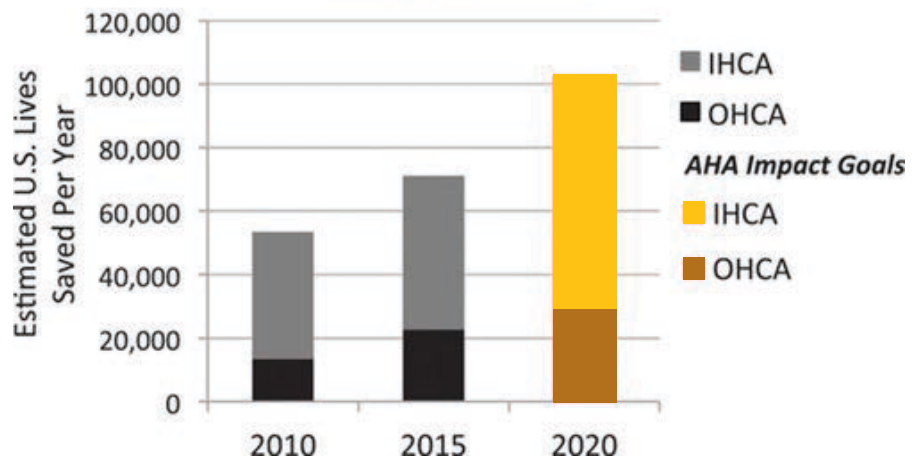


CPR optimization

Driving perfusion during sudden cardiac arrest (SCA)

Ten years ago, the American Heart Association (AHA) Emergency Cardiovascular Care Committee (ECC) estimated a 10-year impact goal of doubling survival rates from SCA. However, current out-of-hospital cardiac arrest (OHCA) and in-hospital cardiac arrest (IHCA) survival rates continue to be low, despite a major shift to high-performance CPR (HPCPR) in the last decade.¹

Estimated Annual Lives Saved after Sudden Cardiac Arrest in the United States



The power of perfusion

Designed to drive optimal perfusion, HPCPR is a multifaceted set of basic interventions requiring choreographed coordination and effective leadership for best results. The attention to preparation, training, and immediate-and post-event performance feedback is key for increased survival rates. Recent data shows the initial shockable rhythms in SCA patients are less prevalent, making HPCPR essential now and in the future.²

1 Compression rate of
100–120 per minute

2 Compression depth of
2–2.4 inches (5–6 cm.)

3 **Recoil**
with no
residual leaning

4 **50–50**
Duty cycle

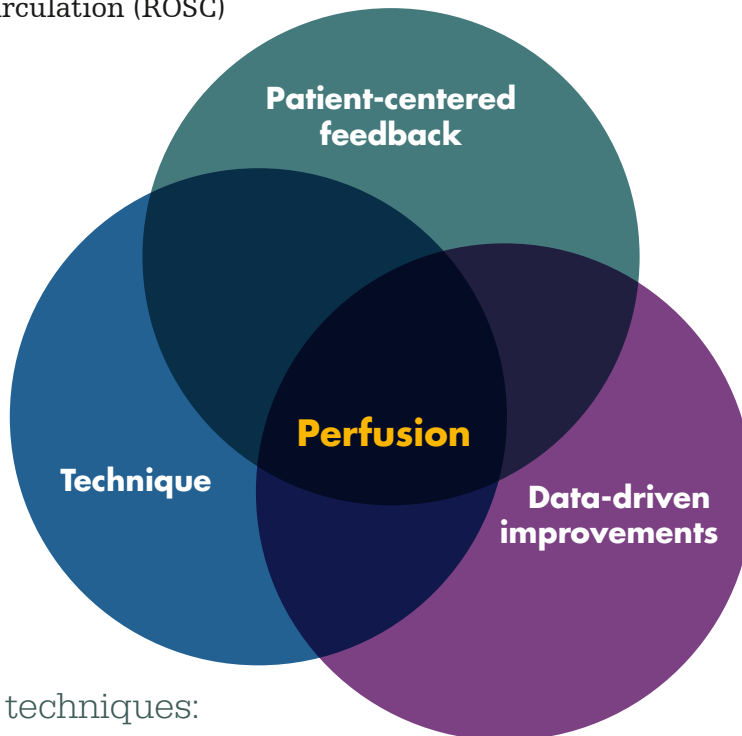
5 All pauses in chest
compressions should be
less than 10 seconds

5 ways
HPCPR
drives
perfusion

Although HPCPR can improve survival rates, there are many options in monitoring, training, implementation, and quality improvement programs.³ How can we help increase the number of lives saved?

