2010 American Heart Association Guidelines for CPR and Emergency Cardiovascular Care Comparison Chart of Key Changes

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2010 Recommendation	**2005 Recommendation**	**Explanation**
Basic Life Support		
A change in the basic life support (BLS) sequence of steps for trained rescuers from "A-B-C" (Airway, Breathing, Chest compressions) to "C-A-B" (Chest compressions, Airway, Breathing) for adults and pediatric patients (children and infants, excluding newborns). Also applies to BLS for healthcare providers.	Use of the "A-B-C" basic life support sequence.	• In the majority of cardiac arrests, the critical initial elements of CPR are chest compressions and early defibrillation. • In the C-A-B sequence, chest compressions will be initiated sooner and ventilation only minimally delayed until completion of the first cycle of chest compressions. • The A-B-C sequence could be a reason why fewer than a third of people in cardiac arrest receive bystander CPR. A-B-C starts with the most difficult procedures: opening the airway and delivering rescue breaths. •
"Look, Listen and Feel" has been removed from the BLS algorithm. Also applies to BLS for healthcare providers.	"Look, Listen and Feel" Included in BLS algorithm	Performance of "Look, Listen and Feel," is inconsistent and time consuming.
A compression rate of at least 100/min. Also applies to BLS for healthcare providers.	A compression rate of "approximately" 100/min.	The number of chest compressions delivered per minute during CPR is an important determinant of return of spontaneous circulation (ROSC) and survival with good neurologic function. In most studies, delivery of more compressions during resuscitation is associated with better survival, and delivery of fewer compressions is associated with lower survival.
The new recommendation for chest compression depth: push down on the adult breastbone at least 2 inches (5 cm). Also applies to BLS for healthcare providers.	Depress adult breastbone approximately 1 1/2 to 2 inches (approximately 4 to 5 cm).	Compressions generate critical blood flow and oxygen and energy delivery to the heart and brain. Rescuers often do not push the chest hard enough.
If a bystander is not trained in CPR, the bystander should provide Hands-Only™ (compression-only) CPR for the adult victim who suddenly collapses, with an emphasis to "push hard and fast" on the	The 2005 AHA Guidelines for CPR and ECC did not provide different recommendations for trained versus untrained rescuers	Hands-Only (compression-only) CPR is easier for an untrained rescuer to perform and can be more readily guided by dispatchers over the telephone. In addition, survival rates from cardiac arrests of cardiac etiology are similar with either

