Challenges in Neonatal Care in High-, Middle- and Low-Income Settings

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CONFLICTS OF INTEREST

- None

800 ANNI 1222·2022

UNIVERSITÀ DEGLI STUDI DI PADOVA

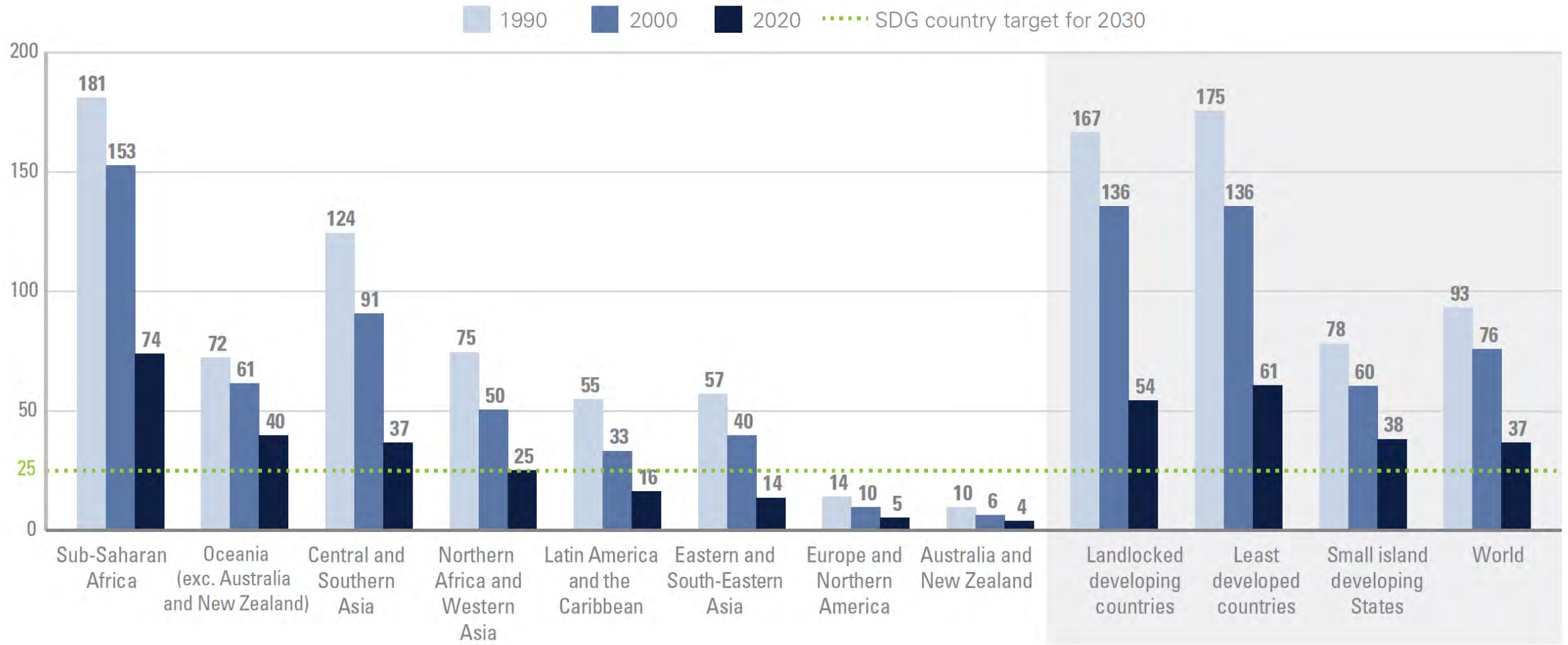
United Nations

The 2030 Agenda for
Sustainable Development,
adopted by all United Nations Member States
(New York, Sept. 2015)

