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The Need for Advanced Cardiac Life Support Certification for Open-Water Lifeguards at Huntington Beach, CA

Daniel Jerome, Peter R. Chambers, Steve Reuter, John Porcari, Peter G. Wernicki, and Elly S. Lensch

The number of people visiting U.S. beaches increased in 2007 to more than 240 million people. This increase in activities does not come without danger. Lifeguards maintain beach safety, but little research is available to assist us in determining appropriate certification levels for lifeguards. The authors analyzed various injuries that occurred in the open-water environment of Huntington Beach, CA. Based on the nature of the injuries, they attempted to determine the level of training lifeguards needed. The vast majority of injuries (99%) were soft-tissue injuries, musculoskeletal injuries, or environmental injuries. It was felt that lifeguards with first-aid and basic-life-support (BLS) -level training were able to handle these injuries adequately and that advanced cardiac life support (ACLS) was not necessary. Injuries that happened at Huntington Beach primarily required lifeguards with first-aid and BLS training. It does not seem necessary that all open-water lifeguards be trained in ACLS.

Keywords*:* aquatic risk management, first aid and CPR, lifeguarding, lifesaving, swimming beaches

Water-oriented activities make a vital contribution to the field of outdoor recreation. In the Western and industrial nations, there has been a significant growth in the pursuit of water-based experiences as forms of sport, leisure, recreation, and tourism (Jennings, 2007). Open-water swimming is an activity in which people swim in large outdoor bodies of water such as the ocean, rivers, and lakes. According to statistics collected by the United States Lifesaving Association (USLA), in 2007, the number of people visiting U.S. beaches increased by 2 million people to more than 240 million people (USLA, 2007b). This increase in activities in, on, and under water does not come without dangers. Patrons who enjoy open-water activities have increased the demand for trained professionals to make the environment safe.

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A professional lifeguard should have a thorough knowledge of some or all of the following marine-safety-oriented subjects: resuscitation and first aid, search and recovery techniques including scuba, operation and maintenance of power rescue boats and rescue vehicles including all equipment thereon, prevention of water-related accidents, coordination of emergency activities with other emergency agencies, operation of multichanneled radios and telephone switchboards, and elements of supervision and administration (USLA, 1981). To meet these responsibilities a lifeguard should possess adequate skills in accident prevention, decision making, and rescuing (YMCA of the USA, 1994).

The USLA was formed for the sole purpose of establishing and maintaining high standards of professional surf and open-water lifesaving to maximize public safety (USLA, 2007a). The diversity of the natural aquatic environment and the many approaches to open-water lifesaving defied the concept of a single rigid curriculum for open-water lifeguards (USLA, 2007a). All marine-safety agencies have a comprehensive training curriculum for their lifeguards. This regimen includes physical training, classroom instruction, skills development, public relations, and specific programmatic features designed to instill professional attitudes toward lifeguarding. The training programs are uniquely tailored to meet the real requirements of the agency they serve (USLA, 1981), so instead of certifying lifeguards, the USLA developed a system of accrediting lifeguard agencies and their training programs (USLA, 2008).

Usually beaches in California, Florida, and Hawaii, which are busy year-round, employ full-time lifeguards. Beaches that do not have much activity, especially during the winter months, like the Great Lakes region, might employ seasonal lifeguards. According to USLA guidelines, a seasonal open-water lifeguard must be at least 16 years of age, be able to swim 550 yd in 10 min or less, and possess adequate vision, hearing acuity, and physical ability. Apart from these attributes, the lifeguards are expected to have currently valid first-aid and CPR certification (USLA, 2008). A seasonal lifeguard might also be certified as a First Responder, which would include training in basic life support (BLS; USLA, 2008). BLS is a specific level of prehospital medical care provided by trained responders. People with BLS training focus on airway maintenance, breathing, and circulation of an accident victim. BLS training also equips these responders to use an automated external defibrillator (Wikipedia, 2008b).

A full-time open-water lifeguard meets the same standards and has the same certification required by seasonal lifeguards and can also additionally be certified as an emergency medical technician (EMT; USLA, 2008). EMTs are classified into EMT basic, intermediate, and paramedic levels depending on the level of care they are trained to provide (State of Wisconsin, 2006). The scope of practice for an EMT would include much more than that of a First Responder, but it varies greatly between states (State of Wisconsin, 2006). Advanced cardiac life support (ACLS) is an extension of BLS and requires extensive medical knowledge and training. In addition to all the tasks done in BLS, an ACLS provider can initiate IV access and manage a patient's airway and understands emergency pharmacology (Wikipedia, 2008a). EMT basics might be trained in ACLS, but it is more usual for EMT intermediates and paramedics.

