

# Elizabeth Foglia, MD, MSCE

Dr. Foglia is an Associate Professor of Pediatrics and a Neonatologist at the Children's Hospital of Philadelphia. She leads an NIH-funded clinical research program focused on neonatal resuscitation, and she is a member of the NRP Steering Committee.



# The Resuscitation Was Unsuccessful Now What?

Elizabeth Foglia, MD MSCE

Associate Professor of Pediatrics

Children's Hospital of Philadelphia

April 18, 2024

# Learning Objectives

- Discuss when and how to stop the resuscitation of a neonate.
- List themes related to family presence during resuscitation
- Recognize potential impact of unsuccessful resuscitation on team members

# You are called to a delivery...

- Gestational age 39 weeks, Uncomplicated pregnancy
- Stat C-Section, Non-reassuring fetal heart tones, Acute placental abruption
- Infant is limp, apneic, undetectable heart rate
  
- Perform Initial steps
  - No response
- PPV, Ventilation Corrective Steps, Intubation, Call for help
  - No response
- Coordinated chest compressions at 4 minutes
  - No response
- First dose epinephrine given via umbilical vein at 8 minutes
  - No response

# 10 minutes after birth

- Ongoing chest compressions coordinated with ventilation through an endotracheal tube
- No heart rate or other signs of life
- 10 Minute Apgar=0

# Audience Poll

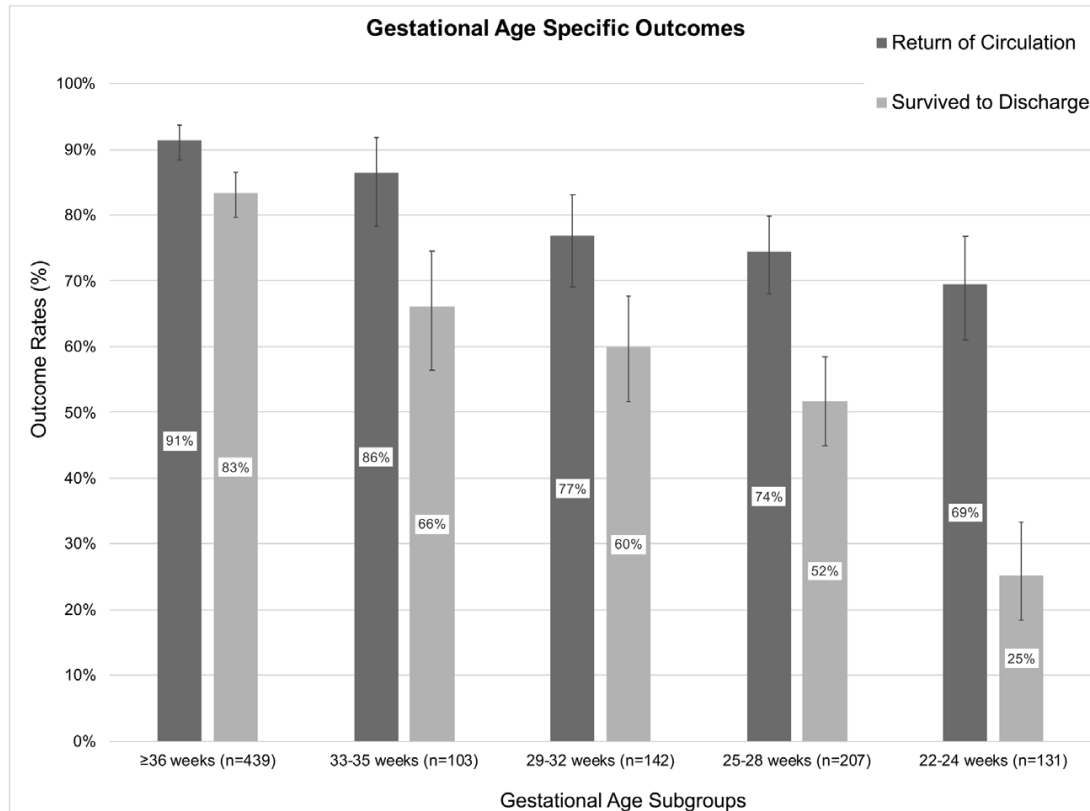
If the heart rate remained undetectable following ongoing high-quality CPR, when would you discontinue resuscitation?

- A. 10 minutes after birth
- B. 15 minutes after birth
- C. 20 minutes after birth
- D. More than 20 minutes after birth

# Fact-Check

- Think about the last time you cared for a patient who died in the delivery room following intensive resuscitation
- How long did your team perform resuscitation?

