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Do we need extended care paramedics?

Malcolm Boyle
Griffith University, Queensland
Do we need extended care paramedics?

Malcolm Boyle PhD, Editor and Academic Lead in Paramedic Education

Affiliations:
1 Australasian Journal of Paramedicine
2 Griffith University, School of Medicine, Queensland

The commentary by Reaburn and colleagues in this issue of the Australasian Journal of Paramedicine suggests another type of paramedic for rural areas of Australia – the rural paramedic – a combination of a paramedic and a physician assistant (1). This view is in line with other international studies, which have proposed and trialled extended care paramedics (2), emergency care practitioners (3), and community paramedics (4).

Australian university-based paramedic education programs were derived from the old state ambulance service-run vocational education and training sector paramedic programs. The university-based paramedic programs added a tertiary perspective to the upgraded paramedic education. What these tertiary education programs have not necessarily done is provide graduates with the education to meet the current and prospective ambulance workload and case type.

As an example, the total trauma workload for the state of Victoria in 2002 was about 15 percent, the remaining workload was made up of medical and other conditions (5). Of the total trauma workload nearly 50 percent of cases were falls (5), a condition that does not receive the educational time it should in Australian paramedic programs.

Therefore, should universities combine in an effort to analyse Australian ambulance data to establish what the caseload and case types are in a bid to guide the refinement of paramedic education programs in Australia, based on current and predicted ambulance caseload and case type?

Do we really need extended care paramedics until we can define what the knowledge and skill set should be for the basic paramedic? Then there is the knowledge level and skill set for the extended care paramedic, including the amount of clinical experience during the program, plus the time needed for knowledge and skill set maintenance. Now we have another knowledge and skill set for paramedics operating away from the urban area as described by Reaburn and colleagues (1), plus there are other models such as those described by O’Meara and colleagues (6).

The Health Workforce Australia (HWA) funded study and report into extended care paramedics in Australia failed to discuss the knowledge and skill set for the base level paramedic on which the extended care program would be built. The HWA study concentrated on five sites around Australia evaluating an extended care program and the potential effectiveness of the extended care paramedic in managing the patients within their scope of practice (7). One noticeable point was the different levels of extended care provided at the sites investigated.

This shows that there is a requirement for defined levels of care that need to be specified before a rigorous course accreditation process, leading to registration. There should be a minimum standard for each level of paramedic in the registration process, similar to that in the United States of America (8). Even though university paramedic courses are currently accredited by the Council of Ambulance Authorities, there is still a variation in the standard of paramedic courses and paramedic graduates. Currently paramedicine is not a registered health profession in Australia, although this is expected to change in late 2018.
So does Australia really need extended care paramedics or do paramedics need to be educated to better serve the community they work in? Is it time to move from the generalist paramedic to a more specialised paramedic? It would make more sense to educate graduate paramedics to a base level that is determined by a more scientific approach, based on current and projected ambulance caseload and case type. Following the generalist training, further educate the graduate paramedic to serve the community they will be working in, be it urban, rural or remote. This concept may need some further thought and discussion, but it may be a better way to meet the needs of different communities in the future.

Dr Mal Boyle
Editor
Australasian Journal of Paramedicine

References

Use of supraglottic airway devices by paramedics in the management of adult pre-hospital cardiac arrest patients: A literature review

Stephen Barr
Victoria University, Melbourne, Victoria

Gavin Smith
Victoria University, Melbourne, Victoria

Shaunagh Darroch
Victoria University, Melbourne, Victoria
# Review

## Use of supraglottic airway devices by paramedics in the management of adult pre-hospital cardiac arrest patients: A literature review

Stephen Barr is an honours student¹; Gavin Smith GradDipEmergHlth, MEH, PhD, is an Associate Professor¹; Shaunagh Darroch BSc, MPharm, GradCertAcaPrac, is a Lecturer¹

Affiliation:
¹Victoria University Centre for Chronic Disease Prevention and Management, College of Health and Biomedicine [Paramedicine], Melbourne, Victoria

## Abstract

### Introduction

Current best practice for paramedic airway management of pre-hospital cardiac arrest is being continually reviewed following changes to the emphasis on intubation as a primary intervention within international resuscitation guidelines. Subsequently, there is increased enthusiasm for the use of next generation supraglottic airway devices. This review aimed to identify the current evidence for the safety and effectiveness of supraglottic airways for the management of pre-hospital cardiac arrest.

### Methods

A search of the electronic databases MEDLINE, PubMed, Science Direct and Cochrane Library was conducted. Papers were excluded if they did not examine airway management in the pre-hospital cardiac arrest setting, involved the use of sedative or paralysing agents, or involved paediatric patients, animals or cadavers.

### Results

Of the 689 articles identified, 22 peer-reviewed articles were included for analysis. All 22 articles were from the following countries: United States of America, United States of America and Canada, Australia, Austria, Finland, Germany, Korea, Japan, The Netherlands, Norway, Taiwan and the United Kingdom.

### Discussion

This review revealed large variances in both device effectiveness and patient outcome, particularly between geographical locations. Second-generation supraglottic airway devices demonstrated considerable improvement in effectiveness over their predecessors. Interestingly, the use of bag-valve mask ventilation reported better outcomes than any other form of advanced airway intervention. Studies also highlighted the diversity of airway management techniques and devices across global emergency medical service systems.

### Conclusion

Despite favourable indications of the effectiveness and safety of the next generation supraglottic airway devices, the paucity of pre-hospital specific research (particularly randomised controlled trials) challenges decision-making regarding pre-hospital airway management best practice.

Keywords:

supraglottic airway device, prehospital, effectiveness

Corresponding author: Gavin Smith, caduceus7@bigpond.com
Introduction

Pre-hospital advanced airway management is controversial and varying in efficacy (1,2). Maintaining a patent airway during out-of-hospital cardiac arrests (OHCAs) is crucial for enhancing gas exchange and reducing the risk of aspiration. It is well known that endotracheal intubation (ETI) is the gold standard for airway management; however, recent pre-hospital research on supraglottic airway devices (SADs) is now questioning ETI as best practice for OHCAs (3-5). First generation SADs evolved from anaesthetic in-hospital practice and were rudimentary pre-hospital devices for protecting a patient’s airway with limited effectiveness (6). Second-generation SADs have evolved in simplicity, speed of insertion, and in their ability to reduce air leaks and gastric insufflation. Since their introduction to the pre-hospital setting there has been growing enthusiasm for their use during OHCAs (7-9).

Supraglottic airway devices are an advanced airway adjunct, introduced into Australian and international paramedic practice for the purpose of securing a patient’s airway. The insertion of a SAD in an OHCA facilitates continuous cardiac compressions without pausing for ventilation (9). This enables devotion of more time to increasing cardiac compression fraction (amount of time spent performing external cardiac compressions) and other advanced life support (ALS) interventions. Increasing cardiac compression fraction has been directly linked to increases in the likelihood of return of spontaneous circulation (10,11).

Current research is providing contradictory evidence for the use of SADs during OHCAs (1,12), furthermore, there remains a degree of uncertainty as to which airway management device provides the most favourable outcomes in the pre-hospital setting.

The follow-on study from this literature review focusses on the i-gel® SAD and its utilisation and effectiveness within an Australian ambulance service. As a consequence, this review represents an important element in developing the researchers’ understanding and identification of any gaps in current research and underpins the proposed follow-on study.

The aims of this review are to identify what Australian-based research has been done, where the pre-hospital research originates from, what the common limitations between studies are, what associations the airway device and patient outcomes have, and whether the pivotal papers within the field provide a strong enough theoretical base for instrumental change.

Methods

A literature search was conducted using the electronic databases MEDLINE (January 2005 to July 2015), PubMed (January 2005 to July 2015), Science Direct (January 2005 to July 2015) and Cochrane Library. The following terms were used in differing combinations to retrieve published articles: ‘pre-hospital’, ‘prehospital’, ‘ambulance’, ‘paramedic’, ‘laryngeal mask airway’, supraglottic airway’, ‘igel’ and ‘i-gel’. The inclusion criteria were papers with a primary focus on SAD use by paramedics or emergency medical technicians (EMTs) and first responders during an OHCA. The article abstracts were screened for their relevance and included in the literature review. We excluded papers that used non-paramedic or non-EMT staff as their pre-hospital health care providers, did not focus on OHCAs, if sedative or paralytic drugs were utilised for the insertion of SADs; and papers where the primary focus was animal, manikin, simulation, paediatric, cadaver or toxic environment studies (Figure 1). Papers were also excluded if they were not published in a peer-reviewed journal, not available in English or not available as full text. We searched the literature between January 2005 and July 2015 as most second-generation SADs were introduced in the early 2000s (6), thus allowing suitable time for introduction and utilisation within ambulance services.

A thematic analysis of the literature was undertaken by grouping airway intervention devices together. All reviewed literature either focussed on one specific type of airway device or a comparison of two or more airway devices. Specific areas for review of each paper included device effectiveness when used in the pre-hospital setting. This was determined by success rate and number of insertions required. Also examined were pre-hospital return of spontaneous circulation (ROSC), patient survival and neurological outcomes, and reported adverse effects including reasons for failure of insertion or premature removal. Considering the plethora of airway devices and manufacturer brands used globally, some consolidation was required for the comparative studies to enable comparison and analysis. This produced six themes to focus the results and discussion: laryngeal tube (5); laryngeal mask airway (2); i-gel® (3); comparison between SAD and ETI (5); comparison between SAD and bag-valve mask (BVM) (2); and comparison between SAD, BVM and ETI (9). The i-gel® group included two single head-to-head comparative studies for simplicity.

Results

Of the 689 articles identified, 22 articles met our inclusion criteria after scrutiny of the abstracts and eliminating duplicates (Figure 1). All 22 articles were from the following countries: United States of America (three), United States of America and Canada (one), Australia (two), Austria (one), Finland (one), Germany (four), Korea (one), Japan (four), The Netherlands (one), Norway (one), Taiwan (one) and United Kingdom (two). All 22 studies were conducted from 2008 to 2015.
Laryngeal tube studies
Five studies were included in the laryngeal tube (LT) group (13-17), with a single study focussing on first responders (16). Reported are success rates, first and subsequent insertion attempt rates and adverse effects (Table 1). Overall success rates ranged between 85% (14) to 100% (13), and number of total attempts required ranged from two to three (13-17) with the first attempt success ranging between 71.9% (16) and 92.4% (13). Incidence of adverse effects ranged from 10% (13) of patients to 52.7% (15). Regurgitation of gastric contents was a common adverse effect in all studies, occurring prior to LT insertion in three studies (13,14,17). There were several limitations in each paper, with common areas being each study not having any comparators and the potentiality for self-reporting bias (13-17). One study did not report a study duration (14), two authors in one study were currently or previously employed by manufacturers of LTs (13), and one study poorly reported on their adverse effects, partially due to the paramedics not adhering to the study protocol for unknown reasons (16).

Laryngeal mask airway studies
Two studies were included in the laryngeal mask airway (LMA) group (12,18). An Australian study focussed on three different brands of first-generation LMAs: LMA-Classic™, Ultimate Laryngeal Mask, and Soft Seal® Laryngeal Mask, which were reported collectively throughout the paper (18). The Netherlands study only utilised the second-generation LMA-Supreme™ (LMA-S) device. Both studies reported on success rates, number of insertions and adverse effects (Table 2) (12,18). The Australian study reported first-attempt success rate of 45%, cumulative second-attempt success rate of 65%, and 16 patients required premature removal of the LMA (18). In contrast to this, the Netherlands study reported a 98% first-attempt success rate, with only one patient requiring three attempts. There was one report each of aspiration and dislodgement, and seven patients with air leakage from the LMA-S, however six of these seven patients did not require any change or further management due to stabilised vital signs (12). Although limited by small sample sizes and a lack of pre-hospital focussed LMA research, there does appear to be improvements between first and second-generation LMAs. There were limitations in both studies with the potential of self-reporting bias (12,18), whether LMA insertion attempts were the primary management, or secondary to failed intubations (18), and considering the study duration was absent in one study it remains unclear how the 50 patients were chosen and in what timeframe (12).

i-gel® studies
Three studies were included in the i-gel® group (9,19,20), two of which were comparisons with either the ETI (19) or LMA (20). All studies reported rates of successful insertion (Table 3) ranging 90–100% for the i-gel® (9,19,20) and 57% for a first-generation LMA in a randomised controlled trial (20). Two studies reported on required insertion attempts, first attempt success rates (Table 3), and a difficulty of insertion rating (9,20). A single study covered air leakage (9), which also found a positive correlation between i-gel® devices that were easier to insert were less likely to have an air leak (9). However, considering both ease of insertion and air leakage were self-reported by the operators at scene, this may be subject to potential bias. Reported adverse effects (Table 3) were two i-gel® devices being removed due to gastric insufflation that occurred prior to airway management (9), and a total of seven i-gel® attempts failed as a consequence of ‘airway complications’ (19).
### Table 1. Pre-hospital laryngeal tube effectiveness

<table>
<thead>
<tr>
<th>Study</th>
<th>Study design</th>
<th>Sample size</th>
<th>Overall insertion success</th>
<th>First attempt success</th>
<th>Maximum number of insertions for overall success</th>
<th>Reported SAD adverse effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiese et al (13)</td>
<td>Single-centre, prospective observational</td>
<td>92</td>
<td>100%</td>
<td>92.4%</td>
<td>2</td>
<td>Cuff problems 7%, RG prior 3%</td>
</tr>
<tr>
<td>Heuer et al (14)</td>
<td>Prospective observational</td>
<td>39</td>
<td>85%</td>
<td>72%</td>
<td>2</td>
<td>Cuff rupture 7.5%, RG prior 7.5%</td>
</tr>
<tr>
<td>Sunde et al (15)</td>
<td>Dual-centre, retrospective observational</td>
<td>347</td>
<td>85.3%</td>
<td>74.4%</td>
<td>3</td>
<td>No auscultation sounds 28.8%, tube position 24.5%, air leak 17.6%, insertion time &gt;30s 13.3%, RG 12.7%, tube dislodge 4.9%</td>
</tr>
<tr>
<td>Lankimaki et al (16)</td>
<td>Prospective observational</td>
<td>64</td>
<td>98.4%</td>
<td>71.9%</td>
<td>3</td>
<td>Unclear between FR and paramedic reporting</td>
</tr>
<tr>
<td>Muller et al (17)</td>
<td>Retrospective observational</td>
<td>130</td>
<td>93%</td>
<td>83%</td>
<td>2</td>
<td>Cuff problems 7.7%, RG prior 4.6%, tube placement 2.3%, morbid obesity 4.6%, tongue swelling 2.3%, laryngeal spasm 0.7%</td>
</tr>
</tbody>
</table>

Legend: SAD = supraglottic airway device, RG = regurgitation, FR = first responder

### Table 2. Pre-hospital laryngeal mask airway effectiveness

<table>
<thead>
<tr>
<th>Study</th>
<th>Study design</th>
<th>Sample size</th>
<th>Overall insertion success</th>
<th>First attempt success</th>
<th>Maximum number of insertions for overall success</th>
<th>Reported SAD adverse effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bosch et al (12)</td>
<td>Prospective observational</td>
<td>50</td>
<td>100%</td>
<td>98%</td>
<td>3</td>
<td>Aspiration 2%, tube dislodge 2%, air leak 14%, RG 8%</td>
</tr>
<tr>
<td>Hein et al (18)</td>
<td>Two retrospective clinical audits</td>
<td>164</td>
<td>74%</td>
<td>45%</td>
<td>6</td>
<td>RG 6%, increase GCS/gag reflex 2.4%, tube dislodge 3.6%</td>
</tr>
</tbody>
</table>

Legend: SAD = supraglottic airway device, RG = regurgitation, GCS = Glasgow Coma Scale
There were several limitations throughout all three studies, with a common limitation of potential self-reporting bias. The German study did not specify whether its 70 patients were a sample of the entire population for the study period, which could potentially introduce selection bias, and did not report why continuous external cardiac compressions with an i-gel® in-situ was only achievable in 74% of cardiac arrests (9). The UK study informed their operational staff about the first audit and the aims of the study prior to commencing the second audit, thereby potentially introducing bias and increasing device utilisation (19). The Australian study failed to achieve a statistically significant sample size, thereby reducing the power of that study (20).

**Comparison of SAD and ETI studies**

Five studies were included in the SAD and ETI group (21-25). Three studies primarily focussed on patient outcomes, neurological and survival (23-25), and the remaining two studies focussed on successful insertion rates (21,22). This enabled examination of the following subthemes: patient outcomes, and success rate outcomes.

**Patient outcomes**

Two studies were from Japan (23,25) and one study was from the USA and Canada (24). The latter study reported on satisfactory functional status at hospital discharge as the primary outcome (Table 4). In comparison with SADs (comprised of King Laryngeal Tube, Combitube™, and LMA), ETI was associated with increased odds of ROSC (Table 4) and 24-hour survival, but not associated with secondary airway or pulmonary complications. This study did not include failed attempts with either advanced airway (ETI or SADs), nor when the devices were inserted, the insertion times and number of attempts required, or for what reason the individual operator chose one device over another. Furthermore, this study had analytical limitations because the original trial was not designed for evaluating airway management (24).

Both Japanese studies reported neurologically favourable outcomes at 1 month, pre-hospital ROSC (Table 4), and 1-month survival (23,25). There was no statistical significance reported for neurologically favourable outcomes at 1 month, and 1-month survival (ETI 3.6%, SADs 3.6%; ETI 10.7%, SADs 9.8%, respectively). However, there was a statistical significance demonstrated for pre-hospital ROSC and ROSC in the emergency department for ETI compared to SADs (16.6% vs. 10.1%; 47.8% vs. 44.4%, respectively) (23).

The second Japanese study (25) reported a statistically significant association between ETI and 1-month survival in comparison to SADs. Only after adjustment for confounders was there a statistically significant association between ETI and 1 month neurologically favourable outcome. It should also be noted the ETI group were more likely to utilise adrenaline (epinephrine) compared to the LMA and oesophageal obturator airway (EOA) groups (11.3%, 2.5% and 3.2%, respectively) (25).

**Table 3. Pre-hospital i-gel® effectiveness**

<table>
<thead>
<tr>
<th>Study</th>
<th>Study design</th>
<th>Sample size</th>
<th>Overall insertion success</th>
<th>First attempt success</th>
<th>Maximum number of insertions for overall success</th>
<th>Reported SAD adverse effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>SAD ETI SAD ETI SAD ETI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Häske et al (9)</td>
<td>Non-random, single-centre, prospective observational</td>
<td>70</td>
<td>100% NA 90% NA</td>
<td>3 NA</td>
<td>Air leak 20%, RG prior 2.8%</td>
<td></td>
</tr>
<tr>
<td>Duckett et al (19)</td>
<td>Two retrospective clinical audits</td>
<td>185</td>
<td>94% and 92% 86% and 90% NA</td>
<td>NA NA NA NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Middleton et al (20)</td>
<td>Single-centre, prospective parallel group, ‘open label’, RCT</td>
<td>48</td>
<td>LMA 57%, i-gel 90% NA</td>
<td>i-gel 100% NA NA NA NA</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

Legend: SAD = supraglottic airway device, ETI = endotracheal intubation, LMA = laryngeal mask airway, RG = regurgitation, RCT = randomised controlled trial, NA = not applicable
Limitations for both studies include the potential for self-reporting bias, and specifically for the second study (25), if a failed ETI attempt occurred and a rescue SAD was used afterward, this was then counted toward the LMA or EOA group, depending on which type of SAD was used. Furthermore, the emergency medical service (EMS) system in Japan is relatively inexperienced with ETI use since its introduction in 2004, and advanced airway devices, including ETI and SADs, are only considered after initial BVM ventilation, when the patient’s airway appears unsecure or there is an expected long transport time (25). Emergency medical technicians in Japan are unable to terminate resuscitation in the field and must transport all patients to hospital on whom resuscitation is attempted (23).

