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How Neonates Die: Mortality Trends and Associations in a Level IV Neonatal Intensive Care Unit

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Introduction

- Broad, quantitative studies of neonatal mortality exist but there are but no data on statistical associations with clinical and demographic factors
- Associations could inform parental counseling before and after delivery, affect medical decision making, identify potential inequities
- Objective is to evaluate statistical association between clinical/demographic factors and mode of neonatal death

Receiving CPR – PALS or NRP intervention within 6 hours of death, excluding routine delivery room resuscitation

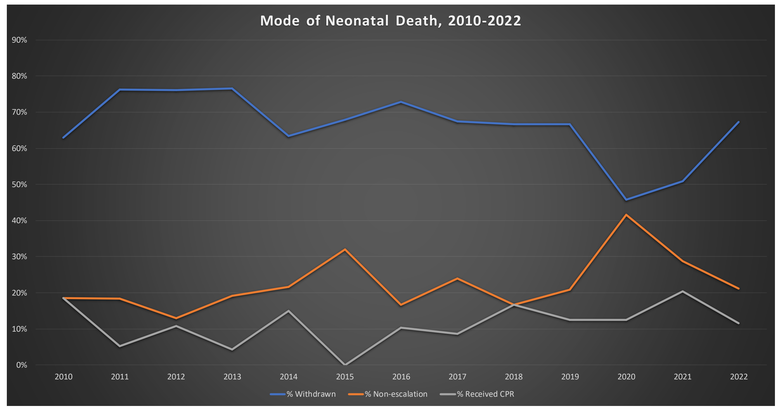
Non-escalation – non-initiation of new intervention when clinically indicated

Withdrawal – removal of existing life-prolonging intervention

Methods

- Patients who died at the Children's Mercy Hospital NICU from January 2012-December 2022
  - Pulled from internal database of 1999-2022 deaths
- Retrospective chart review, multinomial logistic regression model; multivariable model shown
  - Largest group designated as reference

Findings



	Total Cohort n (%) (n = 561)
Sex	
F	257 (45.8)
M	304 (54.2)
Race	
Black	85 (15.1)
Hispanic	56 (10)
Multiracial	24 (4.3)
White	372 (66.3)
Other	24 (4.3)
Ethnicity	
Hispanic/Latino	70 (12.5)
Non-Hispanic/Latino	488 (87)
Unknown	3 (0.5)
Maternal age	
15-19	42 (7.5)
20-29	317 (56.5)
30-39	181 (32.3)
40-49	20 (3.5)
Unknown	1 (0.2)
Parent preferred language	
English	511 (91.1)
Spanish	36 (6.4)
Other	14 (2.5)

Fetal Health Center at CMH

- Opened in 2009, deliveries in 2011
- Parents referred by OB/GYN
- Pre-natal diagnosis and counseling sessions
- High-risk deliveries, fetal intervention

	Total Cohort n (%) (n = 561)
Gestational Age	
<24 weeks	36 (6.4)
24-27 weeks	102 (18.2)
28-31 weeks	57 (10.1)
32-36 weeks	147 (26.2)
37-41 weeks	218 (38.9)
≥42 weeks	1 (0.2)
Primary diagnosis	
Congenital abnormality	358 (63.8)
Preterm	129 (23)
Infection	19 (3.4)
HIE	34 (6)
Other	21 (3.8)
Birthplace	
FHC	200 (35.7)
Outborn	361 (64.3)
Fetal Health Center involvement	
No	326 (58.1)
Yes	235 (41.9)
Palliative team involved	
No	187 (33.3)
Yes	374 (66.7)
Vasopressor need at death	
No	299 (53.3)
Yes	262 (46.7)
Respiratory support at death	
Conventional ventilator	172 (30.7)
High-Frequency Oscillating Ventilator (HFOV)	271 (48.3)
Non-invasive ventilation (NIV)	22 (3.9)
Room air/nasal canula (RA/NC)	91 (16.2)
Other	5 (0.9)

		Adjusted OR (95% CI)		
	p-value	Withdrawn vs CPR	Non-Escalation vs CPR	Withdrawn vs Non-Escalation
Fetal health center involvement	**0.001**	0.68 (0.36-1.30)	2.12 (0.96-4.65)	**0.32 (0.18-0.59)**
Pressors/Hydrocortisone	**0.002**	0.65 (0.35-1.21)	**2.57 (1.01-6.53)**	**0.25 (0.12-0.56)**
Respiratory support (vs Conventional Ventilator)	**<0.001**			
HFOV		1.55 (0.81-2.98)	1.01 (0.41-2.49)	1.53 (0.73-3.23)
NIV		1.13 (0.23-5.53)	3.69 (0.56-24.48)	0.31 (0.08-1.18)
RA/NC		0.60 (0.12-3.04)	**68.36 (12.96-360.65)**	**0.01 (0.003-0.02)**
Other		0.13 (0.01-2.24)	3.47 (0.30-40.62)	**0.04 (0.003-0.46)**
Gestational age	**0.001**	**1.13 (1.07-1.19)**	1.02 (0.95-1.09)	**1.11 (1.05-1.17)**

Discussion

- Fetal health center involvement made significant impact
- No significant difference between withdrawal and CPR other than with gestational age
  - Preterm infants more likely to receive CPR or non-escalation compared to withdrawal
  - Linear relationship with decreasing gestational age
- Black race significant in univariate model, likely because of GA correlation
- Limitations include lack of pre-term delivery room data, single category diagnosis, single-center study

Conclusions

- Prenatal diagnosis and counseling has significant impact on mode of neonatal death
- The more premature the infant, the more likely to receive CPR or non-escalation compared to withdrawal of intervention
- Supports routine and early pre-natal counseling, including palliative services when appropriate, for prematurity
- Need multi-center studies with pre-term delivery
- Needs qualitative research to understand impact of mode of death on staff, families
  - Would they make different choices in retrospect?
  - Indicate need for changes in counseling?

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