Triage Performance of School Personnel Using the SALT System

Daniel H. Celik, MD;[1,2] Francis R. Mencl, MD, MS;[1,2] Michel Debacker, MD;[3] Lisa Kurland, MD, PhD;[4] Scott T. Wilber, MD, MPH;[2] Jennifer A. Frey, PhD, CCRP[2,5]

1. Academic and Community Emergency Specialists, Uniontown, Ohio USA
2. Summa Health System, Akron, Ohio USA
3. Research Group on Emergency and Disaster Medicine (ReGEDiM), Vrije Universiteit Brussel, Brussels, Belgium
4. Department of Medical Sciences, Örebro University and Department of Emergency Medicine, Örebro University Hospital, Örebro, Sweden
5. The Ohio State University, Columbus, Ohio USA

Correspondence:
Daniel H. Celik, MD
Academic and Community Emergency Specialists
3730 Tabs Drive
Uniontown, Ohio 44685 USA
E-mail: dhcelik@gmail.com

Conflicts of interest/disclaimer: Daniel H. Celik presented this research as a poster at the National Association of EMS Physicians (NAEMSP; Overland Park, Kansas USA) 2017 Annual Meeting in New Orleans, Louisiana USA. The authors have no conflicts of interest to disclose. The authors alone are responsible for the content and writing of the paper.

Keywords: disaster medicine; Emergency Medical Services; mass-casualty incidents; tourniquets; triage

Abbreviations:
C-A-T: Combat-Application-Tourniquet
CPR: cardiopulmonary resuscitation
EMS: Emergency Medical Services
MCI: mass-casualty incident
OSCE: objective-structured clinical exam
SALT: Sort, Assess, Life-saving interventions, Treat/Transport

Received: December 30, 2018
Revised: March 19, 2019
Accepted: April 6, 2019

doi:10.1017/S1049023X1900462X

Abstract

Introduction: The aim of this study was to determine if school personnel can understand and apply the Sort, Assess, Life-saving interventions, Treat/Transport (SALT) triage methods after a brief training. The investigators predicted that subjects can learn to triage with accuracy similar to that of medically trained personnel, and that subjects can pass an objective-structured clinical exam (OSCE) evaluating hemorrhage control.

Methods: School personnel were eligible to participate in this prospective observational study. Investigators recorded subject demographic information and prior medical experience. Participants received a 30-minute lecture on SALT triage and a brief lecture and demonstration of hemorrhage control and tourniquet application. A test with brief descriptions of mass-casualty victims was administered immediately after training. Participants independently categorized the victims as dead, expectant, immediate, delayed, or minimal. They also completed an OSCE to evaluate hemorrhage control and tourniquet application using a mannequin arm.

Results: Subjects from two schools completed the study. Fifty-nine were from a private school that enrolls early childhood through grade eight, and 45 from a public school that enrolls grades seven and eight (n = 104). The average subject age was 45 years and 68% were female. Approximately 81% were teachers and 87% had prior cardiopulmonary resuscitation (CPR) training. Overall triage accuracy was 79.2% (SD = 10.7%). Ninety-six (92.3%) of the subjects passed the hemorrhage control OSCE.

Conclusions: After two brief lectures and a short demonstration, school personnel were able to triage descriptions of mass-casualty victims with an overall accuracy similar to medically trained personnel, and most were able to apply a tourniquet correctly. Opportunities for future study include integrating high-fidelity simulation and mock disasters, evaluating for knowledge retention, and exploring the study population's baseline knowledge of medical care, among others.

