CONGRESSO NAZIONALE

BOLOGNA 13-14 DICEMBRE 2024

ABC vs CAB

D. Silvagni S. Talia

European Resuscitation Council Guidelines 2021: Paediatric Life Support

There is no evidence to support nor refute the existing guideline advocating five initial rescue breaths. Considering the impact on education and implementation, we therefore continue to recommend this approach.

Rescuers only trained in adult BLS

BLS providers who are untrained in PBLS, should follow the adult CPR algorithm with ventilations, as they were trained, adapting the techniques to the size of the child. If trained, they should consider giving 5 initial rescue breaths before proceeding with compressions.

Starting CPR (ABC vs. CAB) 2024

Outcomes: Critical:

- ✓ Survival with favorable neurological outcome at hospital discharge or 30-days
- ✓ Survival at hospital discharge or 30 days
- ✓ Survival with favourable neurological outcome to one-year, Survival to one-year
- ✓ Event survival
- ✓ Any ROSC

NESSUNO STUDIO

Starting CPR (ABC vs. CAB) 2024

Important

- ✓ Time to commencement of rescue breaths
- ✓ Time to commencement of first compression
- ✓ Time to completion of first CPR cycle
- ✓ Ventilation rate
- ✓ Compression rate
- ✓ Chest compression fraction
- ✓ Minute ventilation

5 STUDI

5 STUDI (1 solo dopo il 2021…)

*«The overall **certainty of evidence was rated as very low** for all outcomes, downgraded for a very serious **risk of bias and indirectness**.*

Because of this and a high degree of heterogeneity, no meta-analyses could be performed and individual studies are difficult to interpret»

Article

Impact of Two Resuscitation Sequences on Alveolar Ventilation during the First Minute of Simulated Pediatric Cardiac Arrest: Randomized Cross-Over Trial

Laurent Suppan [1,*], Laurent Jampen [2], Johan N. Siebert [3], Samuel Zünd [4], Loric Stuby [5] and Florian Ozainne [2]

The hypothesis underlying this study was that the ERC resuscitation sequence should enable higher alveolar ventilation during the first minute of resuscitation in comparison with the AHA sequence. Therefore, its objective was to determine the difference in alveolar ventilation during the first minute of resuscitation according to the sequence used (AHA vs. ERC) in a pediatric model of OHCA.

Healthcare **2022**, *10*, 2451. https://doi.org/10.3390/healthcare10122451

ABC: PRO

IPOSSIA CAUSA PRIMARIA DELL'AC NEL BAMBINO

ARRESTO CARDIACO SECONDARIO

- **Più frequente nel bambino**
- Preceduto da insufficienza cardio-respiratoria progressiva
- Dovuto a grave ipossia che causa secondariamente disfunzione cardiaca
- Sostenuto da Bradicardia ipossico - ischemica che evolve in PEA o Asistolia

La prognosi dipende dalla prevenzione e dalla rianimazione immediata

EPALS EUROPEAN PAEDIATRIC ADVANCED LIFE SUPPORT — Italian Resuscitation Council

PALS Pediatric Advanced Life Support Provider Handbook

RECOGNIZING CARDIAC ARREST

Unlike cardiac arrest in adults, which is very common due to acute coronary syndrome, cardiac arrest in pediatrics is more commonly the consequence of respiratory failure or shock. Thus, cardiac arrest can often be avoided if respiratory failure or shock is successfully managed. Less than 10% of the time, cardiac arrest is the consequence of ventricular arrhythmia and occurs suddenly.

Pediatric out-of-hospital cardiac arrest in Denmark

Table 3 Allocation of presumed reversible causes of out-of-hospital cardiac arrest in Denmark from 2016 to 2019

Reversible cause	> 1 year (Infants) (N = 52)	1–5 years (Preschool) (N = 41)	6–12 years (School) (N = 33)	13–16 years (Teenagers) (N = 47)	Kappa
Hypoxia	21 (40.4%)	23 (56.1%)	11 (33.3%)	18 (38.3%)	0.64
Hypothermia	0 (0.0%)	1 (2.4%)	0 (0.0%)	0 (0.0%)	1.00
Hypovolemia	0 (0.0%)	0 (0.0%)	1 (3.0%)	2 (4.2%)	0.42
Hypo/Hyperkalemia/Metabolic	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (4.3%)	0.61
Toxic	0 (0.0%)	1 (2.4%)	0 (0.0%)	4 (8.5%)	0.75
Unknown	31 (59.6%)	16 (39%)	21 (63.6%)	21 (44.7%)	0.59

