Ambulance Victoria Triage Simulation

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Abstract. The role of the first ambulance crew, or pre-hospital responders, at a mass-casualty incident is to organise triage of victims and arrange for the victims to be treated and transported away from the incident site. The performance of the first ambulance crew at the incident has been found to be a key to a successful response with minimal complications to injuries or loss of life. Physical simulation is often used for training and rehearsal of pre-hospital responders, however they are often limited due to the resource and time requirements. To address these limitations, grant funds were secured to develop a Virtual Training Environment (VTE), called Ambulance Victoria (AV) Virtual Paramedic, to provide easy access to pre-hospital major incident training for pre-hospital responders. The goal of developing the AV Virtual Paramedic is to provide pre-hospital responders with an immersive environment which provides a representative scenario and representative patients, and access to local pre-hospital resources which are required to support execution of major incident policy and procedures. The example scenario within which pre-hospital responders are immersed is a road traffic accident where they are required to perform triage, allocate resources and provide situational updates to a centralised control. The AV Virtual Paramedic supports maintenance of skills which are critical to AV’s execution of the Victoria major incident response plan and provides exposure to the broad sweep of pre-hospital response community in a manner which cannot be achieved through any other mechanism.

1. INTRODUCTION
The first ambulance crew which arrives at a mass casualty incident adopt key paramedic roles described in Ambulance Victoria’s (AV) major incident response plans. The crew adopts the roles of “Triage Officer”, to perform triage and life saving treatment of victims, and “Transport Officer”, to arrange for victims to be transported away from the incident site. The effective execution of these roles has been found to be critical to a successful outcome and is a key link in the chain of command for AV. While the number of incidents requiring these roles to be undertaken is less than 1% of cases attended by AV, the number of patients and the acuity of their injuries results in them being categorised as “high consequence, low frequency”, and therefore should be targeted for regular rehearsal.

AV has utilised a variety of emergency management exercise programs to both test its level of preparedness, and to provide a training opportunity to its personnel. These exercises have, in the past, taken the form of either full field deployment exercises or desktop discussion exercises.

Full field deployment exercises are costly in terms of planning, resources and equipment. Committing personnel and valuable equipment to exercises, decreases their availability for daily operational shifts, and may make them unavailable or displaced for response to large scale emergencies.

AV has found full field deployment exercises to be of limited value to the majority of the personnel that are involved. It is argued that AV’s paramedic workforce do not need to be tested on their patient management skills in this format, due to the high tempo of their regular daily operations. Those in the role of Triage Officer and Transport Officer can benefit from this form of exercise, but it is of questionable cost benefit.

An alternative is desktop discussion exercises, which AV has found to be useful in testing commanders and strategic decision makers, but are of limited value to field personnel undertaking the key Triage Officer and Transport Officer roles.

AV has had some recent success in using simpler simulation systems such as the EmergoTrain System™ to provide exercise based training and preparedness testing. Those undertaking EmergoTrain System™ based exercises have found them to be more engaging than field exercises, and there is anecdotal evidence of greater retention of the information and experience gained. In addition, these exercises do not require any valuable response equipment and can simulate the roles of most field personnel. This means that the key paramedic and command roles can be rehearsed with minimal resource requirements and can provide greater cost benefit. Despite the improved training outcome achieved, the limited number of exercise opportunities means AV still has a requirement to extend the rehearsal of the Triage Officer and Transport Officer roles to a greater audience.

In 2011, AV and CAE Professional Services received a grant under the Natural Disaster Resilience Grants Scheme – Victoria to develop pre-hospital emergency simulation training. The first phase of this project was to deliver the AV Virtual Paramedic which enabled rehearsal of the role of “Triage Officer”.
2. SIMULATION DESIGN

2.1 Learning Objectives

A set of learning objectives were agreed prior to any development (see Table 1). These were adapted from the role statement of the Triage Officer in AV’s emergency plans. The learning objectives were then used to define the scope of all functional and non-functional requirements, such as simulation fidelity. For each learning objective, functional requirements were defined to guide the technical development of the simulation, along with the method for providing student feedback on achievement of the learning objectives.

