

## Effectiveness of Tactical Emergency Medical Support: A Systematic Review\*

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Any event that involves public order policing has the potential for confrontation and use of force. Tactical law enforcement operations are recognized as posing an increased risk of injury or death to civilians and officers. As many as one third of tactical operations and tactical operations training missions result in injuries, with a disproportionately high number of injuries in barricade or hostage-rescue missions, and during the entry assault phase of a tactical operation [1,2].

Planning for availability and access to emergency medical services (EMS) is essential to minimize and mitigate the effects of any resultant injuries to civilians and law enforcement officers. Provision of emergency medical care to law enforcement officers, perpetrators, and bystanders during tactical operations poses unique challenges. For example, tactical operations may require provision of emergency medical care under conditions in which scene safety has not been secured, or where preservation of evidence is a key consideration. However, conventional emergency medical care providers are instructed to avoid a scene that is not secure, and may unknowingly destroy key evidence during patient care activities.

Although the practice of providing early medical care has long been established in military settings [3], preparation and practice in civilian law enforcement and EMS varies widely. The field of tactical emergency medical support (TEMS) is new and evolving, and optimal preparation and configuration of such services is at best unclear [4]. Some of the questions that need to be asked are: what are the best practices for pre-event planning and preparedness and how are these dependent on the type of event and locale; what is the appropriate degree and character of on-site medical services; how is the availability of rapid removal and evacuation services ensured; what are the appropriate pre-event communications and alerts to nearby medical facilities to assist with their level of staffing and preparedness?

To our knowledge, there are no current systematic reviews of the effectiveness of tactical emergency medical support. Therefore, the objective of this systematic review is to examine available evidence for the effectiveness of tactical emergency medical support on patient outcomes, examine best practices for tactical emergency medical support configuration and deployment, and highlight areas in which further research is needed.

### Methods

A search of the Medline and HealthStar databases from 1966 to 2005, and the EMBASE database from 1980 to 2005 for English language articles was conducted by a hospital librarian. Citations containing titles or titles and abstracts indexed using one of the subject headings 'police', 'law enforcement', or the keyword 'tactical', as well as the subject heading 'emergency medical services' were retrieved. Three authors independently reviewed and conducted a hierarchical selection based initially on title, and then abstract, blinded to journal, author, and results. Selection criteria included: a) study type – guidelines, lessons learned, program development, program description, standards of care, or best practices; b) intervention – tactical emergency medical support (excluding military units); c) target population – anyone involved in public order or public safety events, or disasters; d) methodology – any methods were acceptable. Selection by any of the three reviewers was sufficient to select an article for review at the next level. A kappa statistic of agreement between reviewers was calculated at each level of the review. Journal articles thus obtained were again reviewed by one of the authors (MJF) to ascertain whether they met the above criteria for inclusion in this review.

In addition, a hand search of *The Tactical Edge*, the official publication of the National Tactical Officers Association, was conducted for the years 1989 to 2005 for all articles pertaining to TEMS. The same content-specific selection criteria described above were used for article selection. Articles

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\* Opinions expressed are those of the authors and do not necessarily reflect those of the Ipperwash Inquiry or the Commissioner.

were obtained in full if at least one reviewer determined they met the selection criteria. Data was abstracted into a standardized template by a single investigator (MJF).

## **Results**

The literature search yielded 184 citations from Medline, 181 citations from HealthStar, and 135 citations from EMBASE related to tactical emergency medical support. All of the citations from the HealthStar database search were already included in the Medline search. Of this total, 15 articles met the content-specific eligibility criteria. A further 18 articles were identified in the hand search. Articles selected for inclusion in this review are listed in table 1. The kappa statistic for agreement between three authors for articles selected at each hierarchical level was: 0.51 SE 0.03 for titles and 0.63 SE 0.04 for abstracts.

The studies varied considerably, and in all cases, study quality was very limited. Only four studies examined outcomes of any kind, and no study was designed with randomization, nor was there any study incorporating blinding of investigators or subjects. One evaluated the merits of a tactical awareness training program for emergency physicians, and three reported on outcomes in psychiatric patients to which police responded. There were three position statements or policy statements by major U.S. national or international organizations. Most of the remaining articles reported on standard practices in specific areas of tactical medical support, team configurations, and team training. No articles specifically addressed tactical considerations for disasters, and only one article discussed tactical medical issues pertaining to terrorism or hazardous materials events.

## **Discussion**

This systematic review evaluated outcomes and best practices for emergency medical support for law enforcement tactical operations. The National Tactical Officers Association, the American College of Emergency Physicians, and the National Association of EMS Physicians have all published policy or position statements (see Appendix I to III) that consider TEMS as an essential component of tactical law enforcement teams [5-7]. It has been previously commented that no studies in the medical literature to date have provided outcome-based evidence for tactical emergency medical support [4]. This literature review did not find additional new evidence supporting or refuting the need for tactical emergency medical support.

