An Australian mass casualty incident triage system for the future based on mistakes of the past: The Homebush Triage Standard

Introduction
The combined effects of an aging population, the trend towards day and minimally invasive surgery, plus the increasing cost pressures upon hospitals have significant implications upon the availability of health resources during a mass casualty incident (MCI). There are no universal definitions of what constitutes either a disaster or a MCI within Australia. A ‘disaster’ is said to have occurred when normal community and organisational arrangements are overwhelmed by an event and extraordinary responses need to be instituted (Emergency Management Australia 1995).

When available medical resources are overwhelmed by casualties, transport and treatment priorities need to be assigned to individuals to ensure limited medical resources are used efficiently. The term triage was transposed from French into the English language during the First World War to describe the process of sorting casualties for treatment priority by the American Army Medical Corps (Rutherford 1989). Casualty triage is the most important medical function during a mass casualty incident (MCI) and accurate triage a major determinant of an individual’s survival (Rutherford 1989; Waecherle 1991; Fryberg et al 1988).

This study reviews the evolution of triage, and factors that can potentially interfere with the triage process and compromise the medical response to an MCI. These are then used to synthesise a triage system to provide a common platform so that patient priorities at the incident site can be interfaced with those arising within receiving hospitals.

Historical perspectives MCI triage
The advent of gunpowder and the development of the rifle forced infantry into linear battle formations. As battlefields became larger it became increasingly more difficult to locate wounded soldiers who were left where they fell until the end of battle. The wounded were then evacuated and treated according to rank including the removal of dead nobles taking priority over wounded common soldiers (Hamby 1967).

Dominique Jean Larrey, Surgeon General to Napoleon’s Army of the Rhine, introduced a major revolution in combat casualty care.

Larrey’s philosophy was to rescue casualties during battle, with a dedicated corps using purpose built wagons, the ambulance volantes, and rapidly transport them to a central collection point. Here the most seriously wounded would be operated on, without regard to rank or distinction, by either the Surgeon-in-Chief or a competent surgeon under his direction (Richardson 1974). In 1792 Larrey personally lead his ambulance volantes to treat wounded French soldiers in the field and transport them from the front line during the battle against the Austrian Army near Königsberg (Leroy-Dupré 1862).

In 1807 at the Battle of Eylau against the Russian Army, Baron Larrey, now Surgeon-in-Chief to Napoleon’s Grand Army, gave treatment based on medical need but with priority to the wounded of Napoleon’s Imperial Guard over other wounded French soldiers (Dibble 1970). In spite of Larrey’s pioneering example, during the American Civil War in 1862, three thousand wounded Union soldiers were left virtually unattended and untreated for three days after the second battle of Bull Run (Adams 1952).

In 1846 British Naval surgeon Dr John Wilson described the principles of MCI triage. Dr Wilson classified combat injuries into slight, serious and fatal and described a system of treatment priority directed towards the control of life threatening hemorrhage, ‘To a serious bleeding everything must of necessity at once give way, and the vessel be secured’. Dr Wilson advocated the treatment of those with fatal injuries be restricted to ‘a stimulus, an opiate, a proper easy position’ (Wilson 1846).

In the Second World War the procedure of patient triage was regarded as the biggest single factor contributing to survival following abdominal wounds in the US Army (Welch 1947). In the Korean War the application of a four tiered triage system, (immediate, delayed, minimal and expectant) lead to a striking improvement in casualty survival (Hughes 1976). The combination of triage, advanced resuscitation and rapid evacuation of casualties in the Vietnam War contributed to reducing mortality rates down to 1%, compared to the 4.7% observed during World War Two (Kennedy et al 1996).

Goals of MCI triage
The primary objective of military triage was to identify those wounded soldiers who could be treated rapidly and returned to the battlefield (Kennedy et al 1996). In civilian practice, the triage process attempts to achieve the greatest good for the greatest number of patients (Emergency Management Australia 1995; Rutherford 1989; Waecherle 1991; Fryberg et al 1988; Burke 1984). Traditional individual doctor-patient relationships are overridden by a collective medical responsibility to the group of casualties (Waecherle 1991; Burke 1984; Llewellyn 1992).

In general there is no role for cardiopulmonary resuscitation during an MCI (Emergency Management Australia 1995) except in cases of lightening strikes involving multiple individuals. Here medical efforts should be directed at those victims in cardio-respiratory arrest, since the majority of other victims will make a
good recovery (Myers et al 1977). Normal triage priorities may be reversed for casualties involved in highly toxic hazardous material exposures where decontamination and treatment priority should be directed at the uninjured and even asymptomatic patients (Kirk et al 1994).