Holgersen *et al.*
Scand J Trauma Resusc Emerg Med (2022) 30:58
https://doi.org/10.1186/s13049-022-01045-x

ABC: inizio delle ventilazioni di soccorso

2 randomized manikin studies representing 108 two-person teams

and 159 two-person teams

- ✓ In cardiac arrest scenarios, mean time to **ventilations started later with C-A-B**: 28.4 ±3.1 seconds vs. 22.7 ±3.1 ($p < 0.05$) compared to a mean of **43** ± 10 seconds vs. **37** ± 15 seconds ($p<0.001$).

ABC: ventilation rate

1 cross-over paediatric randomized manikin study with risk of bias and low-certainty evidence due to a lack of blinding, representing 28 two-person teams

- ✓ The **median number of ventilations** delivered in the first minute of resuscitation were **higher with the A-B-C sequence** (delivering 5 rescue breaths before commencing chest compressions) (median 13 [IQR=12-15] vs. 10 [IQR=8-10]; $p<0.05$).

ABC: minute alveolar ventilation

One paediatric randomized manikin study with very low certainty of evidence

- ✓ The **alveolar ventilation** in the first minute of resuscitation was **higher with the A-B-C** sequence (median 370 mL [IQR=203-472] vs. 276 mL [IQR=140–360]; p<0.001).

Ventilation Rates and Pediatric In-Hospital Cardiac Arrest Survival Outcomes*

Objectives: The objective of this study was to associate ventilation rates during in-hospital cardiopulmonary resuscitation with 1) arterial blood pressure during cardiopulmonary resuscitation and 2) survival outcomes.

Patients: Intubated children (≥ 37 wk gestation and < 19 yr old) who received at least 1 minute of cardiopulmonary resuscitation.

Design: Prospective, multicenter observational study.

Setting: Pediatric and pediatric cardiac ICUs of the Collaborative Pediatric Critical Care Research Network.

Measurements and Main Results: −8.1; $p < 0.01$). High ventilation rates were associated with a higher odds of survival to discharge (odds ratio, 4.73; $p = 0.029$). This association was stable after individually controlling for location (adjusted odds ratio, 5.97; $p = 0.022$), initial rhythm (adjusted odds ratio, 3.87; $p = 0.066$), and time of day (adjusted odds ratio, 4.12; $p = 0.049$).

Conclusions: In this multicenter cohort, ventilation rates exceeding guidelines were common. Among the range of rates delivered, higher rates were associated with improved survival to hospital discharge.

Crit Care Med. 2019 November ; 47(11): 1627–1636. doi:10.1097/CCM.0000000000003898.

SEQUENZA ABC

Pediatric out-of-hospital cardiac arrest in Denmark

Results: We identified 173 cases within the study period. The median incidence of POHCA in the population below 17 years of age was 4.2 per 100,000 persons at risk. We found a presumed reversible cause in 48.6% of cases, with hypoxia being the predominant cause of POHCA (42.2%). The thirty-day survival was 40%. Variations were seen across age groups, with the lowest survival rate in cases below 1 year of age. Defibrillators were used more frequently among survivors, with 16% of survivors defibrillated bystanders as opposed to 1.9% in non-survivors and 24% by EMS personnel as opposed to 7.8% in non-survivors. The differences in initial rhythm being shockable was 34% for survivors and 16% for non-survivors.

Holgersen *et al.*
Scand J Trauma Resusc Emerg Med *(2022) 30:58*
https://doi.org/10.1186/s13049-022-01045-x

ABC: CONTRO

NEW DEVELOPMENTS IN RESUSCITATION SCIENCE SINCE 2005

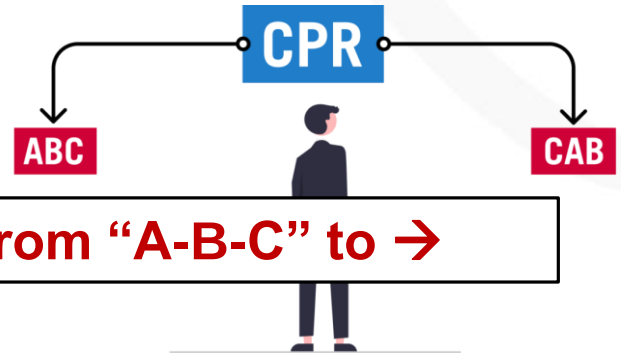
Emergency Medical Services Systems and CPR Quality