As discussed earlier, the nature of challenges that a lifeguard might encounter during his or her surveillance of a beach should determine the required level of

training. A careful evaluation of the injuries that occur in the beach environment and their required level of care give us clear insight into what level of training and certification lifeguards need to have. This study analyzed various injuries that occurred in the open-water environment of Huntington Beach, CA. Based on the nature of injuries in this environment that we discovered from our study, we suggest the level of training that full-time lifeguards need.

Method

We conducted this study using the data that were available from beaches in Huntington Beach, CA, from 2004 to 2006. As per USLA guidelines, injuries where recorded on an emergency report form (Appendix A). The principal investigator for this study traveled to Huntington Beach to collect the information. We used two primary sources of information for our data collection. One was the *Marine Safety Division Statistics* (Appendix B) from January 1, 2004, to December 31, 2006. The second was the emergency report form. The injuries that occurred were classified as minor or major depending on whether they required treatment only at the site or additional treatment at a hospital or primary-care facility. The USLA requires a written report of all medical aid given at a beach, except for the act of distributing Band-Aids. Minor injuries (beyond providing Band-Aids) require medical aid that is given by the lifeguard but do not require a higher level of medical care. Major injuries, on the other hand, require higher levels of medical care including emergency transport or a specialized medical response. We further classified the injuries into categories describing the exact nature of the condition and whether they were treated with first aid, BLS, or ACLS care.

Cardiac Conditions

Cardiac conditions include chest pain, myocardial infarction, and cardiac arrest. The most prominent symptom of a heart attack is persistent chest pain or discomfort. Because a heart attack can lead to cardiac arrest, chest pain must not be taken lightly. Prompt action might prevent serious problems (American National Red Cross, 1996). These conditions will entail the use of ACLS and thus are considered major injuries.

Neurological Conditions

Incidents in the neurological category include loss of consciousness, seizures, and syncope resulting from various causes. Syncope is a partial or complete loss of consciousness. It is caused by temporary reduction in blood flow to the brain. The victim might complain of numbness or tingling before syncope. This disruption of blood flow to a part of the brain, which causes permanent damage to brain tissue, could result in a stroke. Seizures are a result of an irregularity in the brain's electrical activity. Some of these conditions such as syncope and loss of consciousness might require ACLS training for immediate management. Other conditions such as seizures can be treated with first aid initially followed by a call for EMT services if they definitely require more advanced medical attention.

Respiratory Conditions

Conditions in the respiratory category include shortness of breath, asthma, and respiratory distress. Respiratory distress is the most common type of breathing emergency, in which breathing becomes difficult. It might not always be caused by an injury or illness but may be the result of anxiety or excitement. Even though respiratory distress can be an early signal of serious life-threatening conditions, calming down and reassuring the victim would be the first steps to take. Medications that are usually administered to victims of respiratory conditions include oxygen or an inhalant. Immediate ACLS is not necessary in many cases. BLS, which concentrates on the ABCs (i.e., maintaining an open **a**irway, **b**reathing, and **c**irculation), can help greatly with these conditions. They could also require further management if the symptoms do not resolve themselves fairly quickly.

Metabolic Conditions

Conditions in the metabolic category include heat exhaustion and diabetic emergencies. Heat exhaustion is the early stage and most common form of heat-related injuries. It occurs in those who are very active and might be wearing heavy clothing in a hot, humid environment. Often the victim feels better when he or she rests in a cool place and drinks cold water. Without prompt care, heat exhaustion can lead to a more serious, life-threatening condition. Diabetic emergencies include hyper- or hypoglycemia. These result from high or low levels of glucose in the blood. If the victim does not respond to initial care within 5 min, EMT services should be called immediately. Immediate use of ACLS is not usually necessary for victims of metabolic conditions if appropriate BLS action is taken.

Soft-Tissue Conditions

Soft-tissue conditions include open and closed wounds and burns. Open wounds can be as minor as a scrape of the skin or as major as a deep penetration or severe laceration. The amount of bleeding depends on the location and severity of the injury. Burns are a special kind of soft-tissue injury. Burns might be superficial or deep. A closed wound can range from a minor bruise to more serious soft-tissue injuries resulting in profuse bleeding beneath the skin. Depending on the severity of the injury, treatment will vary from immediate first aid to further advanced care at the hospital.