**Success rate outcomes**

Both studies were from the USA (21,22) and focussed on ETI and King LT, with the latter study using only basic life support (BLS) first responders for their LT group (22). Both studies report higher first attempt and overall success rates for SADs compared to ETI (21,22). The first study’s (21) first attempt and overall success rate for the ETI group (Table 5) were higher than the second study (22), but lower for the LT group (21,22). Potential reasons for this may be the first study only having just over 70% of their patients in cardiac arrest, and paramedics were limited to a single size #4 of the King Laryngeal Tube, which may not have been appropriate for all patients in the LT group (21). Adverse effects (Table 5) were reported for both studies. The second study had 51 patients with no attempt made for either ETI or LT without any documented reasoning, and multiple attempts for ETI were not defined (22). Both studies were limited by the potential for self-reporting bias, small sample sizes (21,22), and the second study was not prospective or randomised (22).

**Comparison of SAD and BVM studies**

Two studies were included in the SAD and BVM group (26,27). The study from Taiwan focussed on the feasibility of implementing the intubating-LMA (I-LMA) to their developing EMS system, and therefore didn’t include any successful insertion rates or number of attempts required for the I-LMA, and only listed their adverse effects as non-serious regurgitation (27). The incidence rate of ROSC and 24-hour survival (Table 6) for the BVM and I-LMA groups were extremely high, with the latter group also showing an improvement. Although the authors declare no significant difference in demographic data, the BVM group had a higher incidence of traumatic arrest (21.3% vs. 14.2%), and two key chronic co-morbidities (cerebrovascular 13.5% vs. 4.2%, and diabetes 28.1% vs. 16.9%) (27). The feasibility study from Austria (26) was similar to the feasibility Taiwanese study (27), looking at introducing the LT to their EMS system (26). The methods of this study indicate that the LT would be the primary airway device used in an OHCA, without any prior BVM ventilation, and also if the LT had two failed insertion attempts then BVM would be used instead. However, BVM was utilised initially on 74 patients, which was not comprehensively explained; 395 patients were managed in the LT group and 48 patients in the LT to BVM group. The success rates for the LT group did not include the twice-failed insertion attempts of the LT to BVM group (Table 5).
There was a high incidence of adverse effects throughout all groups, consisting of regurgitation, airway injury or cuff rupture (Table 5) (26). Successful ventilation was self-reported by the attending operators (EMTs who placed the device and an emergency physician that managed the patient afterward) and varied widely between the groups (26). Both studies have the potential of self-reporting bias, and both are restricted by limited training and relatively inexperienced operators (26,27).

### Comparison of SAD, BVM and ETI studies

Five studies were included in the SAD, BVM and ETI group (1,2,5,28,29). The latter study focussed on one of the three arms (i-gel®, LMA-S, or usual practice) within the UK based REVIVE-Airways trial, the ‘usual practice’ arm (29). Out of 196 patients, 108 received BVM airway management, 39 received an LMA and 49 received an ETI. The airway intervention did not need to be changed in 16%, 44% and 76% of patients respectively. Adverse effects that instigated airway intervention abandonment and eventual change in the BVM and LMA group were regurgitation (28 cases and seven cases, respectively) and inadequate ventilation (15 cases and 16 cases, respectively), with a further three displaced LMAs occurring. This study uniquely highlighted how often airway devices can change with the same patient, and the differing reasons behind why devices were substituted (29).

Two studies occurred in Asian countries with basic life support ambulance services and limited experience with ETI (5,28). The first study from Korea employed propensity score matching to accommodate the different patient group sample sizes. After logistic regression and propensity score-based matched analysis, there was a favourable association between BVM and survival to hospital discharge with comparison to LMA (9.6% and 5.7%, respectively), but not ETI (6.9% and 8.1%, respectively) (5). It was unknown when advanced airway interventions took place during the OHCAs, and whether this had any effect on the results. Similarly, the reasoning for advanced airway interventions is not specified, and considering the large difference in group sizes between BVM, ETI and LMA, there is a potential that the advanced airway devices may have been reserved for more difficult patients (5). The second study from Japan reported no statistical significance in pre-hospital ROSC, survival to hospital discharge or favourable neurological outcome (Table 6) between the BVM and advanced airway groups. The advanced airway group of interventions were also associated with higher overall ROSC, and intensive care unit admission (28).

The nation-wide, prospective observational study from Japan with almost 650,000 patients occurred during January 2005 to December 2010 (1). Japan introduced ETI in 2004, 1 year

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**Table 5. Pre-hospital SAD and ETI effectiveness**

<table>
<thead>
<tr>
<th>Study</th>
<th>Study design</th>
<th>Sample size</th>
<th>Overall insertion success</th>
<th>First attempt success</th>
<th>Maximum number of insertions for overall success</th>
<th>Reported SAD adverse effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frascone et al (21)</td>
<td>Prospective, multi-centre, randomised clinical trial</td>
<td>204</td>
<td>SAD: 80.5% ETI: 80.2%</td>
<td>SAD: 68% ETI: 67.1%</td>
<td>SAD: 2 ETI: 3</td>
<td>No advance past OP 7%, no pharyngeal seal 7%, spatial limitations 4.6%</td>
</tr>
<tr>
<td>Gahan et al (22)</td>
<td>Retrospective pre-post analysis</td>
<td>351</td>
<td>SAD: 92.9% ETI: 72.9%</td>
<td>SAD: 87.8% ETI: 57.6%</td>
<td>SAD: * ETI: *</td>
<td>Bleeding into LT 1.2%, RG 1.2%, air leak 0.6%, lung compliance 0.6%</td>
</tr>
<tr>
<td>Roth et al (26)</td>
<td>Prospective, multi-centre, observational</td>
<td>517</td>
<td>SAD: 99% ETI: NA</td>
<td>SAD: 76% ETI: NA</td>
<td>SAD: 2 ETI: NA</td>
<td>RG 5.5%, LT related injury 1%, cuff rupture 4%</td>
</tr>
</tbody>
</table>

Legend: SAD = supraglottic airway device, ETI = endotracheal intubation, OP = oropharynx, LT = laryngeal tube, RG = regurgitation, GCS = Glasgow Coma Scale, NA = not applicable, * = multiple attempts were not defined

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prior to this study commencing. The primary endpoint was 1-month favourable neurological outcome, and secondary endpoints of pre-hospital ROSC (Table 6) and 1-month survival. Bag valve mask was associated with a favourable neurological outcome compared to the advanced airway group. Twenty-seven percent of patients in OHCA were from non-cardiac causes (respiratory and cerebrovascular disease, and cancer); a further 18% were caused by trauma, hanging, drowning, intoxication or asphyxia (1). The secondary analysis of the Cardiac Arrest Registry to Enhance Survival (CARES) registry study (2) also yielded similar results to the Japan study (1), however with a much larger association. No advanced airway in comparison with SAD and ETI in this study reported a greater association with sustained ROSC (Table 6), survival to hospital admission and discharge and, notably, hospital discharge with good neurological outcome. Such large associations – unseen in other large studies – highlights the presence of confounders that are unmeasured or immeasurable, as mentioned by the authors. All remaining studies shared the similar limitation of potential self-reporting bias.

### Discussion

We conducted a review of SAD use during OHCAs. For simplicity, the discussion has been focussed into device outcomes and patient outcomes, as these outcomes are inherently different from each other and are often studied in isolation.

The results from the SAD outcomes cannot determine which SAD is best for OHCAs, however they do collectively report that second-generation devices are safe and feasible options as alternative airway devices, even for first responders and particularly in developing EMS systems. Also, second-generation SADs have higher reported insertion success rates in comparison to their first-generation predecessors. Furthermore, all studies that compared the device outcomes of SAD and ETI report higher first attempt and overall success rates for their respective SAD groups (19,21,22).
The results for the patient outcomes section are conflicting, and report associations that are not congruent with the well-known airway management gold standard of ETI, with two large studies reporting more favourable patient outcomes for BVM in comparison to ETI (1,2). In comparison between SADs and BVM, three studies report that BVM ventilation was associated with greater patient outcomes (1,2,5), one study reported favourable patient outcomes were similar between advanced airway and BVM ventilation (28), and two studies reported higher successful ventilation and 24 hour survival rates of SADs over BVM (26,27). The majority of patient outcome focussed studies with large sample sizes originate from Japan or the USA, and to a lesser extent, Korea.

Overall, there are no consistent trends with patient outcomes relating to SADs and other types of airway management. The variances between results highlight common and unique limitations, associated with either the study methodology or the EMS systems themselves. This emphasises the need for a large, international, multi-centre, randomised controlled trial. Although the follow-on study from this literature review does not examine this aspect of airway management, it does however provide a foundation for Australian based research, allowing for future geographical diversity in pre-hospital airway management research.

Upcoming and ongoing trials that are of interest to the researchers include the Pragmatic Airway Resuscitation Trial (PART) based in the USA, and the AIRWAYS-2 trial based in the United Kingdom, both due to their comparative nature between SADs and ETI.

Limitations

The potential for self-reporting bias is difficult to mitigate, and even more so, the unmeasured and immeasurable confounders. It is likely that many of the clinical observational studies within this review, providing comparison between SADs and ETI (or BVM), are intrinsically confounded by the clinicians decision to use a specific airway device influenced by their understanding of the clinical presentation of the patient and potential ongoing need for airway support. Secondary analyses can also potentially influence results as access to all required data may not be possible, which was highlighted in the study by McMullan et al (2) that reported abnormally larger P-ROSC and favourable neurological outcome rates for all types of airway management. Finally, a lack of reporting on the quality and efficiency of external cardiac compressions are rarely documented or controlled.

Conclusion

The majority of research focussing on pre-hospital SAD use has originated in the USA, Germany or Japan, with little originating from Australia. There is a large variance in patient outcome associations and device success rates, particularly between differing geographical areas, emphasising the diversity in EMS systems and immeasurable and unmeasured confounders. Pivotal papers were also subjected to large variances and should be interpreted cautiously. The maturity of each EMS system, operator skill set and training requirements of paramedics must be taken into consideration before implementing any instrumental change.

The lack of pre-hospital focussed research, particularly high quality, randomised controlled trials, makes it impossible to infer what the best airway device is for OHCAs, which may differ between EMS systems. Therefore, we recommend further high quality research in differing geographical locations, as airway management forms a vital element during an OHCA and can contribute to the overall outcomes of patients.

Conflict of interest

The authors declare they have no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement. Gavin Smith is an Associate Editor of the Australasian Journal of Paramedicine.

References

Decompressive craniectomy in the emergency setting: A historical review, summary of published evidence and review of implications for pre-hospital emergency care

Hannah Kirby  
Victoria University, Melbourne, Victoria, Australia

Jacki Burchell  
Victoria University, Melbourne, Victoria, Australia

Jack Taylor  
Victoria University, Melbourne, Victoria, Australia
Review

Decompressive craniectomy in the emergency setting: A historical review, summary of published evidence and review of implications for pre-hospital emergency care

Hannah Kirby, first-year paramedicine graduate; Jacki Burchell, first-year paramedicine graduate; Jack Taylor, first-year paramedicine graduate

Affiliation:
1Department of Paramedicine, Victoria University, Melbourne, Victoria, Australia

Abstract

Introduction
Decompressive craniectomy is a controversial treatment for increased intracranial pressure resulting from traumatic head injuries. The technique has been around for approximately 5000 years but only now are researchers beginning to unlock its true potential. This article aims to summarise history, review current knowledge and identify the implications of pre-hospital emergency care.

Methods
An electronic search was conducted using the databases MEDLINE (via EBSCOHost), BioMed Central and Cochrane Database of Systematic Reviews.

Results
One hundred and thirty-one articles were identified. Articles excluded from analysis were those unavailable as full text, not available in English and review articles. Twenty articles were included in the analysis.

Conclusion
Decompressive craniectomy is a comparable treatment to alternative techniques. Until recently mortality rates have been misinterpreted and unfairly reported due to the severity of brain injuries patients had already suffered. Timing of decompressive craniectomy is a crucial factor of patient outcome, and it is of popular belief that the best chance of optimal recovery relies on a reduced injury to treatment time. Introducing decompressive craniectomy into the pre-hospital setting may see an increase in favourable outcomes and has the potential to save the health care system millions of dollars in associated costs for patients with traumatic brain injury.

Keywords:
decompressive craniectomy, craniotomy, intracranial hypertension, emergency neurosurgery

Corresponding author: Hannah Kirby, Hakirby@outlook.com
Introduction

Traumatic brain injury (TBI) is a leading cause of disability and death, with the highest incidence occurring in young males. Raised intracranial pressure (ICP) caused from the TBI is responsible for a large majority of these deaths and disabilities (1,2). The most definitive form of current treatment for increased ICP is decompressive craniectomy (DC). The technique of DC involves a scalp incision, surgically removing segments of bone from either one or both sides of the skull and opening of the dura mater. The aim of DC is to prevent brain compression from increased intracranial fluid and therefore preventing cerebral hypoxia (2-5). The swelling that occurs from a head injury results in increased cerebral fluid volume, the increased volume raises ICP which causes cerebral blood flow to decrease and subsequently causes a decrease in cerebral perfusion. The decrease of cerebral perfusion can lead to hypoxic brain injuries and magnify injuries from the primary insult. Furthermore, the increasing swelling can lead to transtentorial herniation, which can quickly lead to death without rapid treatment (6). The technique of DC has a long history, seen as early as 3000BC, and has been seen as a controversial treatment since the 1960s (2,7). However, neurosurgeons are beginning to appreciate the potential of DC and as a result the procedure has been steadily gaining popularity, although debate continues over the correct timing, indications and techniques (2). Decompressive craniectomy can be used to treat raised ICP in trauma, intracranial haemorrhage, hydrocephalus, cerebral abscesses, cerebral infarctions and other disorders and diseases (8,9).

This review will touch on other causes but will focus mainly on trauma related cases. This review aims to summarise historical data and identify current knowledge based on relevant peer-reviewed literature, while recognising the impact paramedics have on outcomes of patients with TBI.

Methods

An electronic search was conducted using the databases: MEDLINE (via EBSCOHost), BioMed Central and Cochrane Database of Systematic Reviews. The following keywords were included in the search: ‘decompressive craniectomy’, ‘craniotomy’, ‘intracranial hypertension’ and ‘emergency neurosurgery’. Articles that were excluded from analysis were those unavailable in full text, unavailable in English, not peer-reviewed and review articles.

Results

One hundred and thirty-one articles were identified, and from these 20 articles were identified as suitable for inclusion in the analysis. Details for the inclusion process are shown in Figure 1.
Discussion

History
Evidence of trepanation (surgically removing a section of skull) is seen as early as 3000BC. It is believed that the origin of the technique is derived from both mythical and religious reasoning (7). Dr Paul Broca, a French neurosurgeon in the 1800s, discovered that some holes found in ancient skulls were caused by a methodical hand and were not trauma related. He speculated that the procedure was carried out in Neolithic times to create an exit point for demons that were causing convulsions. Furthermore, the Neolithic people believed that the bone fragment that was removed held great medical and spiritual importance and was worn as jewellery or made into pills, often sold in pharmacies as a preventive measure for convulsions. Broca became fascinated with the technique and began to experiment on cadavers and live dogs and through his studies he proved a craniectomy could be done on living patients without causing death (7).

Throughout the 1900s, Broca’s theory was widely accepted, although it wasn’t until the late 1960s that the procedure was introduced as a legitimate surgical intervention to treat increased intracranial hypertension (2). Popularity for the procedure plummeted after the majority of outcomes were unfavourable, resulting in severe disability, persistent vegetative state or death. Studies conducted at that time suggested that not only is there no benefit to the procedure, but may even worsen patient outcomes and prolong suffering. The procedure was abandoned until the 1980s when contradictory studies suggested the technique could have a positive outcome and potentially be a lifesaving intervention (10). Today the treatment is still seen as controversial, but is becoming more widely accepted in major hospitals.

Technique
The procedure itself is quite simple. It can be done either bilaterally or unilaterally and with or without opening of the dura mater, these decisions are made based on the extent and location of the injury. Regions of the craniectomy are carefully chosen as an inadequate opening may cause venous infarction or oedema at the margins (11). The aim is to reduce intracranial pressure to below 20 mmHg while maintaining cerebral perfusion pressure of above 60 mmHg (10). After a cranial computed tomography (CT) scan, the patient is placed under general anaesthesia via endotracheal intubation and the procedure is commenced. A myocutaneous flap is created to gain access to the skull and a bone segment is carefully removed. Regions of the skull often removed include frontal, parietal, temporal and occipital squama. After the removal of the bone segment, the dura mater is either left intact or incised in a stellate pattern. The opening of the dura not only allows the surgeon more comprehensive examination, but also allows for irrigation and removal of clots and irreparable contused brain matter. An ICP monitor is often placed under the dura and secured. A synthetic dura material can be placed to allow for the swelling of the brain. The myocutaneous flap is then re-secured with sutures and the bone segment is stored in damp sterile gauze at a temperature of minus 70 degrees Celsius for cranioplasty 3–6 months following DC (2,3,10,11).

Indications and outcomes
Decompressive craniectomy indications vary from hospital to hospital, although all are quite similar. Common indications include bilateral or unilateral brain swelling as shown on CT scans, initial Glasgow Coma Scale (GCS) score of less than 8 or decreasing neurological status, intracranial hypertension of more than 30 mmHg for a period of 15 minutes or more, unresponsive dilated pupils and the failure to respond adequately to other medical interventions (2,9). Kim et al. (9) conducted a study to determine patients’ outcomes after undergoing DC. The study followed 28 patients who underwent DC due to TBI. A favourable outcome was reported in 57.1% of patients while 21.4% of patients died and 21.5% of patients were left with a severe disability or in a vegetative state. It was deemed a ‘favourable outcome’ if the patient was left with a moderate disability or recovered entirely (9). The authors of the study suggested that the high rate of unfavourable outcomes may be due to the increased period of time waiting for the GCS to drop below 8, allowing further damage to occur within this time. Deok-Ryeong et al. (2) agreed, suggesting the poor outcomes of DCs could be a direct result of a few of the indications. By waiting for the patient to decline to meet guidelines, experimenting with alternative treatment and waiting the 15 minutes with increased intracerebral hemorrhage (ICH), irreparable damage could be occurring resulting in the high statistics of unfavourable outcomes (2,9). Deok-Ryeong et al. (2) have proposed that to combat this problem DC should be a first line of treatment, performed as soon as practically possible in order to achieve the best possible outcome.

A group of researchers in Jordan in 2010, Jamous et al. (1) challenged the indications and directed a study on DC patients with a GCS score of 3 with bilateral fixed dilated pupils. Decompressive craniotomies were performed within 2–6 hours post-injury and ICP was seen to decrease, however within 30 days all patients had died. Jamous et al. argued that DC in these patients did not only prove unsuccessful, but prolonged the suffering of the patients and affected families. The authors of the study decided the 100% mortality rate was most likely due to the level of brain injury and these patients likely had no chance of survival regardless of treatment (1). These results should lead to further discussion regarding the exclusion of patients with a GCS score of 3.
Research has been directly responsible for improving patient outcomes. Research by Deok-Ryeong et al. (2) found that consistently monitoring ICP post-DC significantly improves patient outcome. Their study saw 78 patients with severe traumatic brain injury with a GCS of 9 or less split into two groups: a control group (53 patients) and a study group (25 patients). The study group had a subdural ICP monitor inserted under the dura matter and were given constant ICP monitoring for two weeks post-DC. The mortality rate for the control group was 50.9%, while the group with ICP monitoring had a mortality rate of only 24.0% (2). This shows a significant improvement of outcomes and should encourage neurosurgeons to place an ICP monitor in all DC patients.

More research needs to be conducted to properly understand the outcomes of DC and how the indications affect success. Two randomised controlled trials (RCT) are currently underway: one in Europe (RescueICP) and the other in Australia (DECRA), both are yet to publish any findings (12).