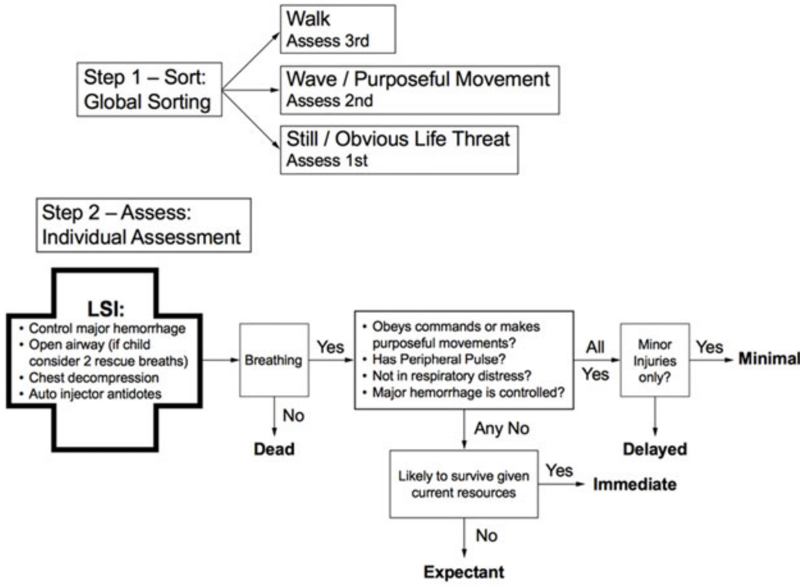
Celik DH, Mencl FR, Debacker M, Kurland L, Wilber ST, Frey JA. Triage performance of school personnel using the SALT system. ***Prehosp Disaster Med.*** **2019;34(4):401–406.**

Introduction

Triage systems are utilized in disasters or mass-casualty incidents (MCIs) when medical needs outweigh available resources. These systems establish the order of priorities for stabilization and evacuation of casualties for the benefit of the largest possible number of victims.[1]

The Sort, Assess, Life-saving intervention, Treatment/Transport (SALT) triage system has been proposed as a national standard based on the best available science and expert consensus.[2–4] It was developed with the support of the Centers for Disease Control and Prevention (Atlanta, Georgia USA), the American Academy of Pediatrics (Itasca, Illinois USA), the American College of Emergency Physicians (Irving, Texas USA), the American College of Surgeons Committee on Trauma (Chicago, Illinois USA), the National Association of Emergency Medical Service (EMS) Physicians (Overland Park, Kansas USA), and others.[3] The SALT method employs global patient sorting, individual assessment, life-saving interventions, and treatment/transport decisions in the setting of disasters and MCIs.[2–8] Life-saving interventions include hemorrhage control, opening the airway, rescue breathing in children, needle thoracostomy, and antidote autoinjectors (Figure 1).

The training and application of triage principles has thus far been limited to medically trained personnel (ie, emergency medical technicians, nurses, physicians, and medical students) and other first responders (ie, firefighters and police officers).[5–20] No studies to



Celik © 2019 Prehospital and Disaster Medicine

Figure 1. SALT Mass-Casualty Triage Algorithm.
Abbreviation: LSI, life-saving intervention; SALT, Sort, Assess, Life-saving interventions, Treat/Transport.

date have examined triage training and application in the lay public. Often, the public is first on-scene during disasters and is in a unique position to sort, triage, and provide life-saving interventions to victims prior to EMS arrival. Life-saving interventions such as tourniquets can save lives; however, these procedures need to be performed correctly and within minutes.[21–25]

The investigators asked if an educated, highly motivated group of lay people, such as school personnel, could be trained to understand and apply SALT triage methods. School personnel were selected because they are typically in close proximity to, and responsible for, large groups of persons for multiple hours per day, many days of the year, and typically over the span of a many-year career. They may be the first on-scene at an incident such as a shooting, explosion, fire, tornado, bus accident, or other disaster.

The aim of the study was to demonstrate that school personnel can learn and apply SALT principles after a brief training. The investigators predicted that their triage accuracy, over-triage, and under-triage rates will be similar to medically trained personnel. In addition, it was predicted that the majority of school personnel would be able to demonstrate hemorrhage control techniques.

Methods

Study Design and Participants

This was a prospective observational study, and included adult school employees from the Akron, Ohio (USA) area during their in-service training. Job titles were recorded, and participation was voluntary. No subjects were excluded. Participants attended two 30-minute oral presentations. The first was an introduction to SALT triage. This presentation was adapted from material available online, which contains a “downloadable [PowerPoint; Microsoft Corp.; Redmond, Washington USA] set for teaching SALT Triage to others.”[4] The second presentation was created by the investigators, and gave an introduction to hemorrhage control techniques. Presentations were followed by a hands-on demonstration of hemorrhage control using direct pressure and Combat-Application-Tourniquets (C-A-T; C-A-T Resources; Rock Hill, South Carolina USA). Presentation materials were piloted and pre-tested for appropriate language and content with a small population similar to the study population.

