STUDY TO ASSESS THE EFFECTIVENESS OF TRAINING AND TRIAGE EQUIPMENT IN RESPONSE TO A MULTIPLE CASUALTY INCIDENT AT A REMOTE OIL AND GAS INSTALLATION

Presented at Kuwait International HSE Conference February 2017

INTRODUCTION

A multiple casualty incident ("MCI") is an incident in which medical services may be overwhelmed by the number or severity of the casualties.

In our previous paper on this subject (Smart, C. and Mark, B. Responding to multiple casualties in remote industrial locations: a discussion document. The Journal of the Institute of Remote HealthCare, July 2015 Vol 6 Issue 2, 25-39. See Appendix 1) we have provided an extensive overview of planning, preparedness, and guidance for MCIs at remote industrial sites with a particular emphasis on the oil and gas industry. We argued and demonstrated that:

- MCIs do happen in the oil and gas industry and the potential for their occurrence is increasing;
- the limited medical facilities at a remote industrial site are particularly susceptible to failure with even a small number of casualties, compared to more conventional situations. In a remote area a handful of casualties can constitute an MCI, rather than tens or hundreds in a highly developed, conventional emergency medical system;
- a successful response to an MCI is dependent on appropriate planning and preparedness;
- there is a major shortfall in standards and guidance on MCIs, and thus preparedness, in the industry compared to the armed forces and civilian medical services of most developed countries;
- this shortfall puts personnel at risk of avoidable mortality and morbidity and companies at risk of litigation;

We therefore warmly welcome the forthcoming document on guidance on MCIs from the Health Committee of IPIECA.

In our paper we also provided our own suggestions for MCI preparedness for remote industrial sites based on our combined experience in the military, emergency medicine, the oil and gas industry, health emergency planning and training and supplying military and civilian health services around the world for MCI management. Our proposals on core issues covered:

- planning
- initial reporting from the scene
- primary triage

- immediately necessary lifesaving treatment
- secondary triage
- communication pathways
- specific competencies
- equipment

We felt it was appropriate to test our ideas in an oil and gas context.

Study

Aim

To assess the effectiveness of providing training and task specific equipment in response to a multiple casualty incident at a remote oil and gas installation by comparing relevant outcomes between a trained and specifically equipped group of first responders, providing the initial response to an MCI, and a group of similar personnel without such training and equipment in a live simulated incident.

Location

The study was conducted outdoors on the training ground of the Fire Training Group facility adjacent to Aberdeen Airport, Scotland, using the mock-up of a crashed helicopter.

Volunteers

As "subjects" we used 12 volunteers, most of whom were attending or contributing to an offshore first aid course at the Fire Training Group. We had planned for more than this number but several personnel were called back to work offshore at short notice. The skill mix described below reflects the fact that personnel responding initially in a casualty care role to an incident offshore will primarily be first aiders in many, if not the majority, of circumstances. Training, described in the next paragraph, is also based on this factor.

Volunteers were initially randomised into two groups and then paired, given that best practice in our view is for personnel to operate in pairs in these very challenging circumstances. Pairing was, however, adjusted to balance skill levels where appropriate. Pairing was as follows:-

Group A (no specific training or equipment prior to trial)

Part time on-shore fire fighter, first aider
Casualty simulation role player

Offshore first aider
Offshore first aider

Offshore medic

Group B (specific training and equipment provided immediately prior to the trial)

Occupational health physician with offshore experience
Casualty simulation role player

Offshore first aider
Casualty simulation role player (first aid training several years ago)

Offshore first aider
Offshore first aider

Training

Whilst Group A were being assessed, Group B underwent training prior to their subsequent assessment. This was the standard TSG Associates approach to providing first responders with the knowledge and skills required to effectively perform primary triage and the necessary supporting activities, as the first wave of medical personnel at the scene of an MCI and are described below.

