

Post crash response arrangements in Australia compared to other high performing road safety nations

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Abstract

The effectiveness of emergency medical and rescue operations is critical in reducing deaths and injuries resulting from road crashes. However, the post-crash phase is rarely mentioned in road safety strategy documents and, when there is coverage, it is often limited in detail. The NSW Road Safety Strategy 2012 – 2021 includes a specific focus on post-crash response and road trauma treatment, particularly better coordination between emergency retrieval and medical services and the Motor Accidents Authority, as well investigating options for automatic crash notification systems.

The literature suggests a number of core features strongly associated with better performance in road crash trauma management. For emergency medical services these include shorter response times, higher levels of staff and standardisation of vehicles. However, to improve the performance of a trauma management system, data is required to establish the characteristics of the system and the current levels of performance of that system. Preliminary work has been undertaken comparing the various characteristics of the Australian Emergency Services with those in the five OECD nations who have performed well in terms of road trauma reduction over the last two decades. This paper will report on the research that has been conducted into how the effectiveness of post-crash emergency response could be measured, the performance indicators that are available, and those indicators that could be collected and recorded.

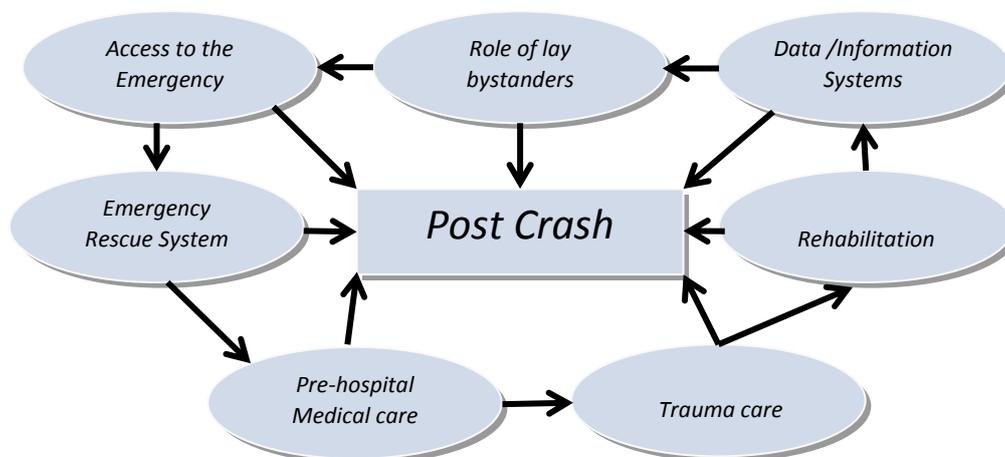
Introduction

Over the past three decades road safety agencies across Australia have been focussing efforts on crash prevention and improved vehicle performance during the crash event. During the same period there have been substantial reductions in crashes involving fatalities and serious injuries. However, as the rate of progress in reducing road trauma slows across the nation (ATC 2011) there is interest in knowing if improved emergency response and pre-hospital emergency care could have a positive impact on the road fatality and serious injury rates across Australia.

Post-Crash Emergency response can be defined as the sub set of activities including emergency rescue, pre-hospital medical care and transport activities conducted immediately following a road crash. In this paper, emergency response activities are considered to cease when the patient is delivered to a major or regional specialist trauma centre.

Focussing on post-crash outcomes, SafetyNet (2009) identified a number of intervention opportunities to reduce post-crash injury outcomes (see Figure 1).

Figure 1. Adapted from SafetyNet (2009) – Post Crash Care Report



Method

In August 2013, Transport for NSW through its Centre for Road Safety commissioned The University of Adelaide's Centre for Automotive Safety Research to conduct a literature review into post-crash response arrangements in well performing road safety nations within the OECD. The results of this review, it was hoped, would allow a comparison of post-crash response arrangements in Australia compared to similar jurisdictions internationally. The project was funded by the NSW Motor Accidents Authority.

A literature search was performed utilising several databases including the Australian Transport Index (ATI), PubMed and Transport Research International Documentation (TRID). Search terms that were found to be effective included: emergency and (accident or crash) and response; ambulance and accident. Relevant literature associated with emergency service response was identified and a particular focus was placed on technology, monitoring, improving and assessing emergency response arrangements. The notion of emergency response was also reviewed in a broad policy context, particularly its status within road safety policy and strategies for Australian and some overseas jurisdictions.

Discussions were also held with emergency rescue organisations to identify possible sources of data and clarify the metrics used for performance monitoring.

Results

Inclusion of post-crash actions in Road Safety Strategic Documents

The World Health Organisation's (WHO) Global Status Report on Road Safety 2013: Supporting a Decade of Action champions the post-crash phase as a fifth pillar to guide national road safety plans and activities over the coming decade. (The first four pillars are: road safety management; safer roads and mobility; safer vehicles and safer road users).

