New CPR Guidelines and the Future of Courses and Instruction

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CONTINUE THE CONVERSATION ON TWITTER

Post your questions and comments on Twitter using this hashtag. I will have links to the references there as well as this presentation.

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2015 AHA GUIDELINES UPDATE FOR CARDIOPULMONARY RESUSCITATION AND EMERGENCY CARDIOVASCULAR CARE
I have no conflict of interest. Please note I am an *unpaid volunteer* with the American Heart Association for nearly 8 years. I receive no money from the production or sales of PALS or any other material.
ACHIEVING CONSENSUS REGARDING RESUSCITATION SCIENCE

The American Heart Association and other member councils of International Liaison Committee on Resuscitation (ILCOR) complete a review of resuscitation science every five years.
ILCOR MISSION STATEMENT

• Review international science and knowledge relevant to CPR and ECC.
• Publish consensus statements on resuscitation science.
• When possible, publish treatment recommendations applicable to all member organizations.
• Encourage coordination of guideline development and publication by member organizations.
2015 ILCOR EVIDENCE EVALUATION PROCESS
ILCOR TASK FORCES FORMED IN 2011

- Advanced Life Support
- Basic Life Support
- Pediatric Life Support
- Neonatal Life Support
- Acute Coronary Syndrome
- Education, Implementation and Teams
- First Aid (first year as an ILCOR Task Force)
  - American Red Cross, via AHA, is part of FA TF
  - AHA & Red Cross will co-publish First Aid Guidelines
  - AHA Guidelines for CPR and ECC are not co-branded with Red Cross
2015 COSTR DEVELOPMENT TIMELINE

Evidence Evaluation Reviews

2011
- ILCOR December Porto
- CoSTR and Guidelines Published Oct 2010

2012
- ILCOR November Orlando

2013
- ILCOR April Melbourne
- ILCOR November Vienna

2014
- ILCOR March Banff

2015
- ILCOR November Chicago
- CoSTR and Guidelines Published October, 2015
- International Consensus February Dallas

International Liaison Committee on Resuscitation (ILCOR)
INTERNATIONAL EVIDENCE EVALUATION PROCESS

- 165 scientific evidence reviews
- February 2015 Consensus Conference
  - 232 professional participants
  - 46% from outside the US
  - 34 countries represented
- Management of potential COI throughout process
PROCESS FROM QUESTION TO GUIDELINE

1. ILCOR task forces formulated and prioritized questions and ranked importance of outcomes.

2. Evidence reviewers performed structured evidence evaluation using GRADE methodology (with help from experts), and presented to task force.

3. Task forces debated, discussed, reached consensus, and drafted manuscripts.

4. International Editorial Board, councils reviewed consensus, and provide input to writing groups.

5. Circulation obtained peer reviews.

6. Consensus on science is published.

7. Councils developed guidelines simultaneously.
Quality of Evidence: The extent to which our confidence in an estimate of the treatment effect is adequate to support a particular recommendation.

GRADE defines 4 categories of quality:
- High
- Moderate
- Low
- Very low

• www.gradeworkinggroup.com
DETERMINANTS OF QUALITY

- Randomized Controlled Trials start high
- Observational studies start low
- What lowers quality of evidence?
  - Methodology limitations (eg, study failed to control for many variables)
  - Inconsistency of results (different studies looking at same outcomes or effects report different results)
  - Indirectness of evidence (ie, adult study applied to children)
  - Imprecision of results (eg, small sample, very wide confidence intervals)
  - Publication bias (eg, neutral studies published less frequently)
For further information, consult:

http://www.guidelinedevelopment.org/
In addition to the evidence, Council guidelines must consider:

• Local factors and resources available
• Educational challenges
• Cost
RECOMMENDATIONS: ILCOR AND AHA

• ILCOR used GRADE to evaluate evidence based on the quality of the evidence for each question’s outcomes. (i.e., Strong For, Strong Against, Weak For, Weak Against).

