

# Clinical handover in the trauma setting: a qualitative study of paramedics and trauma team members

Sue M Evans,<sup>1</sup> Angela Murray,<sup>1</sup> Ian Patrick,<sup>3</sup> Mark Fitzgerald,<sup>2</sup> Sue Smith,<sup>1</sup> Peter Cameron<sup>1</sup>

<sup>1</sup>NHMRC Centre of Research Excellence in Patient Safety, Monash University, Melbourne, Australia

<sup>2</sup>The Alfred Hospital, National Trauma Research Institute, Monash University, Melbourne, Australia

<sup>3</sup>Ambulance Victoria, Australia

## Correspondence to

Dr Sue M Evans, NHMRC Centre of Research Excellence in Patient Safety, Monash University, Level 3 Burnet Building, Alfred Hospital, Melbourne 3004, Australia; sue.evans@med.monash.edu.au

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## ABSTRACT

**Background** Clinical handover between paramedics and the trauma team is undertaken in a time-pressured environment. Paramedics are often required to handover complex problems to a multitude of staff. There is evidence that information loss occurs at this transition. The aims of this project were to (1) develop a minimum dataset to assist paramedics provide handover; (2) identify attributes of effective and ineffective handover; (3) determine the feasibility of advanced data transmission; and (4) identify how to best display data in trauma bays.

**Methods** Qualitative study of paramedics and trauma team members. A thematic analysis was undertaken using grounded theory.

**Results** Ten paramedics and 17 trauma team members were interviewed. A minimum dataset modified on an existing template was developed to include fields required by the trauma team to inform immediate treatment. Respondents stated that an effective handover was one which was delivered succinctly and in a structured manner, and contained only vital data necessary to direct immediate treatment. Advanced transmission of data to the receiving hospital was widely supported. While computers carried by paramedics were capable of exporting data to the receiving hospital, barriers such as time constraints, workflow issues and infection control issues impeded the ability to do this in the current environment.

**Discussion** There is support for the adoption and further evaluation of a handover template. It can provide valuable structure to the face-to-face handover, and experience from other specialties suggests it can reduce information loss. Strategies to enable information to be transmitted in advance of the patients' arrival must address concerns voiced by paramedics.

## BACKGROUND

Clinical handover refers to the transfer of information, professional responsibility and accountability between individuals and teams within the overall system of care.<sup>1</sup> Communication errors resulting from lack of or inappropriate information being given is the most common cause of preventable disability or death.<sup>2</sup> Doctors themselves have stated that the majority of medical mishaps result from communication difficulties.<sup>3</sup> Most mishaps causing death in the Emergency Department (ED) have been attributed to a lack of appropriate management.<sup>4</sup>

The initial assessment, resuscitation and intervention phase of care in the ED is particularly error-prone.<sup>5</sup> During this time, critical decisions are being

made on severely injured patients often based principally on information handed over by paramedics to the receiving trauma team. Despite best efforts, sometimes information loss occurs at this juncture of care.<sup>6</sup> A study of handover in a high-fidelity simulated Emergency Department (ED) environment determined that 18% of information handed over to newly arriving personnel was inaccurate.<sup>7</sup> There is also evidence that only 67% of information handed over by paramedics to the trauma team in the ED is accurately documented.<sup>6</sup> This creates an error-prone environment.

Interventions to provide structure to the handover format and to transmit data to the receiving hospital in advance of the patients' arrival have been introduced in an effort to improve handover. The MIST (M – Mechanism of injury/illness, I – Injuries (sustained or suspected), S – Signs, including observations and monitoring, T – Treatment given) template was developed as a tool to assist paramedics to handover information in a systematic manner.<sup>8</sup> It prompts paramedics to communicate to the trauma team the mechanism of injury, injuries sustained, signs and symptoms, and treatment provided. Use of the MIST format for handover has been introduced as a prehospital key performance indicator for management of trauma in the military.<sup>9</sup> However, little is known about its applicability to trauma and its ability to improve the quality of handover more generally.