The success of the triage process as a means of minimising preventable deaths during an MCI depends upon being able to rapidly identify those casualties at the extremes of care. Medical resources are diverted from those who will either die, or recover irrespective of the medical care they receive, and concentrated on those critically ill casualties with a reasonable probability of survival (Emergency Management Australia 1995, Waeckerle 1991, Kennedy et al 1996, Burkle 1984).

Problems with MCI Triage
During an MCI, triage is approximately 70% accurate (Burkle 1984) with a tendency to under estimate injury severity. This underscores the need for triage to be viewed as a process of repeated casualty reassessments until the patient receives definitive care. The difficulties in making rapid value judgements based upon relative percentage survival probabilities (Kennedy et al 1996; Hughes 1976; Wardrope et al 1991) adds to the emotional stress upon the individual attempting to perform casualty screening assessments in a hostile environment during an MCI (Spengler 1995).

Triage accuracy is also adversely affected by other factors including, the physiological ability of the young to compensate for hypovolaemia, altered perceptions of pain in high stress situations (Beecher 1946) and neuropsychiatric reactions amongst surviving casualties (Burkle 1996).

MCI Triage considerations for single practitioners in isolated locations
The limited resources and long transportation times dramatically reduce the threshold of what constitutes an MCI in isolated locations and creates unique ethical and practical difficulties in managing incidents. Collective experience from the Korean and Vietnam wars provides some triage guidance in delayed management of penetrating trauma (Moyasenko 1984; Coupland et al 1992).

MCI triage considerations for hospitals
Hospitals must have triage systems to cope with potential incidents in close proximity to their facility where a large number of casualties can present without warning before an emergency medical system (EMS) response has been initiated (Caro et al 1973). In addition, large numbers of casualties may be transported directly to the hospital from the incident scene by EMS (Anderson et al 1977) or they may simply overwhelm established EMS field triage & treatment posts, and then move en masse to the nearest hospital (Manning et al 1997).

The hospital triage process has to be fluid as well as continuous and capable of dealing with incidents where the major casualties are medical rather than surgical (Myers et al 1977; Wardrope et al 1991; Buerke et al 1982). During an MCI hospitals have to integrate casualty triage with the triage of normal daily emergency presentations (De Lorenzo et al 1996). In addition, there may be an increase in normal daily emergency presentations from ischaemic heart disease or exacerbation of airways disease in response to the occurrence of an incident (Duclos et al 1990; Leor et al 1996).

Special triage situations can arise when hospital resources are either damaged (Schultz et al 1996) or have to be abandoned (De Lorenzo et al 1996, Smith et al 1996) during an incident. Staffing shortages can suddenly arise as health care workers spontaneously evacuate their families in anticipation of a hazard (Smith et al 1981) or cannot reach hospitals due to disruption of transport links. Hospital triage decisions may also have to take into account those outpatients normally dependent on domiciliary medical services who may have to be admitted should an incident temporarily prevent these services from being delivered.

Table 1: triage considerations for single practitioners in isolated locations

<table>
<thead>
<tr>
<th>Injury</th>
<th>High evacuation and treatment priority</th>
<th>Low evacuation and treatment priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetrating abdominal wounds</td>
<td>Individuals who can access definitive surgical treatment within 6 hours of injury</td>
<td>Survival after 12 hours without operative care</td>
</tr>
<tr>
<td>Major vascular injury in an extremity</td>
<td>Individuals who can achieve vessel reconstruction within 10 hours of injury</td>
<td>If vessel reconstruction cannot be achieved within 10 hours direct ligation of the vessel will result in limb loss in 50% of cases.</td>
</tr>
<tr>
<td>Penetrating head injuries</td>
<td>Unstable patients with evolving neurological signs</td>
<td>Individuals who are stable, conscious with either no deficit or moderate paresis or hemianopia can survive for 36 hours without neurosurgical care with appropriate fluids, wound care and antibiotics</td>
</tr>
</tbody>
</table>

Note

The Homebush triage taxonomy
There are clear benefits from the standardisation of disaster responses within Australia (Senate Standing Committee on Industry, Science, Technology, Transport, Communications and Infrastructure 1994). A national MCI triage system will mean, in the event of an MCI, both
hospitals and ambulance services are already using familiar common terminology which will allow effective and efficient communications under stressful circumstances.

A triage system must rapidly screen both children as well as adults (Kennedy et al 1996; Klein et al 1991), be cost effective, and operable in adverse conditions if they are going to be relevant to single practitioners in isolated areas. The dead and human body parts should be clearly and individually labeled as soon as possible to avoid time being wasted reconfirming death (Rutherford 1989; Burkle 1984) and to prevent the dead being transported to an active treatment area (Faxon 1948).

A simple triage taxonomy with four active treatment levels has been previously used in MCI situations (Hughes 1976; Ammons et al 1988; Gans et al 1996; Williams et al 1974). Increasing the number of categories has not improved the system (Gans et al 1996). The Homebush triage taxonomy (table 2) uses these triage priorities as a common core for both prehospital and hospital emergency department operations. Simple mechanisms can expand the four core active treatment groups if required for emergency department quality assurance purposes.