Table 1: Learning Objectives

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Objective Breakdown</th>
<th>Method of Implementation</th>
<th>Feedback Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assume Role of Triage Officer</td>
<td>Understand difference in role between paramedic and triage officer</td>
<td>Assume role by wearing tabard</td>
<td>Score linked to actions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assume role by taking triage tag bag</td>
<td>Unable to label without bag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assume role by limiting clinical equipment</td>
<td>Equipment list with model answer</td>
</tr>
<tr>
<td>Ensure personal safety</td>
<td>Identify potential hazards at scene</td>
<td>Select Personal Protective Equipment</td>
<td>Personal protective equipment with model answer</td>
</tr>
<tr>
<td>Provide Situation Reports</td>
<td>Observe visual cues</td>
<td>Provide free text SITREP</td>
<td>Time to first SITREP and intervals between</td>
</tr>
<tr>
<td></td>
<td>Question bystanders</td>
<td>Request for additional resources</td>
<td>Freetext SITREPS with model answer</td>
</tr>
<tr>
<td></td>
<td>Question police</td>
<td>Provide number numbers</td>
<td>Score based on timeframes</td>
</tr>
<tr>
<td></td>
<td>Question fire service</td>
<td>Dispatch information</td>
<td>Additional resources linked to provision of SITREP</td>
</tr>
<tr>
<td></td>
<td>Receive information from Communications Centre</td>
<td>Other paramedics report on task outcomes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Receive information from other paramedics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task partner</td>
<td></td>
<td>Provide triage options</td>
<td>Provides overall efficiency</td>
</tr>
<tr>
<td>Rehearse triage sieve</td>
<td>Observe and assess clinical data</td>
<td>Visible triage tag</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decide on triage category</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Tag patient</td>
<td></td>
<td></td>
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<tr>
<td>Perform life saving treatments</td>
<td>Initiate and execute by self</td>
<td>Life saving treatment accuracy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Initiate and execute by bystander</td>
<td>Score for correct treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Initiate and execute by other paramedic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit clinical assessment</td>
<td>List of assessments with time scroll bar</td>
<td>Time penalty</td>
<td></td>
</tr>
<tr>
<td>Limit clinical treatments</td>
<td>List of assessments with time scroll bar</td>
<td>Time penalty</td>
<td></td>
</tr>
<tr>
<td>Set patient treatment priority</td>
<td></td>
<td>Treatment priority accuracy</td>
<td></td>
</tr>
<tr>
<td>Establish a Casualty Clearing Post</td>
<td>Decide location of CCP</td>
<td>Provides efficiency</td>
<td></td>
</tr>
</tbody>
</table>
2.2 Student Engagement

AV’s recent experience with on-line learning has demonstrated that it is difficult to attract personnel to this form of training. To address this, a number of key features were identified to maximize student participation. Alongside the learning objectives, these also guided the functional requirements which were implemented. For example, the scenario and experience need to be realistic, relevant and believable for the training audience. This then drove the selection of the: simulation platform; some of the visual devices; provision of a relevant patient databank; and availability of clinical management. Additional motivational tools were considered and it was determined that implementing a ‘high score’ board to allow for personnel to benchmark themselves against peers and others would assist engagement, as well as providing an element of competition.

2.3 Scenario Selection

AV’s experience with exercises suggested that exposing paramedics to scenarios containing a large number of patients provided the best learning opportunity. Having what is considered to be overwhelming numbers, forces the paramedics to step back from their daily role and consider alternative options for dealing with the situation – including the desired outcome of following AV’s plan for mass casualty incidents. It also provides an opportunity for repeated rehearsal of the triage process.

A traffic accident scenario was selected for representation in the VTE as AV’s data indicates that the highest number of incidents that are escalated for emergency management are road traffic accidents (40% of all AV emergency management incidents).

