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**Sports Medicine Concepts, Inc., Triangles of Critical Care Approach to Sports Medicine Team Emergency Action Planning: recommendations based on clinical experience and observations from an evidence-based sports emergency care training curriculum.**

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This paper was conceived to share important evidenced backed observations made during 20 years of sports emergency response training by Sports Medicine Concepts' instructors that may help other sports health care professionals become better prepared for on-field emergency management. This paper was also conceived to demonstrate a sports medicine team implementation strategy to emergency action planning that has been successfully implemented in various athletic settings, and to serve as a model for others to consider when developing comprehensive emergency action plans.

The need for comprehensive emergency action planning in athletics has been firmly established in the peer-reviewed literature<sup>[1],[2]</sup>. Practically, a sports medicine team strategy to emergency action planning (SMTEAP) has been the single most important factor in determining success for candidates of Sports Medicine Concepts' In 2 Minutes or Less!<sup>TM</sup> psychomotor skills based emergency response certification curriculum. Much of the current literature regarding emergency action planning in athletics focuses on the components of an effective emergency action plan (EAP), including the professional and legal need for, guidelines for development of, and documentation of an EAP. Still, some research suggests that a significant number of athletic venues function in the absence of an emergency action plan even though the importance of emergency action planning is understood<sup>[3],[4]</sup>. Although the need for emergency action planning is understood, and the components of an effective emergency action plan have been established, little has been offered regarding a specific strategy for implementing the components of an effective SMTEAP. It may be that the lack of direction regarding strategies for implementing the components of an effective SMTEAP leaves many feeling overwhelmed by a process that may be perceived as complex, time consuming, or expensive. Therefore, a discussion regarding strategies for the

development of a sports medicine team strategy to the implementation of the components of an EAP is warranted.

For the purposes of this discussion, the sports medicine team strategy refers to inclusion and concurrent training of various health care providers during the creation of an EAP that reduces the likelihood of confrontations between multi-disciplined health care providers, and promotes coordinated and efficient delivery of vital life-saving psychomotor skills to critically injured patients.

This technique article will detail Sports Medicine Concepts, Inc's (SMC) Triangles of Critical Care<sup>TM</sup> strategy for implementation and coordination of a comprehensive, functional, and efficient EAP utilizing a sports medicine team approach that has been demonstrated to be an effective approach during SMC's In 2 Minutes or Less!<sup>TM</sup> post-professional certification curriculum. This discussion includes observational information gathered during 20 years of sports emergency care and response training provided by Sports Medicine Concepts, Inc., clinical instructors. Every attempt has been made to support observations with peer-reviewed literature. While some observations expressed in this article remain anecdotal, professional opinion and experience suggest that these observations are worthy of consideration.

## **Sports Medicine Concepts' Triangles of Critical Care™**

There are three unique triangles that make up SMC's Triangles of Critical Care™, commonly referred to as SMC's Triangles Approach. Appendix A represents a schematic of SMC's Triangles Approach. The first triangle discussed is the Assets Triangle that addresses coordination of the sports medicine team's personnel and facilities. The second triangle discussed is the Response Triangle. The Response Triangle represents a specific strategy for efficiently bringing all implemented assets to bear when responding to sports emergencies. The Response Triangle is comprised of Critical Support, Scene Management, and the Critical Care Triangle. Once assets have been organized and a response plan formulated, the third and final Implementation Triangle™ is used to organize annual rehearsal, provide on-going education, and to document a SMTEAP.

### **The Assets Triangle**

The Assets Triangle addresses coordination of all the personnel and facilities that should be inventoried during the initial stages of emergency action planning. The assets that are inventoried and tallied will provide SMTEAP organizers with a list of whom and what is presently available for use during emergency management. The process of inventorying all of the assets available to a sports medicine team is vital in determining what assets may have to be acquired in order to implement a SMTEAP.