Documenting the Effects of CPR Performance by Lay Rescuers

CPR Quality

Importance of Post–Cardiac Arrest Care

Education and Implementation



Highlights of the 2010 Guidelines: The Change From "A-B-C" to → "C-A-B"

«The newest development in the ***2010*** *AHA Guidelines for CPR and ECC* is a *change in the basic life support (BLS) sequence of steps* ***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 newly borns)»

NEW DEVELOPMENTS IN RESUSCITATION SCIENCE SINCE 2005

American Heart Association GUIDELINES CPR ECC 2010

Highlights of the 2010 Guidelines: The Change From "A-B-C" to → "C-A-B"

In the A-B-C sequence chest compressions are often delayed while the responder opens the airway to give mouth-to-mouth breaths or retrieves a barrier device or other ventilation equipment. **By changing the sequence to C-A-B**, **chest compressions** will be initiated sooner and ventilation only minimally delayed until completion of the first cycle of chest compressions
(30 compressions = 18 seconds)

Fewer than 50% of persons in cardiac arrest receive bystander CPR.
There are probably **many reasons** for this, but one impediment may be the A-B-C sequence, which **starts with the procedures that rescuers find most difficult**: **opening the airway and delivering rescue breaths**.
Starting with chest compressions might ensure that more victims receive CPR and that rescuers who are unable or unwilling to provide ventilations will at least perform chest compressions.

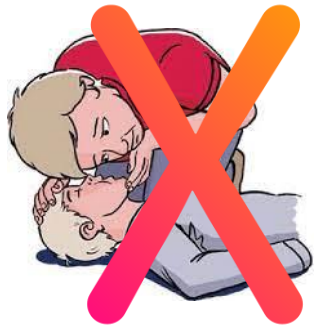
NEW DEVELOPMENTS IN RESUSCITATION SCIENCE SINCE 2005

Highlights of the 2010 Guidelines: The Change From "A-B-C" to → "C-A-B"

Initiate chest compressions before giving rescue breaths (**C-A-B rather than A-B-C**).

Chest compressions can be started immediately, whereas positioning the head, attaining a seal for mouth-to-mouth rescue breathing, or obtaining or assembling a bag-mask device for rescue breathing all take time.

The BLS algorithm has been simplified, and "**Look, Listen and Feel" has been removed from the algorithm.**



NEW DEVELOPMENTS IN RESUSCITATION SCIENCE SINCE 2005

Highlights of the 2010 Guidelines: The Change From "A-B-C" to → "C-A-B"

Pediatric Basic Life Support

The majority of pediatric cardiac arrests are asphyxial, with only approximately 5% to 15% attributable to VF.
Resuscitation from asphyxial arrest is best accomplished by a combination of ventilations and chest compressions. This has been confirmed in a large community pediatric study.

Children with asphyxial arrest who received compression-only CPR had no better results than those who received no bystander CPR.

Despite the importance of providing a combination of ventilations and chest compressions for resuscitation of victims from asphyxial arrest (including most children) as described above, a **switch to a C-A-B sequence was recommended for ease of teaching**. Theoretically this should delay ventilation by a maximum of about 18 seconds (less time if 2 recuers are present).

Circulation 2022; 145:e852-e867 April 26, 2022

AHA SCIENTIFIC STATEMENT

Understanding the Importance of the Lay Responder Experience in Out-of-Hospital Cardiac Arrest: A Scientific Statement From the American Heart Association

Katie N. Dainty, PhD, Chair; Brianna Colquitt; Farhan Bhanji, MD, MSc (Ed); Elizabeth A. Hunt, MD, MPH, PhD; Tiffany Jefkins, PhD(c); Marion Leary, RN, MSN, MPH; Joseph P. Ornato, MD, FAHA; Robert A. Swor, DO; Ashish Panchal, MD, PhD, Vice Chair; on behalf of the Science Subcommittee of the American Heart Association Emergency Cardiovascular Care Committee

OHCA ha quasi il doppio delle probabilità di sopravvivere quando i testimoni eseguono subito la RCP mentre il personale di emergenza sta sopraggiungendo. Tuttavia, la percentuale di persone che soffrono di arresto cardiaco che ricevono RCP da soccorritore laico (*bystander)* è bassa: solo dal 35% al 45% a livello globale.
In uno studio di follow-up di soccorritori laici per l'arresto cardiaco in una comunità suburbana/urbana, quasi l'85% dei soccorritori laici erano membri della famiglia del paziente.