Data Collection and Testing

Participants were assigned a personal identification number (PIN), and all collected data were de-identified. Investigators documented participants’ age, sex, level of education, current job title, and prior medical experience.

Participants evaluated a 25-victim disaster scenario involving a mass shooting (Table 1). The investigator-generated victims ranged in age from 15–65 years old and included two dead, four expectant, seven immediate, seven delayed, and five minimal victims. One victim (Victim 25) was not injured, but presented with a medical emergency. Victims were presented via a timed slide presentation. Each slide was displayed for 30 seconds and contained the victim’s age, sex, mechanism of injury, and pertinent medical information. Participants were not allowed to use reference materials, discuss the cases, or see any of the slides more than once during testing. Participants assigned each victim to a triage category, either immediate, delayed, minimal, expectant, or dead, on an answer sheet.

An objective-structured clinical exam (OSCE) was developed to evaluate hemorrhage control techniques using direct pressure and tourniquet application on a mannequin arm (Table 2). Objective actions necessary to complete the OSCE were derived from Prehospital Trauma Life Support.[26] Researchers directly observed participants and recorded their performance using a checklist of procedural actions. All attempts were made to keep the testing private to prevent participants from observing others.

Data Analysis

Investigators used means and standard deviations (SD) to analyze participants’ demographic information, triage accuracy, over-triage and under-triage rates, and OSCE pass rates.

The triage accuracy was assessed based on triage categories pre-determined by the investigators, an expert group with

	Assigned Triage Category (Number of Responses)				
	I	D	M	E	X
1. 65-year-old male with no obvious injuries. Not moving or following commands. Not breathing after you open his mouth.	2	2	0	7	93[a]
2. 45-year-old female with a massive gunshot wound to the head and exposed brain. Not moving or following commands. Slow irregular gasping. Weak pulse.	3	0	0	93[a]	8
3. 16-year-old male with a gunshot wound through the upper arm. Walking and following commands. Normal breathing. Minimal bleeding and normal pulse.	3	85[a]	14	2	0
4. 17-year-old female who twisted her ankle. Able to walk with assistance. Normal breathing. Normal pulse.	0	10	94[a]	0	0
5. 16-year-old female with multiple gunshots to the head, chest, and abdomen. Not moving or following commands. Not breathing when you open her mouth.	0	0	0	7	97[a]
6. 15-year-old female with a gunshot wound to her forearm. Cannot move injured arm. Walking and following commands. Pulse and breathing normal.	9	85[a]	9	1	0
7. 16-year-old female with an obviously deformed, broken wrist. Walking and following commands. Normal breathing. Normal pulse. [b]	1	73[a]	28	1	0
8. 15-year-old male crying, with no obvious injuries. Walking and following commands. Normal breathing. Normal pulse. [b]	0	10	93[a]	0	0
9. 17-year-old female with a gunshot wound to her knee and exposed bone. Unable to walk. Follows commands. No pulse in injured leg.	84[a]	18	0	2	0
10. 16-year-old male with a gunshot wound to the groin/thigh. Not responding to commands. Profuse bleeding and not able to place tourniquet. Irregular breathing.	39	1	1	62[a]	1
11. 16-year-old male with scrapes on his hands after falling. Walking and following commands. Normal breathing. Normal pulse.	1	3	97[a]	2	1
12. 17-year-old male with a gunshot wound to the chest. Unable to walk, but is following commands. Very rapid and painful breathing. Fast pulse.	90[a]	5	1	8	0
13. 15-year-old male with a gunshot to the leg. Unable to walk. Profuse, major bleeding. Weak pulse in the injured leg.	100[a]	1	0	3	0
14. 15-year-old female with bruising over her right knee. Walking and following commands. Normal breathing and pulse. [b]	0	4	99[a]	0	0
15. 16-year-old male with an obviously deformed, broken ankle. Weak pulse in the injured foot. Unable to walk.	27	75[a]	2	0	0
16. 17-year-old male with a gunshot wound to the lower back. Cannot move or feel legs. Breathing normal. Pulse normal.	39	63[a]	1	1	0
17. 50-year-old male with a broken, deformed ankle. Unable to walk, but following commands. Strong pulse in injured leg. Normal breathing.	0	88[a]	16	0	0
18. 17-year-old female with a gunshot wound to the leg. Follows commands. Bleeding has already been controlled with a tourniquet.	7	87[a]	9	1	0
19. 40-year-old male that fell and hit his head. Uncoordinated. Unable to walk or make purposeful movements.	48[a]	49	5	2	0
20. 15-year-old female found under a bookcase that fell on her. Confused and unable to follow directions. Irregular, rapid breathing. [b]	79[a]	19	4	1	0
21. 35-year-old male with a superficial (grazing) bullet wound. Walking and following commands. Normal breathing and pulse.	1	19	83[a]	1	0
22. 17-year-old female with multiple gunshot wounds to her chest. Not following commands. Irregular gasping breathing. Weak pulse.	16	0	2	82[a]	4
23. 15-year-old male with multiple gunshot wounds to his chest and abdomen. Not moving or following commands. Gasping breaths. Weak pulse.	11	0	0	86[a]	7
24. 16-year-old female with a gunshot wound to her forearm. Profuse, rapid bleeding. Weak pulse in the injured arm. Fast breathing.	98[a]	3	1	2	0
25. 15-year-old female with a history of asthma and no injuries. Rapid, uncontrolled breathing. Rapid pulse. Following commands.	26[a]	45	32	1	0