### **Personnel**

Personnel are the greatest asset of the SMTEAP, and are the critical difference between a general EAP and a specific SMTEAP. Traditional SMTEAP personnel include athletic trainers (AT), physicians (MD), pre-hospital care professionals (EMS), and emergency room personnel (ER). Narrowing the focus to ATs, MDs, and EMS may be appropriate for institutions that have the luxury of a vast medical staff, but for those without access to a vast medical staff, excluding non-traditional potential SMTEAP members such as coaches, school officials, and game officials will likely result in an EAP that does not have the assets required to provide critical care during emergency management. An AT, for example, who may be the only medical staff person on-scene, may be called upon to provide stabilization of an injured athlete's head and neck during a potential cervical spine injury. During this scenario, the AT would not be able to complete other critical tasks such as using a cell phone to activate EMS,

logrolling, face mask removal, support of the athlete's vitals, and AED implementation in a manner that would be most conducive to providing the critically injured athlete with the best possible chance for survival and recovery; particularly when arrival of EMS is delayed. The care provided during this scenario would be vastly improved by including coaches and other school officials in the SMTEAP process, whereby a coach or school official could aid in activating EMS, logrolling, facemask removal, rescue breathing, and completion of other critical care tasks. With appropriate training all of the critical care tasks discussed later can be accomplished by properly trained personnel, including coaches, school officials, and game officials should more traditional SMTEAP members not be sufficiently available. All personnel that may be included in the SMTEAP should have a minimum of training in use of automated external defibrillation (AED), cardiopulmonary resuscitation (CPR), first-aid, and the prevention of communicable diseases. Appendix B provides a sample form that can be used by SMTEAP coordinators to catalog personnel assets, their roles, training, and certification status. A very practical way to begin the SMTEAP development process might be to use Appendix B to catalog personnel assets. Next, use the personnel information to develop a SMTEAP Committee that will be charged with completing the remaining tasks associated with SMTEAP development and maintenance.

### **Facilities**

Once SMTEAP personnel have been identified and a SMTEAP Committee has been established, SMTEAP Committee members should divide up responsibilities associated with collecting facility assets, including those found at the specific venues hosting athletic events and those of the emergency care facility where injured athletes may be transported. Venue locations should be reviewed for accessibility to emergency personnel, communications, equipment, and transport of the injured from the venue. Local emergency care facilities should be assessed for their ability to handle different types of emergencies that may be transported from the various athletic venues. Certain emergency care facilities may be more appropriate than others to handle certain types of injury or trauma based on the level of service provided. Reviewing local emergency care facilities and specific activity venues will help SMTEAP planners determine the support that SMTEAP personnel will have during critical care and will help determine what additional assets may need to be acquired. Appendix C

represents a sample form that could be used to catalog facility emergency equipment availability.

### **Support**

The third and final point of the Assets Triangle addresses the effective coordination of personnel and facility assets in a manner that facilitates emergency response. Coordination of assets specifically details the equipment, communications systems, and mechanisms for transport of the sick and injured from the athletic venue that SMTEAP personnel will rely on when delivering critical care.

The ability of SMTEAP personnel to effectively deliver critical care is dependant on proper training and having on-site access to emergency equipment<sup>[2]</sup>. Research indicates that the chance of recovery for patients suffering from ventricular fibrillation increases significantly with early defibrillation that is provided by on-site equipment<sup>[5],[6],[7],[8]</sup>. Thus, the need to have all emergency equipment on-site and quickly accessible to trained health care providers is firmly established. It is imperative that the on-site emergency equipment be in proper working order, and that SMTEAP personnel be properly trained in proper use of emergency equipment prior to an on-field emergency.

Coordination and delivery of emergency equipment to trained personnel caring for a critically injured patient requires that a venue-specific communications system exists between first-responders providing on-field care and SMTEAP personnel responsible for delivering emergency equipment from its designated location to the injury scene. The venue-specific communications system must include a means for initiating the SMTEAP, activating EMS, and delivery of appropriate emergency medical equipment to the injury scene. A complete communications strategy provides a means for communications between venue pre-hospital health care providers and proper emergency care facilities in order to further direct pre-hospital care and transport of the injured patient.

The SMTEAP should emphasize the need to have an ambulance on-scene during high-risk events, and on-call for all other events. Ambulance coverage can vary from basic life-support (BLS) to advanced life-support (ALS). The equipment, training level of personnel who staff an ambulance as well as ambulance response times can vary. Therefore, the SMTEAP personnel should carefully consider the level of transport service that is likely to be required from each specific venue. For example, it may be more appropriate to coordinate ALS service for collision and contact sports or for teams with athletes with high risk factors while on-call BLS may be

sufficient for other venues. These are decisions that SMTEAP personnel can make once equipment personnel availability is determined.