The studies varied considerably, and in all cases, study quality was low and limited to case reports, narrative reviews, opinions and before and after surveys. Nearly a third of the articles were written by a single author (R. Carmona) which suggests peer reviewed acknowledgment as an expert in the field and yet may bias the results to a single point of view [3,9,11,14,16,20,23,24,27,28,31,34,]. Only four studies examined outcomes of any kind [19, 37-39], and no study was designed with randomization, nor was there any study incorporating blinding of investigators or subjects. One evaluated the merits of a tactical awareness training program for emergency physicians [19], and three reported on outcomes in psychiatric patients to which police responded [37-39]. There were three position statements or policy statements by major U.S. national or international organizations [5-7]. Most of the remaining articles reported on standard practices in specific areas of tactical medical support [8,11,12], team configurations [8,13-16], and team training [2,13,14,17-19]. No articles specifically addressed tactical considerations for disasters, and only one article discussed tactical medical issues pertaining to terrorism or hazardous materials events [32].

Despite a paucity of evidence on effectiveness of tactical emergency medical support for civilian law enforcement operations, we have identified a large body of literature that could serve to inform on implementation priorities. These include team configuration, training, planning, preventative and primary care, emergency care, zones of care, communication, weapons safety, specialized equipment, hazardous materials, terrorism, evidence preservation, considerations for austere environments, sound and light discipline, medicine across the barricade, medical intelligence, response to psychiatric emergencies, and post-mission support.

## *History*

The evolution of military medicine since the Napoleonic campaigns and later the American Civil War has resulted in a steady and continuing decline in mortality from battlefield-related injuries [3]. Military medical concepts such as initiation of treatment in the battlefield, provision of medical care in austere environments, and rapid evacuation of patients to definitive care are all readily translatable to the civilian law enforcement environment [8].

Tactical emergency medical support has adapted several aspects of the military medical model for civilian law enforcement operations. An incident in 1966, in which gunman Charles Whitman killed 15 and wounded 31 from his position in a University of Texas clock tower, is widely reported to have spurred the development of law enforcement tactical units [9]. Early tactical medical support programs were implemented in the U.S. shortly after the inception of the first law enforcement special operations teams. The Los Angeles Sheriff's Department initially trained its Emergency Services Detail deputies in advanced first aid in the late 1960s and later began certifying its deputies as paramedics in 1972 [10]. In 1989 and 1990, the National Tactical Officers' Association (NTOA) and a collaboration between the U.S. Department of Defense, Department of the Interior, the U.S. Park Police Special Forces Branch, and the Uniformed Services University of the Health Sciences developed and championed the Counter Narcotics Tactical Operations Medical Support (CONTOMS) Program training programs for tactical medical support personnel designed to meet the needs of civilian law enforcement tactical teams [2,4,6].

### *Team Configuration*

The optimal configuration of the medical support component of a tactical law enforcement team remains an area of controversy. A number of models have been proposed and implemented, each with specific advantages and disadvantages. Models range from a total lack of any dedicated emergency medical support, to minimal planning with civilian paramedic units posted at the outer perimeter of a tactical operation, to tactically trained paramedics or physicians who deploy with the tactical law enforcement team [8,11]. In a 1996 survey, 69% of the 150 responding SWAT units utilized models in which only civilian paramedic units were placed on standby at a designated location. The next largest group consisted of police officers with only first aid or Emergency Medical Technician (EMT) training [12]. Less commonly, full-time law enforcement officers are sometimes trained as paramedics.

The most common model for provision of advanced care in a tactical law enforcement team incorporates paramedics from outside EMS agencies who receive specialized tactical training [13]. One tactical law enforcement unit described in the literature draws its TEMS component from a local level I trauma centre. The law enforcement agency provides tactical training and equipment while the trauma centre provides medical equipment, supplies, and staff (paramedics, nurses, and physicians). This collaboration between the trauma centre and local law enforcement provides mutual benefits to both agencies, in terms of training as well as optimizing care for injured officers [8].

It has been suggested that in order to maintain competency in some highly specialized skills and maximize training and active deployment opportunities, jurisdictions should consider a regionalized approach to establishing a cost-effective tactical medical support team in areas that have few missions per year. The disadvantage of regionalized TEMS teams is the decrement in response times that may occur when covering a larger geographic area [14].

Most TEMS units require physician consultation and participation. The most common configuration is a medical control physician who provides medical oversight by supervising paramedics, either directly via attendance at scene or via radio, or indirectly through written protocols. Among other benefits, the physician can delegate certain aspects of medical care as well as provide liability protection through their malpractice insurance carrier [15]. Several other arguments in support of inclusion of specially-trained physicians on TEMS units include the ability to have physicians provide direct assessments and medical care that would otherwise not be available in the field, advising tactical commanders of medical risk-benefit ratios of actions that are being contemplated, education of TEMS personnel, and liaison with outside health care agencies [16].