In most situations, paramedics who are transporting the patient or the Ambulance Control Centre telephone the receiving hospital ahead of their arrival, to provide a brief account of the patient's status. This relies on staff in the receiving hospital documenting and then passing on information to the trauma team who will be managing the patient. On 25% of occasions, receiving hospital staff do not document information handed over by paramedics prior to their arrival in the ED.<sup>6</sup> Telecommunication technology offers potential to 'break the barrier of time and space' by providing written documentation to the receiving hospital through mobile networks in advance of the patient's arrival.<sup>10</sup> Where it has been implemented for management of myocardial infarction, it has enabled patients to receive more timely treatment on arrival in the receiving hospital.<sup>11</sup> The capacity for data to be transmitted to the Trauma Centre using personal tablet computers carried in the field by paramedic teams has been established.<sup>12</sup> However, no published studies have explored whether the handover process for trauma patients would benefit from use of this technology.

The aims of this project were therefore to (1) develop a minimum dataset to assist paramedics

provide handover; (2) identify attributes of effective and ineffective handover; (3) determine the feasibility of advanced data transmission; and (4) identify how to best display data in trauma bays.

## METHODS

### Study population

This study took place between August 2007 and July 2008. Paramedics employed by Ambulance Victoria and trauma team members from the Alfred Hospital were recruited to this study. The Alfred Hospital is a 350-bed tertiary teaching hospital in Melbourne, Australia. The Level 1 Trauma Centre within the hospital received 806 major trauma cases (ISS>15) in 2005–2006 and 55% of all major trauma cases in Victoria.<sup>13</sup>

### Recruitment

Following relevant Ethics Committee approval, paramedics from Ambulance Victoria and clinicians from the Alfred Hospital trauma team were invited to participate in the study. Purposive convenience sampling of paramedics and trauma team members was undertaken. Participation was voluntary, and no incentives were provided. Table 1 shows a profile of 27 participants, comprising 10 paramedics and 17 trauma team members. Paramedics were sampled from the Mobile Intensive Care Ambulance (MICA) Air Wing and three paramedic stations in metropolitan Melbourne. All had some experience transporting critically injured trauma patients to a trauma service. Trauma team doctors and nurses were sampled to ensure representation from specialty groups involved in the immediate management of trauma patients in the Trauma Centre. A consultant and registrar were interviewed from each of the following specialties: neurosurgery, intensive care, plastics, burns, anaesthetics, trauma and emergency. The consultant and registrar position covered both plastics and burns specialties. Of the five nurses interviewed, four worked in the Trauma Centre, and the other was a burns clinical nurse consultant responsible for attending all major burns in the Trauma Centre.

### Study design

To identify the minimum dataset to be handed over by paramedics to the trauma team, researchers delivered face-to-face interviews with clinicians from each specialty group, comprising the trauma team using a predetermined topic guide (box 1).

To identify how data should be transmitted, researchers interviewed paramedics and trauma team members to identify

**Table 1** Demographic details of interview participants

| Professional group              | N  | Mean no of years of postgraduate experience (SD) |
|---------------------------------|----|--|
| Paramedic                       | 10 |  |
| Mobile Intensive Care Ambulance | 6  | 21.5 (8.2)                                       |
| Team manager                    | 4  | 20.7 (9.6)                                       |
| Flight paramedic                | 2  | 23 (7.1)   |
| Road car                        | 4  | 7.5 (7.6)  |
| Team manager                    | 1  | 8  |
| Road car paramedic              | 3  | 7.3 (9.3)  |
| Trauma team                     |    |  |
| Medical                         | 12 | 11.4 (9.0)                                       |
| Consultant                      | 7  | 15.9 (9.5)                                       |
| Registrar                       | 5  | 5.2 (2.2)  |
| Nursing                         | 5  | 5.8 (3.3)  |
| Clinical nurse specialist       | 3  | 6.3 (2.1)  |
| Registered nurse                | 2  | 5 (5.6)  |

## Box 1 Topic guide for interviews

### Handover

- ▶ What do you think constitutes a good handover?
- ▶ Can you provide an example of a handover which was not effective?
- ▶ How could it have been improved?
- ▶ What barriers prevented the provision of a good/effective handover?

### Data content

- ▶ Are you aware of the MIST format used by paramedics for handover? What does MIST stand for?
- ▶ What tools do you use (if any) to assist with handover to the trauma team?\*
- ▶ Following review by participant of the MIST handover template:
  - From your experience, is the MIST handover used routinely as a format to assist in the delivery of handover?
  - Can you think of other elements that should be included in the MIST template to provide a good handover?
  - Do you think any of the elements should be excluded?

### Data transmission

- ▶ Do you think electronic transfer of information could help improve communication between the ambulance service and the hospital?
- ▶ Can you see any value in receiving clinical information prior to the patient's arrival in the ED?
- ▶ Can you think of any problems that may occur as a result of electronically transferring handover information to the trauma centre?