Appendix C represents a sample form for tracking availability, deployment and maintenance of equipment that will support the efforts of the SMTEAP during in the delivery of critical care.

### **The Response Triangle**

The Response Triangle™ is comprised of the Critical Care and Assessment, Critical Support, and Scene Management.

#### **Critical Care and Assessment**

The Critical Care and Assessment component of the Response Triangle™ is best represented as a sub-triangle of the Response Triangle (See Appendix A). This sub-triangle is made up of three essential positions, all to be filled, initially, by first-responders. Figure 1 represents the Critical Care Triangle components of the Response Triangle. Position A is likely to be the first person to arrive at the injury scene. Personnel holding position A are responsible for stabilization of the head and neck during potential head and neck injuries. Position A is also responsible for initial assessment, gaining control of the injured athlete, activating the SMTEAP, directing response of the SMTEAP personnel in primary injury implementation and oversight, and accompanying injured personnel to medical facility to relay vital injury information and



**Figure 1. The Critical Care Triangle™ and Assessment Triangle with immediate support positions shown**

pre-hospital care provided. Person A also maintains contact and communication with the injured athlete. During a suspected cervical spine injury (SCI) it is possible for position A personnel to perform certain critical tasks associated with primary survey, but this situation is less than effective. SMTEAPs should be

developed such that other triangle personnel perform primary and secondary survey tasks. During a SCI person A should focus on stabilization, oversight, direction, and coordination of critical tasks performed by others. This is not necessarily the case in non-SCI when stabilization is not critical, such as during cardiac, respiratory, bleed

ing, or other

traumatic injuries. Positions B and C are designated for roles pertaining to the primary and secondary surveys and support of vital signs.

Positions in the Critical Care and Assessment Triangle (CCA) are vital. Therefore, planning to ensure the availability of properly trained personnel to maintain the CCA is essential. This triangle cannot be compromised by poor planning. If personnel are not available to fulfill the roles of the CCA, SMTEAP planning personnel must revisit their Assets Triangle to find and train personnel for CCA roles.

The personnel holding positions within the CCA triangle can be replaced as more qualified personnel arrive on-scene. Therefore, the roles of the CCA can be performed initially by first responders whose training may be limited to the use of AEDs, CRP, first-aid; and who are trained in the implementation of the SMTEAP. Personnel for consideration as first responders might include ATC, coaches, school officials, or nurses. The SMTEAP should be designed to quickly integrate health care professionals trained in advanced respiratory, cardiac, and trauma management to replace first responders with limited training. More qualified health care professionals for consideration to replace first responders with limited training include physicians and EMS.

### **Critical Support**

Positions D and E serve to direct on-going support to the CCT; position D is the designated aid to CCT position C, and position E is the designated aid to CCT position B. Personnel in these roles are responsible for helping CCT personnel with any repositioning or other critical care tasks. It is imperative that persons D and E not leave the CCT as their aid in performing critical tasks may be called upon by CCT personnel at any moment. Should specific emergency response equipment be needed by the CCT, Positions D and E should direct equipment needs via communication with Primary Signal Relays (PSR).

PSR are persons who are positioned between the injury scene and persons designated as Runners. Runners are positioned near the location of emergency response equipment, but in plain view of the PSR. Equipment needs of the CCT are expressed

by persons B and C to their respective aid personnel in positions D and E. Persons D and E then communicate these needs to the PSR. After receiving communications from persons in positions D and E, PSR relay equipment needs to Runners who then gather the requested equipment and deliver it to persons in positions D and E. Persons in positions D and E then distribute the requested equipment to their respective CCT personnel.

Activation of EMS may be initiated by any one within the CCT. Once the signal to activate EMS has been made all SMTEAP members repeat the signal simultaneously.

The above strategy may be facilitated with the implementation of various forms of mobile communications or the existing presence of EMS, but a system relaying on hand signals and relay communications is a vital back-up strategy to implement in the event that other communication systems fail.