center of the chest, or follow the directions of the EMS dispatcher. All trained lay rescuers should, at a minimum, provide chest compressions for victims of cardiac arrest. In addition, if the trained lay rescuer is able to perform rescue breaths, compressions and breaths should be provided in a ratio of 30 compressions to 2 breaths.	but did recommend that dispatchers provide compression-only CPR instructions to untrained bystanders. The 2005 AHA Guidelines for CPR and ECC did note that if the rescuer was unwilling or unable to provide ventilations, the rescuer should provide chest compressions only.	Hands-Only CPR or CPR with both compressions and rescue breaths. However, for the trained lay rescuer who is able, the recommendation remains for the rescuer to perform both compressions and ventilations.
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Healthcare Provider BLS		
The new guidelines more strongly recommend that dispatchers instruct untrained lay rescuers to provide Hands-Only CPR for adults who are unresponsive, with no breathing or no normal breathing. Dispatchers should provide instructions in conventional CPR for victims of likely asphyxial arrest (such as drowning).	The 2005 AHA Guidelines for CPR and ECC noted that telephone instruction in chest compressions alone may be preferable.	• Hands-Only (compressions-only) bystander CPR substantially improves survival after adult out-of-hospital cardiac arrests compared with no bystander CPR. • Other studies of adults with cardiac arrest treated by lay rescuers showed similar survival rates among victims receiving Hands-Only CPR versus those receiving conventional CPR. • It is easier for dispatchers to instruct untrained rescuers to perform Hands-Only CPR than conventional CPR for adult victims, so the recommendation is now stronger for them to do so, unless the victim is likely to have had an asphyxial arrest.
The new guidelines do not recommend routine use of cricoid pressure in cardiac arrest.	Cricoid pressure should be used only if the victim is deeply unconscious. This usually requires a third rescuer, not involved in rescue breaths or compressions.	Cricoid pressure can prevent gastric inflation and reduce the risk of regurgitation and aspiration during bag-mask ventilation, but it may also impede ventilation. Seven randomized studies showed that cricoid pressure can delay or prevent the placement of an advanced airway and some aspiration can still occur despite application of cricoid pressure. In addition, it is difficult to appropriately train rescuers in use of the maneuver.
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Electrical Therapies		
If one is available, the rescuer should use a pediatric dose-attenuator system for attempted defibrillation of children 1 to 8 years of age with an AED. If the rescuer does not have an AED with a pediatric dose-attenuator system, the rescuer should use a standard AED. For infants (<1 year of age), a manual defibrillator is preferred. If a manual defibrillator is not available, an AED with pediatric dose attenuation is desirable. If neither is available, an AED without a dose attenuator may be used.	For children 1 to 8 years of age, the rescuer should use a pediatric dose-attenuator system if one is available. If the rescuer provides CPR to a child in cardiac arrest and does not have an AED with a pediatric attenuator system, the rescuer should use a standard AED. There are insufficient data to make a recommendation for or against the use of AEDs for infants <1 year of age.	The lowest energy dose for effective defibrillation in infants and children is not known. The upper limit for safe defibrillation is also not known, but doses >4 J/kg (as high as 9 J/kg) have effectively defibrillated children and animal models of pediatric arrest with no significant adverse effects. Automated external defibrillators with relatively high-energy doses have been used successfully in infants in cardiac arrest, with no clear adverse effects.
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Advanced Cardiovascular Life Support (ACLS)		
Continuous quantitative waveform capnography is now recommended for intubated patients throughout the peri-arrest period. When quantitative waveform capnography is used for adults, applications now include recommendations for confirming tracheal tube placement and for monitoring CPR quality and detecting return of spontaneous circulation based on end-tidal carbon dioxide (Petco2) values.	An exhaled carbon dioxide (CO_2) detector or an esophageal detector device was recommended to confirm endotracheal tube placement. The previous guidelines noted that $Petco_2$ monitoring can be useful as a noninvasive indicator of cardiac output generated during CPR.	Continuous waveform capnography is the most reliable method of confirming and monitoring correct placement of an endotracheal tube. Because blood must circulate through the lungs for CO_2 to be exhaled and measured, capnography can also serve as a physiologic monitor of the effectiveness of chest compressions and to detect return of spontaneous circulation. Ineffective chest compressions (due to either patient characteristics or rescuer performance) are associated with a low $Petco_2$. Falling cardiac output or re-arrest in the patient with return of spontaneous circulation also causes a decrease in $Petco_2$. In contrast, return of spontaneous circulation may cause an abrupt increase in $Petco_2$
The conventional ACLS Cardiac Arrest Algorithm has been simplified and streamlined to emphasize the importance of high-quality CPR. The new guidelines include a new circular algorithm.	The same priorities were cited in the 2005 guidelines. The box and arrow algorithm listed key actions performed during the resuscitation in a sequential fashion.	Before 2005, ACLS courses assumed that excellent CPR was provided, and, therefore, focused mainly on added interventions, such as manual defibrillation, drug therapy, and advanced airway management, as well as alternative and additional management options for special resuscitation situations. Although adjunctive drug therapy and advanced airway management are still part of ACLS, in 2005 the emphasis in advanced life support (ALS) returned to the

