NEW CPR QUALITY FEEDBACK DEVICES FOR A BETTER CARDIOPULMONARY RESUSCITATION

Guglielmo IMBRIACO[A], Gaetano TAMMARO[A], Federico SEMERARO[A], Erga Laura CERCHIARI[A] Antonio FRISOLI[B], Claudio LOCONSOLE[B], Filippo BANNO'[B]
Luca MARCHETTI[C]

[A]Intensive Care Unit, Ospedale Maggiore, AUSL Bologna
[B]PERCRO, Scuola Superiore S.Anna, Pisa
[C]Studio EVIL, Bologna

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Optimal chest compression technique comprises

- *compressing the chest at a rate of **at least 100/minute***
- *at a depth of **at least 5 cm** (for an adult), but not exceeding 6 cm*

EUROPEAN RESUSCITATION COUNCIL

JP. Nolan et al
European Resuscitation Council Guidelines for Resuscitation 2010
Section 1. Executive summary
Resuscitation 81 (2010)

Improving chest compression quality during CPR could improve patient survival…

Higher chest compression rates were significantly correlated with initial return of spontaneous circulation

Abella BS, Alvarado JP, Myklebust H, Edelson DP, Barry A, O'Hearn N, Vanden Hoek TL, Becker LB
Chest compression rates during cardiopulmonary resuscitation are suboptimal: a prospective study during in-hospital cardiac arrest.
Circulation. 2005 Feb 1;111(4):428-34.

…Increased compression depth was associated with increased short-term survival.

Kramer-Johansen J, Myklebust H, Wik L, Fellows B, Svensson L, Sørebø H, Steen PA.
Quality of out-of-hospital cardiopulmonary resuscitation with real time automated feedback: a prospective interventional study
Resuscitation. 2006 Dec;71(3):283-92..

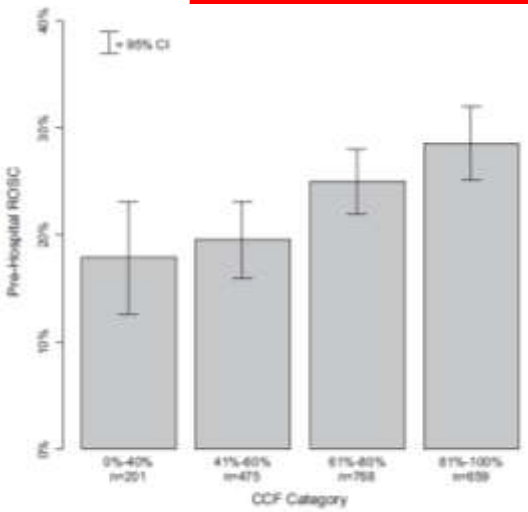

Fig. 3. Return of spontaneous circulation for each category of chest compression fraction ROSC indicates return of spontaneous circulation; CI, confidence interval; and CCF, chest compression fraction Chest compression fraction.

…increased CCF among non-VF OOHCA patients is associated with a trend toward increased likelihood of ROSC.

Vaillancourt C et al
The impact of increased chest compression fraction on return of spontaneous circulation for out-of-hospital cardiac arrest patients not in ventricular fibrillation
Resuscitation. 2011 Dec;82(12):1501-7

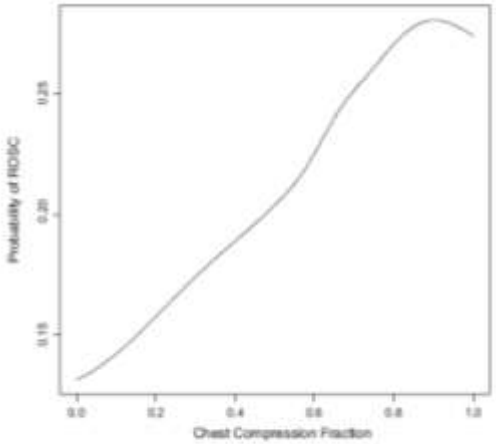

Fig. 2. Smoothing spline representing the unadjusted incremental probability of return of spontaneous circulation corresponding to a linear increase in chest compression fraction.

Chest compression quality during CPR is often sub-optimal…

…chest compressions were not delivered half of the time, and most compressions were too shallow.