Upon arrival EMS may take over vital roles of less qualified personnel within the CCT as demanded by the injury scenario and local protocols. EMS will serve to further stabilize the injured patient, support vital signs, and transport the athlete to the appropriate medical facility.

### **Scene Management**

The SMTEAP should also appoint a Scene Management Director (SMD). The SMD's role involves ensuring that all roles in support of the CCT are appropriately filled and functioning. The SMD also oversees additional scene management personnel who have been assigned to security, crowd control, clearing the area of all non-SMTEAP personnel, ensuring primary, secondary, and tertiary EMS access points are open and viable, having the keys to all access points, and ushering on-call EMS personnel from the primary access point to the most viable access route to the injury scene.

### **The Implementation Triangle**

The Implementation Triangle™ is comprised of documentation, rehearsal and review, and education.

### **Documentation**

Documentation of the established SMTEAP is critical to aiding in any legal issues that are likely to arise following an incident. But, more importantly, documentation is essential to ensuring that all SMTEAP personnel are aware of the SMTEAP and the roles that they may be responsible for fulfilling in the care of a critically injured athlete. A SMTEAP should consider a means of documenting

responsibilities, incident follow-up, annual rehearsal, personnel training, and equipment maintenance. The previous forms offer examples of how documentation forms might be organized. Once the SMTEAP Committee has settled on a SMTEAP the plan should be formally approved by all sports medicine team personnel. The plan should then be committed to writing and distributed to all SMTEAP personnel and school officials. Documentation of a complete SMTEAP and on-going SMTEAP maintenance is critical.

Proper maintenance of a SMTEAP should include annual rehearsal and incident review. Appendix D offers sample forms that might be used to track maintenance of a SMTEAP rehearsal and incident review.

### **Rehearsal and Review**

Regular and appropriate rehearsal considers both the type and frequency of on-going training as a means of providing the best opportunity for retention of critical knowledge and vital psychomotor skills that are essential to delivery of the most effective emergency care. Since testing has been shown to enhance learning, annual testing should be a component of regular rehearsals<sup>[9],[10-14]</sup>. However, the type of test and frequency of rehearsal must also be considered. Research suggests that live simulated scenarios increase the effectiveness of health care professionals performing critical skills<sup>[15-18]</sup>. The ability to perform critical skills deteriorates over time; however, skills can be maintained with regular rehearsal. Evidence suggests that regular rehearsal at six month intervals is sufficient to maintain adequate emergency response skills<sup>[19],[20]</sup>. Further evidence suggests that test-enhanced learning facilitates psychomotor skill acquisition and retention among health care providers<sup>[9],[10-14]</sup>. Therefore, SMTEAP rehearsals should include live realistic scenario training and testing at least every six months. An example of a rehearsal format that includes live realistic scenario training and testing is the 2 Minute Drill™ portion of the In 2 Minutes or Less!™ curriculum.

During SMC's In 2 Minutes or Less!™ curriculum candidates work together to develop a multi-disciplined sports medicine team that demonstrates the ability to effectively perform critical life-saving competencies. During In 2 Minutes or Less!™ training, instructors have observed that the development of a SMTEAP appears to be enhanced by the opportunity for multi-disciplined health care providers to work toward the common goal of a SMTEAP that successfully completes a final live test drill.

The 2 Minutes Drill™ represents that test-enhanced portion of the In 2 Minutes or Less!™ curriculum. The critical life-saving competencies of the 2 Min Drill™ include effectively assessing an injured athlete, logroll a prone athlete to the supine position, gain access to an injured athletes airway (including face mask removal if applicable), begin rescue breathing, and administer the first shock from an automated external defibrillator (AED) in less than 2 minutes. The 2 minute benchmark has been carefully rationed as a basis for successful completion of the 2 Minute Drill™ portion of the curriculum based on federal public access defibrillation (PAD) program guidelines.

Federal PAD program guidelines suggest that the ideal collapse to shock time for an individual suffering sudden cardiac arrest (SCA) is less than 3-5 minutes<sup>[21]</sup>. When the collapse to shock time is 3-5 minutes an individual suffering from SCA has a 50-70% chance of survival. An individual's chance of survival increases approximately 10% each minute that the collapse to shock time decreases. Having immediate access to properly trained health care professionals with access to appropriate emergency medical equipment is the most effective way to reduce the collapse to shock time; and thus increase a SCA patient's chance of survival<sup>[2]</sup>.