This training was delivered by co-author Smart and consisted of:

On-line training with supervision: 1 hour 15 minutes
Familiarisation with equipment: 30 minutes

In this instance they were only taught primary triage, using the latest version of the "triage sieve" algorithm (see Appendix 2) but not the much more advanced secondary triage method. The term "triage" has been used in many very vague ways in the past but here is defined as the prioritisation of casualties, initially for treatment and later for evacuation.

Other areas covered included the donning of appropriate PPE, provision of an initial situation report to the control room, labeling the casualty with a tag denoting the triage category, immediately necessary lifesaving first aid (limited in this initial situation to simple airway management and arrest of catastrophic limb haemorrhage), management of uninjured survivors and time management.

For equity, Group A received the same training, after they had been assessed, during Group B's assessment.

To prevent bias from sharing of information about the incident, individual pairs within each group were "quarantined" from each other during the assessment of their group, as were the two groups from each other until both had been assessed.

Equipment

All of Group A used a medical rucksack containing a broad range of equipment.

Group B were provided with a purpose-made satchel containing standard equipment specific for the role, as listed overleaf. Information or images regarding items related to triage with which the reader might be unfamiliar are provided in appendices as indicated.

Medical gloves
Triage algorithm
Triage cards and DEAD tags (see Appendix 3)
Casualty tally card (see Appendix 4)
Scene reporting "E.T.H.A.N.E." aide-memoire (See Appendix 5)
Pediatric triage tape (see Appendix 6)
Red light sticks (to indicate P1 casualties at night)
CBRNE inserts for triage cards (see Appendix 7)
Oro-Pharyngeal airways
"CAT" arterial tourniquets,
"Emergency care" bandages
"Water gel" burns dressing

Assessors

Two very experienced colleagues from International SOS performed the assessments to reduce bias. They were:

Dr Jonathan O'Keeffe MRCGP, MBA,
Seadrill Corporate Medical Director and
International SOS Regional Medical Director

Mr John Aitken RGN
Senior Trainer International SOS
HSE Offshore Medic

Neither Dr O'Keeffe nor Mr Aitken declare any conflict of interest regarding their participation and evaluation of this study. Dr O'Keeffe's statement on their role is as follows:

The independent assessors' role was to confirm matching of the intervention groups:

Randomisation of the trainees to the two groups

Comparison of the group demographics for:
Experience as a first responder or basic life support provider offshore
Previous certification and training in emergency response activity of any kind
Recent training of any similar genre

Instructions and marking standardisation

Identification of other sources of bias which might influence results.

Scenario

The scenario given to each pair, immediately prior to entering the accident site, was as follows:-

"Your location is an offshore drilling rig, 100 miles North East of the nearest land. The weather is moderate with wind force 4 and 5m swell. Visibility is 200m. A Super Puma Helicopter is approaching for crew change. There is hot work ongoing

to a pressure vessel 30m from the helideck. As the passengers disembark an explosion occurs in the pressure vessel resulting in a fire ball and blast. The fire is extinguished at source. There are no live casualties at the site of the blast. Multiple live casualties are noted on the helideck.

The safety officer advises you that it is safe to enter the scene and assess the casualties. On entering the scene you note there are multiple non-trapped casualties. You are tasked to implement a multiple casualty response."

"Casualties"

Inflatable dummies were used to represent casualties. A transparent pocket on the front of each dummy's chest contained an A4 sheet with information about the casualty, sufficient to enable primary triage to be conducted. See Appendix 8 for an image of a "casualty". The subjects were familiarised with the nature of the dummies before entering the accident site.

Details of the casualties available to the subjects were:-

Casualty 1	Unable to walk due to lower leg injuries, significant facial trauma. Airway open, respiratory rate 18, pulse 90.
Casualty 2	Crush injury to right side of chest. Confused. Airway open, respiratory rate 42, pulse 136.
Casualty 3	Unable to walk, fracture left arm, some soot around the face. Airway open, respiratory rate 22, pulse 96.
Casualty 4	2nd and 3rd degree burns to both arms, walking. Airway open, respiratory rate 24, pulse 80.
Casualty 5	Amputation lower right leg, bleeding very heavily. Airway open, respiratory rate 32, pulse 140.
Casualty 6	Abdominal pain, no external injury, unable to walk. Airway open, respiratory rate 26, pulse 110.
Casualty 7	Closed head injury. Airway closed, respiratory rate 0, pulse 0.