• AHA uses Class of Recommendation and alphabetical Levels of Evidence for each Guideline recommendation (i.e., Class IIb, LOE B).
  – provides internal consistency with other AHA evidence-based Guidelines
## AHA Evidence Classification: 2015

### Class (Strength) of Recommendation

**Class I (Strong)**
- Benefit >>> Risk
- **Suggested phrases for writing recommendations:**
  - Is recommended
  - Is indicated/useful/effective/beneficial
  - Should be performed/administered/other
  - Comparative-Effectiveness Phrases:
    - Treatment/strategy A is recommended/indicated in preference to treatment B
    - Treatment A should be chosen over treatment B

**Class IIa (Moderate)**
- Benefit >> Risk
- **Suggested phrases for writing recommendations:**
  - Is reasonable
  - Can be useful/effective/beneficial
  - Comparative-Effectiveness Phrases:
    - Treatment/strategy A is probably recommended/indicated in preference to treatment B
    - It is reasonable to choose treatment A over treatment B

**Class IIb (Weak)**
- Benefit > Risk
- **Suggested phrases for writing recommendations:**
  - May/might be reasonable
  - May/might be considered
  - Usefulness/effectiveness is unknown/unclear/uncertain

### Level (Quality) of Evidence

**Level A**
- (Randomized)
- High-quality evidence† from more than 1 RCTs
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies

**Level B-R**
- (Randomized)
- Moderate-quality evidence† from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

**Level B-NR**
- (Nonrandomized)
- Moderate-quality evidence† from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies

**Level C-LD**
- (Limited Data)
- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects

**Level C-EO**
- (Expert Opinion)
- Consensus of expert opinion based on clinical experience

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AHA RECOMMENDATION
CLASSIFICATION: NEW CLASS III

CLASS III: No Benefit (MODERATE)
(Generally, LOE A or B use only)

- Benefit = Risk

Suggested phrases for writing recommendations:
- Is not recommended
- Is not indicated/useful/effective/beneficial
- Should not be performed/administered/other

Note: COR and LOE are determined independently, i.e., any COR may be paired with any LOE.

CLASS III: Harm (STRONG)
Risk > Benefit

Suggested phrases for writing recommendations:
- Potentially harmful
- Causes harm
- Associated with excess morbidity/mortality
- Should not be performed/administered/other

† The method of assessing quality is evolving, including the application of standardized, validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.
‡ For comparative-effectiveness recommendations (COR I and IIa; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

COR indicates Class of Recommendation; LOE, Level of Evidence; and RCT, randomized controlled trial.
CPR AND ECC INTEGRATED GUIDELINES NOW AVAILABLE ONLINE

- Integrated Guidelines available online October 15, 2015 at 12:01 a.m. CST.
- Can be downloaded free of charge at http://ECCGuidelines.heart.org
ADULT BLS
BLS SEQUENCES FOR CPR

• Allow for ubiquitous mobile phones (rescuers can remain with victim and activate emergency response system)
• Mobile phone should be placed beside victim on “speaker” so dispatcher can guide rescuer in CPR
• Enable Health Care Provider to tailor activation to clinical setting (but no later than when cardiac arrest identified)
Recommendation:
• Increased flexibility for modifications in BLS algorithm when appropriate.

Why:
• Algorithms have been presented as a sequence to prioritize actions; certain factors may require localized modifications.
KEY NEW AND UPDATED RECOMMENDATIONS: PEDIATRIC BLS
PEDIATRIC RESUSCITATION

- Reaffirmed C-A-B sequence
- Reaffirmed that compressions + ventilation needed for pediatric arrest
- Rescuers are unwilling or unable to deliver breaths should perform compressions.
- Updated 1-rescuer and multi-rescuer algorithms
PEDiATRIC BLS: CHEST COMPRESSION RATE AND DEPTH

• Compression rate change to 100-120 compressions per minute
• Depth: At least 1/3 the AP diameter of the chest
  – Infants: approximately 1.5 inches (4 cm)
  – Children: approximately 2 inches (5 cm)
• Adolescents (beyond puberty): at least 2 inches (5 cm), but no greater than 2.4 inches (6 cm)
Recommendation:
• May be reasonable to deliver 1 breath every 6 seconds (10 breaths/min) while continuous chest compressions are being performed (adult and peds).

Why?
• Simplified from range of 1 breath every 6-8 seconds (8-10 breaths/min).
• Should be easier to learn, remember, and perform.
BLS Healthcare Provider Pediatric Cardiac Arrest Algorithm for the Single Rescuer—2015 Update

Verify scene safety.

Victim is unresponsive. Shut for nearby help. Activate emergency response system via mobile device (if appropriate).

Normal breathing, has pulse

Look for no breathing or only gasping and check pulse (simultaneously). Is pulse definitely felt within 10 seconds?

No normal breathing, has pulse

Provide rescue breathing: 1 breath every 3-5 seconds, or about 12-20 breaths/min.
- Add compressions if pulse remains <60/min with signs of poor perfusion.
- Activate emergency response system (if not already done) after 2 minutes.
- Continue rescue breathing; check pulse about every 2 minutes. If no pulse, begin CPR (go to "CPR" box).