Table 1. Descriptions of Victims and Assigned Triage Categories
Note: I = Immediate, D = Delayed, M = Minimal, E = Expectant, X = Dead.
[a] Denotes correct triage category.
[b] Denotes only 103 responses for this victim.

https://doi.org/10.1017/S1049023X1900462X Published online by Cambridge University Press

The subject is provided with a C-A-T tourniquet and presented with a mannequin arm complete with a simulated puncture wound. The subject is advised that they are treating a middle-aged adult who was shot in the forearm (along with many other victims who were injured). The wound is bleeding rapidly and profusely. The victim is awake and talking.
Actions Performed
1. Recognized rapid and profusely bleeding limb.[a]
2. Applied direct pressure to wound.[a]
3. Reassessed and recognized continued bleeding.[a]
4. Applied self-adherent strap proximal to wound.[a]
5. Avoided joints.
6. Tightened windlass until bleeding stopped.[a]
7. Secured in place with clip and strap.[a]

Table 2. Hemorrhage Control OSCE
Abbreviations: C-A-T, Combat-Application-Tourniquets; OSCE, objective-structured clinical exam.
[a] Denotes a critical action.

Total Subjects (n)	104
Females %	68
Average Age (years)	45 (range 25-71)
Teachers %	81
CPR Trained %	87
Graduate-Level Education %	59
Bachelor's-Level Education %	35

Table 3. Subject Demographic Information
Abbreviation: CPR, cardiopulmonary resuscitation.

Triage Accuracy % (SD)	79.2 (10.7)
Over-Triage Rate % (SD)	8.7 (6.0)
Under-Triage Rate % (SD)	12.0 (8.5)
Hemorrhage Control OSCE Pass Rate %	92.3

Table 4. Summary of Results
Abbreviation: OSCE, objective-structured clinical exam.

experience in emergency medicine, disaster medicine, and EMS. Victim scenarios were designed and edited when necessary to reach a consensus among the expert group. Over-triage was defined as the inappropriate assignment of a victim to a higher triage category than designed by the expert group, a decision that could hinder rapid identification and care for more seriously injured victims. Under-triage was defined as the inappropriate assignment of a victim to a lower triage category than designed by the expert group, which could lead to adverse consequences or death from treatment delay.

In order to pass the OSCE, participants had to complete 80% of the procedural actions and all of the critical actions.