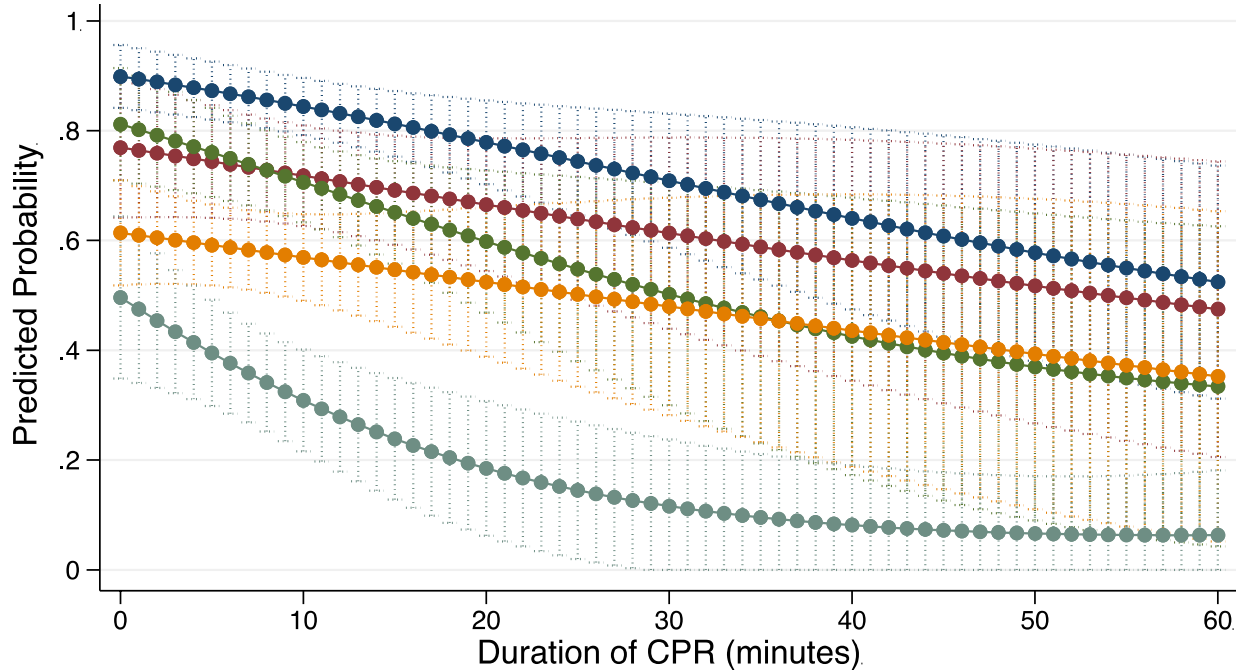
# Get With the Guidelines-Resuscitation Registry: 1022 infants with >1 minute DR-CPR



- 17% died in DR
- 36% died before discharge

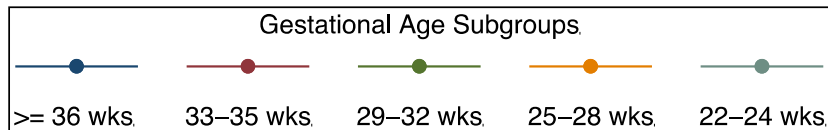


# Survival to discharge based on CPR duration



## CPR Duration

- Death: 15 min (8, 24)
- Survival: 5 min (2, 10)



# When should we stop resuscitation?



**Stop too early:**

Survival may have been achievable



**Continue too long:**

Increased risk of severe neurologic impairment for survivors



# 2015 ILCOR Recommendation

We suggest that, in babies with an Apgar score of 0 after 10 minutes of resuscitation, if the heart rate remains undetectable, it may be reasonable to stop resuscitation.



# Duration of Resuscitation at Birth, Mortality, and Neurodevelopment: A Systematic Review

Elizabeth E. Foglia, MD, MSCE,<sup>a</sup> Gary Weiner, MD,<sup>b</sup> Maria Fernanda B. de Almeida, MD, PhD,<sup>c</sup> Jonathan Wyllie, MBChB,<sup>d</sup> Myra H. Wyckoff, MD,<sup>e</sup> Yacov Rabi, MD,<sup>f</sup> Ruth Guinsburg, MD, PhD,<sup>g</sup> INTERNATIONAL LIAISON COMMITTEE ON RESUSCITATION NEONATAL LIFE SUPPORT TASK FORCE