Assessment

The skills assessed reflected the actions required for first persons on scene attending a MCI.

- selection and application of PPE.
- provision of an initial scene report to the control room

- ☐ assessment of triage priorities
- ☐ securing tagging of the casualties with a triage card
- ☐ counting numbers of casualties in each triage category
- ☐ administration or delegation of immediately necessary lifesaving first aid
- ☐ no provision of initially inappropriate treatment
- ☐ no longer than appropriate spent with each casualty on this "first pass"
- ☐ management of uninjured survivors
- ☐ direction of incoming medical staff to the most appropriate casualty
- ☐ provision of an ongoing situation report to the control room

The following performance scoring system was used:-

Compliance	Score	Interpretation
Fully implemented	2	Excellent / All the required details are mentioned
Partially implemented	1	Good / Part of the requried details is mentioned
Not implemented	0	Bad / Required details are not mentioned at all
N/A	N/A	Not Applicable

Task	**Aim**	**Group A**	**Group B**
Correct PPE worn by responders	Is appropriate to the potential hazards	6	6
	communicates the role of the individual (e.g. uses "Medic" tabard)	0	6
	is worn correctly	6	6
	Total Points	**12**	**18**
	Maximum possible points	**18**	**18**
	Score as a %	**66.7%**	**100%**

	To assess the effectiveness of initial scene reporting	Group A	Group B
Initial scene report	Is a report sent in the first two minutes of arriving on scene?	3	5
	Does the report contain:		
	Exact location	2	5
	Type of incident	1	5
	Hazards	1	5
	Access and egress	0	5
	Number and severity of casualties	2	5
	Emergency Services on scene and required.	2	5
	Total points	**11**	**35**
	Maximum possible points	**42**	**42**
	Score as a %	**26.2%**	**83.3%**

Casualty One Unable to walk due to lower leg injuries, significant facial trauma.	**Prioritisation and management of casualty**	**Group A**	**Group B**
	Was the casualty correctly prioritised P2?	4	6
	Was the casualty labeled correctly with a triage tag?	1	5
	Immediately necessary lifesaving first aid administered?	N/A	N/A
	No inappropriate first aid administered?	6	5
	Less than two minutes spent with casualty?	5	5
	Total points	**16**	**21**
	Maximum possible points	**24**	**24**
	Score as a %	**66.7%**	**87.5%**

Casualty Two	Prioritisation and management of casualty	Group A	Group B
Crush injury to right side of chest. Confused.	Was the casualty correctly prioritised P1?	3	4
	Was the casualty labeled correctly with a triage tag?	1	5
	Immediately necessary lifesaving first aid administered?	N/A	N/A
	No inappropriate first aid administered?	3	6
	Less than two minutes spent with casualty?	5	6
	Total points	**12**	**21**
	Maximum possible points	**24**	**24**
	Score as a %	**50%**	**87.5%**

Casualty Three Unable to walk, fracture left arm, some soot around the face.	**Prioritisation and management of casualty**	**Group A**	**Group B**
	Was the casualty correctly prioritised P2?	2	5
	Was the casualty labeled correctly with a triage tag?	1	5
	Immediately necessary lifesaving first aid administered?	N/A	N/A
	No inappropriate first aid administered?	4	6
	Less than two minutes spent with casualty?	6	6
	Total points	**13**	**22**
	Maximum possible points	**24**	**24**
	Score as a %	**54.2%**	**91.7%**