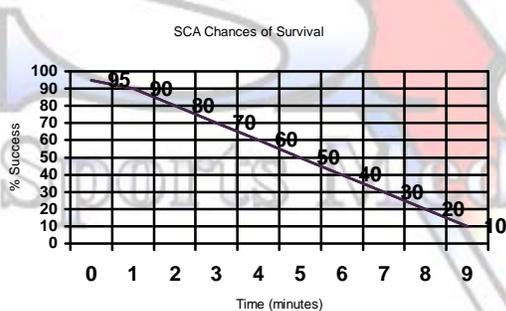
Sports health care professionals are properly trained to deliver the most effective care available during a sports emergency at an athletic venue. To provide care consistent with professional practice acts sports health care professionals should be properly prepared with respect to psychomotor skills training, access to emergency response equipment, and effective emergency action plans<sup>[1]</sup>. Therefore, the sports health care professional should be able to accomplish in 2 minutes what the lay responder is expected to deliver in 3-5 minutes; thereby increasing SCA patient's chance of survival by 10-30% (See Figure 1). Additionally, if sports health care professionals can accomplish critical tasks in 2 minutes during a didactic lab scenario, the additional 1-3 minutes during a real life-threatening injury can be better used to work through the certain unpredictable challenges that sports health care professionals are sure to face during a real life-threatening emergency.

Success during the 2 minutes drill requires a coordinated effort. Those who attempt to simply work fast are rarely successful; and when those that hurry do make it in less than 2 minutes, their efforts are associated with unacceptable movement of the patient or less than effective skill application. Historically, successful candidates are those that have worked together to promote an efficient strategy that allows them to think about their primary objectives

and to respond in an efficient manner. There are two components required for this to happen. The first being that each team member must have all the skills required to perform any given role within the team. The second vital component is an efficient sports medicine team approach, or a strategy for effective coordination and delivery of life-saving skills from multi-disciplined health care professionals.

Another important outcome associated with live scenario-based testing during rehearsal is that the SMTEAP is able to identify where vital flaws in the SMTEAP might exist. The SMTEAP can then be adjusted to improve the performance of SMTEAP personnel during an actual emergency scenario. Providing critical review to identify vital flaws in the SMTEAP is a necessary step that participants of the In 2 Minutes or Less!<sup>TM</sup> curriculum take during a 2 Minutes Drill<sup>TM</sup> practice station that is completed prior to advancing to the final 2 Minute Drill<sup>TM</sup> test. The 2 Minute Drill practice station allows SMTEAP members to iron wrinkles, work out solutions to problems, and rectify performance issues brought about by real-life emergency scenarios.

After the SMTEAP Committee has completed the exercise of gathering information pertaining to the Assets Triangle<sup>TM</sup> a situational practice session that utilizes real-life situational scenarios should be organized. The SMTEAP should then be tested during these real-life situational scenarios to see how proficient the SMTEAP is. Just like in the 2 Minute Drill<sup>TM</sup> practice station, the SMTEAP Committee can review the effectiveness of



**Figure 2. Sudden Cardiac Arrest Chances of Survival.**

the SMTEAP ability to provide adequate emergency response. This information can then be used to update protocols and delivery to increase efficiency of vital emergency response tasks. Appendix D provides sample forms that can be used to review a SMTEAP's effectiveness during practice sessions as well as after an actual emergency.

Following practice sessions designed to assess the effectiveness of a SMTEAP's ability to delivery appropriate emergency response the

SMTEAP Committee designates write-up of protocol, policy, and procedures to SMTEAP personnel. Write-up responsibilities are assigned based on credentials. EMS personnel, for example, write-up their respective components, while athletic trainers, team physicians, and school officials write-up the policies and procedures that provide the most effective delivery of emergency care. The resulting components are organized into a main document that becomes the basic SMTEAP. The main SMTEAP document will focus on policy, protocol, and procedures required to support and maintain vital body functions, including airway, breathing, circulation, and disability. Appendices to the main SMTEAP document can then be added for specific conditions or illnesses. Examples include an appendix establishing policy for concussion management, emergency equipment removal, exercise induced asthma, or diabetic shock.