### Data display

- ▶ Do you think a visual display of information from paramedic handover would be useful?
  - In what format do you think it should be displayed?
  - How might a visual display impact upon your work flow?

\* Paramedic-specific question

attributes of an effective and ineffective handover. After eliciting this information, participants were provided with a copy of the existing MIST handover template and were asked to comment on whether they thought the template contained the necessary fields required to effectively treat trauma patients. Comments were collated, and the template was redesigned to incorporate additional fields and remove any deemed unnecessary. In order to gain consensus from the wider clinical community, researchers presented the proposed minimum dataset to each of the specialties' clinical meetings and asked for feedback either at the meeting or subsequent to it, via email or telephone.

Paramedics were asked questions relating to the feasibility of recording and transmitting data using the electronic medical record housed on the portable tablet computer carried in the field by paramedics.<sup>14</sup> Trauma team members were asked whether displaying data on the patient's condition prior to the ambulance arriving in the Trauma Centre would enhance patient care. The Trauma Centre involved in this study was at the time participating in a study whereby clinical data entered by trauma team members were displayed on LCD screens in each trauma bay.<sup>15</sup>

### Data analysis

To address the aims of this study, we used grounded theory methodology. Grounded theory is a qualitative research method

which uses an inductive process to create emergent theory. Issues of importance which arise from interviews with key informants are tagged and coded. Coded data are then grouped into concepts and then into categories. Categories are the basis for generation of theory.<sup>16</sup> Emergent categories and their inter-relationships were coded using the NVIVO software program (NVIVO 8.0 QSR International Doncaster, Australia). One researcher (SE) developed open-axial coding into which two researchers (SE and AM) then independently categorised participants' comments. The researchers then reviewed transcripts together to check for consistency and to identify any unrecognised themes. Any disagreements were resolved through discussion and consultation with a third researcher (IP).

## RESULTS

From the interview template, three primary nodes for data analysis were proposed, comprising data content, data transmission and data display. Within each of these primary nodes, additional tertiary nodes were developed. For example, data content was further divided to separate comments relating to what should be collected, what should not be collected, and views on the MIST format as a tool for capturing a minimum dataset.

### Data content

Two of the 10 paramedics (20%) and nine of the 17 trauma team members (53%) interviewed were familiar with the MIST format for handing over patient care. In explaining why paramedics might not know of MIST, a paramedic stated, 'MIST is not taught but MIST is understood by a number of us and is practised by a number of us as being a good means of quickly transferring information from the prehospital to the hospital handover.' From another MICA paramedic, 'I think ambos (ambulance officers/paramedics) have a very poor understanding of it. It may well be taught now but it was never sort of a routinely accepted handover technique.'

There was general consensus from both paramedics and the trauma team that the concept of using a template was good and that the data elements included in the MIST template were appropriate. This statement was made by a road car paramedic, 'If you develop something like this, you would go and trial it for 6 months and see what were the problems with it... but yes, its probably got a lot of merit'. When asked to comment on whether it contained all necessary information, respondents proposed that it should also collect, where appropriate, any facial burns, the estimated time of entrapment, oxygen saturation levels, body temperature, categorisation of each element of the Glasgow Coma Scale (scores for eye opening, verbal and motor response), pupil size and reactivity, application of a cervical collar, critical episodes treatment and response, and significant medication, allergies and past history. Figure 1 contains the final MIST template endorsed by specialty groups comprising the trauma team and paramedics.

### Data transmission

#### Attributes of an effective and ineffective handover

As per the topic guide, trauma team members and paramedics were asked to comment on what constituted an effective and ineffective handover. Some of these comments are included in box 2.