- P:** Newborns with at least 10 minutes of asystole, bradycardia, or PEA for which CPR is indicated
- I:** Ongoing CPR for incremental time intervals beyond 10 minutes after birth
- C:** CPR discontinued at 10 minutes after birth
- O:** Survival to any age, Neurodevelopment, Composite of survival to any age without moderate/severe neurodisability

# Study Characteristics

- 16 studies
- 3-177 infants included per study
- Years enrolled: 1982-2017
- Setting: Australia, US, Canada, Japan, UK
- DR and postnatal interventions varied (if reported)
- Follow up duration
  - Hospital discharge to 12 years

# Patient Characteristics

- 579 patients
- Variable gestational age
  - 8 studies: term/late preterm only
- 10 studies: infants had to survive to a specified entry point (ie NICU admission)
- Almost all identified by 10 min Apgar (0, 0/1)

# Risk of Bias

High

Unclear

Low

Author	Selection bias	Confounding	Exposure measurement	Outcome Measurement	Missing data	Selective reporting	Overall risk of bias
Ayrapetyan	High	High	High	Unclear	High	Unclear	High
Billimoria	Unclear	High	High	Unclear	High	Unclear	High
Casalaz	High	High	High	Unclear	High	Unclear	High
Haddad	Unclear	High	High	Unclear	High	Unclear	High
Harrington	Unclear	High	High	Unclear	High	Unclear	High
Jain	Unclear	High	High	Unclear	High	Unclear	High
Kasdorf	High	High	High	Unclear	High	Unclear	High
Natajara	High	High	High	Unclear	High	Low	High
Patel	High	High	High	Unclear	High	Unclear	High
Sarkar	High	High	High	Unclear	High	Unclear	High
Shah	High	High	High	Unclear	High	Unclear	High
Shibasaki	High	High	High	Unclear	High	Unclear	High
Socol	High	High	High	Unclear	High	Unclear	High
Sproat	Unclear	High	High	Unclear	High	Unclear	High
Zhang	Unclear	High	High	Unclear	High	Unclear	High
Zhong	High	High	High	Unclear	High	Unclear	High

# Outcomes

## Survival (n=579)

- Time ascertained: discharge-12 years
- Survival to last follow up: 41%
- Individual studies 2-100%

## Neurodevelopment (n=277)

- 11% survived without impairment
- Among survivors: 38% no impairment



# Survival Outcomes

**TABLE 3** Survival Outcomes

Author	<i>n</i>	Survival at Discharge, <i>n</i> (%)	Time of Last Follow-up	Survival at Last Follow-up, <i>n</i> (%)
Ayrapetyan et al <sup>11</sup>	17	8 (47)	4 mo–5 y	7 (41)
Billimoria et al <sup>12</sup>	109	Not reported	1 y	50 (46)
Casalaz et al <sup>13</sup>	8	1 (13)	20 mo–8 y	1 (13)
Haddad et al <sup>14</sup>	16	2 (13)	3 mo–12 y	2 (13)
Harrington et al <sup>15</sup>	12	3 (25)	11 mo–5 y	2 (17)
Jain et al <sup>16</sup>	58	1 (2)	4–60 mo	1 (2)
Kasdorf et al <sup>17</sup>	9	9 (100)	15 mo–2 y	8 (89)
Natarajan et al <sup>10</sup>	35	Not reported	6–7 y	15 (43)
Patel and Beeby <sup>18</sup>	29	9 (31)	Not specified	9 (31)
Sarkar et al <sup>19</sup>	12	5 (42)	9–24 mo	3 (25)
Shah et al <sup>20</sup>	13	5 (38)	1–2 y	5 (38)
Shibasaki et al <sup>21</sup>	28	21 (75)	18–24 mo	19 (68)
Socol et al <sup>22</sup>	3	Not reported	1–7 y	3 (100)
Sproat et al <sup>23</sup>	22	8 (36)	2 y	8 (36)
Zhang et al <sup>24</sup>	31	5 (16)	15–24 mo	5 (16)
Zhong et al <sup>25</sup>	177	99 (56)	Discharge	99 (56)
<b>Total</b>	<b>579</b>	<b>176 of 432 (40.7)</b>	<b>—</b>	<b>237 of 579 (40.9)</b>

—, not applicable.