### Education

Once a SMTEAP has been established and committed to writing, the SMTEAP personnel can go about providing vital education regarding the SMTEAP. Education regarding the SMTEAP is two-fold. First, SMTEAP personnel can educate parents, school officials, and the community regarding the existence of the SMTEAP and the efforts that SMTEAP personnel are taking to protect the safety of athletes. Table 1 represents some examples of how a sports medicine team might extend educational activities into their community. Extending education into the community can help facilitate the care provided by the SMTEAP personnel by reducing on-field conflicts and interference during critical injury response. Secondly, SMTEAP personnel can provide on-going continuing education to ensure proper training of SMTEAP personnel by providing for regular SMTEAP rehearsal and review.

Forms found in Appendix D may be useful during activities associated with the Implementation Triangle.

### Conclusion

This article discussed specific strategies for the implementation of a SMTEAP that carefully considers inclusion of critical EAP components detailed in current literature, including personnel, facilities, support, documentation, education, and critical care and assessment. Each of these components were organized into three main triangles, including the Assets, Implementation, and Response triangles; collectively refereed to as SMC's Triangles of Critical Care<sup>TM</sup> strategy. The Triangles of Critical Care<sup>TM</sup> strategy was developed based on experience

gathered during observation of seminar participants that were successful in completion of SMC's 2Min Drill™ that serves as the basis for assessing psychomotor skill competency during SMC's In 2 Minutes or Less!™ emergency response training seminar. SMC's 2Min Drill™ competencies are based on federal guidelines for early defibrillation through public access to defibrillation programs (PAD).

The most significant observation of successful 2Min Drill™ candidates is the presence of a coordinated and efficient approach to application of emergency response psychomotor skill and equipment. Successful candidates, without fail, are those who form a team approach that plans to be efficient rather than fast in their coordinated efforts to apply the emergency response psychomotor skills and equipment of multi-disciplined emergency response health care professionals.

<b>SMTEAP Outreach Activities</b>
<ol style="list-style-type: none"> <li>1. Call local school/athletic officials regarding the inclusion of guidelines in educational/certification programs for coaches, officials, and others.</li> <li>2. Offer educational programs throughout the community.</li> <li>3. Offer programming for youth sports leagues.</li> <li>4. Offer programming for the Parent-Teacher Association.</li> <li>5. Contact city or town officials to recommend adoption of accepted guidelines in all local organized sports.</li> <li>6. Ask to address the local school board to encourage implementation of prevention guidelines.</li> <li>7. Make presentations to other health care professionals throughout the community and encourage them to implement accepted protocols.</li> <li>8. Provide information to local newspapers regarding prevention measures.</li> <li>9. Send pertinent injury prevention/protocol articles to the local hospital and emergency room for inclusion in medical staff bulletins and community newsletters.</li> <li>10. Contact the National Athletic Trainers' Association for injury surveillance study information and media release suggestions.</li> </ol>
<p><b>Table 1. Ten Ways SMTEAP Personnel Can Extend Into The Community.</b></p>

Although the need for emergency action planning is well established and accepted, emergency action planning still may not be taken as seriously as it needs to be. This article is intended to be a vehicle for motivating health care providers to initiate discussion regarding the development of a sports medicine team approach to emergency action planning. It is not the intention of this article to profess that the Triangles of Critical Care™ is the only viable approach, but rather to initiate dialogue among health care professionals who understand that their primary, but often forgotten, responsibility, is to be prepared to manage sports emergencies in a fashion that provides a critically injured individual with the best chance for survival and recovery.

#### **Disclaimer**

Michael Cendoma, MS, ATC is the President of Sports Medicine Concepts, Inc., an organization with financial interests in the In 2Minutes of Less!™ educational curriculum and the EMSofT™ Emergency Action Planning software.