No breathing or only gasping, no pulse

Witnessed sudden collapse?

Yes

Activate emergency response system (if not already done), and retrieve AED/defibrillator.

No

CPR
1 rescuer: Begin cycles of 30 compressions and 2 breaths. (Use 15:2 ratio if second rescuer arrives.) Use AED as soon as it is available.

After about 2 minutes, if still alone, activate emergency response system and retrieve AED (if not already done).

AED analyzes rhythm. Shockable rhythm?

Yes

Shockable rhythm

Give 1 shock. Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.

No

nonschockable

No, nonschockable

Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.

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BLS Healthcare Provider Pediatric Cardiac Arrest Algorithm for 2 or More Rescuers—2015 Update

- Verify scene safety.
- Victim is unresponsive. Shout for nearby help. First rescuer remains with victim. Second rescuer activates emergency response system and retrieves AED and emergency equipment.

Monitor until emergency responders arrive.

Normal breathing, has pulse

Look for no breathing or only gasping and check pulse (simultaneously). Is pulse definitely felt within 10 seconds?

No normal breathing, has pulse

No breathing or only gasping, no pulse

CPR
- First rescuer begins CPR with 30:2 ratio (compressions to breaths). When second rescuer returns, use 15:2 ratio (compressions to breaths). Use AED as soon as it is available.

Provide rescue breathing:
- 1 breath every 3-5 seconds, or about 12-20 breaths/min.
- Add compressions if pulse remains <80/min with signs of poor perfusion.
- Activate emergency response system (if not already done) after 2 minutes.
- Continue rescue breathing; check pulse about every 2 minutes. If no pulse, begin CPR (go to “CPR” box).
PEDIATRIC BLS—USE AED AS SOON AS AVAILABLE

No breathing or only gasping, no pulse

CPR
First rescuer begins CPR with 30:2 ratio (compressions to breathes). When second rescuer returns, use 15:2 ratio (compressions to breathes). Use AED as soon as it is available.

AED analyzes rhythm. Shockable rhythm?

Yes, shockable
Give 1 shock. Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.

No, nonshockable
Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.
KEY NEW AND UPDATED RECOMMENDATIONS: PALS
Recommendation:

For children with *febrile illness in settings with limited access to critical care resources*, administration of bolus IV fluid should be undertaken with extreme caution.

Administration of IV fluids to children with septic shock still emphasized.

Individualize therapy with frequent reassessment.

Why?

In trial of children with severe febrile illnesses in resource-limited settings with limited access to critical care (e.g., mechanical ventilation, inotropic support) bolus IV fluids could be harmful.
• No evidence to support the routine use of atropine as a premedication to prevent bradycardia during emergent intubation.
• Note that recommendation for use of atropine for treatment of bradycardia is unchanged.
• Amiodarone or lidocaine are equally acceptable for VF/pVT.
TARGETED TEMPERATURE MANAGEMENT

• For children who are comatose following ROSC
  – 5 days of normothermia (36°C - 37.5°C)
  OR
  – 2 days of continuous hypothermia (32°C - 34°C) followed by 3 days of normothermia
• Prevent or aggressively treat fever during post-cardiac arrest care
KEY NEW AND UPDATED RECOMMENDATIONS:
NEONATAL RESUSCITATION
INITIAL RESUSCITATION

• Order of 3 initial assessment questions changed to:
  – 1. Term gestation?
  – 2. Good tone?
  – 3. Breathing or crying?
• Golden minute for completion of initial assessment and beginning of ventilation (if needed) still emphasized
ASSESSMENT OF HEART RATE AND OXYGENATION

- 3-lead ECG is more rapid and accurate method of assessing heart rate than pulse oximetry
- Pulse oximetry still needed to evaluate oxygenation
Recommendation

- Delayed cord clamping after 30 seconds suggested for both term and preterm infants who do not require resuscitation at birth

Why?

- Beneficial effects include less IVH, higher BP and blood volume, less need for transfusion, less NEC
Recommendation

• If the infant born through meconium-stained amniotic fluid is non-vigorous with inadequate breathing efforts, rescuers should perform routine steps of resuscitation under radiant warmer

• Routine intubation for tracheal suction is not recommended for these infants

Why?