40.7%

40.9%



# Subgroup Analyses

Subgroup	Studies	Infants	Survival to last follow up	Infants assessed for neuro-development	Survival without moderate or severe neurodevelopmental impairment	
					% of survivors assessed	% of all enrolled
<b>Population level studies</b>	6	240	28%	15	60%	7%
<b>Therapeutic hypothermia</b>	9	206	59%	57	37%	20%
<b>≥ 36 weeks GA</b>	13	350	54%	73	32%	14%
<b>&lt; 36 weeks GA</b>	7	144	28%	8	63%	12%
<b>Heart rate detected ≥ 20 min after birth</b>	5	39	38%	15	40%	15%

# Limitations

- Potential selection bias
- Most infants defined by 10-minute Apgar score
- Limited information for preterm infants (n=144)
- Few infants with return of spontaneous circulation at or beyond 20 minutes (n=39)

# Conclusions

Infants with ongoing CPR at 10 minutes are at high risk for mortality and morbidity

Survival without neuroimpairment is possible

One specified duration of CPR is unlikely to uniformly predict survival or survival without impairment for all newborns

# 2020 ILCOR Treatment Recommendation

- If, despite provision of all the recommended steps of resuscitation and excluding reversible causes, a newborn infant requires ongoing cardiopulmonary resuscitation (CPR) after birth, we suggest discussion of discontinuing resuscitative efforts with the clinical team and family
- A reasonable time frame to consider this change in goals of care is around 20 minutes after birth
- Weak recommendation, very low-certainty evidence

# The recommendation does NOT say:

1

You **MUST** continue  
CPR for 20 minutes  
after birth

2

You **MUST**  
discontinue CPR at  
20 minutes after birth

# How should we stop resuscitation?

- C: Clinical features
- E: Effectiveness of resuscitative interventions
- A: Ask the other clinicians present for input
- S: Stop resuscitation efforts
- E: Explain what has happened to the family

# How should we stop resuscitation?

- **C: Clinical features**
- E: Effectiveness of resuscitative interventions
- A: Ask the other clinicians present for input
- S: Stop resuscitation efforts
- E: Explain what has happened to the family



# Clinical Features

- Gestational age 39 weeks, Uncomplicated pregnancy
- Stat C-Section, Non-reassuring fetal heart tones, Acute placental abruption
- Infant is limp, apneic, undetectable heart rate

# Clinical Features

- Gestational age 39 weeks, Uncomplicated pregnancy
- Stat C-Section, Non-reassuring fetal heart tones, Acute placental abruption
- Infant is limp, apneic, undetectable heart rate

Gestational age 25 weeks?

# Clinical Features

- **Gestational age 39 weeks**, Uncomplicated pregnancy
- Stat C-Section, Non-reassuring fetal heart tones, Acute placental abruption
- Infant is limp, apneic, undetectable heart rate

**Gestational age 25 weeks?**

Congenital Anomalies?

# Clinical Features

- **Gestational age 39 weeks**, Uncomplicated pregnancy
- Stat C-Section, Non-reassuring fetal heart tones, **Acute placental abruption**
- Infant is limp, apneic, **undetectable heart rate**

**Gestational age 25 weeks?**

Congenital Anomalies?

**Unknown time of inciting event?**

# Clinical Features

- **Gestational age 39 weeks**, Uncomplicated pregnancy
- Stat C-Section, Non-reassuring fetal heart tones, **Acute placental abruption**
- Infant is limp, apneic, **undetectable heart rate**

**Gestational age 25 weeks?**

Congenital Anomalies?

**Unknown time of inciting event?**

Initial heart rate of 30?

# Local Context

- NICU care
- Access to therapeutic hypothermia
- Parental preference

# How should we stop resuscitation?

- C: Clinical features
- **E: Effectiveness of resuscitative interventions**
- A: Ask the other clinicians present for input
- S: Stop resuscitation efforts
- E: Explain what has happened to the family

# Effectiveness of Resuscitation

Variable	1153 DR-CPR events
Number of intubation attempts	3 (SD 2)
Time to first adrenaline dose (min)	4 (1. 8)
Total number adrenaline doses	3 (SD 2)
Duration CPR (min)	12 (SD 18)





# How should we stop resuscitation?

- C: Clinical features
- E: Effectiveness of resuscitative interventions
- A: Ask the other clinicians present for input
- S: Stop resuscitation efforts
- E: Explain what has happened to the family

# Ask other clinicians for input

- Solicit additional information leader may not have
- Shared mental model for entire team

# How should we stop resuscitation?

- C: Clinical features
- E: Effectiveness of resuscitative interventions
- A: Ask the other clinicians present for input
- S: Stop resuscitation efforts
- E: Explain what has happened to the family



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

# Resuscitation

journal homepage: [www.elsevier.com/locate/resuscitation](http://www.elsevier.com/locate/resuscitation)