CAB: PRO

Circulation

Alexis A. Topjian. Circulation. Part 4: Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, Volume: 142, Issue: 16_suppl_2, Pages: S469-S523, DOI: (10.1161/CIR.0000000000000901)

OUTCOMES FOR PEDIATRIC IHCA HAVE IMPROVED OVER THE PAST 20 YEARS.

Get With The Guidelines Resuscitation Registry → a large multicenter, hospital-based cardiac arrest registry Pediatric cardiac arrest survival to hospital discharge was **19% in 2000 and 38% in 2018**
Survival has increased on average by 0.67% per year, though that increase has plateaued since 2010

Holmberg MJ, Wiberg S, Ross CE, Kleinman M, Hoeyer-Nielsen AK, Donnino MW, Andersen LW. Trends in Survival After Pediatric In-Hospital Cardiac Arrest in the United States. *Circulation*. 2019;140:1398–1408. doi: 10.1161/CIRCULATIONAHA.119.041667

Resuscitation Outcomes Consortium Epidemiological Registry → a multicenter OHCA registry

Annual survival to hospital discharge of pediatric OHCA between 2007 and 2012 ranged **from 6.7% to 10.2%** depending on region and patient age

Fink EL, Prince DK, Kaltman JR, Atkins DL, Austin M, Warden C, Hutchison J, Daya M, Goldberg S, Herren H, Tijssen JA, Christenson J, Vaillancourt C, Miller R, Schmicker RH, Callaway CW; Resuscitation Outcomes Consortium. Unchanged pediatric out-of-hospital cardiac arrest incidence and survival rates with regional variation in North America. *Resuscitation*. 2016;107:121–128. doi: 10.1016/j.resuscitation.2016.07.244

Circulation

Alexis A. Topjian. Circulation. Part 4: Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, Volume: 142, Issue: 16_suppl_2, Pages: S469-S523, DOI: (10.1161/CIR.0000000000000901)

As pediatric cardiac arrest survival rates have plateaued, the prevention of cardiac arrest becomes even more important

When CPR is initiated, the sequence is C-A-B: Compressions → Airway → Breathing

IRC Italian Resuscitation Council

Holmberg MJ, Wiberg S, Ross CE, Kleinman M, Hoeyer-Nielsen AK, Donnino MW, Andersen LW. Trends in Survival After Pediatric In-Hospital Cardiac Arrest in the United States. *Circulation*. 2019;140:1398–1408. doi: 10.1161/CIRCULATIONAHA.119.041667

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Circulation

Alexis A. Topjian. Circulation. Part 4: Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, Volume: 142, Issue: 16_suppl_2, Pages: S469-S523, DOI: (10.1161/CIR.0000000000000901)

One pediatric study (*) demonstrated only a small delay (5.74 seconds) in commencement of rescue breathing with C-A-B compared with A-B-C (two rescuers).

ABC guidelines 2010

T0	Time from start to initial evaluation of child's responsiveness (start from 5 m)
T1	End assess of child's responsiveness
T2	Start opening the airway
T3	End of look–listen–feel
T4	Start 5 rescue breaths
T5	End 5 rescue breaths
T6	Start pulse-check
T7	End pulse-check
T8	Start chest compression
T9	End chest compression
T10	Start ventilation
T11	End ventilation

CAB guidelines 2010

Ta	Elapsed time from start to early assessment of the need for CPR (start from 5 m)
Tb	End assess need for CPR
Tc	Start pulse-check
Td	End pulse-check
Te1	Start Ventilation*
Te2	Start chest compression
Tf	End chest compression
Tg	Start ventilation
Th	End ventilation

(*) If we have a respiratory arrest, and there is the presence of pulse

Mean times of performance (in seconds) of the steps of pediatric BLS in the CAB and in the ABC sequence for healthcare providers (two rescuers).