• No evidence of benefit, and potential harm in delaying bag-mask ventilation
NEONATAL RESUSCITATION: ADDITIONAL RECOMMENDATIONS

• Compression rate and depth: unchanged
• Oxygen concentration for resuscitation of newborns less than 35 weeks gestation: begin with low oxygen concentration (21% to 30%), titrate as needed
• Therapeutic hypothermia in resource-limited settings: clearly defined protocols needed
• Neonatal training recommended more frequently than 2-year intervals
KEY NEW AND UPDATED RECOMMENDATIONS: EDUCATION
• CPR feedback devices (preferably providing corrective feedback rather than only prompts) recommended during training.
• High-fidelity manikins encouraged for programs that have infrastructure, trained personnel and resources
BLS skills seem to be learned as easily through self-instruction (video or computer based) with hands-on practice as with traditional courses.

Blended learning (combination of self-instruction and instructor-led courses with hands-on training) can be an alternative to instructor-led courses.

Precourse preparation may optimize learning for ACLS, PALS.
2015 GUIDELINES SUMMARY
SUMMARY OF 2015 GUIDELINES UPDATE

- Resuscitation systems and communities are reporting improved survival from cardiac arrest.
- Too few victims of cardiac arrest receive bystander CPR.
- High-quality CPR essential
- Victims require excellent post–cardiac arrest care by organized, integrated teams.
- Education and frequent refresher training key to improving resuscitation performance.
- We must rededicate ourselves to improving the frequency of bystander CPR, the quality of all CPR and the quality of post–cardiac arrest care.
PALS TRAINING 2015 AND BEYOND
Using Pediatric Advanced Life Support in pediatric residency training: Does the curriculum need resuscitation?*

Estée C. Grant, MD, FRCPC; Cécile A. Marczinski, PhD; Kusum Menon, MD, FRCPC

• Study done using 2005 version of PALS
  – No stress of team concept and communication
  – No HeartCode

• Used a questionnaire of retention of content

Grant et al, Peds CCM 2007 8(5)
Confidence Judgment

Grant et al, Peds CCM 2007 8(5)
Content Retention

Score on Short Answer

Pre  Post  Month 12

Time

Grant et al., Peds CCM 2007 8(5)
Survey of pediatric resident experiences with resuscitation training and attendance at actual cardiopulmonary arrests

Elizabeth A. Hunt, MD, MPH, PhD; Sachin Patel, MD, MPH; Kimberly Vera, MD; Donald H. Shaffner, MD; Peter J. Pronovost, MD, PhD

Hunt et al, Peds CCM 2009, 10(1)
PALS CURRENT MODEL

• Survey of physician trainees
• Only 25% had sim training in medical school.
• Only 56% PALS certified
• Majority (92%) had attended a cardiac arrest

Hunt et al, Peds CCM 2009, 10(1)
• Physician trainees did not feel confident
• Retention of information was insufficient
• Competency in technical skills was insufficient
• Many forget during the 2 year cycle
  – Hunt et al, Peds Em Care 2007, 23
  – Quan et al, Pediatrics 2001, 108

• Conclusion: Current PALS is not enough

Grant et al, Peds CCM 2007, 8(5)
Hunt et al, Peds CCM 2009, 10(1)
PALS CURRENT MODEL

Ebbinghaus Forgetting Curve

% of Data Remembered

1st Repetition 2nd Repetition 3rd Repetition 4th Repetition 5th Repetition

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Effect of High-Fidelity Simulation on Pediatric Advanced Life Support Training in Pediatric House Staff

A Randomized Trial

Aaron J. Donoghue, MD, MSCE,*† Dennis R. Durbin, MD, MSCE,* Frances M. Nadel, MD, MSCE,* Glenn R. Stryjewski, MD,‡ Suzanne I. Kost, MD,§ and Vinay M. Nadkarni, MD, MS†

Donoghue et al, Ped Em Care 2009, 25(3)
PALS SIMULATION IN PALS

• Physician trainees in two groups
  – Standard manikin vs High-Fidelity Simulation
• Pre-study simulation, didactic teaching of algorithms, post-teaching simulation
• BOTH groups improved
• High-fidelity group improved more
  – Mean score 11.1 vs. 4.8 p=0.007

Donoghue et al, Ped Em Care 2009, 25(3)
Examining Pediatric Resuscitation Education Using Simulation and Scripted Debriefing