Casualty Four	Prioritisation and management of casualty	Group A	Group B
2nd and 3rd degree burns to both arms, walking.	Was the casualty correctly prioritised P3?	4	6
	Was the casualty labeled correctly with a triage tag?	1	5
	Immediately necessary lifesaving first aid administered?	N/A	N/A
	No inappropriate first aid administered?	6	6
	Less than two minutes spent with casualty?	6	6
	Total points	**17**	**23**
	Maximum possible points	**24**	**24**
	Score as a %	**70.8%**	**95.8%**

Casualty Five Amputation lower right leg, bleeding very heavily.	**Prioritisation and management of casualty**	**Group A**	**Group B**
	Was the casualty correctly prioritised P1?	5	6
	Was the casualty labeled correctly with a triage tag?	1	5
	Immediately necessary lifesaving first aid administered? (arrest of catastrophic haemorrhage)	5	4
	No inappropriate first aid administered?	5	6
	Less than four minutes spent with casualty?	4	6
	Total points	**20**	**27**
	Maximum possible points	**30**	**30**
	Score as a %	**66.7%**	**90%**

Casualty Six	Prioritisation and management of casualty	Group A	Group B
Abdominal pain, no external injury, unable to walk.	Was the casualty correctly prioritised P2?	5	6
	Was the casualty labeled correctly with a triage tag?	1	5
	Immediately necessary lifesaving first aid administered?	N/A	N/A
	No inappropriate first aid administered?	5	6
	Less than five minutes spent with casualty?	4	6
	Total points	**15**	**23**
	Maximum possible points	**24**	**24**
	Score as a %	**62.5%**	**95.8%**

Casualty Seven 32 year old female, closed head injury.	**Prioritisation and management of casualty**	**Group A**	**Group B**
	Was the casualty correctly prioritised DEAD?	5	4
	Was the casualty labeled correctly with a triage tag?	1	5
	Immediately necessary lifesaving first aid administered? (opening the airway)	6	6
	No inappropriate first aid administered?	4	5
	Less than two minutes spent with casualty?	4	6
	Total points	**20**	**26**
	Maximum possible points	**30**	**30**
	Score as a %	**66.7%**	**86.7%**