**Complications**

Honeybul et al. (10) recently completed a study on surgical complications of DC. Within the report Honeybul et al. states that complications arising from DC specific to head trauma patients were common, while Yang et al. (5) reported conflicting findings, stating the procedure has a ‘low incidence of complications’. Honeybul et al. explores the complications in depth and their study included 270 patients who underwent both unilateral and bilateral decompression. The complications found attributable to DC were cortical herniation of cortical surface (33.75%), injury of herniated cortex (5.2%), seizures (18.5%), cerebrospinal fluid (CSF) hydrodynamic disturbances including hydrocephalus (14.4%) and subdural effusion (53.8%). The complication incident rates concur with the conclusion of complications being common. Another complication Honeybul et al. (10) identified but did not include in the statistics was the death of patients caused by injury to the unprotected brain, of which two patients died from this cause.

**Cortical herniation**

Cortical herniation is the swelling of the brain, this becomes a concern when the herniated area is so severe that it protrudes from the confinement of the skull. The herniated area can become damaged from the margins of the skull or become injured from an external force; for these reasons patients who develop cortical herniation are at a higher risk of an unfavourable outcome (10).

**Hydrocephalus**

Hydrocephalus is the enlargement of the cerebral ventricles. The pathophysiology is poorly understood, however some researchers speculate it results from placing the medial margin of the craniectomy in close proximity of the midline. This condition can be difficult to differentiate from ventriculomegaly, however hydrocephalus usually shows signs of clinical improvement after the placement of a shunt (10).

**Subdural effusion**

Subdural effusion is the accumulation of fluid between the dura and subarachnoid space and commonly occurs within weeks of DC. Most subdural effusions resolve spontaneously or can be treated conservatively; surgical intervention is only considered when symptoms manifest. The more severe the head trauma, the more likely a patient is to develop this complication (10,13). Subdural effusion normally presents unilaterally, however Yang et al. (5) found bilateral subdural effusion to occur in 6.5% of patients. Though rare, this is a more complicated manifestation that brings higher risk of a poor recovery (5).

**Paediatrics**

Paediatric patients have the potential for ICP to raise more dramatically and rapidly than adults and researchers are in agreement that DC should be considered more quickly in children (14,15). Fagaji et al. (4) studied a group of five paediatric patients who underwent DC at the Red Cross Children’s Hospital in Capetown, 2003. Patients ranged between the ages of five and 12, the group consisted of two females and three males. Surgeons responded quickly once symptoms of raised ICP appeared, with early and aggressive treatment given, 100% of patients resulted in a favourable outcome. While these results sound conclusive a limitation of the study is the small number of involved participants. It may be possible that children react more favourably to DC than adults, however an RCT should be carried out to challenge this conclusion. Josan and Sgourus (16) compared paediatric patients who received DC to those who received non-operative treatment. The DC group had a better outcome and concluded DC offers the fastest relief of ICH and is a safe procedure with a low rate of complications if performed quickly (16).

**Decompressive craniectomy versus craniotomy**

Decompressive craniectomy has been rigorously compared to craniotomy (CR) in many studies. A craniotomy is similar to a DC, however the bone segment is replaced once the surgeon has finished treating the injured site. The clear advantage DC has over CR is the more effective control of ICP, however there is no guideline that states which of the two techniques should be performed, with surgeons currently using their prerogative (17). In 2012, Li et al. (17) completed a study in the United Kingdom evaluating the recovery of 91 patients who underwent either DC (51 patients) or CR (40 patients). Of the DC group, 67% of patients were male with a mean age of 45 years; the CR group had 50% males with a mean age of 59 years. At 6 months, patients were assessed and then deemed to have either a favourable (moderate disability or good recovery) or unfavourable (death, persistent vegetative state or severe disability) outcome. Patients in the DC group had 42% favourable outcomes (58% unfavourable) compared to
45% in the CR group (55% unfavourable). The overall results were not significant and the authors concluded that the rate of unfavourable outcomes in DC was high as patients with more severe TBIs were in the DC group; once injury severity was accounted for the outcomes are quite similar (17).

In the United States, a similar study was conducted by Soukiasian et al. (6), the authors accessed database information, which included patients who underwent DC or CR from 1995 to 2001, the search resulted in 120 patients eligible for analysis. The DC group consisted of 24 patients, who had a mean age of 40 with a standard deviation (SD) of 3.9 and was comprised of 83% males. The CR group consisted of 96 patients, a similar mean age of 42 years with a SD of 2.2, 81% of which were male. The mortality rate for the DC group was 37.5% versus 18.8% for the CR group, the survival rate for the DC group was 62.5% versus 81.2% for the CR group. These rates concluded no significance between the groups in terms of survival (p=0.08) (6). These rates conclude DC is beneficial for patients with TBI and instil the importance of a future RCT. It is important to note that patients with the DC group had suffered more severe brain trauma than those in the CR group, which prevents this study from being definitive, as groups cannot be fairly compared. A further limitation of this study is the use of the database information; authors were not directly involved in the patient’s recovery, resulting in a potential loss of vital information. Furthermore, the majority of these patients were males aged in their 40s, therefore the results could not be generalised.

Pre-hospital implications
Traumatic brain injuries are responsible for a large number of deaths and disabilities annually (2). A recent study conducted by Gershon Spitz et al. (20) found a significant financial effect on the health system amounting to a lifelong cost of $2.5 million per patient suffering from a moderate TBI and $4.8 million for those suffering a severe TBI.

Paramedics are usually the first to treat these patients, therefore it is imperative they are acutely aware of the warning signs associated with increased ICP, and understand the relevant guidelines as well as the importance of rapid transport to definitive care. At present no study or trial has been completed involving DC in the pre-hospital setting. Given the widely accepted conclusion that early DC results in lower mortality and morbidity rates and high associated health care costs, the natural progression is to suggest the implementation of a simplified version of DC into the pre-hospital setting (4,6,14,15,18). Intensive care paramedics already have extensive training coupled with impressive knowledge. Burr holes (drilling holes into the skull to relieve ICP) are recognised as a simplified and justified alternative for DC in underequipped hospitals (19), with further research and collaboration with experienced neurosurgeons it is possible

burr holes may earn a place in the pre-hospital setting in the future.

It is the authors’ belief that intensive care paramedics, equipped with extra training of the burr hole procedure, could potentially decrease the high disability and mortality rate following severe TBI; a RCT and further research would be worthwhile and is strongly recommended. Depending on the results of the RCT, factors such as technique, distance to hospital, injury to treatment time, patient age and the cost of introducing the procedure would all have to be addressed. Using the multiple burr hole technique over the single burr hole technique may prove favourable due to lack of radiographic equipment available preventing operators determining the location of the increased cranial pressure, this also decreases the amount of surgical equipment that needs to be carried in ambulances, and decreases the level of training required. The cost of introducing this procedure into the pre-hospital setting is unknown at this time, however introduction of pre-hospital DC has the potential to save millions of dollars on associated TBI health care costs (20). Training those most likely to utilise the procedure such as rural intensive care paramedics and air ambulance paramedics (due to the time and distance to a major trauma hospital), and providing only rural ambulances and helicopters with equipment will help keep the introduction of DC cost effective.

Conclusion
Severe head trauma is a leading cause of death and no treatment is available until arriving at definitive care. The high mortality and morbidity rates seen associated with DC are more likely to be associated with the injuries suffered before undergoing treatment. The misinterpretation of the mortality rates has caused a considerable amount of controversy relating to DC, but as more research comes to light neurosurgeons are beginning to consider DC an acceptable treatment with great potential. Decompressive craniectomies are seen to have similar outcomes to craniotomies, although further research is needed to conclude the most beneficial timing and technique for the procedure. Many researchers believe favourable outcomes depend on the prompt delivery of DC, which may lead to simplified craniectomies being performed by rural intensive care paramedics. Not only does this have the potential to increase favourable outcomes from TBIs, but also save the health care system what could amount to billions of dollars.

Conflict of interest
The authors declare they have no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.
References


Community ambulance response trolleys: Preparing students for the paramedic workplace

Georgia Clarkson
Australian Catholic University, Melbourne, Victoria, Australia

Heath Gangell
Australian Catholic University, Melbourne, Victoria, Australia
Community ambulance response trolleys: Preparing students for the paramedic workplace

Georgia Clarkson BA (Monash), DipEd (Monash), DipAmbPara (Monash), GCTE (VU), MEd (VU), PhD (VU) is a Senior Lecturer¹, Heath Gangell BHSc(Paramedic) (VU), GCTE (VU), MEd (VU) is Course Co-ordinator, Bachelor of Paramedicine¹

Affiliation:
¹Australian Catholic University, Melbourne, Victoria, Australia

Abstract

Introduction
The curriculum of undergraduate paramedicine programs invariably includes clinical placement. Engagement in learning in the workplace is, however, constrained by lack of familiarity with workplace cultural expectations. Strategies assisting students to understand workplace expectations have the potential to enhance engagement on placements and with workplace transition. This study examines whether one classroom practice initiative heightens students' understanding of specific paramedic workplace expectations.

Methods
Community ambulance response trolleys (CART) (a system developed to mimic equipment management strategies of the paramedic workplace) was introduced on one campus of an Australian university. Another university campus was selected as a comparison site and did not operate CART. The CART campus students were assigned to a team and made responsible for maintaining and restocking all equipment utilised in practical classes, simulating strategies used within the paramedic workplace where a paramedic team shares responsibility for stocking and upkeep of equipment. Both cohorts completed a questionnaire exploring their experiences in the classroom and preparation for clinical placements.

Results
The CART system had a positive influence on the ability of students to collaborate within the classroom and become familiar with industry expectations around equipment management. This increased confidence with transition to learning within the workplace environment.

Conclusion
The CART strategy was effective in mimicking workplace practices and expectation, and evidence indicated that the CART system could assist students with their ability to transition into a vocational environment.

Keywords:
education, allied health personnel, workplace, simulation training, culture

Corresponding author: Georgia Clarkson, Georgia.Clarkson@acu.edu.au
Introduction

By exposing paramedicine students to the culture and expectations of the working environment, clinical placements provide an essential opportunity for students to develop the professional skills and knowledge necessary for entry to the workforce (1,2). However, even where placements provide consistently replicable experiences, sending students on placement does not guarantee learning or competence (3). In addition to practical hurdles, such as the acquisition of placements (4), the ability of ambulance services to meet the challenge of providing quality learning and supervision opportunities for students is variable (5). Students report unproductive downtime, not being given the opportunity to participate in patient care, and a sometimes-unsupportive learning environment (6). To exacerbate this, the nature of the paramedic workplace means that placements vary significantly in their nature (6) and are therefore of inconsistent quality and value for students, resulting in highly variable learning experiences (7). University educators are therefore faced with the challenge of equipping students to maximise their learning in unreliable and dynamic environments.

Understanding workplace expectations in relation to equipment management and integrating these expectations into practice is one such challenge. It is essential that paramedics have all the required equipment available, functional and fully stocked as the majority of clinical functions are dependent on sound practice in this area. Further, because paramedics operate as part of several teams, the ability of the team to operate effectively is dependent on having an operational set of equipment. These teams include the immediate partnership in which the majority of paramedics operate, but also extend to wider teams that share equipment on a vehicle at a branch or station level in addition to other teams that paramedics may interact with at incidents in the field.

In order to regularly and consistently embed good practice around the management of equipment into the classroom at a beginning level, the CART system was introduced into paramedicine practical classes on one campus of a multi-campus university. The CARTs comprise a series of trolleys that house all essential paramedic equipment – mirroring equipment used on an emergency ambulance. This includes cardiac monitor-defibrillators, oxygen administration equipment, diagnostic equipment and simulated versions of commonly administered drugs and consumables. In keeping with the naming conventions used in industry, CARTs are labelled with location names. All students in all year levels were allocated to a CART for the duration of each semester. Handover principles used in the field to ensure that equipment is maintained to a prescribed standard were also applied to classroom practices. This meant that students were accountable for the maintenance of their equipment within their immediate team in practical classes. It also meant that this responsibility extended to students in different practical classes in the same year level, and to other year levels where students shared the same CART. Failure to maintain equipment on the CART to the required standard had the potential to impact on all students allocated to the CART. In this way, the system mirrored the interdependency of paramedicine teams in industry.

An additional motivation for introducing CARTs was practical. The introduction of the CART system responded to repeated incidents of student failure to maintain and restock equipment. Such practices led to disruption of classes due to equipment shortages and malfunction, and laboratory staff therefore operated in a labour intensive and reactionary mode to respond to student needs. This practical aspect provided an additional underpinning justification for a more robust strategy of equipment management by making students accountable while also providing an opportunity to immerse themselves in cultural practices related to equipment management that aligns to the practice of the paramedic workplace. The concept of communities of practice (8,9) underpins the CART initiative and the framework provides a model for understanding how facilitating the establishment and ongoing management of complex social relationships can assist newcomers to gain access to learning opportunities through participation in practice.

By analysing the value of the CART system within the paramedicine practical laboratory and its role in improving the understanding of workplace culture, this study builds on and contributes to work on transition of paramedicine students into the clinical placement experience, and ultimately the workplace. Although studies in transition to practice have examined the value of clinical placements (6,10), there is no extended study of how classroom management practices can assist students to make this transition. The CART system structures classroom communities in a manner that mirrors practice within the paramedic workplace, and provides a more seamless transition to the clinical placement environment through a better understanding of what is expected. In doing so, it also has the potential to create a focal point facilitating the development of student-to-student relationships and underpinning peer-learning networks within the learning environment.

Methods - the CART intervention

In 2014, the CART system was piloted in paramedicine laboratories on one campus of a multi-campus Australian university, the ‘CART campus’. All students were allocated to a CART team in their practical laboratory classes. Students remained in their designated CART teams for the entire semester and were expected to maintain and restock their equipment. They were provided with documents similar to those used in the field to manage the restocking of consumables and the maintenance of equipment.
Another campus not using the CART system within the same university where students were undertaking the same unit of study was used as a comparison site, the ‘non-CART campus’. This campus relied more heavily on laboratory staff for the management of paramedic equipment in the classroom.

Ethics approval was gained to allow for the collection of data on both campuses. Year one students with minimal exposure to the clinical placement environment completed a survey consisting of a 15-item Likert-scale questionnaire based around three main themes (preparation for clinical placement, peer learning and logistical impact in classes). The survey included a free text section where students could provide qualitative feedback.

The survey was administered at the completion of one semester of using the CART system. There was a 55% return rate for the CART campus, consisting of 92 completed questionnaires and a 32% return rate for the non-CART campus where 43 questionnaires were completed.

Results

SPSS software was utilised to analyse quantitative data derived from the Likert scale responses. To identify statistically significant results each item underwent t-tests (p<0.95 deemed acceptable) and Levene’s test (p>.05 deemed expectable). Statistical analysis of the survey questions was undertaken around the three themes presented in Tables 1, 2 and 3) and showed significant evidence of the advantages of the CART system in some areas. Qualitative feedback was analysed thematically (11).

In general, analysis indicated that the CART system made a positive contribution to preparing students for clinical placement with students on the ‘non-CART’ campus feeling less comfortable in the clinical placement environment.

While all findings warrant further exploration, this discussion focuses on how the CART system contributed to student preparation for clinical placement. As shown in Table 1, students from the CART campus felt that the system of equipment management in the practical classroom positively influenced their entrance into the clinical placement environment. In general, students from the CART campus felt more comfortable with the prospect of going on clinical placement than the non-CART campus group. Qualitative comments from those students who had undertaken some clinical placements indicated that they felt more comfortable with the expectations of them regarding equipment management in the field and therefore more confident in their ability to interact with supervising paramedics in this aspect of their placement. One student stated: ‘I got a lot of good feedback from [paramedics]… due to my confidence with equipment’ with another student believing the reason for this improved engagement was ‘because I was able to assist, they were willing and inviting for me to assist’.

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<tr>
<th></th>
<th>Mean (non-CART)</th>
<th>Mean (CART)</th>
<th>Levene’s test (Sig.)</th>
<th>t-test Sig. (two-tailed)</th>
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<tr>
<td>I feel more comfortable about going on clinical placements as a</td>
<td>4.16</td>
<td>4.49</td>
<td>0.437</td>
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<td>result of the way ambulance equipment was managed in practical</td>
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<td>I gained insight into the importance of maintaining equipment to</td>
<td>4.26</td>
<td>4.58</td>
<td>0.001</td>
<td>0.008</td>
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<td>an operational standard in-field as a result of my practical</td>
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<tr>
<td>classes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel that the strategies used in the practical laboratories at</td>
<td>4.10</td>
<td>4.37</td>
<td>0.726</td>
<td>0.026</td>
</tr>
<tr>
<td>ACU mirror the team approach used by paramedics on-road to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>manage ambulance equipment. This makes me feel that I understand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the importance of teamwork in ambulance practice.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel comfortable interacting with paramedic teams in the field</td>
<td>3.63</td>
<td>4.09</td>
<td>0.042</td>
<td>0.004</td>
</tr>
<tr>
<td>to restock and check ambulance equipment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being comfortable with the role of the paramedic in terms of</td>
<td>3.89</td>
<td>4.37</td>
<td>0.082</td>
<td>0.001</td>
</tr>
<tr>
<td>managing the ambulance equipment meant I was able to interact</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with paramedics on placement and gain their support to assist me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to learn.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Peer learning

<table>
<thead>
<tr>
<th></th>
<th>Mean (non-CART)</th>
<th>Mean (CART)</th>
<th>Levene’s test Sig.</th>
<th>t-test Sig. (two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I frequently work as part of a team with other students in my practical class to maintain ambulance equipment.</td>
<td>4.37</td>
<td>4.51</td>
<td>0.499</td>
<td>0.227</td>
</tr>
<tr>
<td>I have developed relationships in practical classes as a result of the requirement to participate in the management of the ambulance equipment.</td>
<td>4.10</td>
<td>4.36</td>
<td>0.447</td>
<td>0.039</td>
</tr>
<tr>
<td>The way that the classroom equipment is setup encourages me to work with other students to ensure equipment is well maintained.</td>
<td>4.09</td>
<td>4.42</td>
<td>0.277</td>
<td>0.006</td>
</tr>
<tr>
<td>The relationships I have developed with other students in practical classes have assisted my learning as a paramedic student.</td>
<td>4.33</td>
<td>4.64</td>
<td>0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>Through the relationships I have developed with other students in practical classes my confidence as a student paramedic has improved.</td>
<td>4.21</td>
<td>4.42</td>
<td>0.095</td>
<td>0.069</td>
</tr>
<tr>
<td>I frequently work as part of a team with students in other practical classes and year levels to maintain equipment.</td>
<td>3.50</td>
<td>3.83</td>
<td>0.493</td>
<td>0.089</td>
</tr>
</tbody>
</table>

Although the focus of the current discussion is on the value of the CART system in assisting students to transition into the clinical placement environment, other trends were evident. The operation of the CART system encouraged the development of a community of practice within the classroom. This assisted students to develop relationships within the student group, with one student indicating ‘to manage equipment I found that all students in the class work together’. Another student stated ‘new friends from prac[tical] classes have become really close’. These relationships were fostered through the shared responsibility for paramedic equipment. Extending from these relationships, students indicated that they used these relationships with peers to assist them with their learning.

One student stated that the CART system ‘definitely... makes you make friends to study’. They also indicated that this process of peer assisted learning helped them to improve their confidence. The propensity of these relationships to encourage a peer-learning environment can serve to improve student confidence and therefore has the potential to provide a critical stepping-stone to student transition to clinical placements.

Results related to the logistical impact in classes were interesting. The non-CART campus indicated that there were fewer interruptions to classes and fewer problems with equipment. While this superficially appears unfavourable to the implementation of CART, these results were produced by a heavier reliance on laboratory staff and must also be offset against the benefits of improved peer relationships and aspects that favoured transition into the placement environment on the CART campus.