Patient-centered feedback:

End-tidal CO₂ (EtCO₂) monitoring can indicate CPR quality and detect return of spontaneous circulation (ROSC)



Data-driven decisions to make improvements:

Objective data collected from a LIFEPAK® device as soon as the pads are placed offers insights to care teams for future CPR improvements

Tactics and techniques:

Mechanical CPR devices like the LUCAS® chest compression system provide Guidelines-consistent CPR metrics on rate and depth with ventilation prompts and pauses



With tones or rate prompts:

Metronome: Chest compression rates are variable during a resuscitation. Metronomes can decrease variability and results in compression rates closer to the target rate of 100 to 120/min.³



With immediate feedback:

Accelerometer-based: Single sensor accelerometers measure the absolute compression distance traveled, which includes compression of the human chest and any soft surfaces underneath the body. Actual sternal-spinal displacement is not isolated. Studies show compression depth calculation is overestimated by as much as 35-40% on soft surfaces.⁴

A large cluster randomized trial across 21 U.S. and Canadian EMS agencies found real-time visual and audio feedback “altered” performance in closer alliance with guidelines, however no improvement in ROSC or “other clinical outcomes” were noted. The difference in depth was only .08 inches or 2 mm.⁵

Patient-centered physiological feedback

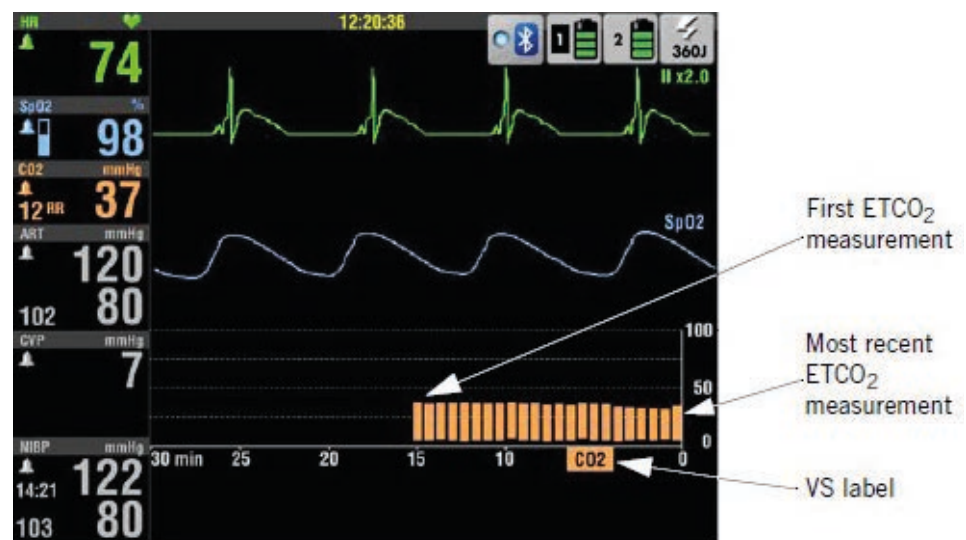
Using hemodynamic monitoring:

- Physiology-directed CPR or “personalized CPR” has been used to monitor the patient’s response to CPR since the AHA Consensus Statement in 2013.³

Using EtCO₂:

- Waveform capnography and EtCO₂ values have been a Class I recommendation for confirmation of endotracheal intubation (ETI) placement and ongoing monitoring since 2010.⁶ However, waveform capnography is also used as a measure of perfusion. The correlation between EtCO₂ and cardiac output has important implications during CPR:
 1. During cardiac arrest, EtCO₂ levels can relate to cardiac output generated by chest compressions providing indication of CPR quality¹⁰
 2. Chest compression depth was a significant predictor of increased EtCO₂. EtCO₂ levels were higher in patients with ROSC.⁷
- The height of the CO₂ waveform should be monitored with the goal of achieving values of at least 20 mmHg.⁸
- Capnography can also monitor effectiveness of compressions related to various hand positions during resuscitation to determine optimal CO₂ output.⁹
- EtCO₂ coronary perfusion pressure, arterial relaxation pressure, arterial blood pressure, and ventral venous oxygen saturation correlate with cardiac output and myocardial blood flow during CPR.¹⁰

Trending EtCO₂ on the LIFEPAK 15 can be used in resuscitations showing the first captured value up to the most recent value. CO₂ measurements are taken every 30 seconds, displaying how the values are trending over a specified time.





Technique

Mechanical CPR

Some SCA patients will not respond to CPR and defibrillation alone, and may need more advanced circulatory intervention. The LUCAS[®] 3 chest compression system provides consistent and high-quality chest compressions shown by research to increase the chances of good patient outcomes.

The LUCAS device also reduces the radiation burden to CPR providers while maintaining Guidelines-consistent chest compressions during continued PCI in the cath lab.

7 seconds
median interruption when transitioning from manual to LUCAS device compressions during routine BLS/ALS use¹¹

+60% increased blood flow to the brain vs. manual CPR¹²

139% higher coronary perfusion pressure vs. manual CPR¹³

Data-driven improvement

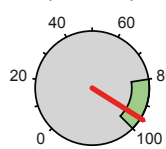
Post-event data review is the last, and arguably the most critical step for sustainable CPR improvement at an institutional level. The collection, analysis, and sharing of data can power performance review and meet AHA recommendations for post-event review. Without measurement, improvement can't occur.

CODE-STAT™ data review software and service provides critical information on CPR metrics and performance and helps drive future improvements.

CPR report

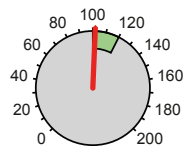
PHYSIO CONTROL	Device Type:	LIFEPAK® 15	Duration:	00:23:49
	Power On:	1/28/2017 3:19:54 AM	Incident ID:	2017012803195400-LP152658
	CPR Annotations Edited:	Yes	Statistical Parameters:	1000-0300-3000-05
	Device Configuration:	2LJ55RO40200OR		
	*Times have been adjusted by the system.			

Compression ratio (/total time)



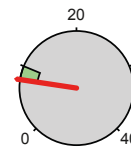
Hands-on time was within predetermined target range of 80-100%

Compression rate

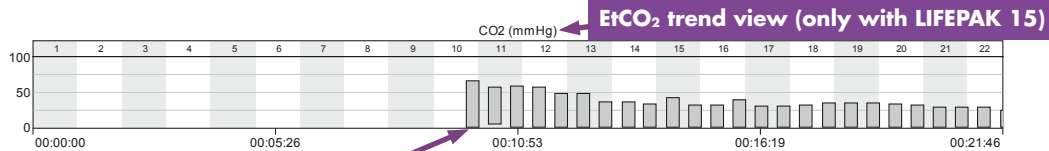


Average compression rate was within target range of 100-120/min

Ventilations/minute



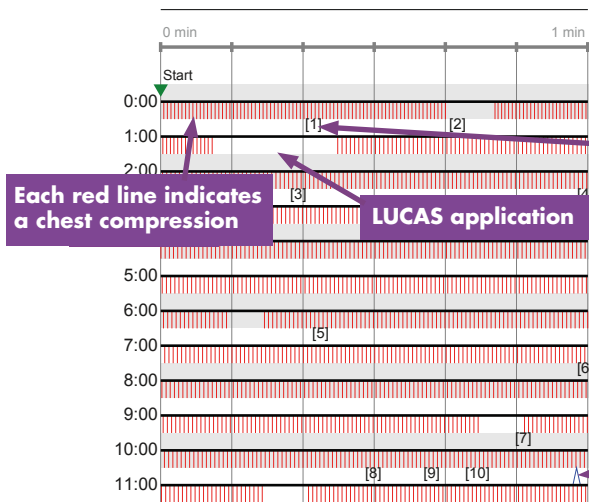
Average ventilations delivered per minute