### *Training*

Generally, tactical law enforcement officers are likely to be the first on the team to encounter casualties or be required to administer self-care or care to a team member. It has therefore been suggested that all tactical operators should receive training in several domains of emergency medical support. These include assessment of mechanism of injury, recognition of shock, recognition of life threatening emergencies, recognition of head injuries, stabilization of extremity injuries, assisting TEMS medics with preparation for transport, recognition of heat and cold emergencies, and critical life saving interventions [17].

The CONTOMS program provides a 1 week, 56 hour program at the EMT-Tactical level. Topics include provision of emergency medical services under hostile conditions, recognition and management of wounds typically sustained during tactical operations, preventive care during special operations, and application of law enforcement principles to emergency prehospital care [2]. Some tactical units provide a tactical emergency medical support component by training law enforcement officers as EMTs or paramedics [18]. However many teams select tactical emergency medical support personnel with prior training (usually paramedics) due to the substantial initial investment in training and ongoing maintenance of certification requirements [13].

As training and deployment opportunities may be limited in small or rural TEMS units, regionalization of tactical units may be one method which can be used to maximize skills retention and ensure competency in specialized areas of knowledge. However, the need to concentrate expertise in a regional team may be counterbalanced by the need for local resources to maintain optimal response times [14].

The CONTOMS Physician Awareness course was demonstrated to be an effective method at increasing physician knowledge and comfort levels for physicians who are likely to be involved with TEMS. Retention of information after at least four months was also shown to be high [19]. Longer term retention over time was not reported.

### *Planning*

Before undertaking any tactical operation, planning considerations should include medical intelligence (known or potential medical problems likely to be encountered among civilians or suspects), destination hospitals or trauma centres for potential victims, engagement and staging of one or more civilian ambulances on standby outside the perimeter of tactical operations, medical communications between TEMS medics and the paramedic base hospital and local EMS service, and meetings with senior EMS officers to work out mechanisms in advance for "handing off" patients [20,21]. The selection of advanced life support, basic life support, or helicopter EMS transport was not specifically addressed in any of the reviewed articles. One vivid case report in which an officer was critically injured by a gun shot wound to the neck highlights aspects of EMS preplanning could have improved management of his injuries. The lack of a designated EMS unit on standby or procedures for handing off care of an injured officer likely contributed to the residual disability suffered by the injured officer [22].

### *Preventive and Primary Care*

In order to optimize the operational effectiveness of a tactical law enforcement team, a key objective for a TEMS unit must be to maintain the health of the team members. This may include pre-mission physical conditioning, periodic health examinations, nutrition, and development of a medical database for each team member [2,23]. During a deployment or operation, preventive care includes ensuring team members are utilizing ballistic and appropriate precautions for chemical or biological materials, environmental protections, and adequate nutrition, hydration and sanitation. Similarly, surveillance for psychological problems or infectious illness outbreak among tactical officers is necessary to prevent potential decrements in performance [2,3,24].

### *Emergency Care*

There was no evidence to support or limit provision of any specific prehospital interventions in a tactical environment. The primary survey, in which immediate threats to life and limb are rapidly identified and addressed, is modified in the tactical theatre. When a threatening environment exists,

the immediate priorities may be limited to controlling exsanguinating hemorrhage and inserting a nasopharyngeal airway [3,25]. This is substantially different to the priorities in the civilian EMS setting in which one rapidly immobilizes the cervical spine and then assesses and corrects a variety of airway, breathing, and circulatory problems. One review suggested that the perennial question of prehospital care, whether to rapidly evacuate patients to definitive care versus whether to provide advanced medical interventions on scene, could best be decided in each specific case by a medical control physician; no conclusive evidence was cited for or against advanced interventions such as fluid resuscitation in the field [26]. It seems clear that specific prehospital interventions provided in a tactical environment are likely to be different than those offered in other prehospital settings. For example, the need for spinal immobilization is probably lower in penetrating traumas sustained in a tactical operation than in blunt trauma usually encountered in other populations. However, most medical procedures in civilian tactical law enforcement operations have not been studied [27]. Similarly, fluid resuscitation is another intervention that should probably be limited in trauma patients in the tactical theatre as it has been shown to worsen bleeding from injuries in penetrating trauma victims in the non-tactical environment [28].

### *Communications*

Prior to deployment, it is useful to establish contacts with civilian EMS authorities. During deployments, it is particularly important to establish meetings with local EMS managers or supervisors in order to determine availability and capabilities of local EMS providers as well as local (or regional) medical facilities as necessary. In addition, communications equipment must permit reliable communication with medical control physicians and receiving emergency departments or trauma centres [20].

### *Zones of Care*

Civilian EMS providers are trained to remain outside the perimeter of law enforcement tactical operations (sometimes referred to as the "cold zone") and provide a specific level of care depending on their level of training rather than tactical considerations (i.e. advanced life support or basic life support). However, when an injury occurs inside the perimeter (inside the "warm zone" or "hot zone") their ability to provide assistance is limited or non-existent until the patient is removed from the tactical theatre of operations. TEMS medics are capable of providing care within the outer perimeter, in the warm zone, or even in the hot zone, if the benefit outweighs the risk of injury [2].