IRB Approval

The study was approved by the Summa Health System Institutional Review Board (Akron, Ohio USA).

Results

Two Akron, Ohio area schools enrolled in the study. Fifty-nine subjects from a private, co-educational school serving students from early childhood through grade eight and 45 subjects from a public, suburban, co-educational school serving students from grade seven through eight participated in the study. The sessions were conducted during a mandatory in-service day for the school personnel to ensure adequate numbers of participants. Participation in the study, however, was entirely voluntary.

Sixty-eight percent of the subjects were female, and the average age was 45 years (range 25–71 years). The majority of subjects (81%) identified as teachers. The other subjects included eight office staff members, seven administrative personnel, one counselor, one librarian, one psychologist, and one secretary. Ninety-four percent were college educated, with 59% of subjects holding a graduate degree, while 35% reported a bachelor's degree as their highest level of education. Most (87%) were cardiopulmonary resuscitation (CPR) trained, and many reported prior first aid training. Two subjects reported prior triage training (Table 3).

All 104 subjects participated in the triage and hemorrhage control testing. Two subjects only triaged 24 of the 25 victims, and one subject only triaged 23 victims. Subjects correctly triaged an average of 19.8 of the 25 victims (79.2%; SD = 10.7%). Individual scores ranged from 11–24. Table 1 shows a breakdown of assigned triage categories for each victim. The over-triage rate was 8.7% (SD = 6.0%). The under-triage rate was 12.0% (SD = 8.5%; Table 4).

Ninety-six of the subjects passed the hemorrhage control OSCE (92.3%). Nine subjects (8.7%) did not avoid the elbow joint on the mannequin arm. This was a non-critical action and did not result in automatic failure of the OSCE. Five subjects (4.8%) failed to tighten the windlass on the tourniquet. This was a critical action and resulted in failure of the OSCE.

Discussion

The study demonstrated that school personnel could learn and apply SALT principles after a brief training. The overall triage accuracy was similar to the 60%–80% observed in studies that evaluated medically trained personnel and other first responders.[6–10,13–16] The over-triage and under-triage rates were comparable to previously published studies with over-triage rates of 5%–23%[6,8–10,13,14,17] and under-triage rates of 3%–33%.[6,8–10,13–16] These results suggest that lay people may be trained to assist with MCI primary triage. In addition, most of the subjects were able to demonstrate hemorrhage control techniques.

It was noted that triage accuracy was higher than expected for dead and minimal victims, and most of these victims were triaged correctly. On the other hand, school personnel had more difficulty triaging immediate, delayed, and expectant patients (Table 5). Investigators also noted that subjects had a large variation of answers for many of the victims. In 15 out of 25 (60%) victims, subjects chose four out of five possible triage categories. Investigators would not expect this finding when testing medically trained individuals. The investigators suspect that it is easier for school personnel to discern victims at clinical extremes (ie, dead or minimal), while the other victims bring a degree of clinical uncertainty. If the lay public were trained to provide triage during a disaster, they may benefit from a simplified triage scheme consisting of three categories (eg, dead, minimal, and injured/ill). This may be easier to teach and implement, and such a scheme could help direct arriving rescuers to focus on re-triaging and treating victims who need medical attention.

Subjects had difficulty with four of the victims in particular. These victims were only correctly triaged by 25%–61% of the

https://doi.org/10.1017/S1049023X1900462X Published online by Cambridge University Press

	Intended Triage Category				
Assigned Category	Immediate	Delayed	Minimal	Expectant	Dead
Immediate	72.2[a]	11.8	0.4	16.6	1.0
Delayed	19.3	76.5[a]	8.9	0.2	1.0
Minimal	5.9	10.9	90.0[a]	0.7	0
Expectant	2.6	0.8	0.6	77.6[a]	6.7
Dead	0	0	0.2	4.8	91.3[a]

Table 5. Assigned Triage Category Compared with Intended Triage Category (%)
[a] Represents the correct category. The percentages above and below the correct categories indicate over-triaged and under-triaged victims, respectively.

subjects, and they may give insight as to how to direct future education and study.