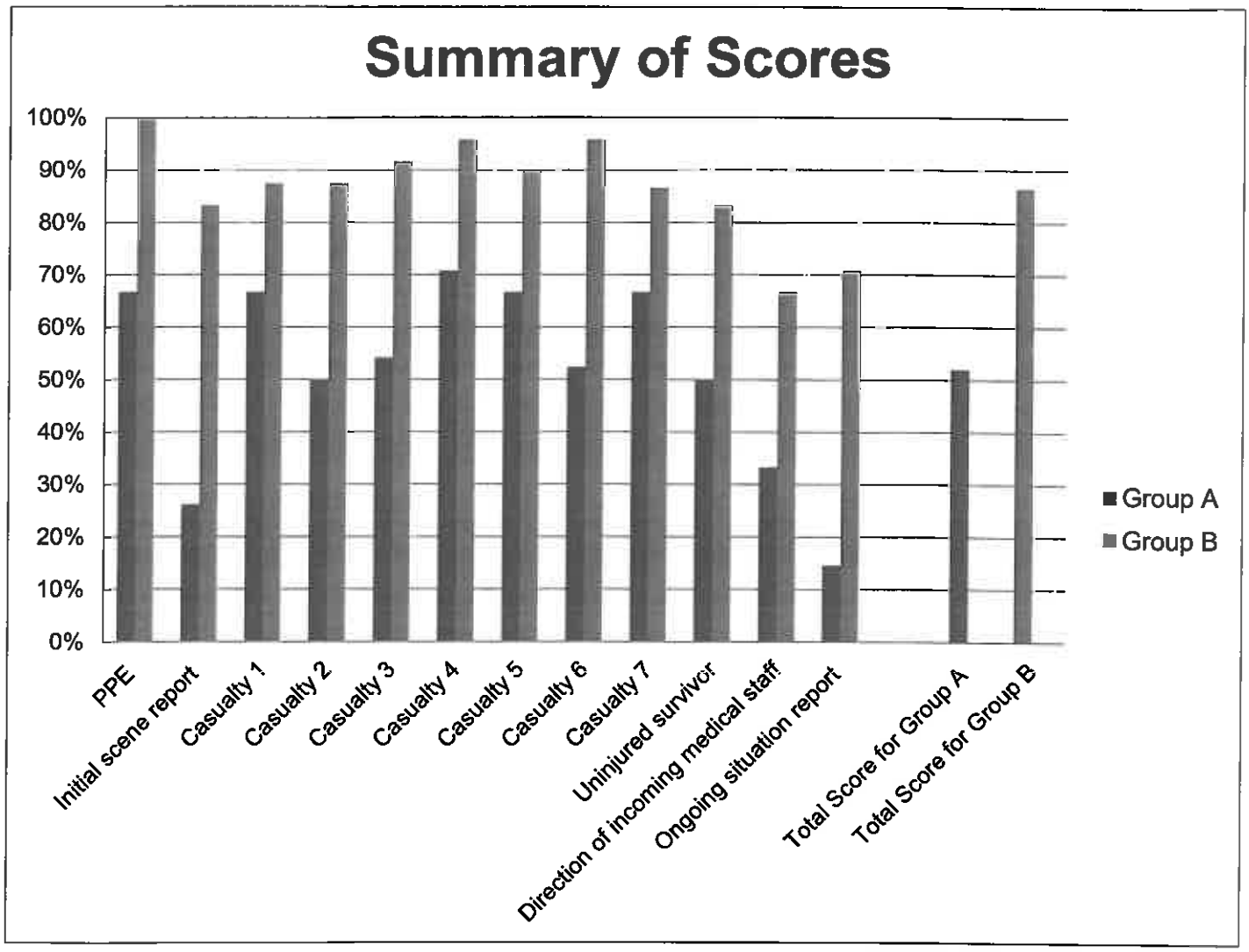
Management of the uninjured survivor		Group A	Group B
	Was the survivor managed appropriately?	3	5
	Total points	**3**	**5**
	Maximum possible points	**6**	**6**
	Score as a %	**50%**	**83.3%**

Direction of incoming medical staff to the most appropriate casualty.		Group A	Group B
	Were further incoming first aid or medical personnel on scene directed to the correct casualties?	2	4
	Total points	**2**	**4**
	Maximum possible points	**6**	**6**
	Score as a %	**33.3%**	**66.7%**

	To assess the effectiveness of follow up scene reporting	Group A	Group B
Ongoing situation report	Was a further scene report volunteered without prompting?	0	5
	Does the report contain additional information on:		
	Exact location	1	5
	Type of incident	0	5
	Hazards	0	5
	Access and egress	0	2
	Correct numbers of casualties	2	5
	Correct severity of casualties	2	4
	Emergency Services on scene and required	2	3
	Total points	**7**	**34**
	Maximum possible points	**48**	**48**
	Score as %	**14.6%**	**70.8%**

Summary of scores

	Group A	Group B
PPE	66.7%	100%
Initial scene report	26.2%	83.3%
Casualty 1	66.7%	87.5%
Casualty 2	50%	87.5%
Casualty 3	52.4%	91.7%
Casualty 4	70.8%	95.8%
Casualty 5	66.7%	90%
Casualty 6	62.5%	95.8%
Casualty 7	66.7%	86.7%
Uninjured survivor	50%	83.3%
Direction of incoming medical staff	33.3%	66.7%
Ongoing situation report	14.6%	70.8%
Total	**52.4%**	**86.6%**



Average time to complete task

Group A	15 mins 40 secs
Group B	8 mins 59 secs

Discussion and Conclusion

It can be readily seen from the results above that in this MCI scenario the trained and equipped group performed better in all the activities that were assessed. This group also completed the task much more quickly. Importantly, the untrained group reported much higher levels of stress than the trained group.

It is worth noting that the scores of the untrained group were actually artificially slightly elevated when the first pair was inadvertently prompted to use their triage cards.