The care provided by the TEMS medics may vary, depending on the risk and threat assessment. Thus, just as tactical operators define an outer and inner perimeter, medical care within each zone varies fluidly not only with capability of the TEMS medic, but also with the zone of operations [25]. This has been referred to as "zones of care" and in some ways is modeled after the military echelons of care through which an injured soldier is cared for during evacuation from the battlefield [3,16]. There are no published studies in the civilian TEMS literature on patient outcomes, although the military experience with this model has led to dramatic improvements in patient survival.

### *Weapons Safety and Specialized Equipment*

TEMS medics should be expected to encounter and have specialized knowledge with respect to the variety of munitions and weapons a tactical law enforcement unit may employ [29]. There is ongoing debate as to whether TEMS medics should be armed [2,8,15,21]. Although armed medics are potentially better able to defend themselves, one of the controversial aspects of armed TEMS medics concerns potential role confusion when law enforcement activities conflict with patient care. What seems well accepted is the concept that TEMS medics should participate in weapons training so that they may take control of the weapons of an injured tactical law enforcement officer [15].

In addition to specialized weapons and munitions, tactical law enforcement teams utilize a variety of personal protective equipment to guard against head and body injury, hearing loss, eye injuries, chemical, biological, or radiological threats. TEMS personnel with knowledge of the equipment have a working familiarity when accessing an injured officer who is wearing multiple layers of protective equipment [30] or may be a resource to help commanders choose a level of protection appropriate to the mission at hand without compromising operator performance [31].

### *Hazardous Materials*

TEMS providers must have a working familiarity with toxicology and hazardous materials in order to select protective equipment, decontaminate, and treat tactical officers and civilians who are exposed to hazardous materials. In addition to intentional criminal release or accidental release of toxic substances, TEMS medics must initiate decontamination and extrication from substances and equipment used by tactical operators to subdue or incapacitate criminals [2].

### *Terrorism*

Tactically-trained emergency medical personnel can play a particularly significant role in terrorist incidents. Tactical awareness among medical responders may aid in the identification of the incident hot zone and prevent other rescuers from exposing themselves to dangerous environments. Tactical decisions such as establishment of early scene control, placement of a base of operations, the need to vary operational and response procedures, the requirement to preserve forensic evidence, and preventing media coverage from divulging sensitive information are all relevant areas in which a tactically trained medical responder would play a significant role in the response to a terrorism event [32].

### *Evidence Preservation*

Emergency medical responders with little or no training in preservation of evidence may inadvertently destroy vital clues in their attempt to treat the patient [33,34]. Tactical emergency medical support personnel are trained to have a working knowledge of forensic evidence collection, handling, maintaining and preserving chain of evidence, and documentation [2,35].

### *Austere Environments*

Although tactical incidents may take place in urban environments in close physical proximity to health care facilities, it may not be possible to safely evacuate a patient to definitive care in a timely manner. In some respects, a TEMS medic may operate under similar conditions to a wilderness search and rescue medic, who is caring for patients in a setting remote from definitive care, with space, weight, and safety limitations restricting the amount and type of medical equipment and care that can be provided [2].

### *Sound and Light Discipline*

Tactical safety considerations, such as the need to maintain concealment, sometimes necessitates conducting patient assessments under cover of darkness [2]. For example, endotracheal intubation, a key skill for managing the airway of an unconscious patient, usually requires illumination of the patient's airway. Digital endotracheal intubation is an alternative method to securing an airway that can be performed without using external sources of illumination. Similarly, medical devices such as suction pumps, oxygen masks, or monitors may produce sounds which threaten operational integrity. Patient assessment and care may take place under the cover of darkness and rely almost entirely on the sense of touch, in some circumstances. Although this is clearly a unique skill to military or tactical medics, there are no published reports of the effectiveness or best practices of these skills in a tactical medical environment.

### *Medicine Across the Barricade*

Remote patient assessments are a set of skills unique to the tactical emergency medical environment, and involve assessment of medical problems or injuries from a safe location. Assessments may take place via binoculars or a remote or infra-red viewing camera. Some communications may be possible with patients by radio or telephone, and care may consist of providing instructions to patients or a non-medical person caring for them [2].

### *Medical Intelligence*

One of the potential benefits of TEMS providers is the ability to gather and analyze medical intelligence related to medical threats (e.g. weapons or hazardous materials), medical resources and capabilities in the event of injuries, and to monitor well being of tactical personnel or civilians affected by an incident [2]. As an extension of remote medical assessments, tactical medics can also provide valuable support to crisis negotiators through remote medical assessments. Remote assessments of hostages or captors can contribute to police negotiations [36].