**Discussion**

Community ambulance response trolleys facilitated a community of practice using paramedic equipment as a focal point to foster relationships that encouraged peer learning. In turn, a number of students grew in confidence in their ability to demonstrate competence to experienced practitioners. This growth in confidence can in part be attributed to building their understanding of workplace practices within the field of paramedicine. In building students’ competence in maintaining a safe and functional working environment, access into the community of paramedic practice was facilitated (12).
Table 3. Logistical impact

<table>
<thead>
<tr>
<th></th>
<th>Mean (non-CART)</th>
<th>Mean (CART)</th>
<th>Levene’s test</th>
<th>t-test Sig. (two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning activities in practical classes are never interrupted due to missing equipment or equipment left in an unusable state.</td>
<td>4.51</td>
<td>3.71</td>
<td>0.057</td>
<td>0.000</td>
</tr>
<tr>
<td>The state that I have found the ambulance equipment left in is always safe.</td>
<td>4.48</td>
<td>4.27</td>
<td>0.596</td>
<td>0.114</td>
</tr>
<tr>
<td>I work with other students to maintain equipment and we never require the assistance of a staff member to locate equipment and/or restock ambulance equipment</td>
<td>3.33</td>
<td>3.21</td>
<td>0.041</td>
<td>0.513</td>
</tr>
<tr>
<td>Practical class activities are never interrupted due to equipment that has not been restocked or replaced.</td>
<td>4.10</td>
<td>3.27</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

In general, findings from this study indicate the CART system is of benefit in making clinical placements a more positive experience by familiarising students with the cultural expectations of the paramedic workplace. In addition, interdependency was fostered between students using equipment management as a platform. The shared responsibility for the CARTs within the classroom compelled students to engage with others and fostered the relationships essential to underpin peer learning. Evidence shows that peer assisted teaching and learning can be a positive feature of paramedic education (13) and students viewed the CART as having made a positive contribution to their ability to relate to peers and a conduit to a collaborative learning. As such, CART can be viewed as improving 'relational competence' in a similar way to other exercises premised on improving peer interaction (14). Further, the CART system facilitated collaborative approaches to learning, which familiarised students with the 'language' of expectations around the management of paramedic equipment and the roles paramedics play in maintaining 'tools of trade'.

The CART system provided simulation of a process governed by workplace language and culture. This is a valid educational resource in the same sense as clinical simulations previously demonstrated as effective in paramedic education (15). Fluency in the language of the workplace can assist students to build rapport with clinical staff and this influences student learning in a positive way (7). This serves to improve student knowledge of expectations of them on clinical placements and grows confidence. As lack of confidence has been identified as a variable inhibiting participation (4) improved confidence increases the likelihood of students operating effectively while on placement. Ultimately, it is anticipated that this enables a smoother transition into the workplace as a beginning paramedic presenting one less challenge to overcome in a challenging work environment.

Current perspectives in workplace learning argue that the skills required for undergraduate students to learn through participation in the practice of a profession are those of managing complex social interactions that are characteristic of everyday work (16-19). The CART system provides an engaging and authentic learning activity and an in-class focal point that fosters a community of practice for paramedic students and also promotes peer learning by building relationships. In doing so, it promotes more seamless student participation during the social experience of clinical placement. In providing students with some of the shared understanding of expectations within the workplace, CART provides a ‘key’ that can assist them to access discussions with paramedics and therefore draw on their knowledge within the clinical placement setting. In a practical sense, the CART system can assist students with planning and preparation for clinical placements, which is critical for a positive experience (20).

One of the challenges in workplace transition is not having enough clinical experience (10) and increasing numbers of paramedic programs and students (2) have resulted in increased demand for services and contributed to growing pressure within the ambulance sector (5). Further, criticism remains of the level of preparation of graduates to undertake the role of a paramedic (21). Students and educators therefore need to capitalise on all available learning opportunities given the current placement shortages and changes to population health (4,7). The CART system demonstrated positive results in improving student familiarity with the workplace and therefore improving engagement on placements, consequently maximising value.
Extending this idea, it is argued that CART has the potential to contribute to assisting with transition into the workplace. Further, the principles underpinning the CART system could be used to mimic other aspects of the workplace and therefore make programs more robust in terms of their ability to provide consistent and reliable collateral support to exposures to the workplace. The use of a community of practice to simulate aspects of the work environment has potential to inform other innovations in paramedic education specifically and health education in general. This is critical in a climate of increasing workload demands on ambulance services (22), where a smooth transition to the workplace depends on skills and theory development during undergraduate programs (4) and when it is becoming increasingly competitive for graduates to find employment (23). Systems such as CART have the potential to give graduates a competitive edge in this context.

Evidence from this study indicates CART is a valuable initiative. Further research into its value and application is required to explore the connection between this classroom practice and learning on clinical placement. While all students on the CART campus used CART, information collected in this study was limited to first year students over one semester and provides some favourable evidence on the value of the system. A further limitation of this study is the cross campus comparison approach adopted. While some significant variances in the responses between campuses were noteworthy, it is acknowledged that experiences on different campuses are a product of multiple variables. Further research into the value of the CART system in improving student participation and understanding of workplace over the course of a full undergraduate program would provide further insight into the value of CART.

Conclusion

The CART system is a simple and low cost strategy used to mimic equipment management practices used within the paramedic workplace. The system encourages students to work collaboratively and therefore fosters peer relationships by providing an engaging and authentic learning activity that instils an understanding of the cultural expectations of roles and responsibilities in the upkeep of essential paramedic equipment. The use of this system on one campus showed it can assist to foster peer learning and familiarise students with expectations embedded in workplace culture around the management of shared equipment. Evidence indicated that this made some students more comfortable with the expectations of them within the clinical placement environment. As familiarity with this integral element of workplace practice can assist with transition into the paramedic work environment, other classroom strategies that mimic workplace practices have the potential to assist students with transitioning to the workplace and optimise learning opportunities in this space. Although evidence is yet to be obtained, it is arguable that a positive experience in the clinical placement environment has the potential to give students a greater opportunity to succeed once they enter the industry as employees.

Acknowledgements

The authors would like to acknowledge Dr Stephen Guinea for providing support with his expertise in simulation assistance in the design and implementation of the CART system. We wish to acknowledge the technical and academic staff teams operating in the practical laboratories at ACU’s Melbourne Campus for assisting with the set up and maintenance of the CART system.

Conflict of interest

The authors declare they have no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

References


Rural paramedic practitioner – a future model of care

Greg Reaburn
Queensland Ambulance Service, Queensland

Rob Zolincinski
Townsville Hospital Emergency Department, Queensland

Scott Fyfe
Tasmanian Ambulance Service, Tasmania
Commentary

Rural paramedic practitioner – a future model of care

Greg Reaburn BA(Psych), GradDip(Para), BHSc(PA) is a rural crucial care flight paramedic¹; Rob Zolincinski Bus(Acc), BAppSc(Comp), Dip HSc(Para), BHSc(PA) is an emergency department physician assistant²; Scott Fyfe MICA, ICFP, BPst, GradCert Ed, CertIV TAE, BHsc(PA) is a critical care flight paramedic³

Affiliations:
¹Queensland Ambulance Service
²Queensland Health
³Tasmanian Ambulance Service

Abstract

This commentary looks at the introduction of the rural paramedic practitioner – a rural paramedic who has completed advanced medical training in primary health care and is able to provide pre-hospital, hospital and primary health care – into the Australian health care system.

Keywords:
physician assistant, rural health care, paramedic, health workforce innovative

Corresponding author: Greg Reaburn, greg.reaburn@dcs.qld.gov.au
Introduction

Australia’s health system is world class, modern and accessible (1). However, it is also complex, expensive and may be unsustainable (2,3). For example, there are multiple layers of government, complex legislation, multiple funding sources, discrete programs operating in isolation and professional boundaries that seem change-resistant (1). The population is aging and life expectancy is increasing; an aging population has a higher incidence of disability, complex and chronic diseases (4). New medical technology is expensive. More efficient and cost effective models of health care need to be developed (1).

Paramedics contribute to health care, but historically only in the pre-hospital environment (5). In rural Australia, paramedics are increasingly being utilised to provide primary health care (5,6). Physician assistants (PAs) provide medical care in collaboration with a doctor. Combining rural paramedic and PA skills could create innovative clinicians who could deliver rural health care in the pre-hospital, hospital and primary health care environments.

Rural health in Australia

The health care of rural Australians is underserviced, with limited access to specialty care, primary and emergency care. Rural communities also have difficulty recruiting and retaining medical personnel and other health care professionals (7-10). As a result, people living in rural settings have higher rates of illness and disease, more hospitalisation presentations and admissions, poorer health outcomes and a shorter life expectancy (8,9).

Addressing rural health care problems requires new paradigms of thought and distinctly new solutions. While numerous national policies and strategies have been developed, contemporary rural health care models need to be flexible, innovative and should be developed locally to meet the unique needs of rural communities (7-9,11). No single health care model is capable of servicing all the health demands of diverse rural communities. These innovative models must be flexible and account for the specific geographical, social, economic and cultural contexts (7-9).

Proposed solutions suggested by Health Workforce Australia (8) and the Standing Council on Health (12) include:

- Extending the scope of practice of existing workforce
- Developing new categories of generalist practitioners
- Developing health assistants
- Better coordination between existing workers
- Growth in community and home-based care
- Traditional professional demarcations and organisational structures should be challenged and care should be integrated between health sectors.

In response to the needs of rural communities, new prototypes of health care providers are evolving. Often the evolution of these new roles is in response to local needs and due to a lack of existing health services within rural locations. Such initiatives could include the expanded roles of paramedics and inclusion of physician assistants (13-16).

What is a physician assistant?

A physician assistant (PA) is a health care provider who practises medicine under the delegated authority of a supervising doctor (17,18). This collaborative relationship is an essential and defining feature of the PA model (19). The scope of practice of a PA is defined by their supervising doctor and with additional training and skills, evolves over time. It is a medical extension model developed to provide health care to underserviced rural and remote populations (17,20,21).

The PA profession was established in the United States in the late 1960s. It has since been introduced into Canada, the United Kingdom, the Netherlands, India and, most recently, New Zealand and Australia (16). Evidence suggests that PAs provide safe and effective health care and can make significant and cost-effective contributions in rural communities (16,17,20). Physician assistants are not doctors. They practice using the medical model and work collaboratively other health care professionals to deliver holistic health care.

Australian PAs have allied health training and experience; many have a paramedic background. Physician assistant training includes a 3-year medical training program with 1800 hours of clinical placement. The PA develops advanced history taking and physical examination skills, and learns to order and interpret radiologic and pathologic tests and diagnose and treat illness, injury and disease (16,17,20,22). With these advanced diagnostic and therapeutic reasoning skills, PAs are able to independently manage acute and chronic conditions within a delegated scope of practice (23,24).

Paramedics in Australia

Paramedics provide medical care in the pre-hospital environment (25). Paramedicine is an expanding and emerging health profession (26). Paramedic education has shifted from the vocational to the tertiary sector (27) with a Bachelor degree now the entry-level qualification into the paramedic profession (28).

The role of the rural paramedic is also evolving (14,29). Many Australian ambulance services are ‘extending’ the skills of their rural paramedics to include primary health care skills (5,28). The purpose of these advanced skills and knowledge programs is to decrease the over-reliance on the hospital and primary health care systems for sub-acute and after-hours care (5,6,30) and to improve the integration of paramedics into the local communities and local health care systems (5).
Extending paramedic skills from the pre-hospital environment and into hospital and primary health care environments will require a deep and broad knowledge of general medicine (5,28). Current extended care paramedic (ECP) education typically consists of a condensed, in-service, primary health care training program (5). However, some Australian universities are introducing community paramedicine into their Master programs (28). The combined training of a paramedic and a PA could provide rural paramedics with the skills and knowledge to perform medical care in the pre-hospital, hospital and primary health care environments. The advanced diagnostic, therapeutic reasoning and treatment skills of such a clinician could be well suited to rural paramedicine. Rural paramedic practitioner (RPP) would be the proposed job title for such a clinician.

A new model of paramedic service delivery
The addition of PA training to an experienced rural paramedic’s current skill set could produce a robust and versatile clinician. During ambulance down time an RPP could provide delegated and supervised medical care at a rural town’s hospital or primary health care facility. This activity would enable the RPP to become an integral member of the local health workforce. The scope of practice for these activities would be defined by the local medical officer and vary according to the background, experience and competence of the RPP and the unique needs of the rural community.

The RPP should always be available for immediate dispatch to a pre-hospital incident. With advanced primary health care skills, in-hospital experience and expert local knowledge the RPP could make broader treatment decisions in the pre-hospital environment. While attending to their pre-hospital patients the RPP could initiate unique, locally developed, treatment pathways for individual patients (Figure 1). Treatment pathways could include:

1. ‘Treat and leave’: the RPP could be capable of assessing and treating simple uncomplicated conditions within the community. These patients may not require ongoing medical care within a hospital setting. Patient education could also occur at this point.

2. ‘Treat and refer’: the RPP can treat the sub-acute patient in the pre-hospital environment. Appropriate treatment may require pre-hospital initiated radiology, pathology or pharmacology. The RPP could collaboratively facilitate primary health care follow-up, thus reducing the need for hospital presentation. Treat and refer could also solve the common experience of many patients being unable to access sub-acute or after hours care in a rural town.

3. ‘Treat/retrieve and admit’: Treat and retrieve is the traditional role of paramedics. The RPP could initiate pre-hospital treatment and also continue that treatment on arrival at hospital. This may include admitting patients and charting treatment plans. The capacity to do this overnight (24/7) could reduce the afterhours call outs for doctors.

Figure 1. RPP treatment pathways

![Figure 1. RPP treatment pathways](image-url)
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Not all patients assessed by paramedics need to be taken to hospital (31,32). Identifying the correct treatment pathway could save between $451.00 for non-admitted patients, and up to $960.00 for patients that avoid admission (33).

A well trained and supervised RPP could deliver a comprehensive range of medical services within the patient’s home, pre-hospital and hospital/clinic settings. Non-emergency patients could be treated and referred to the patient’s primary health care provider. Emergency patients could be retrieved to the local hospital facility where the RPP could continue care within that setting.

A RPP scope of practice and local work practices would be defined locally and continually evolve, as the RPP gains experience and medical officer trust. Consequently, local service agreements between health and ambulance agencies would need to be established. These agreements should outline administrative, communication and clinical quality control mechanisms. Funding the RPP role would also need to be collaboratively developed.

The pre-hospital workload of a rural paramedic is highly variable. The local health infrastructure is also highly variable. Local flexibility, collaboration and innovation would be required to effectively utilise the full potential of the RPP role. The introduction of an RRP and their full integration into the local health care system could enable changes in health care relationships (Figure 2).

Conclusion

Many rural communities are medically underserviced and experience difficulty recruiting and retaining experienced health care workers. To be sustainable, the future provision of health care in rural areas requires local initiative and innovative models. One such model could be the combined skills of a rural paramedic and a PA – the rural paramedic practitioner.

Rural paramedic practitioners would straddle medical and paramedical health domains. They could be safely and efficiently be deployed into the pre-hospital, hospital and primary health care setting. Enabling this to occur would require considerable flexibility, leadership, cooperation and collaboration between both professions. Local nursing and allied health providers would also need to embrace this role for it to be fully effective.

Figure 2. Changes in local health care relationships
Conflict of interest

The authors declare they have no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

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Inquiry into the establishment of a national registration system for paramedics: A response to New South Wales

Dominique Lee Moritz
University of the Sunshine Coast, Queensland, Australia
Policy

Inquiry into the establishment of a national registration system for paramedics: A response to New South Wales

Dominique Lee Moritz LLB, B Jus, LLM, Grad Dip Legal Pract, Grad Cert High Ed, PhD confirmed candidate and admitted lawyer of the Queensland Supreme Court, is a Lecturer

Affiliation:
1Department of Law, University of the Sunshine Coast, Queensland, Australia

Abstract

Introduction
The potential national registration of paramedics is a significant issue. Despite widespread support of paramedics joining other registered health practitioners under the National Registration and Accreditation Scheme, New South Wales continues to oppose.

Aim
This paper considers the New South Wales submission to the Senate Committee’s inquiry into the establishment of a national registration system for Australian paramedics. It evaluates the reasons for New South Wales Health’s opposition to national registration.

Conclusion
New South Wales Health’s reasons for opposing national paramedic registration include the cost to implement a registration scheme, the desire to maintain vocational entry to employment and the purported efficiency of their current regulatory system. However, their position fails to address the challenges of employer-based regulation and the significant public protection benefit, among other things, of national statutory regulation.

Keywords:
registration; regulation; accreditation; New South Wales; public policy

Corresponding author: Dominique Lee Moritz, dmoritz@usc.edu.au
Introduction

The registration of Australian paramedics is a topical issue. Despite the expertise of paramedics, and their practise on vulnerable patients, they remain an unregistered health discipline. In order to assess the value of establishing a national registration system for paramedics, the Australian Senate commissioned a committee to determine whether paramedic registration, under the National Registration and Accreditation Scheme (the ‘National Scheme’) would improve and ensure patient and community safety. The National Scheme, through the Health Practitioner Regulation National Law Act 2009 (the ‘National Law’), currently regulates 14 other health professions including medical practitioners and nurses (1-3).

The Senate Standing Committee on Legal and Constitutional Affairs sought submissions from interested parties, with particular reference to the following categories:

1. The role and contribution of the paramedic profession
2. Existing comparative frameworks for paramedics, doctors and nurses
3. Comparative duties of paramedics, doctors and nurses
4. Whether national accreditation is appropriate
5. Whether national registration is viable and appropriate to support portability of paramedic qualifications between jurisdictions; and
6. Any other related matters (4).

There was widespread support for establishing national registration for paramedics (5-7). For example, Victoria’s Minister for Health, the Hon Jill Hennessy, pledged support for paramedic inclusion in the National Scheme and stated, ‘Victoria has led the push for the national registration of paramedics’ (8). Of the submissions received, New South Wales Health (NSW Health) exhibited reservations about the public interest and employer interests. This raises a potential conflict of interest between the public interest and employer interests. This article will address NSW Health’s current regulatory framework and challenges to NSW Health’s current regulatory framework that the Senate submission has not acknowledged. The regulatory tools addressed in this article include accreditation of educational standards.

The need for an external accreditation body for educational standards

There is an existing accreditation process within the paramedicine industry to ensure paramedic tertiary training courses are delivering requisite competencies for graduates. Accreditation standards are used to enable educational providers to deliver minimum and consistent levels of competence within an industry. The CAA is the organisation whose members make up the public ambulance employer providers in each state and territory of Australia, as well as New Zealand (11). It is also the organisation responsible for accrediting paramedic training at universities (12).

The accreditation body is significant because the credibility of the authorising body can determine the value of accreditation as a regulatory tool (13). If the paramedic accreditation organisation is not independent from the employer bodies, it may serve specific employers’ needs only and not the industry as a whole. As the CAA is the accrediting body, and is made up of the state ambulance services, it is therefore, in effect, accrediting for employer purposes and perhaps not in the public interest. This raises a potential conflict of interest between the public interest and employer interests. In the NSW Health submission, it acknowledges aligning New South Wales paramedic training with the CAA’s accreditation standards, although it does not require tertiary qualifications (10).
There is another additional issue with the CAA acting as the accreditation authority. The final authority for paramedics to practise still lies with employer bodies (14). As such, the accreditation standards are no more than a recommended guideline of minimum standards for employers. While NSW Ambulance might suggest they comply with the industry accreditation, and only employ paramedics who have completed CAA accredited training, they accept Diploma qualifications as a minimum standard of qualification (15). Further, there is no obligation for private paramedic providers in New South Wales to comply with CAA’s accreditation standards either. With an ever expanding body of private sector providers of paramedic services (16-17), it is no longer appropriate for the public employers to solely govern this area of paramedic regulation. The disparity between minimum qualification and training standards of different employers could create differing standards of skill and expertise among people using the title ‘paramedic’.