Using standard colors means there will be consistent production standards for triage materials. Providing a common triage language for all healthcare responders eliminates potential communication problems associated with using different terminology. This will facilitate the integration of medical medical services in the event they were deployed to assist the civilian response of a large-scale MCI within a State. A single common triage system reduces the problems that military personnel would also face trying to interface with different civilian medical services especially with a large number of medical evacuations across State borders, where different systems of MCI triage are used.

The use of phonetic triage priority codes instead of numerical codes takes into account the problems with radio voice transmission. Numbers are reserved to either stratify patient priorities within a particular triage category, or to quantify the number of casualties within a particular triage category.

In an overwhelming situation there will be patients for whom the difficult decision not to treat must be made (Parke et al 1992). However the decision on what constitutes a non-survivable injury is a balance between the magnitude of the incident, an individual casualty’s relative probability of survival, and the capacity of available medical resources at different points in the casualty evacuation chain (Waeckerle 1991; Llewellyn 1992).

A specific triage category for dying patients provides clear management directions for those patients assessed as being beyond help either at the incident site (Fryberg 1988), the casualty collection point or emergency department (Rutherford 1989; Williams et al 1974; Sharpe 1985; Artuson 1981; Das 1983; Seletz 1990) or on the operating table (Burkle et al 1994). The introduction of this classification into daily emergency department operations identifies those patients with advance medical treatment directives and directs appropriate care to patients with terminal chronic illnesses.

### Homebush Triage methodology

The Simple Triage and Rapid Treatment (START) and Secondary Assessment of Victim Endpoint (SAVE) (Benson et al 1996) attempt to apply the principles of evidence based medicine to disaster triage. START triage has been used successfully at several MCIs within the United States. These include the 1995 Oklahoma City Bombing, the 1992 Bombing of the New York World Trade Center, Hurricane Andrew, and the 1989 Northridge earthquake (Personal communication Dr Carl Schultz).

<table>
<thead>
<tr>
<th>Classification</th>
<th>Priority</th>
<th>Priority code</th>
<th>Colour</th>
<th>Colour number^1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate</td>
<td>Top</td>
<td>A (Alpha)</td>
<td>Red (Homebush Red)</td>
<td>R 22</td>
</tr>
<tr>
<td>Urgent</td>
<td>High</td>
<td>B (Bravo)</td>
<td>Yellow (Homebush Gold)</td>
<td>Y 26</td>
</tr>
<tr>
<td>NOT Urgent</td>
<td>Low</td>
<td>C (Charlie)</td>
<td>Green (Homebush Green)</td>
<td>G 27</td>
</tr>
<tr>
<td>Dying</td>
<td>Terminal Care only</td>
<td>D (Delta)</td>
<td>White</td>
<td>N 14</td>
</tr>
<tr>
<td>Dead</td>
<td>Not Applicable</td>
<td>E (Echo)</td>
<td>Black</td>
<td>N 61</td>
</tr>
</tbody>
</table>

**Table 2:** The Homebush triage taxonomy

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**The START triage scheme**

<table>
<thead>
<tr>
<th>Decision Path</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>YES</td>
</tr>
<tr>
<td>NO</td>
<td>Breathing with airway maneuvers</td>
</tr>
<tr>
<td>YES</td>
<td>Obeys command</td>
</tr>
<tr>
<td>YES</td>
<td>Radial Pulse present</td>
</tr>
<tr>
<td>YES</td>
<td>Respiratory rate &gt; 30</td>
</tr>
<tr>
<td>NO</td>
<td>Urgent. Triage Priority Bravo (Homebush Yellow)</td>
</tr>
</tbody>
</table>

**Table 3:** The Simple Triage And Rapid Treatment (START) Triage scheme (modified). Combining START with the Homebush triage taxonomy allows a simple triage decision tree to be developed. Reprinted with the permission of Prehospital and Disaster Medicine.
The simplicity of START (table 3) allows it to be performed rapidly as a quick screening tool and can be easily remembered as:

- anyone who does not breathe with simple airway maneuvers is dead
- anyone who can walk is assigned a not urgent triage priority
- anyone who cannot walk but can obey commands, with both a radial pulse being present and a respiratory rate less than 30 breaths per minute, is assigned an urgent triage priority
- anyone else has an immediate triage priority

SAVE guidelines look at a number of parameters (table 4) which are designed to answer two key triage questions at a major incident site (Benson et al 1996):

- What is the victim’s prognosis if minimal treatment is provided?
- What is the victim’s prognosis with the treatment resources available at the area medical center?

There has never been a situation to date that has required the implementation of both START and SAVE triage criteria.