ABC		CAB	
Times	Seconds	Times	Seconds
T0	3.26 ± 0.63	Ta	3.20 ± 0.75
T1	6.00 ± 1.01	Tb	6.07 ± 1.11
T2	9.62 ± 1.76	Tc	9.35 ± 1.77
T3	19.17 ± 2.38	Td	17.48 ± 2.19
T4	22.66 ± 3.07	Te1	19.13 ± 1.47
T5	31.87 ± 4.11	Te2	19.27 ± 2.64
T6	33.32 ± 4.32	Tf	27.85 ± 2.98
T7	41.67 ± 4.95	Tg	28.40 ± 3.07
T8	43.40 ± 5.03	Th	31.92 ± 3.36
T9	52.31 ± 5.45		
T10	53.40 ± 5.61		
T11	57.05 ± 5.80		

Tg – T4 = 28.40'' – 22.66'' = 5.74''

Italian Resuscitation Council

(*) Lubrano R, Cecchetti C, Bellelli E, Gentile I, Loayza Levano H, Orsini F, Bertazzoni G, Messi G, Rugolotto S, Pirozzi N, Elli M. Comparison of times of intervention during pediatric CPR maneuvers using ABC and CAB sequences: a randomized trial. *Resuscitation*. 2012;83:1473–1477. doi: 10.1016/j.resuscitation.2012.04.011

CONGRESSO NAZIONALE IRC BOLOGNA 13-14 DICEMBRE 2024

Circulation

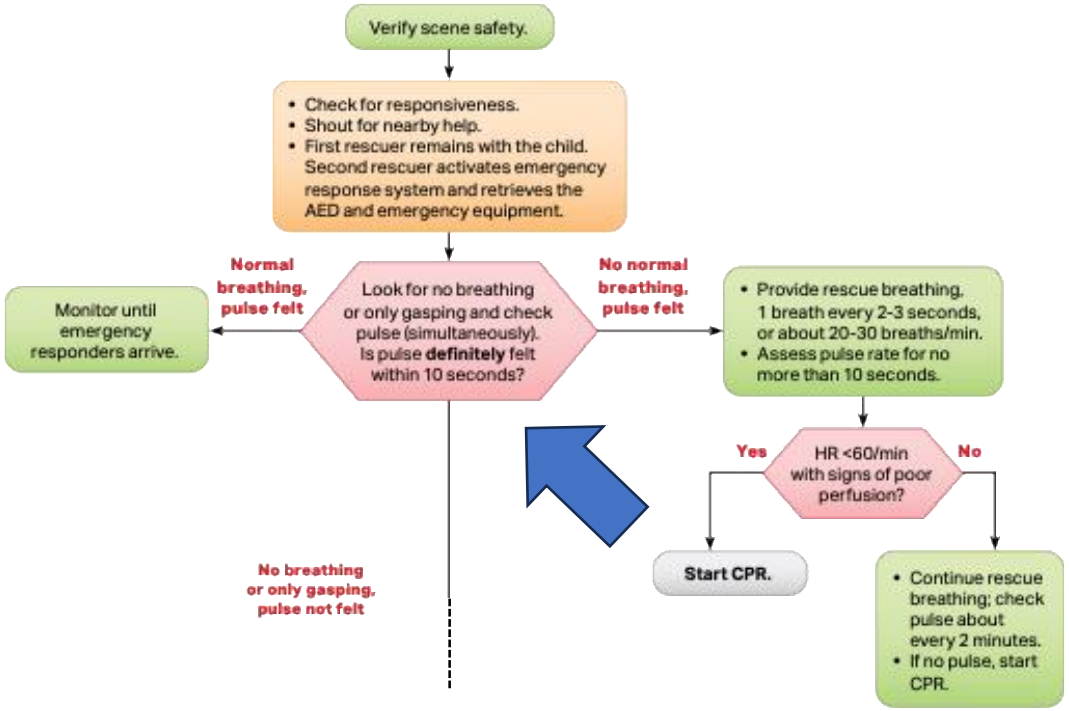
Lubrano R, Cecchetti C, Bellelli E, Gentile I, Loayza Levano H, Orsini F, Bertazzoni G, Messi G, Rugolotto S, Pirozzi N, Elli M. Comparison of times of intervention during pediatric CPR maneuvers using ABC and CAB sequences: a randomized trial. *Resuscitation*. 2012;83:1473–1477. doi: 10.1016/j.resuscitation.2012.04.011