Despite its place in the World Health Organisation's Global Plan, within Australia emergency service response effectiveness does not feature in the National Road Safety Strategy 2011-2020 (Australian Transport Council, 2011), or in the current road safety strategies and action

plans of all jurisdictions with the exception of South Australia and NSW (see reference list for references of all strategies). This may be because, despite the clear implications of quality emergency services for road safety, they do not readily fit as an element of the Safe System approach used to underpin those strategy documents. It might also be the case that road safety is predominantly seen as belonging to the portfolio responsibilities of Ministers of Transport and/or Road Safety, whereas the post-crash phase is often considered to be under the control of Ministers of Emergency Services or Health.

Approaches to emergency care following a crash

Despite the apparent lack of formalisation of emergency response in many road safety strategic documents, Al-Shaqsi (2010) has summarised two distinct approaches to emergency care management, based on their respective philosophies: the Franco-German model and the Anglo-American model. The former is characterised by a ‘stay and stabilise’ emphasis, in which specialised trauma personnel with technological equipment attend an incident and prepare the patient for admittance to hospital where this is deemed necessary. The staff attending have the authority to make complex clinical judgments and administer appropriate emergency treatment, thus often bypassing the emergency department once an emergency patient reaches hospital. Al-Shaqsi (2010) notes the Franco-German model is common in Europe, particularly in Germany, France, Greece, Malta and Austria.

In contrast, the Anglo-American approach is characterised by a ‘scoop and run’ emphasis, in which the aim is to bring patients rapidly to hospital emergency departments with few pre-hospital interventions. The approach commonly exists in alliance with police and fire services, but the operations are overseen by trained paramedics and technicians and in a context in which trauma medicine is regarded as a separate medical speciality. Al-Shaqsi (2010) notes that the Anglo-American model is evident in the United States, Canada, New Zealand, the Sultanate of Oman and Australia. However, the United Kingdom has since adopted an Emergency Care Practitioner Scheme that is now more akin to the Franco-German model (*ibid*).

Measuring the Effectiveness of Post-Crash Emergency Response

Al-Saqsi (2010) noted that, due to their philosophical differences and the manner in which each operates, many studies (for example Nathens, Brunet & Maier, 2004) have shown conflicting results as to whether the Franco-German or the Anglo-American approach is the more effective. Al-Saqsi also discusses how these approaches resemble the dichotomy of Basic Life Support (BLS) versus Advanced Life Support (ALS) systems, but that studies of ALS, typically in the Franco-German model in emergency care, have not yet shown it to be superior to BLS. Similarly, Elvik, Vaa, Hoyle and Sorensen (2009) concluded, “Most evidence indicates that advanced medical treatment at the accident scene may decrease survival chances, compared with a ‘scoop and run’ approach, when the treatment delays transport to definitive care.” (p. 982).

Additionally, Jayaraman and Sethi (2010) conclude from their review of ALS trials that there is no benefit in training ambulance crews in advanced life support methods.

Various factors affect the outcomes of post-crash emergency medical and rescue operations, ranging through identification of the crash, response times, training of personnel, categorisation of patient injury severity, type of treatment at crash scenes, and transport to

hospital-based emergency services. Such areas may well be considered for inclusion in a list of criteria for gauging the quality and efficiency of emergency service response. However, the range of factors and the extent to which they apply to different emergency services can make comparisons procedurally challenging as well as yielding results that are inconclusive.

Thomas et al (2009, p. 58) caution: “In general, international comparisons of trauma management systems should be performed with caution due to a variety of definitions, legislation and systems, which are available for both the emergency and in-hospital trauma care, in different European countries”. Nonetheless, based on best practice recommendations in post-crash care formed by the European Traffic Safety Council in 1999, Thomas et al go on to identify core features definitely associated with better performance in trauma management to form the basis for jurisdictional comparisons. They are:

- shorter response times,
- higher competence among emergency service personnel
- standardisation of emergency service vehicles, and
- adequate hospital trauma care.

While various forms of ambulance service are often perceived as the emergency service most commonly responding to road crashes, fire crews and rescue services are often among the first emergency services to arrive when a crashed vehicle catches fire, or when vehicle occupants are entrapped within the vehicle. Fire crews and rescue services are of no less importance, as ambulance crews may not be able to take action until a vehicle fire is extinguished or access to occupants is gained. Moreover, fire crews and rescue services can support ambulance crews, as they are trained in first aid. However, it is not unknown for cooperation and coordination across fire services to be lacking (for example where both metropolitan and country fire crews attend the same incident), but also lacking in terms of cooperation and coordination with ambulance services.