Summary

Compression count = 2114 Longest compression pause = 0:17
 Pauses over 10 sec = 1 **Pauses over 10 sec.** **Longest pause time**

CPR QUIK-VIEW



Interval Statistics

Compr. ratio, %	Compr. rate	Vent. /min	Comments
90	116	--	
72	102	--	LUCAS application completed and mechanical chest compressions initiated
100	102	--	
100	102	--	
100	102	--	
100	102	--	
93	102	--	
100	102	--	
91	102	--	
100	102	--	
91	102	1	First breath capnography

For more information on CPR optimization, contact your Stryker sales representative.

1. Neumar RW. Doubling Cardiac Arrest Survival by 2020. *Circulation*. 2016;134(25):2037-2039.
2. Keller SP, Halperin HR. Cardiac arrest: the changing incidence of ventricular fibrillation. *Current Treatment Options in Cardiovascular Medicine*. 2015;17(7):392.
3. Meaney PA, Bobrow BJ, Mancini ME, et al. CPR quality: Improving cardiac resuscitation outcomes both inside and outside the hospital: A consensus statement from the AHA. *Circulation*. 2013;128(4):417-435.
4. Perkins GD, Kocierz L, Smith SCL, et al. Compression feedback devices over estimate chest compression depth when performed on a bed. *Resuscitation*. 2009;80:79-82.
5. Hostler D, Everson-Steward S, Rea TD, et al. Effect of real-time feedback during cardiopulmonary resuscitation outside hospital: prospective, cluster randomized trial. *BMJ*. 2011;342:d512.
6. Neumar RW, Otto CW, Link MS, Kronick SL, et al. Part 8: adult advanced cardiovascular life support: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2010;122(suppl 3):S729-S767.
7. Shaeak KR, Wiebe DJ, Leary M, Babaeizadeh S, et al. Quantitative relationship between end-tidal carbon dioxide and CPR quality during both in-hospital and out-of-hospital cardiac arrest. *Resuscitation*. 2015;89:149-154.
8. Einav S, Bromiker R, Weiniger CF, Matot I. Mathematical modeling for prediction of survival from resuscitation based on computerized continuous capnography: Proof of concept. *Academic Emergency Medicine*. 2011;18:468-75.
9. Ovigstad E, Kramer-Johansen J, Tømte Ø, et al. Clinical pilot study of different hand positions during manual chest compressions monitored with capnography. *Resuscitation*. 2013;84:1203-1207.
10. Link MS, Berkow CL, Kudenchuk PJ, et al. Part 7: adult advanced cardiovascular live support: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2015;132(suppl 2):S444-S464.
11. Levy M, Yost D, Walker R, et al. A quality improvement initiative to optimize use of a mechanical chest compression device within a high-performance CPR approach to out-of-hospital cardiac arrest. *Resuscitation*. 2015;92:32-37.
12. Carmona Jimenez F, Padro PE, Garcia AS, et al., Cerebral flow improvement during CPR with LUCAS, measured by Doppler. *Resuscitation*. 2011; 82S1:30,AP090. [This study is also published in a longer version, in Spanish language with English abstract, in *Emergencias*. 2012;24:47-49.
13. Magliocca A, Olivari D, De Giorgio D, et al. LUCAS versus manual chest compression during ambulance transport: a hemodynamic study in a porcine model of cardiac arrest. *Journal of the American Heart Association*. 2018;8(1).

For a brief summary of important disclosure and safety information regarding LIFEPAK devices, visit our website at <https://www.strykeremergencycare.com/disclosure-and-safety-information/>. Please consult Operating Instructions at www.physio-control.com or call 800.442.1142 for complete list of indications, contraindications, warnings, cautions, potential adverse events, safety and effectiveness data, instructions for use and other important information.

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Emergency Care

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