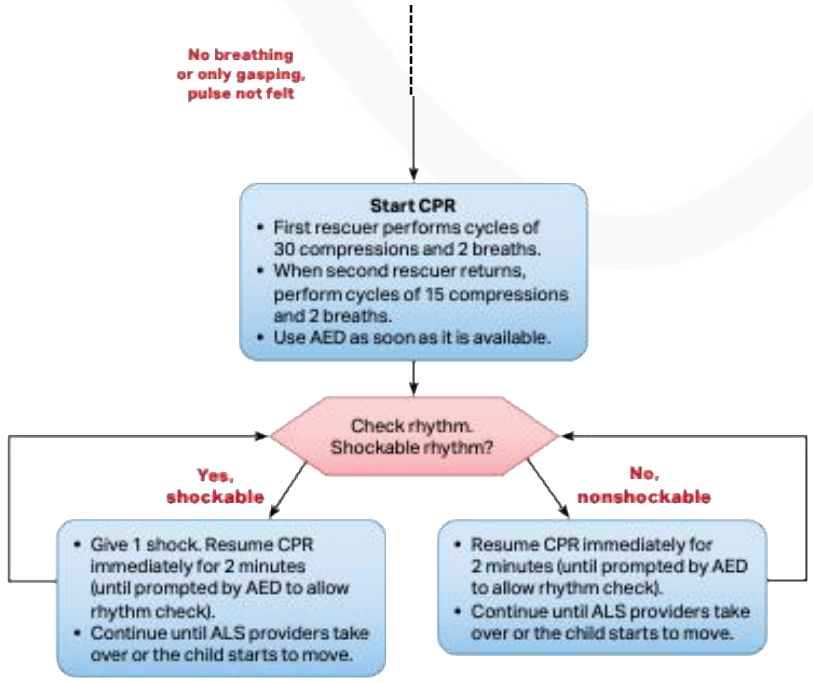
Comparison of time of intervention in the scenarios of cardiac arrest and respiratory arrest with ABC and CAB sequences

Scenario	Action	Sequence		
		ABC Seconds from start	CAB Seconds from start	$p <$
Cardiac	Diagnosis of cardiac arrest	41.67 ± 4.95	17.48 ± 2.19	0.05
	Start of ventilation	22.66 ± 3.07	28.40 ± 3.07	0.05
	Start of cardiac massage	43.40 ± 5.03	19.27 ± 2.64	0.05
Respiratory	Diagnosis of respiratory arrest	19.17 ± 2.38	17.48 ± 2.19	0.05
	Start of ventilation	22.66 ± 3.07	19.13 ± 1.47	0.05

CAB: CONTRO

Pediatric Basic Life Support Algorithm for Healthcare Providers—2 or More Rescuers





Alexis A. Topjian. Circulation. Part 4: Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, Volume: 142, Issue: 16_suppl_2, Pages: S469-S523, DOI: (10.1161/CIR.0000000000000901)

European Resuscitation Council Guidelines 2021: Paediatric Life Support

Unconscious children with an obstructed airway might experience ventilatory arrest. Spontaneous breathing may be restored with simple airway opening and a few positive pressure breaths. Such children have an excellent outcome but might not be captured in CA registries, unless chest compressions are started before airway opening.

COMPRESSION-ONLY

Compression-Only Versus Rescue-Breathing Cardiopulmonary Resuscitation After Pediatric Out-of-Hospital Cardiac Arrest