Musculoskeletal Conditions

Conditions associated with the muscles and bones include spinal injuries, as well as other fractures and joint dislocations. Injuries to the musculoskeletal system occur as a result of mechanical forces. They include bone fractures, joint sprains, joint dislocations, and muscle strains. Many musculoskeletal injuries are minor, but fractures and dislocations require additional care. Immobilization and safe transport are vital in injuries involving the spinal column. First aid and safe transport skills are vital in handling cervical injuries. All fractures and dislocations will require further evaluation and management in a hospital or primary-care facility.

Environmental Conditions

Injuries resulting from environmental conditions include jellyfish and stingray attacks. Stings from marine life not only can be painful but also can result in a serious allergic reaction. Allergic reactions can cause breathing and heart problems and paralysis. Environmental injuries might require further management in a hospital depending on the type of bite or sting.

Mental Health Conditions

Injuries associated with mental health conditions include drug overdose, alcohol-related problems, and suicide. These unfortunate events definitely require further management at the hospital and are normally beyond the scope of BLA and lifeguard training.

Submersion Injuries

Injuries or incidents related to water submersion include drowning, near drowning, asphyxia, and immersion injuries. *Drowning* refers to a submersion event in which the victim is pronounced dead at the scene of attempted resuscitation (Graver, 2004). *Near drowning* refers to submersion victims who survive for at least 24 hr. Both these terms are still being used, although they do not give a clear idea of what the exact condition is. The preferred term would be *submersion injury,* which is classified into three further subcategories: aspiration syndrome, caused by aspiration of fluid into the lungs; suffocation with loss of consciousness; and immersion syndrome, in which the victim dies immediately after entering the water. Alcohol intoxication can be a very important predisposing factor for immersion syndrome. Submersion injuries require BLS immediately, which might be followed by hospitalization.

Results

We found 9,999 injuries that occurred in and around Huntington Beach between 2004 and 2006 (Table 1). In each of the years 2004 and 2006, approximately 60% of injuries were classified as minor injuries and 40% were considered major injuries. In 2005, there was an unusually high incidence of minor injuries (6,535)

Table 1 Injuries at Huntington Beach, CA, Between 2004 and 2006 Recorded by the Marine Safety Division

	Injuries		
Year	Major	Minor	Total
2004	616	908	1,524
2005	767	6,466	7,233
2006	525	717	1,242
Total	1,908	8,091	9,999

in the area because of an infestation of jellyfish. Overall, the percentage of minor injuries was 80% over the 3-year period.

As discussed previously, depending on their nature the injuries were further classified into cardiac, neurological, respiratory, metabolic, soft-tissue, musculoskeletal, environmental, mental health, and submersion conditions. We present the total number of injuries in each condition by year in Table 2. The reader can see that the vast majority of injuries (99%) were soft-tissue injuries, musculoskeletal injuries, or environmental injuries. The environmental injuries were primarily jellyfish stings.

We then categorized the total number of injuries into those that required first-aid and BLS training and those that required ACLS training (Table 3). In 2004, there were 1,517 injuries that needed immediate first aid and BLS training, and only seven injuries required personnel with ACLS training. Out of the 1,517 injuries that required first aid and BLS, 59 were conditions that required immediate transport to

Table 2 Classification of Beach-Related Injuries at Huntington Beach, CA

	Beach-Related Injuries									
Year	Cardio	Neuro	Resp	Meta	ST	MS	Env	MH	Sub	Total
2004	5	4	5	7	829	121	541	5	7	1,524
2005	5	3	—	3	1,035	96	6,087	—	4	7,233
2006	2	16	15	11	908	138	147	2	3	1,242
Total	12	23	20	21	2,772	355	6,775	7	14	9,999

Note. Cardio = cardiac conditions; Neuro = neurological conditions; Resp = respiratory conditions; Meta = metabolic conditions; ST = soft-tissue injuries; MS = musculoskeletal injuries; Env = environmental injuries; MH = mental health conditions; Sub = submersion injuries.

Table 3 Categorization of Level of Training Required to Treat Beach-Related Injuries at Huntington Beach, CA, From 2004 to 2006

	Training Level		
Year	FA & BLS	ACLS	Total
2004	1,517	7	1,524
2005	7,227	6	7,233
2006	1,228	14	1,242
Total	9,972	27	9,999

Note. FA & BLS = patients requiring first aid and basic life support with additional transport to emergency services at the hospital; ACLS = patients requiring advanced cardiac life support with additional transport to emergency services.

a hospital for advanced care (e.g., victims with symptoms of shortness of breath, loss of consciousness, cervical fractures, diabetic emergencies, and seizures). The average response time for those conditions was 10 min. Another 550 of those injuries required hospitalization but not immediate transport (e.g., open wounds, closed wounds, fractures, and joint dislocations). For the injuries that required ACLS personnel and immediate transport to the hospital, the average ambulance response time was 9 min.