## Review

# Family presence during resuscitation in paediatric and neonatal cardiac arrest: A systematic review



*Katie N. Dainty\**, *Dianne L. Atkins*, *Jan Breckwoldt*, *Ian Maconochie*,  
*Steve M. Schexnayder*, *Markus B. Skrifvars*, *Janice Tijssen*, *Jonathan Wyllie*,  
*Marie Furuta*, for the *International Liaison Committee on Resuscitation's (ILCOR) Pediatric<sup>a</sup>*  
*Neonatal Life Support Task Force*  
*Education, Implementation and Teams Task Force*



# Family presence: pediatric resuscitation

- 5 studies of families who had been present for child's resuscitation
- Overall, being present was a helpful experience for parents
- Majority would recommend being present to other families
- Trained provider should be available to support families

Desire to be present

Understand what was happening

Need for physical contact with child

Witnessing helped them know that everything had been done

Sense of chaos and panic

Importance of relationship with staff

Perception that it brought child comfort

Helped with grieving process

# Nuances for neonatal resuscitation

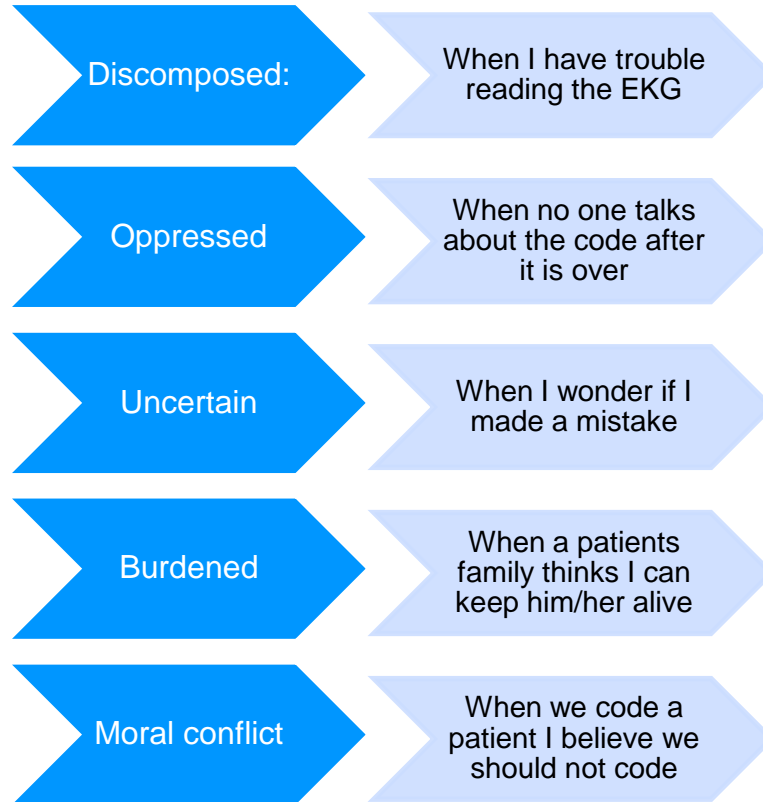
- Unique experience for fathers:
  - Split focus between baby and mother
- Being present provided reassurance and opportunity for involvement and communication
- Some reservations about emotional toll
- First contact between parent and baby carries intense emotions
  - Desperation to see baby immediately
  - Fear of witnessing situation
- **Need for staff training for support and debriefing**

What about the team?



# Post Code Stress

- First described in 1992 among critical care nurses after failed resuscitation
- Validated post-code scale with 5 domains





# Trainee Perspectives on Manikin Death During Mock Codes

- Randomized crossover study of 62 pediatric residents
- 2 simulated neonatal codes requiring chest compressions
  - One manikin responds to resuscitation, One manikin dies
  - Residents endorsed higher measures of stress when manikin died

In debriefing, 2 key themes emerged:

1. The manikin does not die
2. A dying manikin equals inadequate resuscitation

These themes may apply to clinical resuscitations



# Critical event debriefing checklist: WATER

Welfare check

(Providers' wellbeing to continue providing care)

Acute/short-term corrections

(Matters to be addressed before the next case)

Team reactions and reflections

(Summarizing case; plus/delta conversation)

Education

(Lessons learned from the event and debriefing)

Resource awareness and longer-term needs

(Safety/quality improvement report), local peer-support



# Take Home Points

1. The decision to discontinue resuscitative efforts should be individualized
  - Consider changing goals of care if CPR is ongoing 20 min after birth
2. Standard framework (CEASE) helpful approach to discontinue resuscitative efforts
3. Non-successful resuscitation can be stressful to team members
  - Important to consider in post-resuscitation activities

# Thank you

foglia@chop.edu