**Paediatric triage**

The basic principles of triage remain the same for children as they are for adults (Holbrook 1991). The START methodology will tend to overtriage children. This is acceptable given the higher probability of children surviving head injury (Luerssen et al 1988) and multiorgan system failure compared with adults (Wilkinson et al 1986), along with the fact that most blunt abdominal trauma is managed conservatively in children compared with adults (Powell et al 1987).

The initial Glasgow Coma Score following head injury in children does not reliably predict outcome unless there is associated hypoxia and hypotension present (Liebl et al 1992).

**Triage documentation**

Triaging patients into geographic areas has been raised as an alternative to the use of triage tags (Rutherford 1989; Vayer et al 1986; Vukmir et al 1991; Kerns et al 1990). Geographic triage provides a major time saving in triage documentation especially when there is a large influx of patients. (Waeckerle 1991; Kennedy et al 1996; Vayer et al 1986; Angus et al 1993).

In a series of six major air accidents within the USA the largest incident, involving 297 people with 59 critically injured and 124 less severely injured, had the shortest prehospital time using geographic triage instead of triage tags, combined with efficient ground and rotary wing transport systems (Anderson 1995).

**SAVE Guidelines**

- Mangled Extremity Severity Score (MESS) (Johansen et al 1990) to assess crush injury to extremities
- Glasgow Coma Score less than eight in adults with significant head injury.
- Abdominal trauma with refractory hypotension
- Chest trauma with abnormal vital signs
- Spinal trauma
- Burns with < 50% probability of survival or adults over 60 years of age with an inhalational injury.
- Adults with pre-existing diseases
- Non traumatic emergencies
- Special triage categories such as healthcare workers with minor injuries who with simple treatment may be able to assist in the medical response

**Table 4: Secondary Assessment of Victim Endpoint (SAVE) Guidelines**

Triage is generally carried out once the casualties have been taken to a casualty collection point (Burkle 1984; Vayer et al 1986; Orr et al 1983). Triage flags provide the first ambulance on scene at an MCI with the capability to lay the foundation for the site medical response irrespective of the number of casualties. Geographic triage may reflect the normal disposition of trauma patients at an incident (Vukmir et al 1991) that can assist single practitioners with limited site resources to triage casualties efficiently.

The casualty profile following an MCI typically has 6 to 25% of patients requiring medical or surgical treatment within 12 hours to prevent loss of life or severe morbidity (Anderson 1995; Sklar 1987). The bulk of the casualty load consists of patients with non-urgent injuries who have little to gain from immediate medical care. Using expensive triage tags to identify them or label dead bodies is an inappropriate use of resources especially in a large scale MCI (Rutherford 1989; Waeckerle 1991; Angus et al 1993). In 1974 a Turkish DC10 crashed into a forest at Ermenoville, France killing 345 persons. Nearly 20,000 fragments of human tissue were produced from the impact with the remains of 188 victims subsequently positively identified (Personal communication Mr. Peter J. Stuart).

Triage procedures should avoid unnecessarily complicating the subsequent investigation of the incident. Labelling human remains with numbered chemically resistant tags helps to document the location of human body parts and their relationship to objects such as motor vehicles at the scene. This facilitates their systematic removal from the site for subsequent forensic examination and can play an important role in victim identification.

**Conclusion**

Australia has the opportunity to build upon past experience and develop a nationally integrated system of casualty triage. Appropriate preplanning can mitigate some of the problems that complicate the triage process, but those involved in the medical response to an MCI must have a common language and understanding of triage issues to remove existing fundamental barriers to good communications.

**References**


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EMA
Safer Communities Awards

From flood recovery processes to innovations in firefighting, the entries in this year’s Emergency Management Australia (EMA) Safer Communities Awards have shown excellence in many areas of emergency management.

More than 75 entries were received from across Australia. They were submitted by State Government, Local Government, private sector and volunteer organisations, and covered both pre and post-disaster emergency management.

The innovation and leadership exhibited in the entries demonstrated real achievement in helping communities prepare for, as well as recover from, disasters such as flooding, cyclones or bushfires.

Following the selection of 26 winners at a State and Territory level, the judging panel chose the following eight National winners, with five commendations made to other entries. The winners were presented with their Awards at a ceremony hosted by the Minister for Defence, Mr John Moore MP, at Parliament House, Canberra, on 28 June 2000.

Department of Human Services,
Gippsland (VIC)
Post-disaster category
Federal/State Government Stream
For its pro-active response in resourcing, implementing and monitoring the immediate welfare and recovery activities following the severe flooding of the East Gippsland Shire in 1998.

Wollongong City Council (NSW)
Post-disaster category
Local Government Stream
For the work of their geo-technical team which had the task of assessing landslide risks following flash flooding in the area. The team’s knowledge and expertise saved valuable resources by evacuating only those who absolutely had to be evacuated.