		basics, with an increased emphasis on what is known to work: high quality CPR. While continuing this emphasis, the 2010 guidelines note that CPR is ideally guided by physiologic monitoring and includes adequate oxygenation and early defibrillation, while the ACLS provider assesses and treats possible underlying causes of the arrest. There is no definitive clinical evidence that early intubation or drug therapy improves neurologically intact survival to hospital discharge.
Atropine is no longer recommended for routine use in the management of pulseless electrical activity (PEA)/asystole. Adenosine is recommended in the initial diagnosis and treatment of stable, undifferentiated regular, monomorphic wide-complex tachycardia (this is also consistent in ACLS and PALS recommendations).	Atropine was included in the ACLS Pulseless Arrest Algorithm: for a patient in asystole or slow PEA, atropine could be considered.	Evidence suggests that the routine use of atropine during PEA or asystole is unlikely to have a therapeutic benefit. On the basis of new evidence of safety and potential efficacy, adenosine can now be considered as recommended.
Post–Cardiac Arrest Care is a new section in the 2010 guidelines. To improve survival for victims of cardiac arrest who are admitted to a hospital after return of spontaneous circulation, a comprehensive, structured, integrated, multidisciplinary system of post–cardiac arrest care should be implemented in a consistent manner. Treatment should include cardiopulmonary and neurologic support, as well as therapeutic hypothermia and percutaneous coronary interventions (PCIs), when indicated. An electroencephalogram for the diagnosis of seizures should be performed with prompt interpretation as soon as possible and should be monitored frequently or continuously in comatose patients after return of spontaneous circulation.	Post–cardiac arrest care was included within the ACLS section of the 2005 guidelines. Therapeutic hypothermia was recommended to improve outcome for comatose adult victims of witnessed out-of-hospital cardiac arrest when the presenting rhythm was VF. However, there was limited evidence to support these recommendations.	Since 2005, two nonrandomized studies with concurrent controls and other studies using historic controls have indicated the possible benefit of therapeutic hypothermia after in-hospital cardiac arrest and out-of-hospital cardiac arrest with PEA/asystole as the presenting rhythm. Organized post–cardiac arrest care with an emphasis on multidisciplinary programs that focus on optimizing hemodynamic, neurologic, and metabolic function may improve survival to hospital discharge among victims who achieve ROSC after cardiac arrest either in or out of hospital.
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Pediatric Basic Life Support		
Initiate CPR for infants and children with chest compressions rather than rescue breaths (C-A-B rather than A-B-C). CPR should begin with 30	Cardiopulmonary resuscitation was initiated with opening of the airway and the provision of 2	This proposed major change in CPR sequencing to compressions before ventilations (C-A-B) led to vigorous debate among experts in pediatric resuscitation. Because most

compressions (any lone rescuer) or 15 compressions (for resuscitation of infants and children by two healthcare providers) rather than with two ventilations.	breaths before chest compressions.	pediatric cardiac arrests are asphyxial, rather than sudden primary cardiac arrests, both intuition and clinical data support the need for ventilations and compressions for pediatric CPR. However, pediatric cardiac arrests are much less common than adult sudden (primary) cardiac arrests, and many rescuers do nothing because they are uncertain or confused. Most pediatric cardiac arrest victims do not receive any bystander CPR, so any strategy that improves the likelihood of bystander action may save lives. Therefore, the C-A-B approach for victims of all ages was adopted with the hope of improving the chance that bystander CPR would be performed. The new sequence should theoretically only delay rescue breaths by about 18 seconds (the time it takes to deliver 30 compressions) or less (with 2 rescuers).
To achieve effective chest compressions, rescuers should compress at least one third of the anterior-posterior diameter of the chest. This corresponds to approximately 1 ½ inches (about 4 cm) in most infants and about 2 inches (5 cm) in most children.	Push with sufficient force to depress the chest approximately one third to one half the anterior-posterior diameter of the chest.	Evidence from radiologic studies of the chest in children suggests that compression to one half the anterior-posterior diameter may not be achievable. However, effective chest compressions require pushing hard, and based on new data, the depth of about 1 ½ inches (4 cm) for most infants and about 2 inches (5 cm) in most children is recommended.
For infants, a manual defibrillator is preferred to an AED for defibrillation. If a manual defibrillator is not available, an AED equipped with a pediatric dose attenuator is preferred. If neither is available, an AED without a pediatric dose attenuator may be used.	Data have shown that AEDs can be used safely and effectively in children 1 to 8 years of age. However, there are insufficient data to make a recommendation for or against using an AED in infants < 1 year of age.	Newer case reports suggest that an AED may be safe and effective in infants. Because survival requires defibrillation when a shockable rhythm is present during cardiac arrest, delivery of a high-dose shock is preferable to no shock.
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Pediatric Advanced Life Support		
Specific resuscitation guidance has been added for management of cardiac arrest in infants and children with single-ventricle anatomy, Fontan or hemi-Fontan/bidirectional Glenn physiology, and pulmonary hypertension.	These topics were not addressed in the 2005 guidelines.	Specific anatomical variants with congenital heart disease present unique challenges for resuscitation.
Although there have been no published results of	Based on extrapolation from	Additional adult studies have continued to show the benefit of