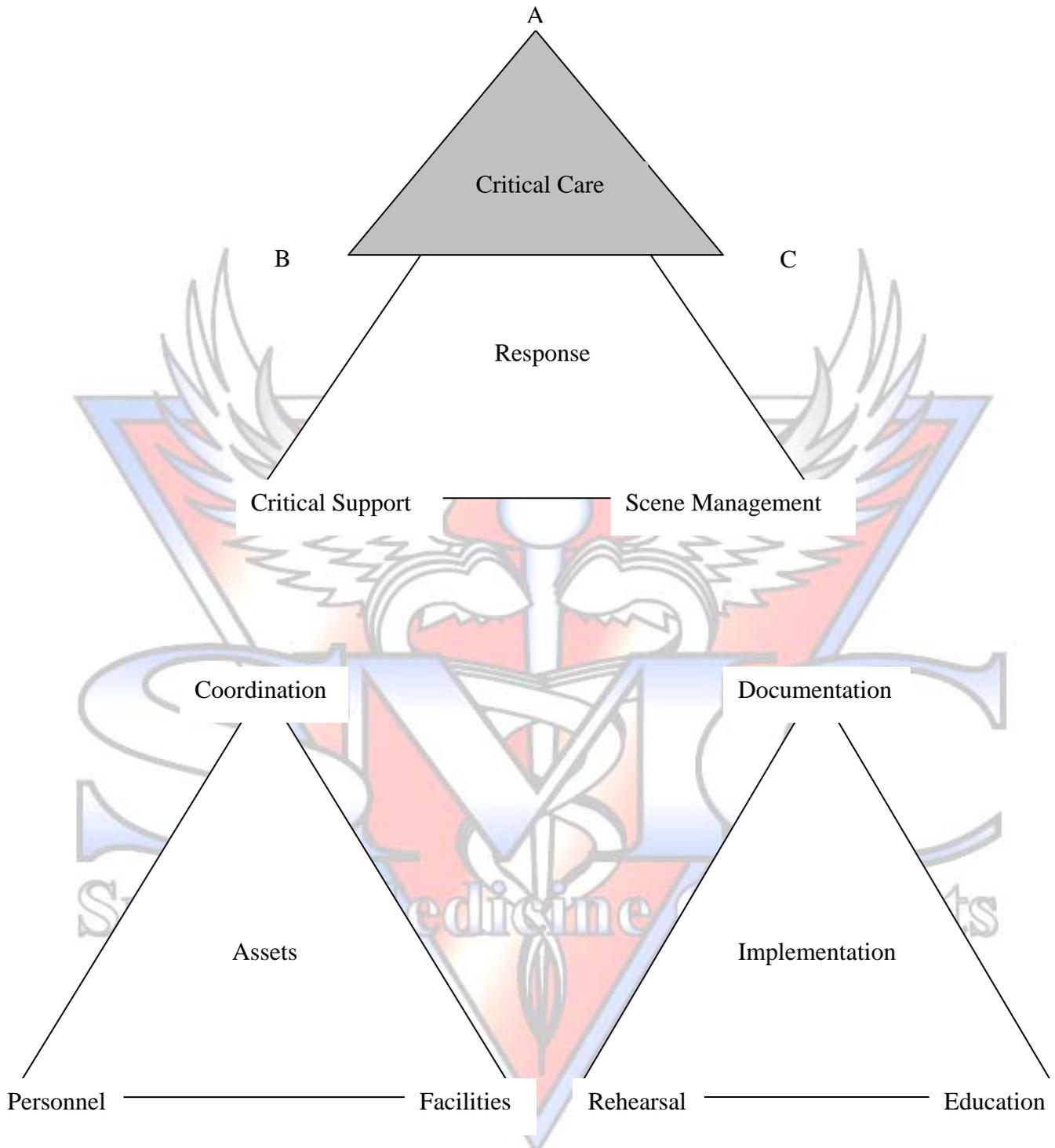
#### **References**

1. Andersen, J.C., et al., *National Athletic Trainers' Association Position Statement: Emergency Planning in Athletics*. Journal of Athletic Training, 2002. **37**(1): p. 99-104.
2. Drezner, J., *Preparing for sudden cardiac arrest-the essential role of automated external defibrillators in athletic medicine: a critical review*. Br J Sports Med, 2009. **43**(9): p. 702-707.
3. Rosenbaum, M., Davis, S, *Emergency planning for sudden cardiac events in North Carolina high schools*. N C Med J, 2009. **70**(3): p. 198-204.
4. Pulley T, S.A., Elder CL, Easter B., *Assessment of athletic department emergency action plans*. J Athl Train, 2006. **41**(2): p. S-90-S91.
5. Valenzuela TD, R.D., Nichol G, Clark LL, Spaite DW, Hardman R., *Outcomes of Rapid Defibrillation by Security Officers after Cardiac*