#### *Response to Psychiatric Emergencies*

A small series of articles retrieved specifically addressed the issue of police responses to patients with mental illness. This group of patients has been reported to have a high potential for violence, and are often jailed by police. One team consisting of police officers and psychiatric nurses implemented in Los Angeles reported on a case series with a remarkably low rate of jailing patients, although in the six month follow-up period, almost a quarter were found to have committed acts of violence [37]. In a combined crisis team-police response model used in Honolulu, it was noted that a law enforcement officer's years of experience was inversely proportional to the likelihood of a mentally ill individual being arrested [38]. In a comparison between teams comprised of only police officers, only mental health professionals, or a combined multidisciplinary team, the most effective team configuration was observed to be the police-only team with an arrest rate of 2% and a substantially higher transport to treatment rate than the other teams [39]. The multidisciplinary model involves providing law enforcement officers with 40 to 56 hours of training in psychiatric diagnoses, psychotropic medications, alcohol and substance abuse, comorbid disorders, developmental disabilities, post-traumatic stress disorder, personality disorders, and suicide prevention. Other aspects of training include role playing, hostage negotiation, and physical management skills [40].

#### *Post-Mission Support*

The position paper of the National Tactical Officers Association requires that TEMS units participate in medical incident review, data collection and analysis, and medical quality improvement [5].

### **Conclusions**

The concept of tactical emergency medical support teams is endorsed by several major U.S. and international medical and law enforcement organizations, and is defined by a large body of specialized knowledge and skills. However, as a subspecialty of emergency prehospital care, little evidence specific to the effectiveness of civilian law enforcement tactical emergency medical support is available. Future research should identify clinical and system outcomes that could evaluate implementation strategies and performance benchmarks. Tactical emergency medical support teams should be encouraged to document and report on the population based epidemiology of events precipitating a tactical emergency medical response and on its outcomes.

Experience with medical care in military tactical theatres has shown a dramatic decrease in deaths from injuries sustained on the battlefield. Until further research into the value of civilian TEMS is available, tactical emergency medical support modeled on the military system should comprise part of every civilian tactical law enforcement unit.

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### **References**

1. Casualty Care Research Center Injury Data Collection Project, [http://www.casualtycareresearchcenter.org/data\\_injury\\_page.htm](http://www.casualtycareresearchcenter.org/data_injury_page.htm), accessed April 10, 2006
2. Rinnert KJ, Hall WL: Tactical emergency medical support. *Emerg Med Clin N Am*, 2002;20:929-952.

3. The Committee on Tactical Combat Casualty Care: Military Medicine. In: *Prehospital Trauma Life Support*, 5<sup>th</sup> edition. Ed. By Honeycutt L, Elsevier Mosby, St. Louis, 2005.
4. Carmona R: Inside the perimeter: TEMS transitioning into the new millennium. *The Tactical Edge*, 2002; Fall: 64-65.
5. National Tactical Officers Association: Position statement on the inclusion of physicians in tactical law enforcement operations in the USA. *The Tactical Edge*, 1994; Spring: 86.
6. Heck JJ, Pierluisi G: Law enforcement special operations medical support. *Prehospital Emergency Care*, 2001; 5: 403-406.
7. ACEP Board of Directors: Tactical emergency medical support. *Ann Emerg Med*, 2005; 45: 108.
8. Lavery RF, Addis MD, Doran JV, Corrice MA, Tortella BJ, Livingston DH: Taking care of the "good guys:" A trauma center-based model of medical support for tactical law enforcement. *J Trauma*, 2000; 48: 125-129.
9. Heiskell LE, Carmona RH: Tactical emergency medical services: An emerging subspecialty of emergency medicine. *Ann Emerg Med*, 1994; 23: 778-785.
10. Rathbun D: Inside the perimeter: TEMS-specific training and continuing education. *The Tactical Edge*, 2003; Spring: 52-54.
11. Rasumoff D, Carmona R: Inside the perimeter: Evolving roles of the TEMS provider. *The Tactical Edge*, 1997; Summer: 57-59.
12. Jones JS, Reese K, Kenepp G, Krohmer J: Into the fray: Integration of emergency medical services and special weapons and tactics (SWAT) teams. *Prehospital and Disaster Medicine* 1996; 11: 202-206.
13. Murphy MJ: FBI SWAT paramedics. *The Tactical Edge*, 1989; Fall: 22-24.
14. Carmona R: Regionalization of SWAT operations. *The Tactical Edge*, 1990; Fall: 35-36.
15. Ellison B: EMS at tactical operations. *The Tactical Edge*, 1991; Spring: 43-45.
16. Rasumoff D, Carmona R: Inside the perimeter: Echeloned field medical care: Definition and justification. *The Tactical Edge*, 1993; Fall: 72-76.
17. Rathbun D: Inside the perimeter: The tactical operator's role on the TEMS team. *The Tactical Edge*, 2003; Winter: 56-57.
18. Taigman M, Forster J: Borstar: Border Patrol EMS. *EMS*, 2002; 31: 40-47, 65.
19. Bozeman WP, Eastman ER: Tactical EMS: An emerging opportunity in graduate medical education. *Prehospital Emergency Care*, 2002; 6: 322-324.
20. Rasumoff D, Carmona R: Insider the perimeter. *The Tactical Edge*, 1990; Winter: 54-56.
21. Maunder M: Paramedics and tactical operations: The integration of medical personnel in law enforcement. *The Tactical Edge*, 1991; Fall: 33-34.
22. MacMillan DS, Cone DC: Officer down. *Prehospital Emergency Care*. 2003; 7: 402-404.