Both groups cited the need for the person delivering the handover to be confident and succinct. Experience was a key factor in being able to give a good handover. The presence of appropriate personnel to receive the handover, coupled with their ability to actively listen were important factors in

## Trauma / Time Critical Notification M.I.S.T.

Date \_\_\_\_\_ ETA \_\_\_\_\_ Hospital \_\_\_\_\_

|  |  |
|--|--|
| <b>Demographics:</b> Patient Age _____ Gender: M / F Time of injury _____  |  |
| <b>Mechanism:</b> MCA >60kph <input type="checkbox"/> Rollover <input type="checkbox"/> Ejected <input type="checkbox"/> Death other occupant <input type="checkbox"/><br>Pedestrian <input type="checkbox"/> Motorcyclist <input type="checkbox"/> Cyclist <input type="checkbox"/> Fall >3m <input type="checkbox"/> Burns <input type="checkbox"/> Explosion <input type="checkbox"/><br>Trapped <input type="checkbox"/> Time entrapped _____ Other: <input type="checkbox"/> _____  |  |
| <b>Injury Pattern:</b> Penetrating <input type="checkbox"/> Blunt <input type="checkbox"/><br>Region: Head <input type="checkbox"/> Neck <input type="checkbox"/> Chest <input type="checkbox"/> Abdo <input type="checkbox"/> Pelvis <input type="checkbox"/> Axilla <input type="checkbox"/> Groin <input type="checkbox"/> Limbs <input type="checkbox"/><br><b>Injury Description:</b> Amputation <input type="checkbox"/> Crush <input type="checkbox"/> Spinal <input type="checkbox"/><br>Tension Pneumothorax <input type="checkbox"/> Rigid Abdo <input type="checkbox"/> Fractures of ≥ 2 Long bones <input type="checkbox"/> Fractured Pelvis <input type="checkbox"/><br>Burns <input type="checkbox"/> > 20% <input type="checkbox"/> Estimated % _____ Facial burns <input type="checkbox"/>   |  |
| <b>Signs</b> Initial Observations:<br>PR: _____ BP: _____ GCS: _____ EVM Pupil size and reactivity _____<br>RR: _____ T°: _____ SKIN: _____ SpO2 _____ SOB: Yes / No   |  |
| <b>Treatment:</b><br>Cervical Collar <input type="checkbox"/><br>O.P./N.P. airway <input type="checkbox"/> LMA <input type="checkbox"/> E.T.T. <input type="checkbox"/> RSI <input type="checkbox"/> Ventilated <input type="checkbox"/><br>Chest Decompression <input type="checkbox"/> Side: Right, Left or Bilateral _____<br>IV access <input type="checkbox"/> IV Hartmanns Administration YES / NO<br>Volume given _____ ml<br><b>Drugs given:</b><br>Methoxyflurane <input type="checkbox"/> Maxolon <input type="checkbox"/> Morphine <input type="checkbox"/> Midazolam <input type="checkbox"/> Fentanyl <input type="checkbox"/><br>Suxamethonium <input type="checkbox"/> Pancuronium <input type="checkbox"/> (Timing of last dose) _____ Adrenaline <input type="checkbox"/><br><b>Other Drugs:</b><br><b>Critical episodes treatment and response:*</b> |  |
| <b>Significant other information:</b><br>Allergies: <input type="checkbox"/> List _____<br>Significant past history: _____<br>Significant medications: eg Warfarin _____   |  |

\* e.g. grade of intubation, response to fluid/drugs

**Figure 1** The MIST template. (M – Mechanism of injury/illness, I – Injuries (sustained or suspected), S – Signs, including observations and monitoring, T – Treatment given)

determining a good handover for paramedics. Conversely, three paramedics, five doctors and three nurses made the point that an ineffective handover was one in which perceived extraneous information was communicated and when interruptions occurred. A noisy environment was considered by nursing staff to adversely impact on handover. While three paramedics felt that dismissive attitudes by trauma team members impacted on their ability to handover effectively and that they often had to repeat themselves because of inattention, three trauma team members stated that they became dismissive when paramedics 'rambled on'.

### Transmission of data to hospital

When asked to comment on whether electronic transmission of data would improve patient care, respondents felt that it would reduce information loss, better enable resources to be gathered (human and equipment), reduce transcription errors, reduce the time required to handover when the patient arrived, and decrease repetition of information and 'Chinese whispers' which occur when information is handed over multiple times. However, there were a number of concerns raised in relation to data security, human error being introduced in the transmission process, time constraints and that it might place increased emphasis on talking to the computer rather than focussing on the patient's care. All paramedics reported that information would need to be captured with minimal disruption to clinical