The Special Inquiry into the Margaret River 2011 Bushfire (Government of Western Australia, 2012) found major improvements were still needed in coordination of emergency response operations. Queensland Floods Commission (2012) also remarked on a need to improve interoperability between relevant agencies, particularly a need for training standards for emergency call operators to be uniform across agencies. The Commission also called for common use of the Emergency Services Computer-Aided Dispatch (ESCAD) system as this assists when emergency calls have to be transferred to different operators at times of peak demand, as well as reducing congestion on radio networks.

WHO's (2013a) Global Status Report contains seven areas for which countries are asked to supply data to assist with measuring and comparing emergency response capabilities:

- whether or not a Vital Registration System (for accurate recording of deaths and death circumstances) is functional in the country (NB not whether it covers the whole country)
- whether or not an Emergency Room-based Injury Surveillance System is in place in the country (though the WHO report does not specify what comprises such a surveillance system)
- whether a standard telephone number exists for accessing emergency services
- the proportion of seriously injured who are transported by ambulances (based on expert opinion)
- the proportion of the population who are permanently disabled due to road crashes (but only if from a robust data source)

- whether there is formally recognised emergency medicine training for doctors (e.g. post-graduate qualification)
- whether there is formally recognised emergency medical training for nurses.

Data from WHO (2013b) for the five OECD countries nominated for comparison with Australia in the present paper are shown in Figure 2.

Figure 2. Emergency Response Capability Data (WHO, 2013b)

	Sweden	United Kingdom	Switzerland	Germany	Canada	Australia
Vital Registration System	Yes	Yes	*	Yes	Yes	Yes
Emergency room based Injury Surveillance System	Yes	Yes	No	No	No	Yes
Emergency access telephone number	Yes	Yes	Yes	Yes	Yes	Yes
Seriously injured transported by ambulance	≥ 75%	*	*	≥ 75%	≥ 75%	≥ 75%
Permanently disabled due to road crash	6%	*	*	*	*	*
Emergency training for doctors	Yes	Yes	Yes	Yes	Yes	Yes
Emergency training for nurses	Yes	Yes	Yes	No	Yes	Yes

* Data not supplied by the country to WHO, or was not available

The approaches and issues experienced when attempting to measure the effectiveness of particular emergency responses, for example for comparison purposes, was also examined. Emergency response times constitute a major criterion for gauging response effectiveness and response times are often affected by key factors such as the ability to identify crash locations in rural and remote areas, and by the availability of technological improvements in communications. These were examined as well as emergency response data contained in recent literature for five of the top performing OECD countries with respect to road safety, concluding with a set of core criteria for future efforts in assessing emergency service response.

An earlier European Union (EU) report (Vis & Gent, 2007) sought road safety trauma management data from 27 EU countries over a much broader range of safety performance indicators than in the WHO (2013b) study. Vis and Gent's range of parameters is worthy of consideration when measuring emergency response effectiveness, including:

- population in the country
- total road length
- rural road total length
- vehicle kilometres travelled (in millions)

- number of emergency dispatching centres
- number of emergency service stations
- number of active emergency service personnel (broken down by doctors, paramedics, nurses and medical technicians)
- number of emergency service transportation units in service (broken down by basic life support units (BLSU), mobile intensive care units (MICU) and air transport)
- annual numbers of emergency service calls
- percentage of calls for road crash responses
- annual numbers of emergency service trips
- percentage of trips for road crash responses
- time goal for responding to emergency calls (in minutes)
- percentage of responses meeting the time goal
- average response time.

Gitelman (2008) then used all this information to produced rankings of overall trauma management performance based on a five level scale, in which Austria and Germany rated consistently the highest level of EMS performance across all criteria.

A European Union analysis of post-impact care policy considers the following elements as essential policy components (among others) (SafetyNet, 2009):

- telephone notification of an incident requiring an emergency service
- in-vehicle emergency notification systems
- telephone answering by emergency services
- dispatching of emergency crews
- coordination between emergency services
- training of emergency service personnel
- the availability and response times of ambulances / helicopters, etc
- type of medical treatment at crash scene (basic vs advanced)
- staffing of ambulances (paramedics / nurses / physicians)
- triage approaches and hospital selection
- medical direction of pre-hospital care
- planning and care in multiple casualty crashes
- the legislative framework for pre-hospital care
- national trauma systems
- documenting and monitoring pre-hospital care, including the extent to which procedural protocols (where they exist) were followed.

Interestingly, despite their comprehensive listings, neither Sasser et al (2005) nor SafetyNet (2009) include incident evaluation by the response team as to whether the response could have been improved upon.

Figure 3 attempts to combine many of the performance indicators outlined in the literature and compare the Australian situation with that of the nominated OECD nations.