•Chest compressions were not given **48%**
•mean compression rate of **121/min**
•Mean compression depth was **34 mm**

Wik L, Kramer-Johansen J, Myklebust H, Sørebø H, Svensson L, Fellows B, Steen PA.
Quality of cardiopulmonary resuscitation during out-of-hospital cardiac arrest
JAMA. 2005 Jan 19;293(3):299-304.

…the quality of multiple parameters of CPR was inconsistent and often did not meet published guideline recommendations, even when performed by well-trained hospital staff.

•chest compression rates were **less than 90/min in 28.1%**
•Compression depth was too shallow **(<38 mm**) for **37.4%** of compressions
•Ventilation rates were high **(60,9% >20/min)**

Abella BS, Alvarado JP, Myklebust H, Edelson DP, Barry A, O'Hearn N, Vanden Hoek TL, Becker LB
Quality of cardiopulmonary resuscitation during in-hospital cardiac arrest
JAMA. 2005 Jan 19;293(3):305-10.

CPR prompt and feedback devices

CPR prompt or feedback devices improve CPR skills acquisition and retention and may be considered during CPR training for laypeople and healthcare providers. These devices may be considered for clinical use as part of an overall strategy to improve the quality of CPR.

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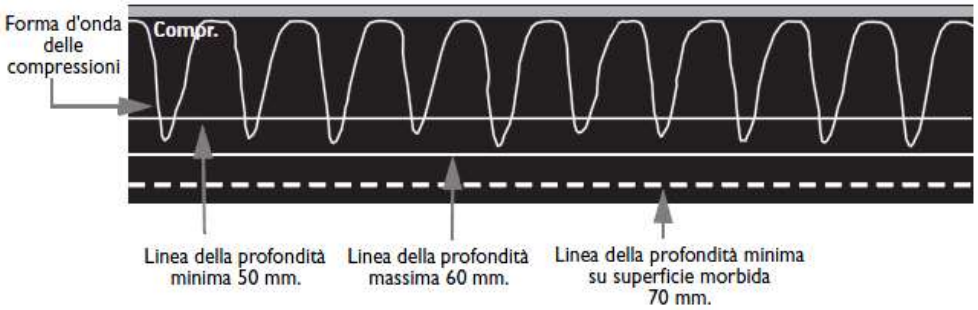
Integrated in defibrillators and AEDs