23. Carmona R: Inside the perimeter: Public health aspects of tactical emergency medical support. *The Tactical Edge*, 2002; Summer: 58.
24. Carmona R, Rasumoff D: Inside the perimeter: Evaluation of risk factors causing performance decrement during special operations. *The Tactical Edge*, 1991; Fall: 53-55.
25. Fitzgerald DJ: The tactical primary survey. *Internet Journal of Rescue and Disaster Medicine*, 2005; 1. <http://www.ispub.com/ostia/index.php?xmlFilePath=journals/ijrdm/vol5n1/tems.xml>. Accessed May 21, 2006.
26. Heiskell LE, Carlo PA: Inside the perimeter: Scoop and run vs. stay and treat. *The Tactical Edge*, 1996; Summer: 61-63.
27. Rasumoff D, Carmona R: Inside the perimeter: Standardized prehospital care: The next major issue in TEMS. *The Tactical Edge*, 1997; Spring: 59-64.
28. Rasumoff D, Carmona R: Inside the perimeter: Advanced life support in TEMS: The effect of new trauma studies. *The Tactical Edge*, 1997; Fall: 78-80.
29. McCarthy PM: Inside the perimeter: TEMS and specialty impact munitions. *The Tactical Edge*, 2005; Spring: 52-54.
30. Burg M: Tactical EMS. *Emerg Med Serv* 1992; 21: 73-76.
31. Carmona R, Rasumoff D: Inside the perimeter: Understanding the risks and benefits in selection of mission-specific personal protective equipment. *The tactical Edge*, 1993; Winter: 68-70.
32. Christen HT, Denney JP, Maniscalco PM, Rubin DL: Terrorism: Response procedures for terrorist/tactical violence incidents. *JEMS*, 1999; 24: 58-66.
33. Vollrath RC: Crime scene preservation. It's everybody's concern. *JEMS* 1995; 20: 53-56.
34. Limmer D: Crime scene interaction. Providing patient care while preserving evidence. *JEMS* 2002; 27: 68-81.
35. Carmona R, Rasumoff D: Insider the perimeter: Forensic aspects of tactical emergency medical support (TEMS). *The Tactical Edge*, 1992; Summer: 54-55.
36. Greenstone JL: The role of tactical emergency medical support in hostage and crisis negotiations. *The Tactical Edge*, 2002; Winter: 33-35.
37. Lamb HR, Shaner R, Elliott DM, DeCuir WJ, Foltz JT: Outcome for psychiatric emergency patients seen by an outreach police-mental health team. *Psychiatric Services*, 1995; 46: 1267-1271.
38. Green TM: Police as frontline mental health workers. The decision to arrest or refer to mental health agencies. *International Journal of Law and Psychiatry*, 1997; 20: 469-486.
39. Steadman HJ, Williams-Deane M, Borum R, Morrissey JP: Comparing outcomes of major models of police responses to mental health emergencies. *Psychiatric Services*, 2000; 51: 645-649.
40. El-Mallakh RS, Wulfman G, Smock W, Blaser E: Implementation of a crisis intervention program for police response to mental health emergencies in Louisville. *KMA*, 2003; 101: 241-243.

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Table 1: List of articles included in systematic review.

<b>First Author, Year of Publication</b>	<b>Methodology</b>	<b>Objective</b>	<b>Outcome</b>	<b>Strengths</b>	<b>Weaknesses</b>
Murphy, 1989	Review article	Describes incorporation of paramedics into FBI SWAT team	N/A	Describes early TEMS team and discusses medics' roles and responsibilities	No evidence presented to support statements
Rasumoff & Carmona, 1990	Review article	Discusses issues relating to planning for TEMS	N/A	Overview of principles of planning medical communications, medical intelligence, and transportation of victims	No evidence provided to support statements
Carmona, 1990	Review article	Argument presented for regionalization of SWAT teams	N/A	Discusses advantages of regionalization in terms of administrative and training benefits	No balanced discussion of disadvantages; no evidence provided to support statements
Ellison, 1991	Review article	Discusses issues relevant to TEMS: training, recruitment, number of medics, role of medical control physician, and equipment	N/A	Overview of important aspects to consider for TEMS	No evidence to support salutary effect of TEMS
Maunder, 1991	Review article	Describes one tactical unit's experience with incorporation of paramedics	N/A	Adds to a body of literature describing experience with forming a TEMS units	No evidence to support statements or choices made
Carmona & Rasumoff, 1991	Review article	Reviews factors potentially affecting performance of tactical officers	N/A	Presents review of environmental, social, psychological, and infectious factors that could lead to decrements in performance of tactical officers. Cites references	No outcome-based evidence presented to support statements