In 2005, there were 7,233 injuries, of which 6,470 required personnel with first-aid and BLS training and only six needed personnel with ACLS training. Out of the 6,470 injuries that needed first aid and BLS, six required immediate hospitalization for advanced care and 755 eventually needed hospitalization, although the hospitalization did not need to be immediate. The average response time for injuries that required immediate hospitalization was 19 min. For injuries that needed ACLS personnel and further hospitalization, the average response time was 6 min.

In 2006, there were 1,242 injuries. Of those, 1,228 needed lifeguards with first-aid and BLS training and 14 needed ACLS-trained personnel. Out of the 1,228 injuries that needed immediate first aid and BLS at the site, 71 needed immediate hospitalization for advanced care and the average ambulance response time was 9 min. The remaining 440 injuries eventually needed subsequent hospitalization, although the need was not immediate.

Discussion

This study focused on analyzing and classifying the injuries that occurred on the beaches in Huntington Beach, CA, during the years 2004–2006, with the purpose of trying to define the level of emergency training needed for open-water lifeguards employed at those beaches. We classified the injuries into various categories based on their nature (e.g., cardiac, musculoskeletal, environmental) and classified them further based on the level of care that was needed.

In our analysis of the beach-related injuries we attempted to determine whether they could have been treated with first-aid- and BLS-trained personnel or the rescuer needed ACLS training. We found that 99% of the injuries that occurred were soft-tissue, musculoskeletal, or environmental injuries. We felt that lifeguards with first-aid and BLS-level training were able to handle the vast majority of these injuries adequately. A small number of those injuries (19%) were transported to the hospital for further care. The response times for injuries that needed immediate transport to the hospital for further care averaged 10 min. Because these injuries were not immediately life threatening, although they were potentially serious, this response time was sufficient to ensure patron safety. Some of the other injuries, apart from the ones mentioned earlier that required first aid and BLS at the beach site, also required immediate transportation and hospitalization for complete management. These included neurological, respiratory, metabolic, mental health, and submersion injuries.

Patients who experienced chest pain, myocardial infarction, syncope, or loss of consciousness had the highest potential to need ACLS-trained personnel. Over the 3-year period, there were 27 instances of cardiac or neurological conditions that required personnel with ACLS certification. Treatment at the site included

gaining intravenous access and administration of fluids, use of artificial airways and administration of oxygen, use of emergency medications, and initiation of 12-lead EKG monitoring. All of these patients needed immediate transportation to the hospital. The average ambulance response time for these was 7 min and 20 s, well within the commonly accepted response time of 8 min.

Studies have revealed that early defibrillation and CPR are key for survival in a life-threatening situation, which might begin with chest pain, syncope, or loss of consciousness (Capucci et al., 2002; Cummins, Ornato, Thies, & Pepe, 1991; Sanna et al., 2008; Spearpoint, McLean, & Zideman, 2000; Valenzuela, Roe, Cretin, Spaite, & Larsen, 1997). Because BLS training would cover these important steps of lifesaving, the need for advanced ACLS intervention is not necessarily immediate. As revealed in this study, EMS personnel with ACLS certification were able to arrive at the scene quickly enough to ensure adequate handling of each situation. Even though the result of this study might indicate that ACLS training is not an absolute requirement for open-water lifeguards at Huntington Beach, it is conceivable that open-water lifeguards at other locations might need it, if other emergency responders could not arrive within the critical minutes.

As discussed earlier, each marine agency trains its lifeguards to be able to respond to the specific conditions and common injuries that happen in that area. In this regard, this study suggests that the predominant injuries that happen in Huntington Beach require lifeguards with first-aid and BLS training in the vast majority of cases. Because there were only 27 injuries in 3 years that required ACLS-trained personnel, it does not seem necessary that all open-water lifeguards be trained in ACLS.

The result of the study cannot be taken as a gold standard for lifeguard-training needs nationwide or worldwide, because we looked only at the injuries that happened during a 3-year period on one particular beach in southern California. Open-water environments vary geographically and demographically, so the nature of injuries that happen on a particular beach might also vary and might change over time. Another important finding of our study is the critical need for the availability of advanced care whenever there is a serious emergency. If the advanced care is not readily accessible in the open-water environment, ACLS-trained lifeguards might be a necessity. If advanced care and ambulance services are readily available and the response time is short, ACLS training might not be absolutely necessary for all or most open-water lifeguards. As we discovered in this study, the most common injuries in our open-water environment at Huntington Beach were open and closed wounds and musculoskeletal and environmental injuries. Future studies might focus on the need for training open-water lifeguards in advanced-trauma life support.

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