Portable devices

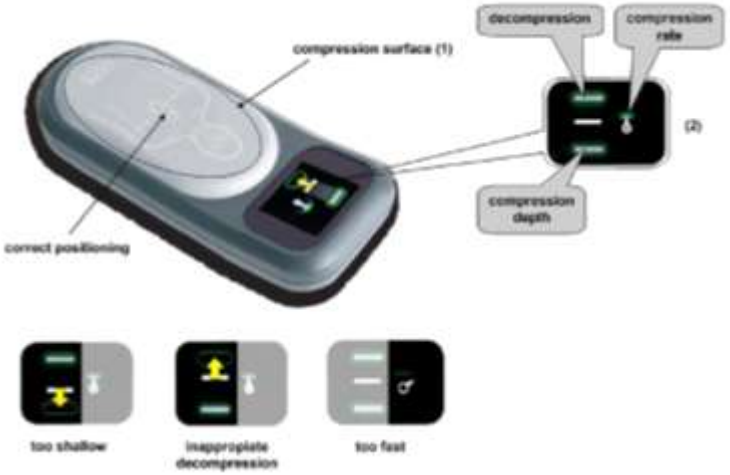
Applications for smartphones

CPR prompt and feedback devices integrated in AEDs and monitor-defibrillators

Integrated metronome
LifePak15

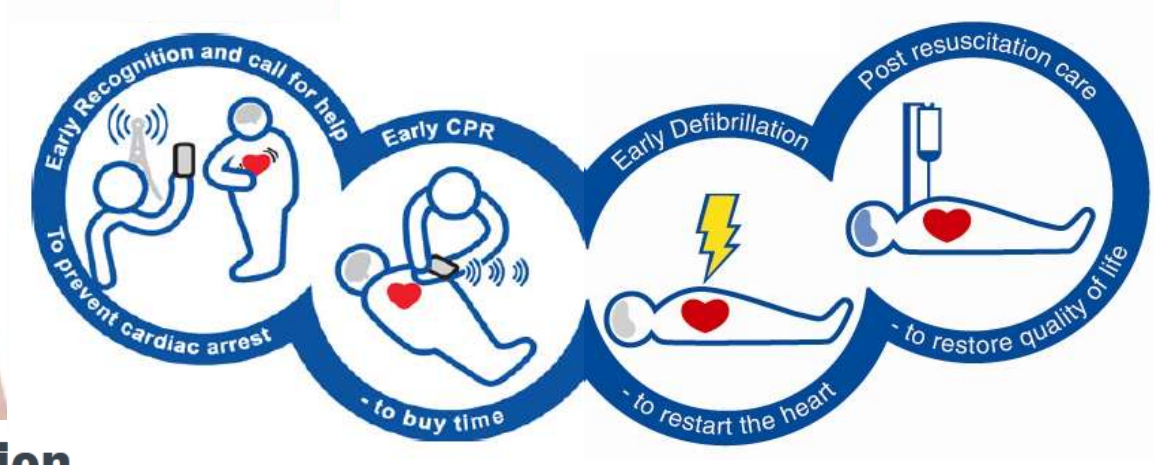


CPR prompt and feedback portable devices



CPR prompt and feedback applications for smartphones

2011 ends with almost 6 billion mobile phone subscriptions



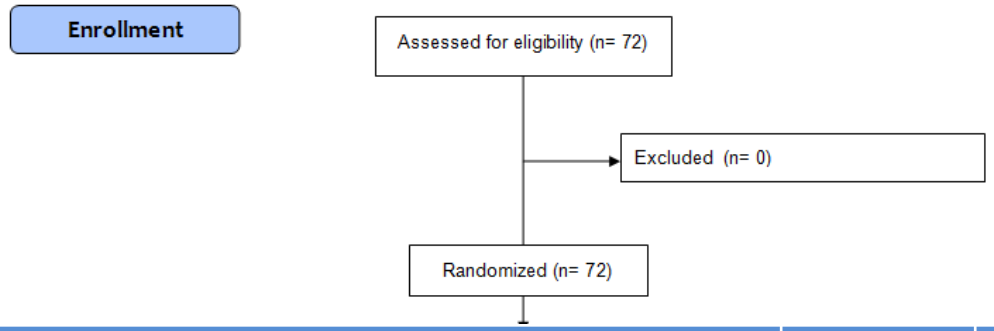
Mobile phones, which have become the most ubiquitous piece of modern technology, possess a strong potential to strengthen each link of the chain.

Kovic I, Lulic I..
Mobile phone in the chain of survival.
Resuscitation. 2011 Jun;82(6):776-9.

PocketCPR

iCPR

Chest compression quality in healthcare professionals



Compression data without QCPR feedback	Average	SD
Compression rate (/min) [90-120]	**109.26**	**25.61**
Compression depth (mm) [38-51]	**46.37**	**12.73**
Adequate depth	**73.95%**	**37.82**

Compression data with QCPR feedback	Average	SD
Compression rate (/min) [90-120]	**104.77**	**13.03**
Compression depth (mm) [38-51]	**44.48**	**5.87**
Adequate depth	**88.97%**	**19.13**

Semeraro F, Tammaro G, Imbriaco G, Taggi F, Cerchiari EL.
CHEST COMPRESSION QUALITY IN HEALTHCARE PROFESSIONALS
Resuscitation 81S (2010) S1-S114