<b>First Author, Year of Publication</b>	<b>Methodology</b>	<b>Objective</b>	<b>Outcome</b>	<b>Strengths</b>	<b>Weaknesses</b>
Carmona & Rasumoff, 1992	Review article	Discusses specialized considerations for forensic evidence preservation relevant to TEMS	N/A	Reviews important considerations for TEMS evidence preservation	No evidence presented to support statements
Carmona & Rasumoff, 1993a	Review article	Discusses TEMS considerations regarding choice of personal protective equipment	N/A	Contention that TEMS providers can be a useful resource in helping commanders choose PPE	No evidence cited to support statements
Rasumoff & Carmona, 1993b	Review article	Describes echeloned approach to providing increasing levels of care; specifically addresses question of whether physicians offer benefits to TEMS units	N/A	Presents arguments which support having physician expertise as part of TEMS unit	Uses logical fallacy to support argument (i.e. if physicians are beneficial to EMS systems then they are also beneficial to TEMS)
NTOA, 1994	Position statement	Endorses of concept of TEMS, staffed at a level similar to EMS provided in the surrounding community, and overseen by physicians; calls for TEMS specific training for medical officers; outlines roles and responsibilities of medical officer; states physician-level care should generally be provided in a safe area	N/A	Statement by recognized tactical officers association; formal recognition of need for TEMS training; clear delineation of roles and responsibilities	No evidence cited to support position
Heiskell & Carmona, 1994	Review article	Discussion of history, development, training, and role of tactical medical support	N/A	Focus on rationale for and history of TEMS development and on roles for physician	No studies cited which show a beneficial effect of TEMS on outcomes

First Author, Year of Publication	Methodology	Objective	Outcome	Strengths	Weaknesses
		teams; specifically addresses the role of a team medical director and a team physician		involvement No studies cited which show a beneficial effect of TEMS on outcomes	
Heiskell & Carlo, 1996	Review article	Considers perennial question of how much medical care on scene is appropriate in tactical environment	N/A	Provides clear discussion of role of advanced prehospital interventions (citing medical research into patient outcomes) in trauma patients in a tactical environment	Limited evidence available; has few specific conclusions
Jones et al, 1996	Research article	Survey of U.S. SWAT teams for TEMS practices	75% response rate; Most common medical support was a civilian ambulance on standby (69%); 94% had no specific TEMS training; 78% had no medical director	Provides survey of TEMS practices	U.S. data only obtained
Green, 1997	Case series	Reports on a program that links crisis intervention teams (outreach worker and shelters) with police responses	A one month convenience sample was obtained; descriptive statistics reported and multivariate regression to determine factors associated with various outcomes	Presents alternative police response model to mentally ill patients	No comparison group; no follow-up
Rasumoff & Carmona, 1997	Review article	Calls for standardize prehospital TEMS medical protocols; reviews role of two prehospital interventions in	N/A	Arguments regarding the roles of spinal immobilization and tourniquets are presented; provides framework for	Little evidence is available to support conclusions; some conclusions are opinions only

<b>First Author, Year of Publication</b>	<b>Methodology</b>	<b>Objective</b>	<b>Outcome</b>	<b>Strengths</b>	<b>Weaknesses</b>
		TEMS environment		examination of other aspects of prehospital care in TEMS environment	
Rasumoff & Carmona, 1998	Review article	Reviews research related to advanced life support in TEMS environment	N/A	Presents evidence suggesting advanced life support interventions in the field should be limited	No specific evidence from tactical medical environment
Christen et al, 1999	Review article	Discusses tactical emergency medical aspects of response to terrorist incidents	N/A	Presents relevant aspects of tactical emergency medical response to terrorist incidents	Opinion and current practices are described, but not supported with outcome-based evidence
Lavery et al, 2000	Descriptive study	Description of major models of TEMS provision; describes implementation, training, and deployment experience of a TEMS team in Newark NJ	33 deployments and 99 training days; casualty care provided to 14 patients (including 8 law enforcement officers)	Detailed discussion of various models for TEMS providers and particular advantages of model chosen	No outcome based evidence of advantages of any model are used to support choice of TEMS system
Steadman et al, 2000	Research study	Compares outcomes in three settings with distinct differences in police responses to mental health emergencies	Convenience sample from 3 cities was obtained in which police responded to mental health emergencies. Outcomes (resolution of incident, arrests, referral to treatment) were compared: fewest patients were arrested in Memphis, with a team	Comparison between teams with three different configurations	No determinations of statistical strength of inferences; causation not demonstrated; no discussion about variance in population