Victim 10 had uncontrollable bleeding from a gunshot wound to the groin. Sixty percent of subjects correctly identified this patient as expectant, while 39% over-triaged him. While the victim was not able to follow commands, was in respiratory distress, and had uncontrolled bleeding, it may have been a challenge for the subjects to recognize that this victim was unlikely to survive.

Victim 16 had a gunshot wound to the lower back resulting in paralysis. Sixty-one percent of subjects triaged this victim as delayed, but 38% triaged him as immediate. While the victim did not meet SALT criteria as an immediate patient, investigators suspect some subjects failed to follow the SALT algorithm and may have over-triaged him because of the perceived severity of his injury.

On the other hand, Victim 19 may have been under-triaged because the severity his injuries was unknown, or at least not readily apparent. He had a head injury, was uncoordinated, and was unable to make purposeful movements. Only 46% of subjects correctly triaged him as immediate, while more than one-half of subjects failed to follow the SALT algorithm, resulting in under-triage.

Finally, Victim 25 was under-triaged by 75% of school personnel. She had a history of asthma and presented with rapid, uncontrolled breathing, and rapid pulses. The investigators suspect that the school personnel had difficulty applying the triage algorithm to a patient with an emergent medical condition. It may also be that SALT criteria are not specific enough to apply to uninjured or medical patients. Investigators also considered that school personnel may have experience dealing with asthma exacerbations through their careers, and this may bias their assessment.

The findings suggested that subjects were able to use tourniquets, and the majority of subjects passed the hemorrhage control OSCE. This was not surprising as research has demonstrated that lay people are able to correctly apply a tourniquet after a one-hour Bleeding Control Basic (BCon) course.[27,28] Others have suggested that brief training can increase self-efficacy and willingness to use tourniquets among the lay public.[29] Educational programs such as Stop the Bleed have since been implemented throughout the United States.

Although the findings were promising, there was some room for improvement. The most common reason for failing the OSCE was failure to tighten the windlass, a critical action missed by five subjects. Three subjects failed to secure the tourniquet in place with the clip and strap, and two subjects failed to apply the strap proximal to the wound. These were also critical actions, which resulted in failure of the OSCE. The most commonly missed, non-critical action was failure to avoid the elbow joint. Other research has shown that C-A-T application failure among lay persons is mainly due to incorrect positioning, device too loose, and did not use the windlass.[30]

Limitations

The study had several limitations. Complete application of the SALT algorithm was not tested—victims were not globally sorted due to limitations in the study design. Also, chest decompression and auto injectors were not taught or tested. Investigators felt that school personnel did not have the background knowledge nor the equipment necessary for these procedures.

In addition, opening the airway and rescue breathing skills were not tested. Investigators initially surmised that school personnel would have no difficulty with these interventions due to prior CPR training, but were surprised to learn that 13% of subjects did not report prior CPR training. Furthermore, with the emphasis shifting towards compression-only CPR, the investigators believe future studies should evaluate these skills in the lay public.

It was noted that this study, like similar studies performed on medically trained personnel, does show that school personnel can triage victims in a slide presentation; but it does not indicate how they will perform during a real disaster or MCI. Although the mannequin arm did add some realism to the testing, it is still very different than a real arm with real injuries. Further triage and hemorrhage control testing should utilize mock disasters, live actors, high-fidelity simulation, and/or simulated pulsatile bleeding amenable to tourniquet placement.

It is unknown how well school personnel or other lay people will retain SALT triage training over time. One study did show that firefighters were able to sustain SALT triage skills at least six months after 60 minutes of initial training.[10] Another study, however, showed degradation of SALT triage skills after only three months,[15] and this finding may benefit from future research.

The investigation presented some challenges with regard to training the lay public. While the investigators were careful to adapt language and content for non-medical subjects, they suspect that subjects need further training to put medical conditions into context using the SALT algorithm (eg, what type of bleeding constitutes a "major hemorrhage?" What does "respiratory distress" look like? How can the public learn to quickly and accurately identify a peripheral pulse? Which victims are "likely to survive given current resources?"). The investigators suspect that lay people are unlikely to know the extent of available EMS and local health care resources, and furthermore would not expect them to make predictions about victim mortality. These questions require further study.