Of particular importance is the differential in scores for the situation reports, in that the poor quality of these in the untrained group would have an immensely negative impact on the overall management of the incident.

Lower scores in the untrained group in casualty prioritisation and management would not only effect the outcomes for the individual patient in question but would lead to limited resources being diverted to the wrong patients i.e., not in order of clinical priority.

In the untrained group the lower scores regarding PPE, management of uninjured survivors, direction of incoming first aid or medical personnel to the most appropriate casualty, the time taken to complete the task and anecdotally reported high stress levels all speak for themselves.

We recognise that these results might seem self-evident: training and equipping an operator for any task is likely to enable them to perform better than an untrained operator without a task-specific kit. We would agree with such criticism. However the relative paucity of MCI preparedness in the oil and gas industry's remote locations and, until recently, the lack of guidance in the industry, had lead us to believe that such empirical evidence can only advance the cause of MCI preparedness at remote sites.

Opportunities for further study include a larger study, as we recognise the small numbers in this one; the effect of a longer period of training than that in this study and the differential in performance between the two groups with a significant time lag between training and testing in Group B.

Further commentary by Dr O'Keeffe

Although this study was small in terms of number participants, it is important for several reasons. Multiple Casualty Incident response competency offshore is often under resourced and under rehearsed in terms of training. This study aimed to assess the baseline competency of a group of offshore workers who would be expected to respond to an incident involving several injured workers simultaneously. It also aims to compare the efficacy of primary triage in those who receive focused deliberate short training in MCI versus those who do not.

Due to the low number of trainees and the unblended nature of the study, it is not possible to conclude that results are statistically significant.

The trained and untrained groups were roughly similar in demographic, experience and prior training in offshore medical emergency response.

The instructions and assessment environment were standardised for both groups as much as possible.

Both groups were kept separate throughout the study.

Both groups were given identical instructions on the severity of the casualties and their role.

On this occasion there is a marked increase in MCI triage capability as a result of the training.

In addition there was a marked difference in the time it took for first responders to carry out their initial assessment and stabilisation of casualties, the untrained and unequipped group taking much longer.

Intuitively we know the value of good communication in emergency or crisis situations. The trained group provided much more useful information on the emergency situation than their untrained counterparts.

Resources are always scarce in MCI response. This study demonstrates that MCI trained responders perform better in allocating resources appropriately. This can mean all the difference when deciding modes of transport, for example.

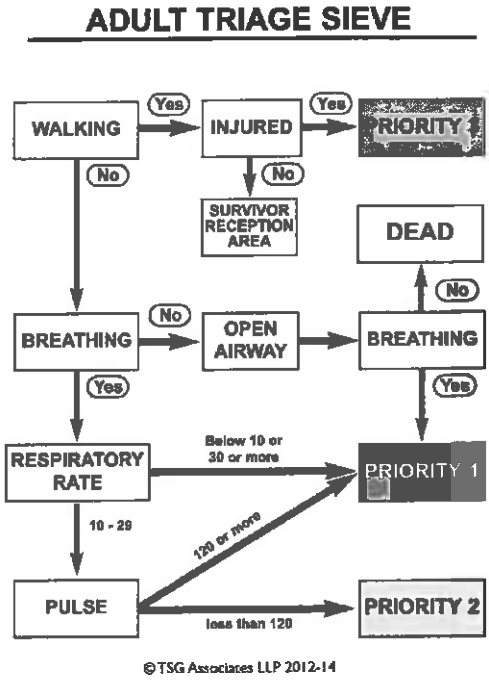
Summary:

This study demonstrates the value of MCI training to improve offshore first responders' ability to conduct triage, stabilise life and limb threatening injuries and to call for appropriate help and definitive care support.

A further larger study would be necessary to reduce the likelihood of bias and improve the statistical power of the results. However it is unlikely, in my opinion, that a larger study would change the positive effects of the intervention i.e., provision of high quality MCI training systems to offshore workers.