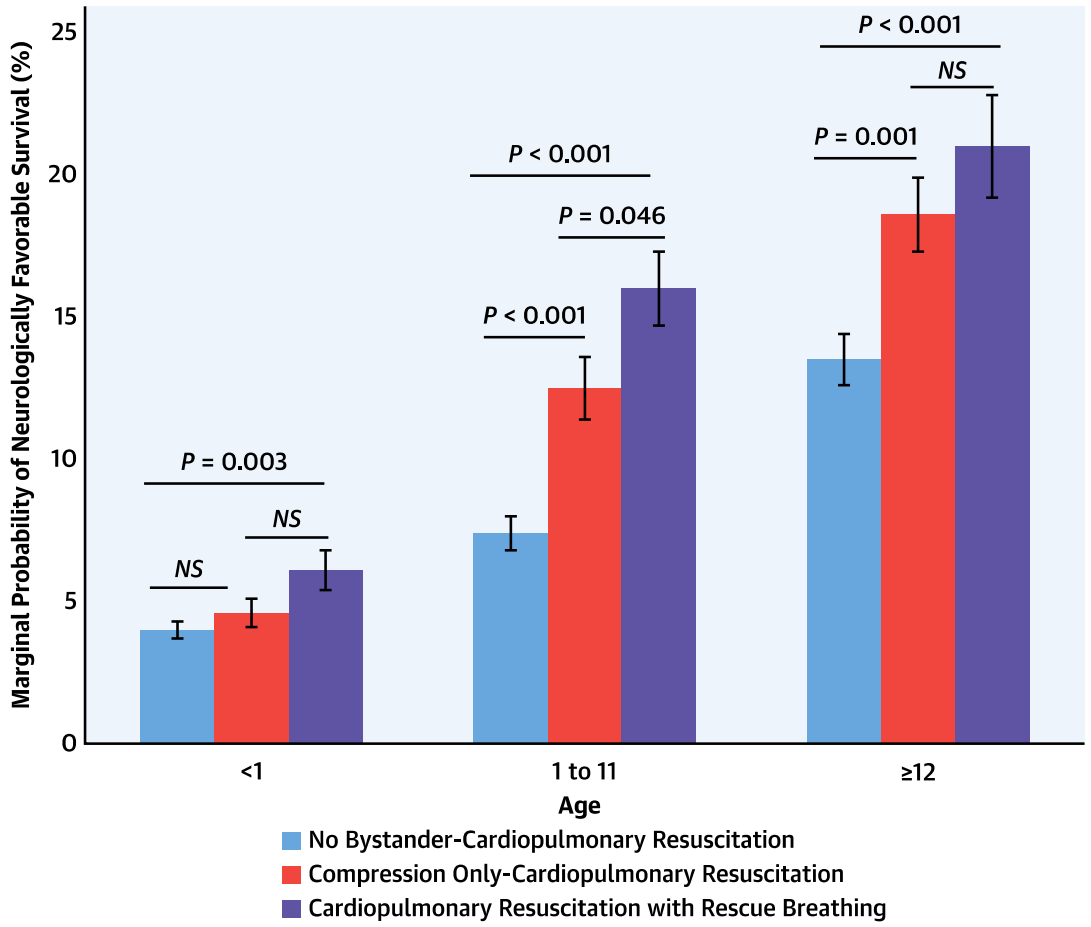
TABLE 3 Logistic Regression Comparing the Association of CO-CPR and RB-CPR With Neurologically Favorable Survival

	Adjusted Neurologically Favorable Survival		Adjusted OR		
	%	95% CI	OR	95% CI	*P* Value
CPR type					
CO-CPR	11.6	10.4-12.7			
RB-CPR	14.2	12.8-15.6	1.36	1.10-1.68	0.005