New South Wales Health addresses accreditation in a very limited way (10, p3). They seek changes to the National Scheme’s accreditation mechanisms dealing with the qualifications for registered professions before agreeing to inclusion under the National Scheme. More specific guidance on the scope of these changes was not provided, although NSW Health suggest clarity was needed on whether paramedics would be part of a merged, existing board or separate board.

New South Wales Health still actively supports sustaining vocational training as an entry-to-employment qualification. However, tertiary qualifications have been identified as an important way for paramedic graduates to develop critical thinking and problem solving skills, among others (18). By continuing to support vocational entry-pathways, NSW Health does not fall into line with the other jurisdictions of Australia, which require tertiary education as a minimum standard of entry to the discipline. Given some New South Wales paramedics undertake vocational training, rather than tertiary education, NSW Health is concerned their paramedics will not be eligible for registration under the National Scheme (10, p8). It is likely some practising paramedics, in jurisdictions other than New South Wales, would also be concerned about their eligibility for registration if they have undertaken paramedic training under the old vocational model of ‘on-the-job’ training, rather than achieving higher educational qualifications at a tertiary institution.

A grandfathering provision that allows for practising paramedics without tertiary qualifications to be given a period of time to complete a bridging course to upskill may well be drafted into the national regulatory framework (17). A ‘grandfather clause’ is one which exempts people from statutory provisions for conduct which they were engaging in at the time the legislation was passed (19). The accreditation of any such bridging course would then fall to the external accreditation body. A grandfather clause may also allow anyone currently practising as a paramedic to be registered, and remain registered, without the need to obtain a tertiary qualification.

Challenges of jurisdictional regulatory disparity
New South Wales Health administers paramedic regulation at a state level and it argues that it already delivers many of the benefits of a national registration system including, most importantly, that the public is protected (10). However, their approach to paramedic regulation fails to appreciate the broader benefits of a national regulatory framework or the challenges posed by the continuing jurisdictional disparity (17).

Indeed, its senate submission did not acknowledge either the benefits of adopting a national system or the risks of each state and territory governing their paramedics in a different way. When the regulatory mechanisms for governing paramedics in each state and territory differs there is the potential for issues to arise such as differing educational standards, disciplinary practices and continuing professional development requirements. There are additional problems with the current Australian state-based paramedic regulatory framework including that paramedic practice is not just regulated differently between states and territories but between employers.

New South Wales Health has not acknowledged the potential challenges of jurisdictional regulatory disparity in their Senate submission. Regardless of NSW Health’s purported ability to protect the public from harm using their existing regulatory mechanisms, there are still significant issues with paramedic regulation being administered on an employer level that cannot be resolved using the existing regulatory framework. Specific issues are outlined below.

New South Wales Health, in their Senate submission, identify, ‘there is no nationally consistent regulatory standard that governs ongoing fitness for practice, currency or continuing professional development for private or public providers’ (10, p4). They suggest that each employer develop their own regulatory standards for continuing professional development and seem to suggest this to be a barrier to registration. However, the opposite is true. Registration on a national level would ensure the nationally consistent regulatory standards to which NSW Health refers.

The method for dealing with paramedic complaints between jurisdictions is one such concern. New South Wales Health boasts a ‘strong’ and enforceable code of conduct to promote high standards and a rigorous NSW Health Care Complaints Commission for dealing with complaints against paramedics.
It is significant that the Complaints Commission is responsible for investigating complaints against other registered health practitioners as well as paramedics. This provides some support for NSW Health’s assertion that their complaints mechanisms are adequate (20, ss4,7). However, while breaches of the code of conduct can require the paramedic to cease practice or have conditions imposed on practice, (s41A) there is no positive power for any sanctions imposed to be communicated to the paramedic’s employer, meaning employers could be unaware of any conditions of practice applicable to a paramedic.

There is no requirement for the outcome of any investigation or sanctions for paramedic conduct to be communicated to an employer in another jurisdiction if a paramedic moves interstate. Further, employers may have difficulty locating details of a prior complaint or the outcome of an investigation. The same problem exists if paramedics change from the public ambulance system to private practice. National registration ensures all employers, and the public, can access a paramedic’s conditions of practice and whether paramedics have been struck off the register.

Arguably, section 41(2)(d) of the Health Care Complaints Act 1993 (NSW) allows the Complaints Commission to give notification of any complaints decisions to a ‘relevant person or body’, which could include an employer. However, notification is voluntary rather than mandatory. It is relevant to note that national boards are obliged to report ‘health, conduct or performance action’, following an investigation, to registered practitioners’ employers (21, s206).

The New South Wales Code of Conduct is a form of negative licensing. Negative licensing does not restrict entry to the profession but provides avenues to take action against a practitioner who fails to comply with the standards of conduct (13,22). Should a code of conduct be breached, limitations can be applied to a practitioner’s future conduct in the form of suspension or prohibition orders, for example (23,24).

Negative licensing is a tool used for paramedic regulation because the codes of conduct, in participating jurisdictions, impose sanctions on paramedics for contravening the codes (17). Negative licensing has been criticised for being reactive to problems, rather than proactive, meaning behaviour can only be regulated following a negative outcome (13). While New South Wales uses negative licensing as a regulatory tool for paramedic governance, it is not consistently used on a national level. A system of paramedic registration, instead of relying on a negative licensing scheme that varies between jurisdictions, allows enforcement bodies to proactively institute standards for paramedic behaviour.

National registration provides an avenue for NSW Health to maintain their strong regulatory framework. With national registration, paramedics will have an improved capacity to respond to public health threats because of national uniformity, portability of qualifications, better data on registrants, transparency of operations and practice, and enhanced public confidence, among other things (25,26). It is noted that NSW Health does not address portability of qualifications, better data, transparency or enhanced public confidence, other benefits of adopting national registration as a regulatory tool, in their submission (27).

Loss of employer control

New South Wales Health also expresses concern that national registration would mean its loss of industry control. One of their grounds for opposing a national system of registration includes the ‘loss of control of the scope of practice and associated workforce flexibility for employers’ (10, p9). As employers are currently the industry regulator, national registration would mean NSW Health would defer to the national industry regulators to ensure consistency in industry regulation. Although employers would still retain the right to make employment decisions unrelated to their employee’s training, education and discipline. Employers would also still be responsible for dictating paramedic scopes of practice. The other registered health professions underwent similar changes in their professional evolution prior to the National Scheme’s amalgamation of health professional regulation (3).

Costs of paramedic registration

New South Wales Health is concerned the costs of registration will outweigh the minimal additional benefits that would be achieved. It is acknowledged paramedic registration would cause additional costs (17). One of these costs is an annual paramedic registration fee. The paramedics themselves could pay registration or it could be an employer responsibility, although practitioners in other health professional groups pay their own registration fees. It is likely employers would object to the additional costs this would impose on their organisation if responsibility for payment of paramedic registration fees rests with them.

New South Wales Health also identifies a cost to ‘establish the registration scheme’. While there would be a cost to the government to include paramedics in the current National Scheme, such as legislative drafting, parliamentary sitting time and the establishment of an infrastructure to support the additional discipline (17), there is an existing and functioning scheme which could incorporate paramedics. No resources are needed to establish a separate regulatory system.

Finally, the additional benefits of national registration are, by no means, minimal. The purpose of health professional regulation is to reduce the likelihood of risk to the public and to enable ‘trust and confidence in the standing of the profession’ (28,29).
Promoting public safety has also been legislatively acknowledged as an important consideration of the national statutory health professional regulation currently governing Australian registered health practitioners (21 s3A, 30). A national statutory regulation framework would ensure public safety is the most important consideration. With employer regulation, it is more difficult to determine whose interests current regulation is serving.

The exclusion of paramedics in New South Wales from national regulation
New South Wales Health has acknowledged they will reserve the right to participate in national registration. The Australian Government has suggested additional professions can be added to the National Scheme if a majority of the jurisdictions support the addition and regulation would minimise public safety risks (31). If NSW Health maintains its refusal, national paramedic registration can still go ahead. Paramedics in New south Wales could be expressly excluded from the operation of the National Scheme if NSW Health continues to object to their inclusion. National registration would then apply to all Australian paramedics except for those employed within New South Wales.

Excluding only paramedics in New South Wales from health professional regulation is problematic. A number of potential issues arise if NSW Health chooses this path. New South Wales paramedics may not be recognised as ‘professional’ in the same way as registered paramedics might, which has been considered an outcome of obtaining professional status under national health practitioner registration (32-34). Further, moving between Australian jurisdictions may be challenging as they would need to apply for registration for interstate work and there may be no reciprocal acknowledgement of their qualifications and training (16,17). New South Wales tertiary institutions may also suffer as potential applicants may choose to study in a jurisdiction supporting national registration. As a result, paramedics in New South Wales may seek registration to enable a transportability of their qualifications.

Conclusion
The potential national registration of paramedics is a significant issue warranting thorough consideration. Despite the scholarship in support of paramedics joining the National Scheme (16,35), NSW Health continues to express their objection to being part of national paramedic regulation. Their reasoning for the exclusion includes the cost to implement a registration scheme, the desire to maintain vocational entry to employment and the purported efficiency of their current regulatory system. However, NSW Health’s position fails to address the challenges of employer-based regulation and the significant public protection benefit of national statutory regulation. Refusing to take part in national registration will also ostracise paramedics in New South Wales from registered paramedics in other jurisdictions, as they will not have portability of qualifications. Should NSW Health opt out of national regulation, their paramedics, the profession and the public will be disadvantaged.

Conflict of interest
The author declares she has no competing interests. The author of this paper has completed the ICMJE conflict of interest statement.

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Abstracts and poster presentations of the 2016 Paramedics Australasia International Conference
The evaluation of a web based guideline and educational resource ‘Trauma Victoria’

A/Prof Marcus Kennedy¹, Ms Danielle McDonald¹, Ms Fiona Langdren²

¹Adult Retrieval Victoria
²Project Health

Introduction
Trauma Victoria commenced in 2014 to support a sustainable, trauma focused, guideline and education system for clinical staff in Victoria. A formal evaluation report of phase 1 (from inception to April 2016) has been conducted by an independent evaluator to support and inform phase 2.

Methods
A formative evaluation was completed to ascertain the needs for guidelines and education with relation to major trauma. This was used to then create the resources of Trauma Victoria which have recently undergone a summative evaluation. The evaluation framework outlines measures in relation to the following educationally focused objectives: reach, reaction, learning, behaviour and application. The evaluation data was obtained by extensive analysis of website and learning management system (LMS) usage and ratings. Individual feedback was achieved by electronic survey and independent interview discussions of website and LMS users including focus groups.

Results
The website was accessed with over 10,000 users and 55,000 page views. There were 874 individuals using the LMS from 80 health services, with the learning module approval ratings ranging from 8.8-9.1/10. The moderated tutorials participation from 32 health services delivered an average rating of 8.62/10. Respondents indicated improvements in early activation of trauma management protocols and retrieval (59%), increased use of retrieval services (41%), consistent care in line with guidelines (56%), more efficient timely retrieval or transfer (36%), better clinical outcomes (44%).

Conclusion
The formal evaluation process has established that this trauma guideline education resource has had a positive impact on knowledge and confidence of clinicians, an improvement in the access to evidence based information and positive impacts on patient care.
‘Midwifery PALs’: midwifery in paramedicine, interdisciplinary peer-assisted learning

Mr James King1, Ms Catherine Wright1, Ms Maxine Hardinge1, Dr Georgia Clarkson1, Dr Jane Morrow1

1Australian Catholic University, Melbourne

Introduction
Delivery of obstetric content to paramedicine students has historically proven challenging due to lack of expertise on the part of paramedic academics. To overcome this challenge the specialised expertise of midwifery staff and students was engaged to deliver content within an undergraduate paramedicine program. This interaction is enhanced by the use of specialised video resources using a flipped learning approach. This project aimed to draw upon appropriate expertise to facilitate staff-student and student-student interdisciplinary learning. A collateral aim was to consolidate learning for midwifery students through engaging them in the teaching process.

Methods
Content on normal birth was facilitated by midwifery students and abnormal birth by midwifery academics. Strategies used by both groups were enhanced with the use of specially produced video resources made available to students prior to classes. Interventions were evaluated through university satisfaction surveys and quantitative surveys administered to both student cohorts. Asynchronous engagement with video resources was monitored through the learning management system (LMS).

Results
Data obtained from both cohorts indicated high satisfaction. Paramedicine students were grateful to have access to staff with specialised expertise and to work alongside students with advancing ‘step ahead’ knowledge. Midwifery students indicated they felt the opportunity to teach paramedicine students in their chosen field consolidated understanding. Learning analytics indicated high engagement with video resources through the LMS.

Conclusion
The use of video resources as part of a flipped learning approach combined with peer and expert facilitated teaching and learning of obstetric content positively impacted the experience of both cohorts.
How can we improve paramedic confidence when dealing with paediatric patients? A scoping review

Mr James Fowler\(^1\), A/Prof Brett Williams\(^1\)

\(^1\)Department of Community Emergency Health and Paramedic Practice, Monash University

**Introduction**
Paediatric patients comprise a moderate portion of paramedic workload, however, evidence suggests cases involving children can evoke anxiety and discomfort. Such feelings of low self-efficacy have been linked with a reluctance to initiate treatment, and consequently poorer care. It is unknown to what extent these apprehension-producing perceptions are held by paramedics, and what educational strategies can improve them. This study aims to fill this gap by performing a scoping review to examine and map the effectiveness of educational interventions on improving paramedic perceptions of caring for paediatric patients.

**Methods**
Arksey and O’Malley’s scoping methodology was used. CINAHL, AMED, Embase, Medline, and PsychINFO databases were searched, alongside several networks and grey literature services. The search strategy was validated by a subject librarian. Two reviewers independently reviewed retrieved articles against inclusion and exclusion criteria determined in advance.

**Results**
Seventeen articles were included in the review, comprising six conference abstracts, one letter to the editor, and 10 journal articles. These articles were categorised into three themes: identifying educational needs and preferences, novel education programs, and evaluating education delivery methods.

**Conclusions**
The results of this scoping review found that paramedics feel uncomfortable with paediatric patients and desire more paediatric training, particularly simulation and exposure to children. There is insufficient evidence to demonstrate superior effectiveness of any particular training program. While the most effective education delivery method is unclear, it seems web-based learning can be as effective as traditional teaching. Further research is needed to identify and develop the most effective educational intervention to improve paramedic confidence with paediatric patients.
Paramedic transition into academic roles in universities: a demographic and qualification survey of paramedic academics in Australia and New Zealand

Mr Graham Munro¹

¹University of Tasmania

Introduction
To identify the demographic and qualification characteristics of paramedic academics holding teaching and research positions at universities in Australia and New Zealand offering entry-level undergraduate or postgraduate degree programs in paramedicine.

Methods
A 17 item online normative internet survey was used to obtain demographic and qualification characteristics about the target group. The survey was divided into five categories: demographic data, professional qualifications, educational qualifications, learning and teaching experience, and level of academic skills. Data were collected over a 2 month period in 2013 and then collated and reported utilising the capabilities of the Survey Monkey instrument.

Results
Of the estimated 66 eligible participants, 30 responded to the survey, 70% were male, the average age when entering academia was 43 years, and the average age when initially entering paramedicine was 23 years. Two-thirds completed their paramedic training in Australia and New Zealand, with the other third training in the United Kingdom (UK), United States (US) or Canada. There was a wide range of levels of training and qualification reported with three having a PhD on entering academia, while most had little to no experience in research, academic writing, and publication.

Conclusions
Issues of the transference of cultural and professional capital from one community of practice (CoP) into another, the variance in the levels of academic qualifications when entering academia, and the resources needed to mentor and educate a large majority of these new academics pose significant challenges to both these new academics and the universities employing them.
Preparing paramedic preceptors for supervising clinical placements in residential aged care facilities

Dr Peter Lucas¹, Ms Leigh Parker¹, Mr Dale Edwards¹

¹University Of Tasmania

Introduction
Research has identified a gap in the evidence about paramedic preceptors and the role they play in supervising student placements. This paper discusses the experience of preceptors supervising undergraduate paramedic student clinical placements in residential aged care facilities (RACF) in Tasmania and NSW. These placements have previously been identified as providing a range of learning opportunities for students, however, there is a gap in the academic literature regarding the preparation of preceptors to supervise these placements.

Methods
The research adopted qualitative methods involving semi-structured in-depth interviews with preceptors at the completion of the placement program. Data analysis involved preliminary independent coding by members of the research team who then convened to compare results and reach concordance on key themes. These themes were then structured into a narrative description of the preceptors' views on the placement experience.

Results
The preceptors identified a range of factors that enabled them to work effectively in the role, as well as areas where their preparation could be improved. These factors included the documentation provided prior to the placements, the amount of lead in time preceptors had to prepare prior to the placements and understanding what was expected of them in their role and what were the anticipated learning outcomes for students during the placement experience.

Conclusions
Structured clinical placements in RACFs play an important role in developing students' knowledge and understanding of the elderly and RACFs. Appropriate preparation of preceptors is critical in order to maximise students' learning opportunities.
Can incorporating 360 degree video and virtual reality technology enhance the learning experience of paramedic students in distance education

Mr Darryl Clare¹, Mr Shane Rae¹, Miss Sally Clarke¹

¹Central Queensland University

Introduction
The field of paramedic education is a constantly evolving area. With an increased demand and widening scope of practice, paramedic pedagogy requires the same adaptive qualities. Advances in technology have created new opportunities to make student learning experiences more engaging, in particular the emergence of Virtual Reality applications incorporating 360 degree video recording.

As recent research has shown, 81% of student found adaptive learning technologies were most effective in aiding study with an overall 85% indicating a moderate to major improvement in grades. As paramedic practice is based centrally around patient care, applications in Virtual Reality allow for early and constant exposure to scene management, patient care and interventions fundamentally changing the way paramedic education is delivered.

Discussion
This presentation will demonstrate how Virtual Reality applications incorporating 360 degree video recording have been used to create interactive environments enabling self-directed learning within the distance education sector. It will also demonstrate how in the traditional learning environment 360 degree video recording can be used as a tool for students and staff to critically evaluate performance in scenario situations.

Conclusion
The initial results of student feedback conducted through surveys show incorporating 360 degree video and virtual reality technology assists as both an effective and engaging learning tool and also as a useful adjunct to help critically evaluate scenario performance.
Melbourne to London: the challenges, changes and opportunities of a professional transition across the globe

Mr Julian Hannah¹

¹London Ambulance Service

Introduction
Travelling across the globe to begin your paramedic career is both challenging and rewarding. This perspective piece will discuss the 2 year journey of an Australian graduate paramedic as he transitioned to a fully qualified paramedic with the London Ambulance Service.

In 2015/2016 ambulance services within the United Kingdom (UK) ran mass recruitment drives in response to a national paramedic shortage. Paramedics were recruited as new graduates, others as fully qualified paramedics from a range of international settings including Australia and New Zealand.

Discussion
The experience of transitioning to paramedic practice in the UK was classified into three themes. 1. Professionalisation and registration – experiences in the UK can inform Australian and New Zealand paramedics and services as they navigate towards registration. 2. Clinical autonomy and development – the London model and clinical practice guidelines are very different to that in Australia. 3. Interplay between personal and professional life – living in a different cultural setting and the effect on work-life balance.

Each of these themes will be discussed in relation to the challenges faced as well as the opportunities for future change within the Australasian setting.