Appendix 1: Responding to multiple casualties in remote industrial locations: a discussion document. The Journal of the Institute of Remote HealthCare, July 2015 Vol 6 Issue 2, 25-39.
(See attachment Appendix 1)

Appendix 2: Triage sieve primary triage algorithm
This is the "triage sieve" algorithm for primary triage that can be used by suitably trained first responders.



Appendix 3: Triage cards and DEAD tags
This is the "Smart" triage card used by Group B.

Appendix 4: Casualty tally card

This is the system used by Group B to maintain an ongoing record of patients in each triage category.

CASUALTY COUNT

The Triage Sieve flow chart on the reverse should only be used for adults.
For Paediatric Triage (0 to 10 years) use the Smart Tape.

Cross out the next number in each priority as you label a new casualty

PRIORITY 1 IMMEDIATE	1	2	3	4	5	6	7	8		
	9	10	11	12	13	14				
	15	16	17	18	19	20				
PRIORITY 2 URGENT	1	2	3	4	5	6	7	8		
	9	10	11	12	13	14				
	15	16	17	18	19	20				
PRIORITY 3 DELAYED	1	2	3	4	5	6	7	8		
	9	10	11	12	13	14				
	15	16	17	18	19	20				
DEAD	1	2	3	4	5	6	7	8	9	10

Appendix 5: Scene reporting E.T.H.A.N.E. aide-memoire

SCENE UP SIZE REPORT

EXACT LOCATION

TYPE OF INCIDENT

HAZARDS

ACCESS AND EGRESS

NUMBER AND SEVERITY OF CASUALTIES

EMERGENCY SERVICES ON SCENE AND REQUIRED

SMART EQUIPMENT
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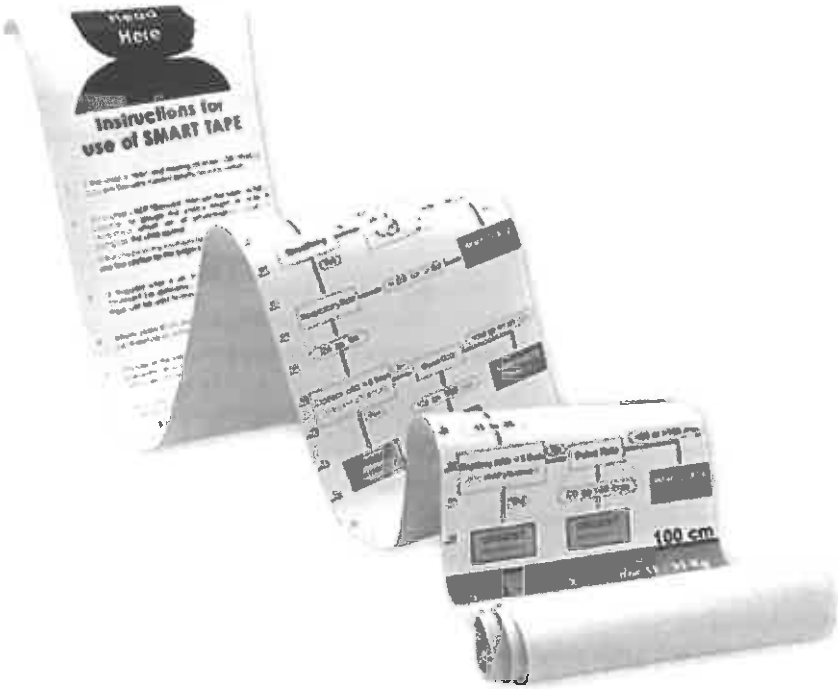
Appendix 6: Paediatric triage tape

This system is used to adapt the adult triage sieve algorithm for primary triage in children but was not needed in this study.



Appendix 7: CBRNE inserts for triage cards

These inserts are available for use with standard triage cards in the event of chemical, biological, radiological or nuclear incidents.

Appendix 8: Casualty dummy

This is the inflatable dummy with patient information used in this study.