Training teachers and school personnel also posed unique limitations. While the study was met with almost universal interest by teachers and school administrators, it was difficult to recruit subjects. School personnel only had limited days during the school year for staff in-

https://doi.org/10.1017/S1049023X1900462X Published online by Cambridge University Press

service, and they had limited schedules to allow for any lengthy training and testing. One school system declined to participate, stating that they would rely on local EMS and law enforcement for disaster response. School personnel raised unique concerns regarding triage training, including fear of liability and medical malpractice, risk of personal injury during a disaster, and possible emotional and psychological sequelae from responding to disasters.

Conclusion

This was the first study to show that school personnel are able to apply the SALT algorithm after a 30-minute educational presentation, and their triage accuracy is similar to that of medically trained personnel and first responders shown in other studies. Most subjects were able to pass a hemorrhage control and tourniquet use OSCE after a 30-minute presentation and hands-on demonstration. The study population was associated with many unique challenges, including fears regarding safety, liability, and emotional/psychological sequelae, plus difficulty with scheduling availability for training. Future opportunities for research include the integration of high-fidelity simulation and mock disasters, evaluating knowledge retention, and exploring medical knowledge and clinical skills in this population.

Acknowledgments

The authors would like to thank the faculty and staff of the European Master's Degree in Disaster Medicine for assistance with developing the concept and methodology; also Dr. Colleen M. Mcquown, Dr. Kirk A. Stiffler, Joel Biro, Michael Kollert, Christopher Morrison, Brian Tritchler, and Jon Zalewski for help with data collection.