<b>First Author, Year of Publication</b>	<b>Methodology</b>	<b>Objective</b>	<b>Outcome</b>	<b>Strengths</b>	<b>Weaknesses</b>
			comprised of police officers with specialized training in dealing with mental health emergencies		
Heck JJ & Pierluisi, 2001	Position statement	Cites standards for training, certification, medical oversight for tactical emergency medical support; proposed role of TEMS in preventive and urgent medical care; highlights need for further research	N/A	Position statement of internationally recognized EMS physicians' organization may serve to increase recognition of need for TEMS in law enforcement tactical operations	No evidence cited to support position
American College of Emergency Physicians, 2001	Policy statement	Calls for establishment of TEMS for tactical law enforcement operations, including appropriate funding, professional liability protection, clinical care standards, and research to support evidence-based methods	N/A	Policy statement of internationally recognized emergency physicians' organization may serve to increase awareness of the need for TEMS in law enforcement tactical operations	No evidence cited to support policy
Lamb et al, 2001	Case series	Reports on a series of psychiatric patients seen by a combined police-mental health team	101 patients referred to team; 68% hospitalized and 2% were jailed	Presents alternative police response to mentally ill patients who would otherwise often be jailed	No comparison group, short follow up period
Rinnert & Hall, 2002	Literature review	Description of history of TEMS, training, unique skills, recruitment, team composition and structure,	N/A	Extensive discussion of all relevant aspects of TEMS; outlines standards of care and usual or best practice	No outcome-based studies showing salutary effect of TEMS

<b>First Author, Year of Publication</b>	<b>Methodology</b>	<b>Objective</b>	<b>Outcome</b>	<b>Strengths</b>	<b>Weaknesses</b>
		TEMS goals, zones of care, equipment considerations, medical threat assessment		in most areas of operation	
Burg, 2002	Editorial	Argues case for including EMS planning as part of tactical law enforcement team	N/A	Provides rationale for unique situations in tactical environment	Opinion piece; no evidence cited to support opinions
Taigman & Forster, 2002	Review article	Discusses provision of emergency medical support in U.S. Border Patrol	N/A	Presents experience from U.S. Border Patrol law enforcement team in which all members are trained as EMTs No studies are cited which support benefit for EMT-trained law enforcement officers	No studies are cited which support benefit for EMT-trained law enforcement officers
Bozeman and Eastman, 2002	Before and After observational study	Survey of tactical medicine knowledge of emergency physicians who completed CONTOMS Physician Awareness course	CONTOMS Physician Awareness course was effective at increasing physicians' knowledge and comfort levels in areas relevant to TEMS	Demonstrates that CONTOMS Physician Awareness course is an effective method at increasing physicians' knowledge of TEMS	Participants were not blinded to intervention; no comparison to other training programs
Carmona, 2002	Editorial	Discusses history and future of tactical emergency medical support; calls for scientific review of TEMS	N/A	Calls for new research into outcomes from TEMS	Opinions only presented
Greenstone, 2002	Review article	Discusses role of TEMS medics in hostage and crisis negotiations	N/A	Support use of TEMS in gathering medical intelligence that can support hostage or crisis negotiation	No evidence presented to support salutary effect of TEMS on hostage negotiations

<b>First Author, Year of Publication</b>	<b>Methodology</b>	<b>Objective</b>	<b>Outcome</b>	<b>Strengths</b>	<b>Weaknesses</b>
MacMillan & Cone, 2003	Case report	A case of prehospital care of an injured officer is presented along with lessons learned	Lack of preparation for TEMS contributed to poor delivery and outcome after a law enforcement officer sustained a penetrating injury	Provides rationale for TEMS	Study design limits strength of conclusions
El-Mallakh et al, 2003	Brief report	Detailed description of implementation of a police-based mental health crisis intervention team in Louisville, KY	N/A	Provides detailed report as to police officer training	No outcomes reported
Rathbun, 2003a	Review article	Presents areas in which all tactical law enforcement officers should receive medical training	N/A	Reviews medical training of relevance to all tactical law enforcement officers	No outcomes reported
Rathbun, 2003b	Review article	Presents roles and responsibilities of TEMS medics and discusses issues with training in these areas	N/A	Highlights important areas to focus TEMS training	Paucity of TEMS training programs limits applicability of recommendations; no evidence presented to support statements
McCarthy, 2005	Review article	Discusses specific injury patterns and care for injuries caused by "less lethal" impact munitions used by law enforcement tactical units	N/A	Brief overview on types of weapons and patterns of injuries observed	Topic is reviewed at a very superficial level; no discussion of merits of particular weapon in terms of safety or effectiveness

Appendix I  
Position Statement of National Tactical Officers Association

Appendix II  
Position Statement of National Association of EMS Physicians

Appendix III  
Policy Statement of American College of Emergency Physicians

*See attached files.*