## Box 2 Attributes of effective and ineffective handovers in the trauma centre

- ▶ I think it comes down to experience as a lot of things do with knowing what's important and what isn't important. And most experienced clinicians no matter what their specialty will be able to sift out the wheat from the chaff and give you the important details of what you need to know. (Anaesthetist)
- ▶ I can think of generally, when people don't follow a structured process they can tend to get things disjointed. If you follow a process, like the MIST process, then the people at the receiving end if they understand that that's how it's going to be and if you look at most of the trauma resuscitation, most of the trauma team understand that process and listen for that sort of thing. (MICA Team Leader)
- ▶ So not keeping the details succinct and to the point would be the most common reason for handovers falling apart. (Senior registrar, ICU)
- ▶ If they are really confident in what they are doing and they're experienced at it, then they'll give a much better handover. (ED Critical Care Nurse)
- ▶ I actually feel that the team, there's always somebody listening or there's always somebody with a whiteboard marker. So I think even though... the team are getting on with what's getting on with the patient they're always listening. (MICA paramedic)
- ▶ It's really good when everyone is there and you can see... they've all got their coats on and wear labels and you can see who's who. (Road Car Paramedic)
- ▶ If you overwhelm somebody with extraneous information then you are going to lose the important stuff. (Anaesthetist)
- ▶ ...it's not necessarily the ambulance's fault because they get interrupted a lot by our doctors so you'll find that a handover's half complete because the doctors will go 'alright that's enough' (Clinical Nurse Specialist ED)
- ▶ What often ends up happening is you get this ongoing ramble that can sort of .... and you feel a bit rude because a couple of minutes into it you put your stethoscope on and go, yeah okay, fine. (ED Registrar)
- ▶ I find that impediments to a good handover are sometimes when people don't listen or sometimes interventions are done and people are not listening at the time or if, all the people aren't there to hear. (MICA paramedic)
- ▶ I feel great frustration when they're talking about 10mg of Maxolon, another 10mg of Maxolon this, that, whatever fluid. One bit of fluid, this bit of fluid, blah blah. (ED Consultant)
- ▶ Sometimes it can depend on the size of the team, if there are so many people in the room then there's just so much going on, so many voices and so many people talking. (ED Nurse)
- ▶ X-ray is a big impact on the handover because everyone has to clear out when x-ray is called, and x-rays get done so quickly at the Alfred which is great for patient care, but it does sort of interrupt the flow of a handover. (MICA paramedic)

work. This view was reiterated by trauma team members, who stressed that any intervention to capture information should not delay transporting the patient to hospital.

Paramedics were asked their views on the feasibility of collecting and transmitting data. The current workflow process, in which paramedics documented little and when they did, used different mediums such as loose sheets of paper, gloves and bed linen, was seen as a significant impediment to transmitting data. This comment about data transmission was made by a MICA paramedic and reinforced by other paramedics:

I use a combination of things. I use memory. I use the data printout from the Propaq or whatever monitor in the device I have. I use notes on my glove. I use notes on a sheet. So I don't have any one, fixed thing but what I usually try and do is get my mindset right as I get out of the helicopter or ambulance and run through my brain as to what I see as the significant things I need to pass on. Generally it comes off from memory.

Other barriers to collecting data were time constraints, infection control hazards associated with touching the computer with bloodied gloves, difficulty using an unharnessed computer in transit and an interface which could be more intuitive.

Suggestions for improving data capture included more effective use of portable handheld devices such as video and satellite phones, more intuitive computer interface design and investment in developing the ability of monitors to automatically capture and transmit data.

### Data display

When trauma team members were asked whether displaying data on screens in the ED would improve clinical care, most thought that it would enable care to be better tracked, reduce

repetition and avoid information loss. This comment was made by an ED clinical nurse specialist in relation to the potential of data display to reduce information loss:

There are so many different specialties coming and going, and you find that the trauma reg or the emergency reg is repeating themselves unnecessarily. A lot of these facts can all be just put up on a screen and it's easier for everyone if you're at the head of the bed and you can't hear because of the noise in the department at least you could look up and that's the same with the trauma resuscitation. Sometimes you can look back on the screen, what were their vital signs when they first came in versus now. And so if you couldn't hear for it because it was too noisy at least you have another form of being able to see what's going on with them. So yes, I think it would be good.

Trend data represented in a graphic format were considered to provide the most useful information. However, concerns were expressed over whether having clinicians focussing on a screen would divert attention from the patient.

### DISCUSSION

This qualitative study of frontline clinicians provided the basis for the development of a program to improve transmission of information between paramedics and the receiving trauma team. It identified critical data elements required by the trauma team to assist them in administering timely, safe and appropriate care. Additionally, it provided insight into what constituted an effective handover and issues for consideration in the development of a system to transmit data to the receiving hospital in advance of the patients' arrival.