A Multicenter Randomized Trial

Adam Cheng, MD; Elizabeth A. Hunt, MD, MPH, PhD; Aaron Donoghue, MD; Kristen Nelson-McMillan, MD; Akira Nishisaki, MD; Judy LeFlore, PhD; Walter Eppich, MD, MEd; Mike Moyer, MS; Marisa Brett-Fleegler, MD; Monica Kleinman, MD; JoDee Anderson, MD; Mark Adler, MD; Matthew Braga, MD; Susanne Kost, MD; Glenn Stryzewski, MD; Steve Min, MD; John Podraza, MD; Joseph Lopreiato, MD, MPH; Melinda Fiedor Hamilton, MD; Kimberly Stone, MD, MS, MA; Jennifer Reid, MD; Jeffrey Hopkins, MSN, RN; Jennifer Manos, RN; Jonathan Duff, MD; Matthew Richard, BSc; Vinay M. Nadkarni, MD; for the EXPRESS Investigators

Cheng et al, JAMA Peds 2013, 167(6)
PALS SIMULATION IN PALS

- 97 novice instructors, IP subjects
- Randomized to do scripted vs unscripted debriefing
- Also randomized to high vs low-fidelity
- Tested individual knowledge (MCQ), Team Leadership & Team Performance
- Scripted debrief improved outcome
  - Knowledge 5.3% vs 3.6% baseline $p=0.04$
  - Leadership 16% vs. 8% baseline $p=0.03$
  - Team 7.9% vs. 6.7% baseline NS
- High vs. Low-fidelity manikin no effect

Cheng et al, JAMA Peds 2013, 167(6)
PALS EDUCATION (CONCLUSIONS)

• Training should be more frequent
• Simulation improves learning
• Debriefing is KEY part of simulation
• Manikins models help
  – High-Fidelity vs. Low-Fidelity not clear

Cheng et al, JAMA Peds 2013, 167(6)
PALS WHAT’S NEXT?

• How do we train more people?
• Is PALS the right course for everyone?
• Is it “too easy” for some, “too hard” for others?
• How do we keep people competent?
• What is the most efficient way to teach PALS?
  – HeartCode model?
  – “Just in Time” (JIT) model?
  – Rolling refreshers?
  – Continuous Maintenance of Certification (MOC)?
  – Competency based testing?
Low-Dose, High-Frequency CPR Training Improves Skill Retention of In-Hospital Pediatric Providers

**What’s Known on This Subject:** Low-dose, high-frequency cardiopulmonary resuscitation (CPR) training has not been rigorously evaluated previously.

**What This Study Adds:** This study is the first to demonstrate that low-dose, high-frequency CPR training can improve CPR skill retention of pediatric providers.

**Authors:**
- Robert M. Sutton, MD, MSCE, Dana Niles, MS,
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Sutton et al, Pediatrics 2011, 128(1)
PALS WHAT’S NEXT?

• “Rolling Refresher” approach
• Instructor vs. Automated Feedback vs. BOTH vs. Nothing (control)
• Pre-training eval (1 min) then Training (2 min) then POST-training evaluation (1 min)
• Retention of GOOD CPR skills better after 2 sessions (CI=2.3, p=0.02) and better after 3 sessions (CI=2.9, p=0.05)
• Most effective with instructor AND feedback device

Sutton et al, Pediatrics 2011, 128(1)
Simulation and education

Increasing pediatric resident simulated resuscitation performance: A standardized simulation-based curriculum

Kimberly Stone\textsuperscript{a,*}, Jennifer Reid\textsuperscript{a}, Derya Caglar\textsuperscript{a}, Ana Christensen\textsuperscript{b}, Bonnie Strelitz\textsuperscript{b}, Li Zhou\textsuperscript{c}, Linda Quan\textsuperscript{a}

\textsuperscript{a} Department of Pediatrics, University of Washington School of Medicine and Division of Emergency Medicine, Seattle Children’s Hospital

- Standardized approach with video review, structured debrief, etc.
- Improved score on medical management and teamwork
- Confirms benefit of frequent training

Stone et al, Resuscitation 2014, 85

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Simulation Training for Pediatric Residents on Central Venous Catheter Placement: A Pilot Study*

Scott M. Thomas, MD¹; Wesley Burch, AAH²; Sarah E. Kuehnle, BA³; Robert G. Flood, MD⁴; Anthony J. Scalzo, MD²; James M. Gerard, MD⁴

- Physicians in training
- 60 minutes of ultrasound guidance simulation
- Evaluation, placement success and confidence all increased
- Skills had degraded by 3 month
- Proves sim training for residents in PALS skills can be effective

Thomas et al, Peds CCM 2013, 14(9)
QUESTIONS?
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