prospective randomized pediatric trials of therapeutic hypothermia, based on adult evidence, therapeutic hypothermia (to 32°C to 34°C) may be beneficial for adolescents who remain comatose after resuscitation from sudden witnessed out-of-hospital VF cardiac arrest. Therapeutic hypothermia (to 32°C to 34°C) may also be considered for infants and children who remain comatose after resuscitation from cardiac arrest.	adult and neonatal studies, when pediatric patients remain comatose after resuscitation, consider cooling them to 32°C to 34°C for 12 to 24 hours.	therapeutic hypothermia for comatose patients after cardiac arrest, including those with rhythms other than VF. Pediatric data are needed.
The new guidelines have added this topic: When a sudden, unexplained cardiac death occurs in a child or young adult, obtain a complete past medical and family history (including a history of syncopal episodes, seizures, unexplained accidents/drowning, or sudden unexpected death at <50 years of age) and review previous ECGs. All infants, children, and young adults with sudden, unexpected death should, where resources allow, have an unrestricted complete autopsy, preferably performed by a pathologist with training and experience in cardiovascular pathology. Tissue should be preserved for genetic analysis to determine the presence of channelopathy.	This was not addressed in the previous guidelines.	There is increasing evidence that some cases of sudden death in infants, children, and young adults may be associated with genetic mutations that cause cardiac ion transport defects known as channelopathies. These can cause fatal arrhythmias, and their correct diagnosis may be critically important for living relatives.
Suctioning immediately after birth should be reserved for babies who have an obvious obstruction to spontaneous breathing or require positive-pressure ventilation.	The person assisting delivery of the infant should suction the infant's nose and mouth with a bulb syringe after delivery of the shoulders but before delivery of the chest. Healthy, vigorous newly born infants generally do not require suctioning after delivery. When the amniotic fluid is meconium stained, suction the mouth, pharynx, and	There is no evidence that active babies benefit from airway suctioning, even in the presence of meconium, and there is evidence of risk associated with this suctioning. The available evidence does not support or refute the routine endotracheal suctioning of depressed infants born through meconium-stained amniotic fluid.

	nose as soon as the head is delivered (intrapartum suctioning) regardless of whether the meconium is thin or thick.	
The recommended compression-to-ventilation ratio for newborns remains 3:1. If the arrest is known to be of cardiac etiology, a higher ratio (15:2) should be considered.	There should be a 3:1 ratio of compressions to ventilations.	The optimal compression-to-ventilation ratio remains unknown. The 3:1 ratio for newborns facilitates provision of adequate minute ventilation, which is considered critical for the vast majority of newborns who have an asphyxial arrest. The consideration of a 15:2 ratio (for 2 rescuers) recognizes that newborns with a cardiac etiology of arrest may benefit from a higher compression-to-ventilation ratio.
There is increasing evidence of benefit of delaying cord clamping for at least 1 minute in term and preterm infants not requiring resuscitation. There is insufficient evidence to support or refute a recommendation to delay cord clamping in babies requiring resuscitation.	No recommendation.	
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Ethical Issues		
In adult post–cardiac arrest patients treated with therapeutic hypothermia, it is recommended that clinical neurologic signs, electrophysiologic studies, biomarkers, and imaging be performed where available at 3 days after cardiac arrest. Currently, there is limited evidence to guide decisions regarding withdrawal of life support. The clinician should document all available prognostic testing 72 hours after cardiac arrest treated with therapeutic hypothermia and use best clinical judgment based on this testing to make a decision to withdraw life support when appropriate.	No prognostic indicators had been established for patients undergoing therapeutic hypothermia. For those not undergoing therapeutic hypothermia, a meta analysis of 33 studies of outcome of anoxic-ischemic coma documented that the following 3 factors were associated with poor outcome: • Absence of pupillary response to light on the third day • Absence of motor response to	On the basis of the limited available evidence, potentially reliable prognosticators of poor outcome in patients treated with therapeutic hypothermia after cardiac arrest include bilateral absence of N20 peak on somatosensory evoked potential ≥ 24 hours after cardiac arrest and the absence of both corneal and pupillary reflexes ≥ 3 days after cardiac arrest. Limited available evidence also suggests that a Glasgow Coma Scale Motor Score of 2 or less at day 3 after sustained return of spontaneous circulation and presence of status epilepticus are potentially unreliable prognosticators of poor outcome in post-cardiac arrest patients treated with therapeutic hypothermia. Similarly, recovery of consciousness and cognitive functions is possible in a few post-cardiac arrest patients treated with therapeutic hypothermia despite bilateral

	pain by the third day • Bilateral absence of cortical response to median nerve somatosensory-evoked potentials when used in normothermic patients who were comatose for at least 72 hours after a hypoxic-ischemic insult Withdrawal of life support is ethically permissible under these circumstances.	absent or minimally present N20 responses of median nerve somatosensory evoked potentials, which suggests they may be unreliable as well. The reliability of serum biomarkers as prognostic indicators is also limited by the relatively few patients who have been studied.