, will ensure