Conclusion
There are numerous differences between international paramedic services and practice. There is significant opportunity for positive change alongside the globalisation of paramedic practice as it develops a unique professional identity. However, the challenges of this progression may also be significant, and it is important to understand the transitional experiences of paramedics. This perspective piece begins this process by exploring the personal experiences of one individual.
Response to terrorism: a Churchill Fellowship report

Mr Matthew Pepper

1NSW Ambulance,
2Monash University Accident Research Centre

Introduction
Australia faces an unprecedented threat level from terror attacks. A growing number of attacks ranging from lone actors with knives to complex attacks on military and law enforcement bases have been thwarted by Australian authorities. Australian ambulance services have an obligation to the public to plan and train for the health consequences of these events, and current preparedness is inadequate.

Background
The pre-hospital response to intentional mass violence has intrinsic difficulties that no other incident provides. Active, dynamic and evolving threats require enhanced risk mitigation strategies and situational awareness, and specific skillsets are required to provide interventions to minimise preventable deaths. The lessons from battlefield medicine guide this process once adapted to the nuances of the civilian pre-hospital environment. Internationally, these concepts have been used in various models to provide a robust response capability.

Discussion
This paper is a Churchill Fellowship report on response to high threat incidents. Findings on international best practice from pre-hospital providers in the United States, Canada and United Kingdom guide the recommendations for training and capability to build Australian resilience and streamline clinical care in high risk incidents.

Conclusion
Australia currently faces a capability gap in the ability to respond effectively to terror attacks, and enhanced training, equipment and capability will save lives and ensure that the burden of death and injury is minimised in future terrorism events.
Dying for adventure: how do New Zealand outdoor instructors manage death of adventure activities participants?

Dr Malin Zachau

Introduction
• During 2011-2015 on average 8 deaths occurred annually in the outdoor instructor (OI) and adventure client group combined. The care of the dying patient and the psychological impact on the OI, surviving group members and relatives need to be addressed.
• Unless death is instant, the OI may need to manage the dying patient as well as other clients.
• First aid training is focused on saving life, not managing death. Generally only emergency service or healthcare professionals are trained in this.

Discussion
• We must realise and adjust training to the fact that OIs are laypersons, not healthcare providers. Not only is there some emotional attachment to their deceased client or colleague, they likely will never have seen a dead body, less alone one involved in a fatal mechanism of injury.
• Outdoor instructors have dual professional responsibility, for the deceased and for the physical and emotional wellbeing of the group survivors, a task onerous when distressed oneself.
• By training OIs in death management they will be better prepared to manage situations where they may be powerless to manage pain due to unavailable analgesia, feel more comfortable with being unable to distinguish between survivable and non survivable injuries and have some idea what to say in agonal conversations.
• Investigations and coroners’ inquests may be perceived as punitive, compounding any self imposed feeling of blame. Appropriate psychological support is crucial.

Conclusion
• Death should be planned for in all OI first aid training.
• A death management module will help the dying and the living.
Endotracheal intubation of burns patients with suspected inhalation injury in Victoria, Australia

Ms Kylie Dyson1,2, Mr Paul Baker3, Dr Marcus Kennedy2, A/Prof Karen Smith1,2,4, Ms Heather Cleland1,3, A/Prof Belinda Gabbe1,5

1Monash University
2Ambulance Victoria
3Alfred Hospital
4University of Western Australia
5Swansea University

Introduction
We aimed to describe burns patients who had endotracheal intubation (ETI) attempted and identify factors associated with potentially avoidable ETI.

Methods
We retrospectively extracted records from the Victorian Adult Burn Service (age >15 years) and Ambulance Victoria patient care records for patients with burns where ETI was attempted within 24 hours of medical contact (1-July-2009 to 31-June-2015). Using univariate analysis, we identified factors associated with 1) inhalation injury on bronchoscopy, and 2) extubation within 24 hours.

Results
During the 6 year study period ETI was attempted in 110 burns patients. Intubation was unsuccessful in one patient. Most patients were male (78%) and had ≤20% total body surface area burns (75%). The majority of ETIs occurred before arrival at the burn centre (81%); in non-burn centre emergency departments (48%) or by paramedics in the field (33%). Most patients were Glasgow Coma Scale (GCS) 15 (85%) and ETI was facilitated by rapid sequence induction (89%). A higher proportion of patients intubated by paramedics had inhalation injury confirmed on bronchoscopy (52%), compared to patients intubated in the burn centre (26%) and non-burn centres (10%, p=0.012). Median time to extubation was 21 hours and there was no difference in the proportion extubated in <24-hours. The median temperature of patients intubated in the field (35.4°C) was lower than burn centre intubations (36.1°C, p=0.026). Where the documented reason for ETI was to facilitate transfer, most patients did not meet burn centre referral criteria (67%).

Conclusions
Endotracheal intubation of burns patients is uncommon. The presence of inhalation injury varied but was highest in patients intubated by paramedics.
Exploring New Zealand paramedic attitudes towards advance directives: Rural perspectives

Mr Paul Davey¹, Ms Amanda Lees¹, Mr Harry Misselbrook¹, Dr Rosemary Godbold²

¹Auckland University of Technology
²University of Hertfordshire

Introduction
The pre-hospital environment adds complexity to the existing challenges associated with applying advance directives in health care practice. The rural setting contributes further layers to the decision-making process in general and to advance directive decisions specifically. Rural paramedics may be well known within their community but may have to make clinical decisions in isolation, with poor access to peer review and collegial support, thus compounding ethical tensions associated with advance directives. This research aims to highlight and explore ethically complex advance directive decisions made by paramedics practising in the New Zealand rural sector.

Methods
This qualitative, interpretative study explored the attitudes of twenty one rural based ambulance staff of various practicing levels towards an ethically challenging out of hospital cardiac arrest scenario involving the presentation of an advance directive by a family member, following the initiation of cardiopulmonary resuscitation (CPR) by attending paramedics. The Values Exchange, a web-based educational technology, provided an ethical decision-making framework for participants to consider the scenario. Their responses were thematically analysed.

Results
Participants’ responses reflected three main themes, irrespective of their decisions to continue or cease CPR, namely a deontological approach to practice; legal and moral tensions; and, conflict between emotions and paramedic objectivity.

Conclusions
Ethical deliberation contributes to practitioners’ critical thinking skills and helps prepare them for decision-making under uncertainty. Rural perspectives make an important contribution to wider paramedic research and their voice provides the foundation for further research that can inform ongoing clinical education in relation to end-of-life decision-making.
Does a New Zealand early warning score contribute more to the pre-hospital assessment of patient acuity than ambulance status codes?

A/Prof Andy Swain¹ ²

¹Auckland University of Technology
²University of Otago

Introduction
There is no accepted prehospital early warning score (EWS) to identify patients at risk of deterioration in New Zealand. Currently paramedics make a subjective assessment of the severity of illness or injury and allocate a status code (1 to 4). It is not known if an EWS would more accurately reflect acuity.

Methods
A pre-hospital EWS (nzPHEWS) based on an established in-hospital EWS (nzEWS) was applied retrospectively to 200 ambulance reports for consecutive patients in each status level admitted to the emergency department. The inclusion criterion was documentation of all components of nzPHEWS on ambulance report forms.

The first full set of vital signs and initial status code were used. nzPHEWS was compared with status code for patients admitted to hospital, admitted to the Intensive Care Unit (ICU), who suffered cardiac arrest, or who died within 24 hours. ROC graphs were plotted and the area under the curve (AUC) was calculated.

Results
For admitted patients, the AUC increased from 59.6% for nzPHEWS alone, to 65.2% for status alone, and 66.9% for both combined. The ROC analysis was of poor utility for more extreme outcomes (ICU admission, arrested or died) because of smaller number of events.

Conclusion
The nzPHEWS score appears to offer no advantage over the clinical ‘gestalt’ of initial status level assessment. A combination of status code and nzPHEWS offered no significant benefit. Bigger studies using computerised records are recommended for a larger pool of patients and more extreme outcomes.
Fluid resuscitation for trauma patients: Does evidence support pre-hospital paramedic interventions?

Mr Anthony McErvale

University of The Sunshine Coast

Introduction
Trauma is a significant cause of death and disability. Major haemorrhage is associated with significant mortality. Strategies to reduce mortality focus on reducing blood loss and increasing perfusion by restoring intravascular fluid volume. However, resuscitation fluids are associated with haemostatic disturbances. Consequently, complex pathologies result from the traumatic injury and fluid resuscitation. This report describes the evidence base for hypovolemic resuscitation with an emphasis on prehospital settings and paramedic practice.

Methods
Searches were performed of CINAHL, Scopus, PubMed and the Cochrane library. Search terms were: fluid resuscitation AND trauma AND pre-hospital, crystalloids VS colloids fluids, hypovolemic shock AND trauma. Date was limited to 2006-2016. The search yielded over 2000 abstracts and citations. Fourteen articles were selected based on relevance. A bias toward “pre-hospital resuscitation” was maintained.

Results
Blood products are the preferred hospital resuscitation practice although this present logistical challenges for broader pre-hospital use. Although studies of traumatic brain injury have investigated resuscitation with hypertonic fluid, there is no evidence of benefit for hypertonic fluid to correct hypotension in the presence of TBI. In other injuries involving uncontrolled haemorrhage, permissive hypotension reduces the incidence of coagulopathy and hypothermia. Thus early small volume isotonic fluid administration is a recommended strategy.

Conclusion
Beyond surgical intervention there is no single panacea to treat hypovolemic shock thus present management strategies vary significantly. Moreover, consensus is divided on whether fluid resuscitation, in civilian trauma, should occur pre-hospital. More data is required to reduce variations in initial hypovolemic resuscitation management.
Is there a place for portable ultrasounds in the pre-hospital environment as a diagnostic tool?

Miss Ngozi Anyadike-Danes

1Auckland University of Technology

Introduction
Portable ultrasound is widely used in hospitals to identify a number of medical conditions and assist with performing procedures. Portable ultrasound machines have started appearing in ambulances in certain parts of Europe and the United States as a diagnostic tool that can identify certain medical conditions (for example, pulmonary emboli). This paper reviews the evidence for the usefulness of a portable ultrasound equipment in a pre-hospital setting.

Methods
A literature search of online databases (including PubMed, Science Direct) was performed using key terms (monitoring, prehospital, ultrasound) which returned 904 articles. After reviewing titles and abstracts, 22 articles met the inclusion criteria.

Results
One of the key findings was the use of ultrasound for diagnosing abdominal trauma using focused abdominal sonography for trauma (FAST) which has become incorporated into some advanced trauma life support guidelines. In Germany, Italy and some parts of America, FAST is used by ambulance personnel to determine cardiac activity and to identify, for example, cardiac tamponade. One study found that the FAST exam could be completed in less than three minutes with 99% specificity compared to the diagnosis made in a hospital. Another study examined the use of ultrasound during management of cardiac arrest which was able to improve survival to the hospital by detecting cardiac activity and differentiating between different rhythms.

Conclusions
Portable ultrasound could be a useful diagnostic tool in the pre-hospital setting because it can assist with differentiating between conditions that present with similar symptoms and allowing for more targeted and appropriate treatment.
Impact of hand dominance on quality of external chest compressions in a simulated setting

Mr Joel Arndell¹, Mr Jamie Cross¹, Mr Tommy Lam¹, Mr John Quach¹, Mr Buck Reed¹, Dr Liz Thyer¹, Dr Paul Simpson¹

¹Western Sydney University

Introduction
Current guidelines recommend placement of the dominant hand on the chest when performing external chest compressions (ECC), however a paucity of evidence exists to support this position. The aims of this pilot study were to 1) investigate impact of hand dominance on quality of chest compressions in simulated cardiac arrest; and 2) inform sample size calculations for an adequately powered future study.

Methods
A prospective randomised crossover trial was performed, in which student paramedics performed ECC on a manikin. Each student performed two three-minute periods of ECC, randomised to either their dominant or non-dominant hand for the first period, and the alternative hand in the second period, with a recovery period in between. Participants and researchers were blinded to sequence allocation, and participants to the study objective. The primary outcome was ‘CPR score’ (CS) (%). Wilcoxon’s rank sum test was used to determine a difference in mean CS, and multivariate linear regression to provide adjusted results.

Results
Seventy-five student paramedics participated in the study. There was no difference in mean CS (69.9% dominant hand versus 69.1% non-dominant; p=0.92). Secondary outcomes of flow fraction, compression rate and correct hand position were similarly not impacted, though compression release was improved with dominant hand (53% v 42%; p=0.02).

Conclusion
Dominant hand placement on the chest did not result in a clinically significant difference in quality of ECC. Based on these pilot data 16,913 participants would be required to conduct a clinical trial powered to detect a difference in CS of 0.8%.
Investigating paramedic student professional identity

Miss Hannah Stack¹, Miss Siobhan Graham¹, Mrs Tania Johnston¹

¹Charles Sturt University

Introduction
Little research has been conducted on the topic of paramedic identity; an identified weakness for a discipline on the brink of professionalisation (O’Meara, 2011). The purpose of this study was to investigate levels of paramedic student professional identity (PI). It also aimed to explore factors that may contribute to PI development in first year students.

Methods
This was a cross-sectional study using a self-reporting survey administered to a convenience sample of first year paramedic students at the Charles Sturt University Port Macquarie campus during the first and final week of session one, 2016. Via Survey Monkey, students completed two surveys that included the 9-item Macleod Clark Professional Identity Scale (MPIS-9) using a five-point Likert scale for responses (Worthington, Salamonson, Weaver, & Cleary, 2013).

Results
Of the 55 students eligible, n=51 participated in survey one (93% response rate), with n=46 of 53 in survey two (87% response rate). While overall students reported positively on the MPIS-9, there was a significant increase in those who indicated that they felt more affiliated with the paramedic profession after one session at university. The majority of students agreed that wearing a uniform, attending a community placement, participating in simulations, as well as interacting with lecturers and working paramedics made them feel part of the profession.

Conclusion
Results for this study indicate that paramedic student PI can increase during their first session of university. These findings can be utilised by educators and discipline leaders to further enhance PI levels amongst paramedic students and future graduates.
The impact of a mass media campaign to improve ambulance use for chest pain

Mr Ziad Nehme¹², Prof Peter Cameron², Dr Muhammad Akram³, Mr Harry Patsamanis⁴, Dr Janet Bray², Prof Ian Meredith⁵, A/Prof Karen Smith¹²⁶

¹Ambulance Victoria  
²Monash University  
³Federation University  
⁴Heart Foundation  
⁵Monash Medical Centre  
⁶University of Western Australia

Introduction
Although mass media campaigns have been used to educate the community on the appropriate response to acute myocardial infarction (AMI) symptoms, previous studies have been unable to determine their value for increasing ambulance use. We sought to evaluate the impact of a 5 year mass media intervention on ambulance utilisation for non-traumatic chest pain in Melbourne, Australia.

Methods
Between January 2008 and December 2013, 253,428 emergency ambulance attendances for non-traumatic chest pain identified during the emergency call were included. Time series analysis adjusted for the underlying trend and seasonal effects were used to assess the impact of mass media intervention on monthly ambulance attendances for chest pain.

Results
The median monthly attendances for chest pain were 3609 (IQR: 3011, 3891), but were higher in campaign months compared to non-campaign months (3234 vs. 3880, p<0.001). After adjustments, campaign activity was associated with a 10.7% (IRR 1.11, 95% CI: 1.07, 1.15; p<0.001) increase in ambulance use during campaign activity or 15.4% (IRR 1.15, 95% CI: 1.10, 1.21; p<0.001) with the addition of two month lag periods. Clinical presentations for suspected acute coronary syndromes, as determined by paramedics, increased by 11.3% (IRR 1.11, 95% CI: 1.07, 1.16; p<0.001) during campaign activity. When compared to campaign periods <14 days, campaign periods lasting ≥14 days were associated with a higher cumulative incidence in ambulance use (IRR, 1.13 vs. 1.21; p=0.03).

Conclusion
A public awareness campaign targeting the community’s response to AMI symptoms was associated with a significant increase in EMS utilisation for chest pain and clinical presentations for suspected acute coronary syndromes.
Forecasting pre-hospital emergency medical service demand for diabetic emergencies using time series modelling

Ms Melanie Villani1,2, A/Prof Arul Earnest2, A/Prof Barbora de Courten2,3, Dr Natalie Nanayakkara2,3, Prof Sophia Zoungas2,3,4

1Ambulance Victoria
2Monash University
3Monash Health
4The George Institute for Global Health

Introduction
Acute diabetic emergencies are often managed by pre-hospital emergency medical services (EMS). The projected growth in prevalence of diabetes is likely to result in rising demand for these services, therefore efficient resource allocation will have increasing importance. The aims of this study were to quantify temporal trends in utilisation of prehospital EMS for diabetic emergencies and to generate a time series model to forecast future demand.

Methods
A longitudinal time series analysis on monthly case rates was conducted using data from the Ambulance Victoria data warehouse between 2009 and 2015. All cases of hypoglycaemia and hyperglycaemia were included. Using the autoregressive integrated moving average (ARIMA) modelling process, we evaluated different formulations of the auto regressive, moving average and differencing terms. The data was separated into training (2009-2014) and validation (2015) sets. The most parsimonious model with the lowest mean average percentage error (MAPE) was selected.

Results
The mean monthly case count steadily increased throughout the study period, from 487±52 in 2009 to 551±47 in 2015. The modelling process found that the ARIMA with differencing and a moving average order of 1 model provided the best fit and generated a MAPE of 5.5%, demonstrating a good fit between observed and predicted monthly values.

Conclusions
ARIMA time series models are a valuable tool to allow forecasting of future monthly cases of diabetic emergencies with very good accuracy. The model generated by this study may be used by service providers to allow appropriate planning and resource allocation of pre-hospital EMS for diabetic emergencies.
Shades of grey: self-reported ethical issues in the everyday practice of New Zealand paramedics

Ms Amanda Lees¹, Mr Paul Davey¹, Dr Rosemary Godbold²

¹Auckland University of Technology  
²University of Hertfordshire

Introduction
The complexity of the pre-hospital environment means that paramedics are likely to frequently face ethical decisions, yet little is formally known about the types of ethical issues faced by paramedics in New Zealand (NZ) nor the strategies they utilise for resolution. This research aims to identify and analyse paramedics’ self-reported accounts of practice-based ethical issues, providing a foundation for a wider study that will inform specific ethics education resources for the NZ paramedic profession.

Methods
During the period 2012 to 2016 participants in three NZ based qualitative studies, focusing on ethical decision-making, were asked: What do you see as the main ethical issues encountered in your work as a paramedic in the pre-hospital care environment? Content analysis identified the issues most frequently experienced.

Results
Analysis of the responses from 64 paramedics, representing all practising levels and drawn from the metropolitan Auckland area as well several rural localities, gave rise to six main areas of identified ethical issues. These related to: consent, resuscitation, stakeholder differences, bystander pressures, what counts as evidence and perceived gaps in paramedic education.

Conclusions
The findings show that paramedics feel unsettled by the ‘greyness’ of ethical issues and are looking for greater guidance. Ongoing research aims to inform professional paramedic ethics education. With a greater awareness of the ethical complexity within their practice, ambulance crews may have more confidence to resolve ethical issues satisfactorily, thus potentially increasing resilience in the paramedic workforce and improving outcomes for patients and their families.
The knowledge, attitudes and preparedness to manage intimate partner violence patients of Australian paramedics and paramedic students

Mr Simon Sawyer¹, A/Prof Jan Coles¹, Dr Angela Williams², A/Prof Brett Williams¹

¹Monash University
²Victorian Institute of Forensic Medicine

Introduction
Australian paramedics have a key role to play in preventing and reducing violence towards women, particularly the recognition and referral of intimate partner violence (IPV) patients. Paramedics frequently encounter IPV patients yet rarely receive training and therefore their response is largely directed by their individual knowledge, attitudes, and preparedness, which are currently unknown. This study provides the first reported data on the knowledge, attitudes and preparedness to manage IPV patients of paramedics and paramedic students, which can inform the development of educational packages.

Methods
Survey of a cohort of paramedics and paramedic students from two Australian universities using the Modified PREMIS, a previously validated instrument.