In order to present the trainee with the number of patients representative of a mass casualty incident, the final scenario was determined to be a road traffic accident involving two passenger buses. The scenario is illustrated in Error! Reference source not found.. To support both the metropolitan and rural workforce, the training scenario was situated in two locations, one urban and one rural, with both having a similar accident geometry. The context for the training was set through a scenario briefing which was developed for each location, including maps and local health and emergency service resourcing and distances. The scenario briefing was provided to students prior to commencing the simulation, in order for them to orient themselves with the location and situation.

2.4 Patient Databank and Dynamic Patients

In order to make the simulation as relevant and believable as possible, a specific patient databank was developed. Using AV’s clinical database, a de-identified sample of 130 patients that were involved in road traffic accidents were used as the inspiration for the development of 130 case studies.

Within the VTE, the patient’s conditions change dynamically, reflecting a variety of patient outcomes based on the clinical treatments undertaken. In developing the databank, Senior AV clinicians were engaged to review the sample and provide case studies that determine the lifesaving treatments required, the optimum treatment requirements for the patients to improve and the patient outcomes should the optimum treatment not occur.
2.5 Dialogues for Non-Player Characters (NPCs)

The AV Virtual Paramedic provides a representation of the range of people (NPCs): paramedics, patients, bystanders and emergency workers; with whom pre-hospital responders interact. Interaction with NPCs is through a set of dialogues and corresponding actions that the NPCs undertake. In developing the dialogues and actions, AV engaged a group of paramedics to review each of the dialogues to ensure that the flow of conversation and language used was engaging and consistent with current local procedures and practice.

2.6 Learning Management System

The AV Virtual Paramedic is integrated with a Learning Management System (LMS). The LMS provides a number of functions:

- Authentication for students
- Simulation installation instructions
- Repository for the scenarios
- Pre-simulation briefing information
- Storage of results of each scenario session
- High score board for each scenario

2.7 Student Feedback

Methods for providing student feedback were developed alongside the learning objectives (see Table 1). Feedback is provided both during scenario execution and through the LMS on scenario completion. For example in the scenario, realistic time delays were implemented for each treatment option to provide real time feedback to the student regarding their selected action. Similarly tasking a paramedic character to perform treatment of a patient removes the ability of that paramedic performing other tasks in the simulation for the appropriate time.

Other elements of quantitative feedback are provided through the LMS following completion of the scenario. For example, a table of all patients assessed is provided to compare the student assignments against the correct triage assignments (illustrated in Error! Reference source not found.). Some qualitative feedback is also provided at the completion of the scenario, including a listing of equipment used and communications made during the scenario alongside some model answers as a comparison.

A final score is also determined for each scenario session, which is based on the learning objectives and includes bonuses for timely actions and overall efficiency.

Figure 2: Student Feedback on Triage and Treatment Provided to a Patient.

3. FINDINGS TO DATE

A field trial was undertaken as part of the VTE development. Three sites were selected based on organisational demographic and demonstrated commitment to emergency management training. Despite this pre-selection, which was intended to maximize feedback, the number of evaluation forms received was limited. The feedback resulted in a number of enhancements that were implemented to provide a more flexible environment and options for improved student triage efficiency. The trial also provided evidence of the need to upgrade the computer equipment being used to better support the AV Virtual Paramedic graphic environment.

An unexpected outcome of the field trials was identification of the simulation as an operations analysis tool to test a range of decision making options and resource management. In one example, by a change to the approach to the standard scenario a 67% improvement in efficiency (i.e. total time to completion with 100% accuracy) has been demonstrated through repeated use of the simulation and refinement of incident approach.

An illustration of the system in operation is provided at Reference 1.

4. CONCLUSION

The project has developed a realistic 3D simulation of a multi-casualty road traffic accident where pre-hospital responders can perform triage, allocate resources and provide situational updates. During and after the completion of the scenario, participants receive direct feedback on their performance and a rating against their peers.

A cross-benefit of the trial has been the development of new strategies to approaching multi-patient incidents to minimise the time taken to triage all patients. VTE simulation has been found to be a valuable educational tool with an operational analysis application in the management of the pre-hospital component of major incidents.

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REFERENCES

1. http://youtu.be/-sTaatU1stI, AV Virtual Paramedic Video