We used qualitative techniques to better understand views of frontline clinicians because it can effectively gather information

on problems that are 'complex, contextual and influenced by the interaction of physical, psychological and social factors'.<sup>17</sup> Where interventions have been introduced in the absence of clinicians' support and without being tested on a small scale, they inevitably fail.<sup>18</sup>

Multiple strategies are needed to improve handover. Paramedics should be taught how to provide a succinct handover focussing on critical elements; trauma team members should learn effective listening. The concept of 'time out'; where a checklist-guided safety pause occurs in the operating room prior to making the first incision, has led to a reduction in error and lowering of mortality.<sup>19</sup> The same concept of pausing to listen to handover and using a checklist to assist paramedics deliver information, requires consideration in the Trauma Centre. This approach would require a focused education and training programme. Where a handover template has been introduced by paramedics without accompanying training and education, it had no positive impact on improving information retained by those receiving the handover.<sup>20</sup>

Paramedics in this study stated that an impediment to effective handover was inattention by the trauma team, a view also shared by paramedics in Scotland.<sup>21</sup> Even when paramedics are provided with training on how to handover, information recall by the receiving trauma team has been found to be as low as 36% of the paramedic verbal report, with recall even worse for more severe trauma reports.<sup>22</sup> This suggests that trauma team members should focus more intently on listening to the handover and that paramedics are simply handing over more information than can be retained. The tool created as a result of this project has the potential to improve information retention because it focuses the attention of paramedics on transmitting the information that the trauma team has deemed important to inform treatment decisions.

Nursing staff mentioned on a number of occasions the adverse effects of a noisy ED on their ability to hear handover by paramedics. It has been identified that noise levels in EDs often exceed the uppermost noise levels recommended by the Environmental Protection Agency (EPA).<sup>23</sup> Haka *et al* summarise the adverse impact that noise can have on cognitive tasks such as serial recall, mental arithmetic and logical reasoning.<sup>24</sup> Noise reduces performance of complex tasks in the Operating Theatre<sup>25</sup> and causes stress, which has been implicated in increased risk for error and staff burnout in the critical care setting.<sup>26</sup> Given that noise was a recurrent theme when discussing barriers to effective handover, acoustic properties of trauma rooms should be evaluated and, where required, structural modifications made to reduce sound reverberation and pressure. Behavioural modification used successfully in the critical care setting, such as having beepers in vibrate mode, turning down the volume of overhead intercoms and eliminating loud and unnecessary conversation at the bedside, may have a place in the Trauma Centre to ensure that handover can be heard by the trauma team.<sup>27</sup>

The finding that both paramedics and trauma team members supported the concept of advanced transmission of data provides opportunity to explore this further as a tool to reduce information loss. However, current technical and workflow barriers need to be addressed first. Voice-recognition software might provide some assistance in capturing and recording information. While accuracy rates have improved markedly over the past few years,<sup>28</sup> there is still some work to be done before it will be considered a viable option in reducing the burden on time-pressured paramedics.<sup>29</sup>

This study has a number of limitations. We purposefully selected paramedics who had experience handing over the care of

trauma patients. It may be that less experienced paramedics would identify different data elements for collection and different barriers to transmitting information to trauma team members. However, most trauma patients are transferred by intensive care road and air paramedics. While we asked trauma team members and paramedics to identify barriers and facilitators to effective handover, in discussing solutions we only asked them to comment on the use of a predefined tool. There may be other solutions to improving face-to-face handover that were not canvassed by researchers in this project. Data for this study were collected from staff working in a busy tertiary referral hospital, and while consensus on the dataset was provided by the wider specialty groups, findings should be generalised to other hospital settings with caution.

Findings from this study have implications for both paramedics and the trauma team. Paramedics need to be trained to use the template, and its impact needs evaluation. Paramedics suggested pasting it inside ambulances as a prompt for paramedics to use when preparing for the face-to-face handover with the trauma team. Testing the tool and handover technique in a simulation environment will help develop skills and team training, and provide an opportunity to assess the tool's ability to improve flow and retention of information.<sup>30</sup>

It is not uncommon for important details to be missed when providing handover, especially in a pressured environment.<sup>31</sup> If we are to improve outcomes for patients, we must provide front-line clinicians with tools and techniques to enhance their ability to collect information with minimal burden and deliver it with seamless integration between services.

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