Results
We received 260 paramedic student surveys (80.5% response rate) and 28 currently practising paramedic surveys (16.5%). Results show that knowledge and preparedness to manage IPV patients was low. Previous training was associated with significantly increased perceived knowledge (p<.05) and preparedness (p<.01), but not actual knowledge (p>.05), in student populations. Participants reported low self-efficacy, confidence and preparedness to manage IPV patients, and demonstrated mostly neutral attitudes towards women and patients which should be considered insufficient.

Conclusions
Most paramedics reported encountering IPV patients in their professional role, therefore both paramedics and students would benefit from IPV education which improves knowledge and preparedness to recognise and refer IPV patients, and modifies inappropriate or insufficient attitudes. Failure to address these deficiencies may result in unprepared practitioners whose actions may negatively affect IPV patients, while increased education may provide significant benefits to patients.
Exploration into how paramedics manage mental health related presentations: challenges and changes in pre-hospital care

Ms Kate Emond¹, Prof Peter O’Meara¹, Dr Melanie Bish¹, Prof Dan Lubman², Dr Belinda Lloyd², Dr Michael Savic²

¹La Trobe University
²Turning Point

Summary
Paramedics account for the majority of the workforce providing emergency care in the pre-hospital setting in Australia. Despite approximately 20% of their workload comprising of mental health related presentations, there is a paucity of research focusing on the preparedness, and clinical decision-making of paramedics to manage these presentations. This nationwide study will present findings on how paramedics make clinical decisions, and what guides their practice when attending to mental health related presentations. Paramedics (n=2000) were asked to complete an online questionnaire, and were invited to participate in an in-depth interview (n=60). Likert scale items from the questionnaire generated descriptive statistics, and a thematic analysis was applied to the interviews. Key themes emerging from the data have revealed that although paramedics feel moderately prepared and confident in managing mental health related presentations, there is inadequate training and education to guide their decision making process, and decision making is largely based on experiences. Despite identifying that organisations had clinical practice guidelines related to mental health presentations, these were not always found to be useful in the decision making process. Paramedics generally identified their role specifically in managing mental health presentations as being that of transport; identifying a need to focus research on clinical practice, and education relating to mental health presentations. To support paramedics, research needs to address the changing role of paramedicine and the challenges they face when managing mental health related presentations.
**Closet fatigue – the hidden layer of burnout in paramedicine**

Dr Georgia Clarkson¹

¹Australian Catholic University

**Introduction**
Paramedicine currently faces the challenge of developing workforces that reflect the communities they support. Workplace cultures which do not support the inclusion of minority groups present barriers to such goals. This study aimed to explore the workplace experiences of Gay and Lesbian paramedics from a non-heteronormative perspective.

**Methods**
Using a qualitative approach informed by a bricolage of critical theory and hermeneutic phenomenology, the experiences of inclusion and marginalisation of participants was explored. Experiences of the accounts of a hidden population of 10 Gay and Lesbian paramedic participants provide the first known account of the culture of the paramedic workplace in Australia from a non-heteronormative perspective.

**Results**
Findings indicate that participants were marginalised within their places of work. The practices that marginalised them had a detrimental impact on the paramedics themselves. These practices were also detrimental to their colleagues, paramedic organisations and the communities they support. The heteronormative nature of the culture of the paramedic workplace was not found to be supportive of Lesbian paramedics, and even less so of Gay paramedics. This resulted in subtle pressure to work in less favourable ghetto areas and, more distinctly, negative experiences in rural areas. Paramedic organisations that participants worked for failed to capitalise on the attributes of these employees for the benefit of the community.

**Conclusion**
Heteronormative cultural practices can marginalise non-heterosexual paramedics. This adds an additional layer of psychological burden which can increase the likelihood of burnout. Workplace initiatives that promote inclusivity can reduce this burden of this ‘closet fatigue’.
9/11 medics fifteen years on: Recounting the long-term physical and mental health impacts

Dr Erin Smith¹, Prof Frederick Burkle Jr², Prof Julie Ann Pooley¹

¹Edith Cowan University
²Harvard University

Introduction
One of the painful legacies of 9/11 is the lasting impact on the physical and mental health of thousands of individuals who survived the attacks - including the first responders. The upcoming fifteenth anniversary will mark an important milestone in our collective remembrance of 9/11. First responders and their families will reflect on the unique impacts experienced by this group. Previous research has largely focused on 9/11 firefighters and police officers. This research explores the ongoing consequences on paramedics at the fifteen-year anniversary, a critical data-gathering milestone.

Methods
This research employed qualitative methods to compile and review 42 first-person accounts from 9/11 medics who recounted their experiences of 9/11 on the fifteen-year anniversary.

Results
Medics reported ongoing mental health impacts including post-traumatic stress disorder, anxiety, depression, problems sleeping, negative impacts on relationships, addictive behaviours, and suicidal thoughts. They experienced a range of health issues such as respiratory disorders, eye problems and cancers. Medics reported having access to a range of peer-support services, but most delayed in seeking help. Of note, medics identified considerable negative follow-on consequences for their families and highlighted that partners, spouses and children of medics should have access to the same support services as the responders.

Conclusions
These findings suggest that 9/11 medics need ongoing monitoring to protect their physical and mental health. The testimony of this research is to ensure that an important voice is not lost, and that the deeply personal and richly descriptive experiences of the 9/11 medics are not forgotten.
Factors influencing the timeliness of emergency medical service response to time critical emergencies: an observational study

Mr Ziad Nehme1,2, Ms Emily Andrew1,2, A/Prof Karen Smith1,2,3

1Ambulance Victoria
2Monash University
3University of Western Australia

Introduction
While emergency medical service (EMS) response times (ERT) remain a leading measure of system performance in many developed countries, relatively few studies have explored the factors associated with meeting benchmark performance for potentially time critical incidents. The purpose of this study was to identify system-level and patient-level factors associated with ERT, which are readily available at the time of ambulance dispatch.

Methods
Between July 2009 and June 2014, we included data from 1,000,458 EMS responses to time critical “lights and sirens” incidents in Melbourne, Australia. The primary outcome measure was ERT, defined as the time from emergency call to the arrival of the first EMS team on scene. Quantile regression models were used to identify system-level and patient-level factors associated with 10-percentile intervals of ERT.

Results
The median ERT was 10.6 minutes (IQR: 8.1-14.0), increasing from 9.6 minutes (IQR: 7.6-12.5) in 2009/10 to 11.0 minutes (IQR: 8.4-14.7) in 2013/14 (p<0.001). System-level factors independently associated with the 90th percentile ERT were distance to scene, activation time, turnout time, case upgrade, hour of day, day of week, workload in the previous hour, ambulance skill set, priority zero case (e.g. suspected cardiac or respiratory arrest), and average hospital delay time in the previous hour. Patient-level factors such as age, gender, chief medical complaint, and severity of complaint were also significantly associated with ERT.

Conclusions
System-level and patient-level factors available at the time of ambulance dispatch are useful predictors of ERT performance, which could be used to improve the timeliness of EMS response.
Integration of low acuity pathways into paramedic practice: a NSW Ambulance perspective

Mr Matthew Simpson1,2, Dr Paul Simpson3

1NSW Ambulance
2Health Education and Training Institute NSW
3Western Sydney University

Introduction
Low acuity patient presentations are an important issue for many ambulance services. Increasing rates of low acuity presentations are reported to impact delivery of clinical services by ambulance services and emergency departments. This presentation will describe Low Acuity Pathway (LAP) utilisation in NSW Ambulance after the integration into paramedic clinical practice. Establish the proportion and frequency of non-transports after patient contact with NSW Ambulance paramedic clinicians. Compare non-transport proportions and frequency between LAP trained paramedics and extended care paramedics specialists.

Methods
A retrospective cohort study analysing routinely collected clinical data documented by NSW Ambulance paramedics was undertaken. Patient participants had an emergency or urgent (priority 1 or 2) ambulance response between March 1, 2011 and February 29, 2012; were aged >16 years; and had a recognised LAP recorded in the protocol section of their paramedic clinical record.

Results
Of the 568,927 cases analysed, 16.8% (97,509) resulted in a non-transport disposition after assessment by paramedics. Patient presentations with a LAP condition accounted for 19% (108,163) of total workload. The non-transport disposition of ‘P5 recommended non-transport’ was reported at <1% (n=3,239) of total workload. Paramedic Specialists Extended Care non-transported 46 patients for every one patient non-transported under LAP.

Conclusion
The integration of a metropolitan trialled LAP model of care into a rural context achieved similar outcomes. The integration of LAP care models has yet to achieve the forecasted presentation rates. Further research is required to identify barriers and enablers in the delivery of paramedic initiated LAP and non-transport of patients.
Pre-hospital emergency medical service utilisation for hyperglycaemia

Ms Melanie Villani, Dr Natalie Nanayakkara, Mr Sanjeeva Ranasinha, A/Prof Arul Earnest, A/Prof Karen Smith, Dr Georgia Soldatos, Prof Helena Teede, Prof Sophia Zoungas

1Monash University
2Ambulance Victoria
3Monash Health
4University of Western Australia
5The George Institute of Global Health

Introduction
Given the morbidity and mortality associated with acute hyperglycaemia, and the significant health and financial burden of diabetes, data on pre-hospital emergency medical service (EMS) use for hyperglycaemia is required to inform interventions and measure improvements. This study aims to investigate utilisation and patterns of demand for pre-hospital EMS for cases of hyperglycaemia, including patient characteristics and factors related to hospital transport.

Methods
A state-wide, community-based observational study of all patients requiring prehospital EMS for hyperglycaemia during the 7 year study period (2009-2015) using data from the Ambulance Victoria data warehouse was conducted. Data on patient demographics, paramedic treatment and transport outcomes were obtained. Logistic regression was used to assess factors associated with hospital transport.

Results
There were 11,417 cases of hyperglycaemia attended by pre-hospital EMS during the study period, accounting for 0.3–0.4% of the total annual EMS caseload. There was a 1.7 fold increase in annual caseload between 2009 (n=1316) and 2015 (n=2325). 50% of individuals had type 2 diabetes, 37% had type 1 diabetes and 8% had no recorded diabetes history. The transport rate was 90.6%, with age <30 years, case time 0600 - <1800 hours, cases in rural locations or from GP/community clinics, concurrent infection and increasing number of comorbidities associated with increased odds of transport.

Conclusion
There is substantial utilisation of pre-hospital EMS for hyperglycaemia. With increased projection of population prevalence of diabetes, further research on opportunities for prevention, as well as optimal management in the pre-hospital environment is warranted.
Paramedic exposure to endotracheal intubation is associated with successful placement

Ms Kylie Dyson1,2, Dr Janet Bray1,4,5, A/Prof Karen Smith1,2,3, Prof Stephen Bernard1,2,4, Dr Lahn Straney1, Dr Resmi Nair2, Prof Judith Finn1,3,5

1Monash University
2Ambulance Victoria
3University of Western Australia
4Alfred Hospital
5Curtin University

Introduction
Paramedic exposure to endotracheal intubation (ETI) may be an important factor in skill performance and quality of care. Our objective was to describe annual paramedic exposure to ETI and examine the association between previous exposure and successful placement. In a sub-cohort of out-of-hospital cardiac arrest (OHCA) cases, we aimed to measure the association between paramedic exposure to ETI and patient survival.

Methods
We searched Ambulance Victoria electronic patient care records and the Victorian Ambulance Cardiac Arrest Registry for ETIs performed by paramedics from 1-January-2008 to 26-September-2014. We measured the number of cases each paramedic attempted ETI and their exposure in the 3 years preceding each case. Using logistic regression we measured the association between paramedic ETI exposure in the previous 3 years and 1) successful placement; and in a sub-cohort of OHCA cases (adjusting for predictors of survival), 2) patient survival.

Results
During the 6.7-year study period 769 paramedics attempted ETI in 14,857 patients. Paramedics typically performed 3 (IQR:1-6) ETIs/year. The majority of ETIs were successful (95%), including 80% on the first attempt. Previous paramedic exposure to ETI was associated with successful placement (OR:1.04, 95%CI:1.03-1.05) and first-pass success (OR:1.02, 95%CI:1.01-1.03). The majority of cases where ETI was attempted were OHCA (66%). Although paramedic exposure to ETI was not associated with OHCA survival, successful placement was associated with return of spontaneous circulation (ROSC)(AOR:2.13, 95%CI:1.59-1.2.85).

Conclusions
Paramedics rarely perform ETI. Previous exposure is associated with successful placement. For OHCA patients, successful placement was associated with ROSC.
Women's experience of birth in paramedic care

Mrs Belinda Flanagan¹, A/Prof Bill Lord¹, Prof Margaret Barnes¹, Dr Rachel Reed¹

¹University of the Sunshine Coast

Introduction
In Queensland, approximately 422 (0.7%) planned hospital births occur prior to arrival at hospital and roughly 75-85% of these occur in or just prior to paramedic care. This research aimed to identify factors related to the need for paramedic attendance, identify possible factors that complicate clinical management and explored opportunities to promote a positive birth experience.

Methods
Women who were over the age of 18 years and who had birthed within the last 5 years were recruited via social media and through newspaper advertisements. Using narrative inquiry 20 women were interviewed in person, via phone or skype, depending on their location.

Results
Mothers identified a need to avoid attending hospital too early for reasons such as a fear of being sent home or protecting themselves from obstetric interventions. Mothers reported feeling empowered, confident and exhilarated during the birth. However, mothers also identified concerns around privacy, communication, lack of consent, feeling judged and issues with maternal and paternal bonding.

Conclusion
The research described the birth experience of women in the event of a BBA, it described intra-partum care provided by paramedics and identified possible factors that may complicate clinical management of labouring and birthing women.
Standardisation of guidelines for clinical placement of undergraduate students to reduce confusion

Mr Anthony Smith¹,²

¹Queensland Ambulance Service
²Australian and New Zealand Association for Health Professional Educators

Introduction
Standardisation maintains consistency across the educational process for students. Mentors require clarification and consistency about the process of mentoring from both universities and ambulance services while students are on their practicum. Empirical evidence also acknowledges that ambulance service staff are perplexed by the differences from one university to another.

Anecdotal evidence arising from, observation, discussions with on road paramedics, reflects the literature raising questions about standardisation in mentoring processes and differing expectations of student performance. This can present a challenge for on road staff as they mentor and assess students from different universities, and has the potential to impact the student experience and assessment.

Discussion
The variations in learning outcomes, documentation, scope of practice, and assessment requirements of paramedic student throughout Australia and New Zealand universities appears to be causing confusion for on road paramedics mentoring student’s paramedics. This includes terminology used to describe practice and assessment requirements. This presentation will clarify some of the issues surrounding clinical placement of undergraduate student paramedics and address the need for standardisation.

Conclusion
Standardisation maintaining consistency across educational processes for on road staff and students is important if professional exceptions of new graduates are to be realised. This presentation will be of interest to academics and paramedic practitioner involved in the mentoring of undergraduate paramedic universities students.
Approaches to Indigenous health care in the emergency ambulance setting in Aotearoa

Mrs Michelle Brett¹

¹St John New Zealand

Introduction
As pre-hospital health providers we all strive to improve the health outcomes for our patients and to deliver culturally appropriate services. Our aim is to address inequalities in health delivery. St John, New Zealand in addressing this with the development and implementation of Māori delivery strategy.

The strategy is aimed at “closing the gap that St John faces in delivering healthcare to New Zealand Indigenous peoples, the tangata whenua. The vision is to be, a leader in the inclusion of Māori in health care delivery and the engagement with both Iwi and Māori organisations thereby enhancing the health and wellbeing of Māori. St John actively promotes a Māori recruitment and retention strategies increasing the number of Māori participating as staff/volunteers. Progressing formal and informal links with Iwi, Hapu and Whanau. Collaboration with targeted Māori healthcare providers and other Māori organisations is critical to the strategy.

Discussion
Māori are disproportionately represented in negative health profiles. Identifying how the ambulance service can more effectively engage in health care provision to Māori can only enhance and improve outcomes. St John is leading in the delivery of appropriate services addressing Māori health through policies and practices and training which acknowledge Māori health issues and the culturally appropriate delivery of ambulance services.

Conclusion
The establishment of a Te Ara Hato Hone, (St John Māori strategy) Pou Takawaenga, Māori advisors and a Māori Advisory group provide St John leadership with the critical support to ensure appropriate cultural safety and cultural competence is achieved in the delivery of St John services to tangata whenua.
How effective are mandatory physical fitness reassessments and wellness programmes in improving the health and wellbeing of paramedics?

Miss Ngozi Anyadike-Danes

1Auckland University of Technology

Introduction
New Zealand has the third highest obese population with approximately one in three adults classified as obese. This data implies that up to 500 ambulance personnel might be obese. Despite no New Zealand-specific evidence, an abundance of international research indicates that the working conditions of paramedics may lead to poor diet and lack of exercise.

Methods
A literature search of multiple online databases (including PubMed, Science Direct) was performed using key terms which returned 188 papers. After reviewing titles and abstracts, 28 articles were identified that met the inclusion criteria. Articles discussing fitness programmes in other emergency services were included due to a lack of paramedic-specific research.

Results
One study cited 33% of paramedic recruits as obese while another found 81% of seasoned paramedics to be overweight or obese. Post-traumatic stress and sleeping disorders were found to be prevalent amongst emergency workers and shift work was shown to increase the likelihood of obesity or overweight workers. Ambulance personnel experience more health problems (for example, hypertension) than any other occupation. Adjustments to nutrition and physical activity had positive effects and programmes that had the support of the organisation were more likely to be successful. Changes in diet and exercise often led to reduced work stress.

Conclusions
The current health status of New Zealand suggests that obesity is quite likely to a problem in the ambulance service. Physical fitness and overall health of ambulance personnel may be improved with the implementation of mandatory physical fitness reassessments and the development of wellness programmes.
An interdisciplinary learning experience assisting student paramedics to plan for wellbeing and career sustainability

Dr Vanessa Rice¹, Ms Alyse Miller¹, Dr Georgia Clarkson¹, Mr Anthony Whitty¹

¹Australian Catholic University

Introduction
Personal health management strategies are critical for paramedicine graduates transitioning into the workplace. The paramedic role is inherently demanding and requires considerable physical and psychological resilience to sustain a career. This project aimed to implement and evaluate a structured interdisciplinary student learning experience in a controlled clinical setting to assist paramedicine students to develop professional responsibility, skills and knowledge to manage their health and wellbeing in the workplace.

Methods
Final-year paramedicine students were paired with a final-year exercise science student. Exercise science students conducted an initial health assessment of the paramedicine students’ physical fitness and nutrition. Following this individualised assessment, exercise science students developed a personalised health management plan for the paramedicine students. Plans were reviewed intermittently and informed the final student assessment which was a structured and realistic workplace health management plan developed by individual paramedic students. Following completion of the program, evaluation was conducted using a Work Experience Questionnaire (WEQ) and focus groups.

Results
Initial results from the WEQ indicate that this program was beneficial to supporting paramedicine students in development of health management strategies. Focus group discussions indicated the program assisted the paramedicine students’ preparation for the physical requirements of the workplace and enhanced their ability to develop skills that underpin health management for their future career.

Conclusion
Drawing upon an interprofessional peer assisted learning strategy to provide an individualised and consultative approach to planning for the health challenges of a beginning paramedic, this interdisciplinary learning experience assisted paramedicine students to prepare for the workplace.
Comparison of video laryngoscopy and direct laryngoscopy in the pre-hospital setting

Mr Bobby Fox¹, Mr Paul Davey¹

¹Auckland University of Technology

Introduction
Intubation as an airway management strategy in cardiac arrest has demonstrated improved outcomes compared to laryngeal mask airway. Historically pre-hospital endotracheal intubation success has been inconsistent. With recent technological advances video laryngoscopy (VL) is a viable option in the pre-hospital setting where its use may improve intubation success and have the potential to improve patient outcomes. Aim: compare outcomes of first pass success, number of attempts, time taken for intubation and overall success between VL with direct laryngoscopy (DL) in the pre-hospital setting.