Figure 3. Emergency Services Response Matrix – Australia compared to five well performing road safety OECD Nations

	Sweden	UK	Netherlands	Norway	Germany	AU
Road deaths per 100,000 population	2.85	3.07	3.24	4.28	4.46	5.74
Population, million	8.94	57.85	16.30	4.58	82.54	22.68
Road length - total, km	212,000	392,321	117,430	91,825	626,981	810,022
Road length - public, outside built-up areas, km	98,000	249,649	63,280	90,663	231,500	Unk
Vehicle-kilometres travelled, million	74,000	494,800	138,800	37,000	682,215	232,453
EMS Stations & Dispatch Centres						
No of dispatching centres	18	53	24	44	270	26
No of EMS stations	275	979	51	200	1,832	1,131
EMS staff in service:						
No of paramedics	-	17,272	-	n.a.	22,000	8,213
No of nurses	2,000	-	1,400	n.a.	-	79
<i>Sub Total</i>						<i>2,781</i>
No of medical technicians	2,000	9,630	1,240	n.a.	8,800	
<i>Total</i>	<i>4,010</i>	<i>26,902</i>	<i>2,640</i>	<i>n.a.</i>	<i>53,000</i>	<i>11,073</i>
EMS transportation units in service:						
No of BLSU (Basic Life Support Unit)	500	n.a.	-	604	2,673	3,051
No of helicopters/ planes	10	14	4	19	91	78
<i>Total</i>	<i>510</i>	<i>n.a.</i>	<i>654</i>	<i>672*</i>	<i>7,600</i>	<i>3,129</i>
EMS calls						
No of EMS calls annually	600,000	5,340,000	n.a.	350,000	n.a.	3,121,371
No of EMS rides annually	900,000	3,400,000	450,000	n.a.	10,300,000	2,593,816
Rates & Percentages						
<i>EMS stations per 10000 citizens</i>	<i>0.31</i>	<i>0.17</i>	<i>0.03</i>	<i>0.44</i>	<i>0.22</i>	<i>0.50</i>
<i>EMS stations per 100 km of rural road length</i>	<i>0.28</i>	<i>0.39</i>	<i>0.08</i>	<i>0.22</i>	<i>0.79</i>	<i>0.14</i>
<i>EMS medical staff per 10000 citizens</i>	<i>4.48</i>	<i>4.65</i>	<i>1.62</i>	<i>n.a.</i>	<i>6.42</i>	<i>4.88</i>

Notes: the table is based on the synthesis of data from several sources including Vis & Gent (2007), BITRE, ABS and the Productivity Commission. Data spans the period 2003 to 2012. * Includes 49 marine EMS vessels.

Within Australia, Ambulance services provide various performance data to the Council of Ambulance Authorities (CAA). Whilst a range of data is reported including average response times, data specific to road crashes are not reported. The Australian Government Productivity Commission has used the CAA data to create a report on Government Services (Productivity Commission, 2011) and the Australian snapshot presented in Figure 3 is synthesised from that data. It should be noted that there is a great deal of variation in the data collected and published by the Australian States and Territories. It was therefore not possible to build a complete picture of Australia's performance in many areas of emergency response

With no consistent methodology for post-crash data collection within Australia and internationally it is difficult to draw meaningful results from the Emergency Services Response Matrix we have created. In the UK and Germany where the number of vehicle kilometres travelled by the populations exceeds Australia the number of EMS staff employed is much higher than Australia. However, in terms of EMS staff rates, Australia and United Kingdom have similar rates (4.88 vs 4.65) of EMS staff per 1,000 population whilst Germany has a higher rate of 6.42. Sweden also has slightly lower rate (4.48) of EMS staff per head of population than Australia.

The only rate to vary substantially between the developed nations examined and Australia is the number of EMS stations per 100 km or rural road length. Australia has half the rate of Sweden, and one fifth the rate of Germany. It should be noted that the Netherlands has a lower rate of EMS stations per 100 km of rural road than Australia but still performs better overall in terms of road fatality rates.

Conclusion

Whilst it is clear that preventing crashes from occurring in the first place is the ideal outcome for road safety professionals, crashes inevitably do occur in our road transport system. Better vehicle design and compensatory roadside environments have played an important role in improvement in road safety outcomes over the last three decades within Australia and internationally across OECD nations. However, the rate of progress in reducing the number and severity of road trauma incidents has slowed at least in Australia (ATC 2011).

There appears to be a distinct lack of published data available on the effectiveness of different post crash response treatments and systems when we compare this with the well developed data sets focussed on crash events, vehicles and road users. Whilst we readily strive towards a road fatality rate per 100,000 population in the majority of our road safety strategic plans few jurisdictions around the world include performance indicators for how well they respond to crash events. It is hoped that this study may contribute to the beginning of the conversation about the need to collect post-crash performance indicators, and which to collect, amongst road safety strategists, planners and first responders in Australia.

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