- Arrest in Casinos.* N Engl J Med, 2000. **343**: p. 1206-9.
6. Page RL, J.J., Kowal RC, Zagrodzky JD, Nelson LL, Ramaswamy K, Barbara SJ, Hamdan MH, McKenas DK., *Use of automated external defibrillators by U.S. airline.* N Engl J Med, 2000. **343**: p. 1210-16.
  7. CW., C., *Improving neurologic outcomes after out-of-hospital cardiac arrest.* Pre Hosp Emer Care, 1997. **1**(1): p. 45.
  8. RM, R., *Sudden death from cardiac arrest-improving the odds.* N Engl J Med, 2000. **343**: p. 1259-60.
  9. Kromann CB, B.C., Jensen ML, Ringsted C, *The testing effect on skills learning might last 6 months.* Med Educ, 2009. **43**: p. 21-27.
  10. Kuo TM, H.E., *Investigations of the testing effect.* Am J Psychol, 1996. **109**: p. 451-64.
  11. Rosenbaum DA, C.R., Gilmore RO, *Acquisition of intellectual and perceptual motor skills.* Annul Rev Psychol, 2001. **52**: p. 453-70.
  12. Roediger HL, K.J., *Test-enhanced learning: taking memory tests improves longterm retention.* Psychol Sci, 2006. **17**: p. 249-55.
  13. Crocker PR, D.J., *Incidental psychomotor learning: the effects of number of movements, practice and rehearsal.* J Mot Behav, 1984. **16**: p. 61-75.
  14. Ringsted C, L.F., Hesselfeldt R, Rasmussen MB, Morgensen SS, Frost T, Jensen ML, Jensen MK, Van derVleuten C, *Assessment of Advanced Life-Support competence when combining different test methods-Reliability and validity.* Resuscitation, 2007. **75**(1): p. 153-60.
  15. Aliner G, H.B., Gordon R, *Determining the value of simulation in nurse education: study design and initial results.* Nurs Educ Pract, 2004(4): p. 200-7.
  16. Chopra V, G.B., DeJong J et al., *Does training on an anaesthesia simulator lead to improvement in performance?* Br J Anaeth, 1994. **73**: p. 293-7.
  17. Gaba, D., *Improving anesthesiologists' performance by simulating reality.* J Anesthesiol, 1992. **76**: p. 491-4.
  18. Medley CF, H.B., Gordon R., *Using simulation technology for undergraduate nurse education.* J Nurs Educ, 2005(44): p. 31-4.
  19. Berden, H., Willems F, Hendrick J, Pijls N, Knape J, *How frequently should basic cardiopulmonary resuscitation training be repeated to maintain adequate skills?* BMJ, 1993. **306**: p. 1576-7.
  20. Kromann CB, B.C., Jensen ML, Ringsted C. *The testing effect on skills learning might last 6 months.* Adv Health Sci Edu 2009 [cited 2010 May 4].
  21. *Guidelines for Public Access Defibrillation Programs in Federal Facilities.* May 23, 2001: Federal register. p. 28495-28511.

Appendix A  
Schematic of Sports Medicine Concepts'  
Triangles of Critical Care Approach™ to Emergency Action Planning





**Sports Medicine Concepts' Triangles Approach**

## Appendix B

### Sample Forms from Sports Medicine Concepts' EMSOft™ Emergency Action Planning Software

The Top portion of this form may be useful when cataloging SMTEAP personnel.

The lower half of this form may also be useful when completing Implementation Triangle activities, such as annual rehearsal, SMTEAP updates, and maintenance.



**Appendix C**  
**Sample Forms from Sports Medicine Concepts' EMSOft™ Emergency Action Planning Software**

This form may be useful in cataloging SMTEAP venue equipment



**Appendix D**  
**Sample Forms from Sports Medicine Concepts' EMSOft™ Emergency Action Planning Software**

These forms may be found useful for documentation, annual rehearsal and review, incident review, and annual SMTEAP updates.