Methods
Electronic databases SCOPUS, Medline and EBSCO were searched using key terms “video laryngoscopy” AND “prehospital” OR “emergency medical services” AND “out of hospital”. Limits of date (≥2010), full articles and English language were applied.

Results
Six studies met inclusion criteria. There was heterogeneity of metrics reported and device types used which complicates interpretation. Reduction in number of attempts and time to intubation were observed with VL compared to DL. First pass success was reported to be higher in the VL group however overall success rates between DL and VL were conflicting. Outcomes of morbidity and mortality are not reported. Overall studies report that VL positively impacted airway management in the pre-hospital environment.

Conclusion
Use of VL demonstrates advantages of improved first pass rates, time to intubation and the number of attempts over DL which may positively impact airway care in the pre-hospital environment. Further research is needed to evaluate patient clinical outcomes before firm recommendations are made.
Morphine administration and acute coronary syndromes: A review

Ms Melanie Wintle², Mr Paul Davey¹

¹Auckland University of Technology
²St John Ambulance

Introduction
Intravenous morphine administration is commonly used to manage pain associated with acute coronary syndromes (ACS) and is recommended by the International Liaison Committee on Resuscitation in ST Elevation Myocardial Infarction (STEMI) where chest pain is unresponsive to nitrates (Class I, LOE C). Australasian prehospital clinical practice guidelines recommend the administration of IV Morphine for the management of pain in ACS. The review investigated morphine administration in the setting of ACS with the view of informing pre-hospital management.

Methods
Electronic databases Cochrane, OVID, CINAHL, Medline and EBSCO were searched using key terms “morphine” AND “acute coronary syndrome” OR “anticoagulation therapy”, reference lists of eligible studies were reviewed. Selection criteria included: English language, full text journal articles and date of publication 2000 to 2016.

Results
Six studies met inclusion criteria, (five registry and one small RCT). Morphine was associated with larger infarct size and decreased effectiveness of Clopidogrel, but not mortality in STEMI. Morphine in non-STEMI is associated with higher mortality despite more timely diagnostic assessments and invasive cardiac procedures compared to the non-morphine cohort.

Conclusion
Registry studies have identified an association between morphine administration and mortality in non-STEMI but not STEMI. Registry studies do not enable direct extrapolation to causation and as such randomized control trials are needed before firm recommendations can be made. Pre-hospital guidelines should advise cautious use of morphine in the setting of unstable angina and non-STEMI.
Paramedic resuscitation competency: a survey of Australian and New Zealand emergency medical services

Ms Kylie Dyson¹,², Dr Janet Bray¹,⁴,⁵, A/Prof Karen Smith¹,²,³, Prof Stephen Bernard¹,²,⁴, Dr Lahn Straney¹, Prof Judith Finn¹,³,⁵

¹Monash University  
²Ambulance Victoria  
³University of Western Australia  
⁴Alfred Hospital  
⁵Curtin University

Introduction
We have previously established that paramedic exposure to out-of-hospital cardiac arrest (OHCA) is relatively rare, therefore clinical exposure cannot be relied on to maintain resuscitation knowledge and skills. We aimed to identify current practices within emergency medical services (EMS) for developing and maintaining paramedic resuscitation competency.

Methods
We conducted a cross-sectional online survey of all Australian and New Zealand EMS in 2015. The survey was targeted at education managers.

Results
Nine of the 10 EMS agencies responded to the survey. All agencies provide resuscitation training to paramedics at the commencement of their employment (median 16-hours, IQR:7-80). With the exception of one agency that did not provide any refresher training, a median of four-hours (IQR:1-7) resuscitation training was provided to paramedics annually. All agencies used OHCA simulations and skill stations to train paramedics. Training was not formally accredited by a resuscitation council and did not take into account individual paramedic exposure to OHCA. Resuscitation competency was tested by EMS agencies: annually (3/9), biennially (4/9) or not at all (2/9). Two agencies used CPR feedback devices in clinical practice and only one regularly performed formal debriefing after OHCA cases. Commonly reported barriers to resuscitation competency included: difficulty removing paramedics from clinical duties for training and a lack of paramedic exposure to OHCA.

Conclusions
All of the surveyed EMS provided initial resuscitation training to paramedics, but competency testing and refresher training practices varied between services. A lack of individual exposure to OHCA and training time were identified as barriers to resuscitation competency.
Developing indicators to measure pre-hospital care quality in Australia: commentary

Mr Robin Pap¹, A/Prof Craig Lockwood², Dr Matthew Stephenson², Dr Paul Simpson¹

¹Western Sydney University
²Joanna Briggs Institute, University of Adelaide

Introduction
Quality improvement (QI) has become an integral part of any healthcare organisation including ambulance services providing pre-hospital care. Measurement not only produces data to ensure the maintenance of quality, it also provides information to direct improvement efforts.

Currently the number of nationally utilised prehospital care quality indicators is limited to only a few. A more comprehensive set of Australian pre-hospital care quality indicators would contribute to safe and high-quality, information-driven pre-hospital health care services.

Discussion
The concept of quality is easily understood, but defining it is challenging because quality is highly contextual. A definition is not required before initiating QI efforts. A definition of quality is vital though in order to assess it. Many quality indicators to measure pre-hospital care have been developed. In order to ensure an appropriate set of Australian pre-hospital care quality indicators, de novo indicator development may be required. Indicators need to be clear, valid, acceptable, feasible and reliable. Ideally, indicators should be based solely on high-level scientific evidence, however, many health care disciplines (including paramedicine) have a limited evidence base. Thus validity needs to be assessed using a method that combines available scientific evidence and expert consensus. Finally, indicators should be tested for acceptability (to both those being assessed and those using the tool), feasibility (technical and practicability) and reliability (both in- and inter-service).

Conclusion
Ambulance services are under pressure to maintain quality whist undergoing organisational change and to improve quality to optimise patient care. Quality indicators are an essential tool to demonstrate quality and to provide direction for QI initiatives.
Do paramedics adequately restrain paediatric patients in road ambulances?

Ms Stephanie Lockett², Mr Dale Edwards¹, Ms Leigh Parker¹

¹University of Tasmania
²South East Coast Ambulance Service

Introduction
Literature on the use of paediatric restraints shows that children are not always properly restrained in ambulances. Due to the exemption for ambulances, for the use of child restraints in Australasia, paramedics may not feel obliged to restrain paediatric patients. Having a child unrestrained in any vehicle can cause injury and even death if an accident occurs. This research aimed to discover the attitudes, beliefs and self-reported practices of Australasian paramedics in regards to the use of child restraints in road ambulances, to gain a preliminary look into this under-explored topic.

Methods
An online survey using a mixture of Likert scale questions, closed-ended questions and open-ended questions to allow for both quantitative and qualitative data. The survey was sent to practicing paramedics throughout Australasia to gain a general understanding of paediatric restraint use.

Results
The survey resulted in 194 respondents, representing approximately 1.7% of the Australasian paramedic population. Paramedics identified a wide range of available restraints, however only one participant was able to identify the correct weight criteria for use of any restraint (0.005%). There is a concerning number of paramedics that either indicated they do not use restraints in some situations (n=147), would not wait if one was available to be delivered in an emergency situation (n=126) or even a non-emergency situation (n=46).

Conclusions
Paediatric restraints are underutilised in ambulances and poorly understood, resulting in potential risk to the welfare of paediatric patients.
Epidemiology of atypical acute coronary syndrome: a systematic review of the literature

Ms Meriem Perona¹, Dr Jocasta Ball¹, Dr Aziz Rahman², Prof Simon Stewart¹

¹Australian Catholic University
²Deakin University

Introduction
Patients presenting with atypical acute coronary syndrome are frequently not recognised due to vague symptomology, and are often misdiagnosed. Furthermore, these patients receive less guideline driven care in comparison to their typically presenting counterparts, consequently having greater mortality and morbidity. Where pre-hospital care strives for early recognition and early treatment initiation of cardiac patients, these patients are at greater risk of being under-treated, not transported to the most appropriate facility or not recognised. The aim of this systematic review was to understand the epidemiology of atypical ACS including its prevalence, clinical profile, morbidity and mortality.

Methods
MEDLINE, CINAHL, PsychINFO, EMBASE and ProQuest were systematically searched using the search terms: acute coronary syndrome, STEMI, NSTEMI, NSTEACS, unstable angina, atypical presentation, angina equivalent, absence of chest pain/discomfort. Limits of adult humans and English language were applied. Two researchers independently reviewed the list of extracted studies and a consensus was obtained regarding study selection. After duplicate papers were removed, titles and abstracts of 3,026 papers were examined and among those articles, 287 met the criteria for further analysis.

Results
In the absence of typical chest pain, dyspnea, fatigue, syncope, lethargy, indigestion and anxiety are commonly reported symptoms and are often confused for other conditions. Risk factors include older age and female, with co-morbidities hypertension, diabetes and hyperlipidaemia. These patients also experience higher morbidity and mortality rates.

Conclusions
Findings of this review have the potential to assist paramedics in early identification of atypically presenting ACS patients, thus optimising preliminary diagnosis, treatment and outcomes of a vulnerable population.
Pre-hospital anti-fibrinolytics for traumatic coagulopathy and haemorrhage (PATCH): A randomised controlled trial of early pre-hospital treatment with tranexamic acid

Dr Veronica Pitt1, Prof Stephen Bernard4, A/Prof Biswadev Mitra2, Dr Dashiel Gantner2, Dr Colin McArthur5, Dr Tony Smith6, Dr Andy Swain7,8, Prof Russell Gruen3, On behalf of the PATCH-Trauma Study Investigators1

1Monash University
2The Alfred Hospital
3Nanyang Technological University
4Ambulance Victoria
5Auckland City Hospital
6St John Ambulance
7Wellington Free Ambulance
8Wellington Hospital

Introduction
The CRASH-2 trial showed tranexamic acid (TXA) reduced mortality in trauma patients with, or at risk of, haemorrhage but only if it was given within 3 hours of injury. Emergency medical services (EMS) are ideally situated to administer TXA within this time frame however, important questions need to be addressed before TXA is implemented into pre-hospital protocols across Australasia.

The PATCH study aims to address whether early prehospital administration of TXA can improve survival and recovery in severely injured adults likely to have acute traumatic coagulopathy that are treated in advanced trauma systems.

Methods

Inclusion criteria
• Adult patients (age ≥18 years);
• Injured through any mechanism;
• Likely to have acute traumatic coagulopathy (COAST score ≥3);
• First dose of study drug can be administered within three hours of injury; and
• Patients to be transported to a participating trauma centre.

Exclusion criteria
• Suspected pregnancy
• Nursing home residents

Patients are screened, enrolled, and randomised pre-hospital by EMS clinicians. Enrolled patients are randomised to receive an IV bolus dose of either 1g TXA or placebo as early as possible following injury. After arrival in the ED, patients are given 1g TXA or placebo infused intravenously for 8 hours. Blood samples are collected immediately after arrival to hospital, at the end of 8 hour infusion, and 24 hours after the prehospital dose of study drug. Patients undergo screening for deep venous thrombosis 5-7 days after injury. Telephone interviews will be conducted to assess recovery and quality of life outcomes at 6 months.
A systematic review of intimate partner violence educational interventions delivered to allied health care practitioners

Mr Simon Sawyer¹, A/Prof Jan Coles¹, Dr Angela Williams², A/Prof Brett Williams¹

¹Monash University  
²Victorian Institute of Forensic Medicine

Introduction
Intimate partner violence (IPV) is a significant cause of morbidity and mortality to women worldwide. Numerous health organisations have recently called for increased education for healthcare practitioners who encounter IPV patients, which has created a need to examine the current educational evidence so that it may inform the next generation of educational interventions. Our objective was to examine the effects of IPV educational interventions on the knowledge, attitudes, skills and behaviours of allied healthcare practitioners. Results will inform the creation of occupational specific educational interventions.

Methods
We conducted a systematic search of 14 databases and selected studies that included IPV educational interventions to allied healthcare practitioners and which measured knowledge, attitude, skill or behavioural outcomes (KASB). Studies were evaluated based on methodological quality, educational context, and outcome measurement.

Results
We selected 18 articles for inclusion. Study participants included nurses, dentists, social workers and paramedics. Educational interventions ranged widely in length, delivery format and topics covered. Findings indicate that improvements in some knowledge, attitudes, skills and behaviours is associated with education, though due to the lack of high quality studies conclusions should be treated with caution.

Conclusions
Future IPV educational interventions should ensure rigorous methodology with validated instruments measuring evidence based outcomes relevant to allied healthcare practitioners and the paramedic discipline. Interventions should ensure they follow a recommended syllabus, provide skills practice, thoroughly evaluate participant KASB and measure outcomes to at least 12 months post-intervention. Additionally there should be attempts to measure the impact of education on patient healthcare outcomes.
Graduate paramedic jurisdictional transition: an Australian and United Kingdom comparison

Mr Matthew Simpson¹, Dr Scott Devenish², Prof Michele Clark², Dr Paul Simpson³

¹Queensland University of Technology
²Queensland University of Technology
³Western Sydney University

Introduction
Over the last 10 years, the transition of paramedic education in Australia from an in-house vocational model to the university sector has resulted in an increase in both tertiary institutions offering paramedic courses, as well as undergraduate paramedic student numbers, possibly leading to an oversupply of graduates. Research suggests that students are willing to cross state borders in pursuit of paramedic employment. Conversely, the United Kingdom (UK) is experiencing an under-supply of paramedic graduates. Thus an increasing trend for graduates seeking employment interstate and overseas has appeared. This presentation reviews the literature on the transition of paramedic graduates into the workplace.

Methods
A scoping review of the literature was undertaken. Medline, CINAHL, SCOPUS and Australian theses were search, using the keywords paramedic, graduate and transition.

Results
Literature about the transition of paramedic graduates to the workplace is in its infancy. What does exist focusses on issues such as the perceived work readiness of graduates and the transition from university to the workplace. It identifies a reality shock, explores differences in UK and Australian paramedic programs and transition to work practices. The literature also outlines a model to explain the professional socialisation of Australian and UK paramedic graduates. However, there appears to be a gap in the literature which specifically examines the experiences of paramedic graduates transitioning to interstate and United Kingdom ambulance services.

Conclusions
This presentation highlights the presence of a knowledge gap relating to the transition of Australian paramedic graduates to interstate and international ambulance services.
Introduction
The calls came in without pause on the morning of 9/11, more than 3,000 of them in the first 18 minutes - constant pleas for help. Approximately 300 9-1-1 dispatchers could do little but record the location of people in the towers and to tell people that “help was on the way”. 9-1-1 dispatchers faced impossible decisions. Did they stay on the line when someone was no longer responding? How long did they stay on the phone with someone when thousands of others were trying to call? The day was so traumatic, many would never return to work. This research captures the voice of an often overlooked 9/11 group – the 9-1-1 dispatchers.

Methods
This research employed qualitative methods to compile and review 21 first-person accounts from 9-1-1 dispatchers who recounted their experiences of 9/11 on the 15-year anniversary.

Results
On the morning of 9/11, New York’s already overworked and stressed 9-1-1 dispatchers were thrust into a situation for which no training could adequately prepare them. Forced to improvise answers with little to no information, dispatchers reported feeling helpless and overwhelmed. With no access to radio or TV, they knew less than the public watching at home. Haunted by the confronting content of those calls, many now live with feelings of guilt and overwhelming sadness, even 15 years after 9/11.

Conclusions
These findings suggest that the 9/11 9-1-1 dispatchers need ongoing support to protect their mental health, as many are still plagued by lingering questions, nightmares and flashbacks from that day.
Is blended learning an effective design strategy for undergraduate paramedic education?

Mr Gary Strong¹

¹Plymouth University

Introduction
This study asks whether blended learning is an effective educational design strategy for a prequalification degree in paramedic practice, using a mixed methods evaluation of the Flexible Learning Stream BHSc offered by Whitireia New Zealand.

Methods
Graduates were invited to participate in an online nominal group technique (NGT) and to complete a student experience questionnaire, focussing upon levels of preparedness for professional practice. Teaching staff were invited to participate in an online focus group discussing benefits and challenges of the programme.

Results
Nine graduates participated in the NGT. Numerical data proved problematic due to marginal differences between mean scores. Textual data suggested themes of importance to the student, including accessibility, interactivity, integration with practice, flexibility, autonomy and self-direction. Twenty-one graduates completed the questionnaire. Results suggest high levels of satisfaction across the three domains of psychomotor, cognitive and affective learning. Five lecturers took part in the focus group. Themes of importance included flexibility and the need to maximise the value of contact time. Discussion points included challenges of growth, of ongoing assessment of progress and of the imperative to ‘think outside the classroom’.

Conclusions
This programme is proving effective and offers a suitable model for wider adoption. Two aspects of design are to be highlighted: the primacy afforded to learning and teaching methodology over and above content, and the high level of learner-centredness. An effective blended design is one which facilitates learner autonomy and self-direction, key professional attributes for paramedics.
Teaching students to think like a paramedic: improving professional judgement through assessment conversations

Mr James Thompson¹, Dr Don Houston¹, Miss Kathryn Dansie¹

¹Flinders University

Introduction
The ability to self-assess is essential to the practitioner who often works independently, and reflective practice is entrenched within the paramedic process of care. In order to develop these practices a paramedic student must be able to self-identify mistakes and learn from their errors. However, student assessment has traditionally focused heavily upon outcomes, with errors being penalised. Justification for these customary approaches towards the assessment of paramedic students acknowledges the potentially catastrophic consequences associated with mistakes being repeated in the real pre-hospital setting. Responding to the challenge of balancing the reflective practice skills set with ‘real world’ implications of case outcomes, an assessment process was re-designed. The “Student-Tutor Consensus Assessment” (STCA) was created to rebalance assessment weighting from being exclusively outcomes-focussed, and encourage students to apply a similar critical lens to events as the paramedics assessing them. Parallel tutor and student self-assessments are applied to simulated scenarios, with scores only awarded to criteria where consensus has been reached.

Method
Final year undergraduate Bachelor of Paramedic Science students enrolled in a capstone topic were invited to complete a paper based questionnaire at the end of their studies. Questions sought student perceptions about the STCA features and effectiveness.

Results
Ninety responded (from a class of 92). Responses to the six different questions showed a range of between 85.6 - 95.6% broad agreement regarding the value, effectiveness and suitability of the method.

Conclusion
The pilot of the STCA approach proved highly successful, with student endorsement for the continued and expanded application for this teaching approach.
Dehydration in the elderly; underdiagnosed and undertreated?

Mr Howard Wills¹

¹Whitireia NZ

Introduction
Dehydration in the elderly can be a contributing factor in many presentations seen by paramedics. The causes of dehydration can be multifactorial and can include social, mental health, medication-related and age-related pathophysiology. For effective treatment of the elderly, paramedics need to be cognisant of contributing issues, rather than just the physical presentation.

Discussion
Age-related changes in many body systems can be exacerbated by hydration issues and with chronic issues the individual may be limiting their lifestyle more than necessary. While paramedics typically do not have an involvement in chronic care, contributing features may be observed during acute presentations where hydration status should be included in the assessment.

Assessment of hydration in the elderly can be difficult and the reliability of commonly used tools such as skin turgour, fluid intake and urine output can be less reliable, with some signs quite subtle and easily overlooked.

Enteral and parenteral routes for rehydration will be examined, looking at advantages and disadvantages. Difficulties with enteric rehydration can often be for the same reasons as contributing factors to the acute presentation.

Conclusion
Paramedic assessment of hydration in the elderly can be complex, involving the consideration of many factors and can involve a more proactive approach to practice, where modification to contributing behaviours can be encouraged. While the focus will primarily be on short-term management, the longer term management should be a goal of community paramedicine.
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