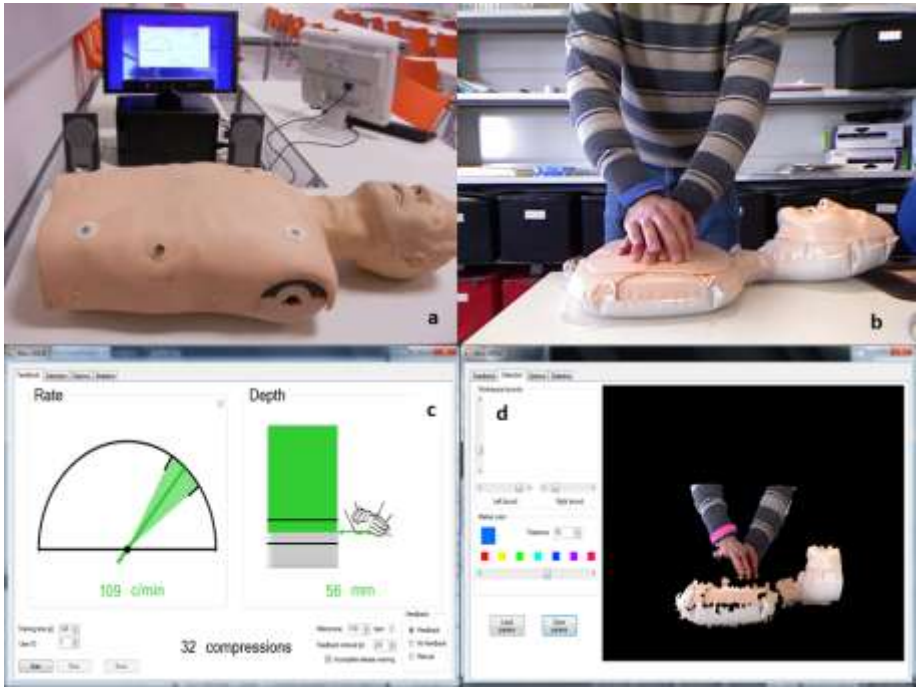
iCPR: A new application of high-quality cardiopulmonary resuscitation training

Compression data without iCPR feedback	Average	SD
Compression rate (/min) [90-120] Compression depth (mm) [38-51	**107.8** **46.37**	**20.5** **13.1**
Compression data with iCPR feedback	**Average**	**SD**
Compression rate (/min) [90-120] Compression depth (mm) [38-51]	**101.1** **37.2**	**2.8** **12**

Semeraro F, Tammaro G, Imbriaco G, Taggi F, Marchetti L, Cerchiari EL.
iCPR: A new application of high-quality cardiopulmonary resuscitation training
Resuscitation 82 (2011) 436-441

Mini VREM (Virtual Reality Enhanced Mannequin)

KINECT
for XBOX 360



Mini-VREM system combines a commercial motion sensing device (Microsoft Kinect®) to a specifically developed software to provide audio-visual feedback during CPR training

Semeraro F, Frisoli A, Bannò F, Loconsole C, Tammaro G, Imbriaco G, Marchetti L, Cerchiari EL.
Motion detection technology as a tool for cardiopulmonary resuscitation (CPR) quality training: a randomised crossover mannequin pilot study
Resuscitation (under review)

Mini VREM (Virtual Reality Enhanced Mannequin)

Semeraro F, Frisoli A, Bannò F, Loconsole C, Tammaro G, Imbriaco G, Marchetti L, Cerchiari EL.
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Mini VREM (Virtual Reality Enhanced Mannequin)

Overall performance results with and without Mini-VREM feedback

Conclusions

The Mini-VREM system was able to improve significantly the quality of chest compressions, in terms of compression rate and depth, performed by healthcare professionals and lay people in a simulated cardiac arrest scenario.

The system was perceived as easy to use and providing an effective feedback.

Adequate Compressions ª	6307	35,78	1200	7,27	p < 0.001

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Motion detection technology as a tool for cardiopulmonary resuscitation (CPR) quality training: a randomised crossover mannequin pilot study
Resuscitation (under review)

Improving survival in cardiac arrest victims…

Sharing CPR knowledge…

Bystanders CPR

- US 32% (AHA 2012)
- Sweden 40% (1992) to 55% (2005) (Norderg et al. 2005)
- Taiwan 5.9% (Lin et al. 2012)
- Amsterdam 54% (Koster et al. 2001)
- Bologna 11% (118 Bologna 2011)
- Milano 11.1% (Morici et al. 2010)

…working for high quality CPR …

…by any means necessary!

http://www.cprguidelines.eu

www.icpr.it

www.mini-vrem.it
www.facebook.com/miniVREM

Nothing is impossible for the man who does not have to do it himself…

GUGLIELMO IMBRÌACO
gu.imbriaco@libero.it