References

1. Debacker M. "Some considerations on triage in disasters." In: de Boer J, Dubouloz M (eds). *Handbook of Disaster Medicine*. Van der Wees, Utrecht, The Netherlands: CRC Press; 2000:329–335.
2. Lerner EB, Schwartz RB, Coule PL, et al. Mass casualty triage: an evaluation of the data and development of a proposed national guideline. *Disaster Med Public Health Prep*. 2008;2(Suppl 1):S25–S34.
3. Lerner EB, Cone DC, Weinstein ES, et al. Mass casualty triage: an evaluation of the science and refinement of a national guideline. *Disaster Med Public Health Prep*. 2011;5(2):129–137.
4. SALT Triage Training PowerPoint (Download). NDLSF Web site. www.salttriage.org. Accessed March 7, 2013.
5. Byrum S, Lerner EB, Coule PL. SALT triage drill. *Disaster Med Public Health Prep*. 2009;3(3):129.
6. Cone DC, Serra J, Burns K, MacMillan DS, Kurland L, Van Gelder C. Pilot test of the SALT mass casualty triage system. *Prehosp Emerg Care*. 2009;13(4):536–540.
7. Deluhery MR, Lerner EB, Pirrallo RG, Schwartz RB. Paramedic accuracy using SALT triage after a brief initial training. *Prehosp Emerg Care*. 2011;15(4):526–532.
8. Lerner EB, Schwartz RB, Coule PL, Pirrallo RG. Use of SALT triage in simulated mass-casualty incident. *Prehosp Emerg Care*. 2010;14(1):21–25.
9. Heffernan RW, Lerner EB, McKee CH, et al. Comparing the accuracy of mass casualty triage systems in a pediatric population. *Prehosp Emergency Care*. 2018.
10. Nilsson A, Aslund K, Lampi M, Nilsson H, Jonson CO. Improved and sustained triage skills in firemen after a short training intervention. *Scand J Trauma Resusc Emerg Med*. 2015;23:81.
11. Risavi BL, Salen PN, Heller MB, Arcona S. A two-hour intervention using START improves prehospital triage of mass casualty incidents. *Prehosp Emerg Care*. 2001;5(2):197–199.
12. Cicero MX, Auerbach MA, Zigmont J, Riera A, Ching K, Baum CR. Simulation training with structured debriefing improves residents' pediatric disaster triage performance. *Prehosp Disaster Med*. 2012;27(3):239–244.
13. Cone DC, Serra J, Kurland L. Comparison of the SALT and SMART triage systems using a virtual reality simulator with paramedic students. *Eur J Emerg Med*. 2011;18(6):314–321.
14. Lee CW, McLeod SL, Van Aarsen K, Klingel M, Franc JM, Peddle MB. First responder accuracy using SALT during mass-casualty incident simulation. *Prehosp Disaster Med*. 2016;31(2):150–154.
15. Lee CW, McLeod SL, Peddle MB. First responder accuracy using SALT after brief initial training. *Prehosp Disaster Med*. 2015;30(5):447–451.
16. Jones N, White ML, Tofil N, Pickens M, Youngblood A, Zinkan L, Baker MD. Randomized trial comparing two mass casualty triage systems (JumpSTART versus SALT) in a pediatric simulated mass casualty event. *Prehosp Emerg Care*. 2014;18(3):417–423.
17. Kaplan BG, Connor A, Ferranti EP, Holmes L, Spencer L. Use of emergency preparedness disaster simulation with undergraduate nursing students. *Public Health Nursing*. 2011;29(1):44–51.
18. Sapp RF, Brice JH, Myers JB, Hinchey P. Triage performance of first-year medical students using a multiple-casualty scenario, paper exercise. *Prehosp Disaster Med*. 2010;25(3):239–245.
19. Kilner T. Triage decisions of prehospital emergency health care providers, using a multiple casualty scenario paper exercise. *Emerg Med J*. 2002;19(4):348–353.
20. Kilner T, Hall FJ. Triage decisions of United Kingdom police firearms officers using a multiple-casualty scenario paper exercise. *Prehosp Disaster Med*. 2005;20(1):40–46.
21. Mabry RL, Holcomb JB, Baker AM, et al. United States Army Rangers in Somalia: an analysis of combat casualties on an urban battlefield. *J Trauma*. 2000;49(3):515–528.
22. Butler FK Jr, Hagmann J, Butler EG. Tactical combat casualty care in Special Operations. *Mil Med*. 1996;161(Suppl):3–16.
23. Rasmussen TE, Clouse WD, Jenkins DH, Peck MA, Eliason JL, Smith DL. Echelons of care and the management of wartime vascular injury: a report from the 332nd EMDG/Air Force Theater Hospital, Balad Air Base, Iraq. *Perspect Vasc Surg Endovasc Ther*. 2006;18(2):91–99.
24. Beekley AC, Sebesta JA, Blackbourne LH, et al; 31st Combat Support Hospital Research Group. Prehospital tourniquet use in Operation Iraqi Freedom: effect on hemorrhage control and outcomes. *J Trauma*. 2008;64(2 Suppl):S28–37.
25. Welling DR, Burris DG, Hutton JE, Minken SL, Rich NM. A balanced approach to tourniquet use: lessons learned and relearned. *J Am Coll Surg*. 2006;203(1):106–115.
26. NAEMT. *PHTLS: Prehospital Trauma Life Support*. 7th edition. St. Louis, Missouri USA: Elsevier Mosby; 2010.
27. Goralnick E, Chaudhary MA, McCarty JC, et al. Effectiveness of instructional interventions for hemorrhage control readiness for laypersons in the public access and tourniquet training study (PATTS): a randomized clinical trial. *JAMA Surg*. 2018;153(9):791–799.
28. Teaching Bleeding Control. Bleeding Control Web site. https://www.bleedingcontrol.org/~/media/bleedingcontrol/files/private/bleeding%20control%20basic%20course%20guidelines.ashx. Accessed November 18, 2018.
29. Ross EM, Redman TT, Mapp JG, et al. Stop the Bleed: the effects of hemorrhage control education on laypersons' willingness to respond during a traumatic medical emergency. *Prehosp Disaster Med*. 2018;33(2):127–132.
30. Ross EM, Mapp JG, Redman TT, Brown DJ, Kharod CU, Wampler DA. The tourniquet gap: a pilot study of the intuitive placement of three tourniquet types by laypersons. *J Emerg Med*. 2018;54(3):307–314.