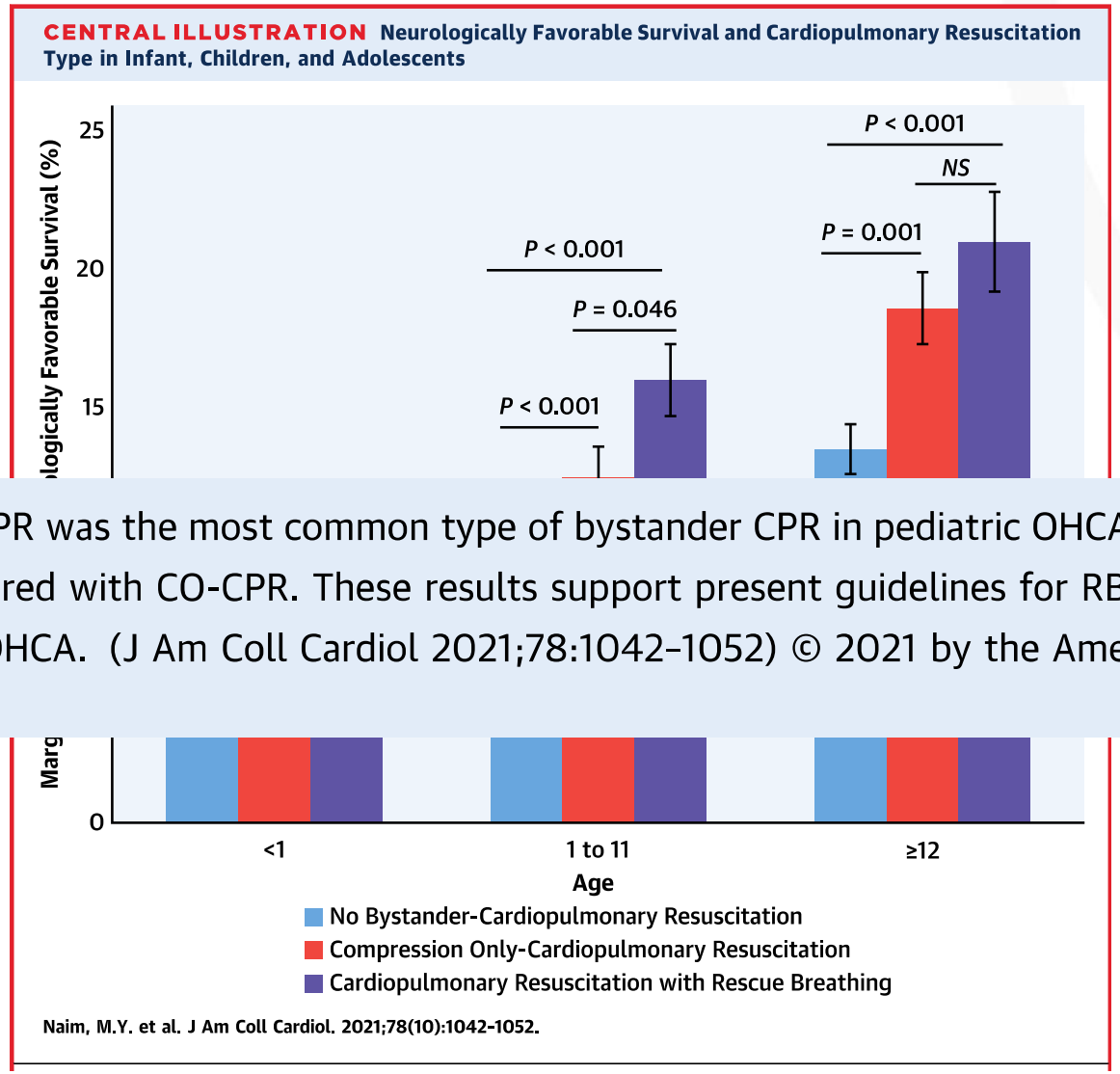
JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

PUBLISHED BY ELSEVIER

CENTRAL ILLUSTRATION Neurologically Favorable Survival and Cardiopulmonary Resuscitation Type in Infant, Children, and Adolescents



Naim, M.Y. et al. J Am Coll Cardiol. 2021;78(10):1042-1052.



CONCLUSIONS CO-CPR was the most common type of bystander CPR in pediatric OHCA. RB-CPR was associated with better outcomes compared with CO-CPR. These results support present guidelines for RB-CPR as the preferred CPR modality for pediatric OHCA. (J Am Coll Cardiol 2021;78:1042–1052)

Review

Chest-compression-only versus conventional cardiopulmonary resuscitation by bystanders for children with out-of-hospital cardiac arrest: A systematic review and meta-analysis

XiaoMing Zhang [1], WenWu Zhang [1], CongHua Wang, WuYuan Tao, QingLi Dou [*], YunZhi Yang

Results: Five studies with 14,427 participants were included. Pooled results indicated that children who received conventional CPR had a higher 30-day survival than those who received CC-CPR (odds ratio, 1.49; 95% confidence interval [CI], 1.27–1.74). Moreover, conventional CPR led to a higher 30-day neurologically intact survival compared to CC-CPR (odds ratio, 1.63; 95%CI, 1.30–2.04). Subgroup analyses showed that the higher survival associated with conventional CPR was only significant in children who had cardiac arrest with non-cardiac causes (odds ratio, 1.77; 95% CI, 1.30–2.40).

Conclusions: Children who receive conventional CPR for out-of-hospital cardiac arrest may have better outcomes than those who receive CC-CPR. Due to the limited number of studies and lack of randomized trials included in this meta-analysis, more evidence is needed to confirm our findings.

RESUSCITATION 134 (2019) 81–90

grazie