17 Sustainable Development Goals (SDGs)

FIGURE 3

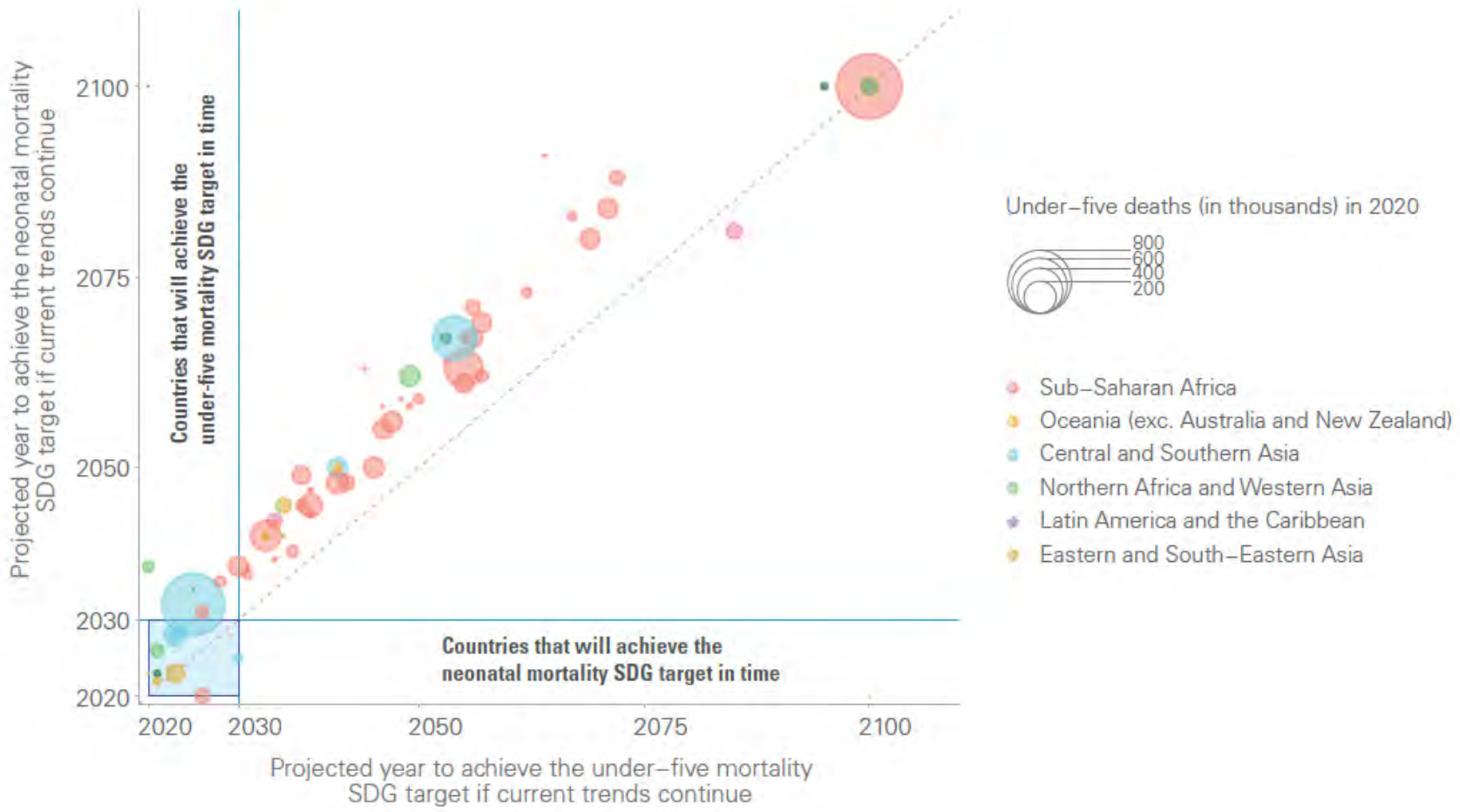
Under-five mortality rate (deaths per 1,000 live births) by Sustainable Development Goal region, 1990, 2000 and 2020



Note: All figures are based on unrounded numbers.

Unicef, Levels and Trends in Child Mortality, Report 2021

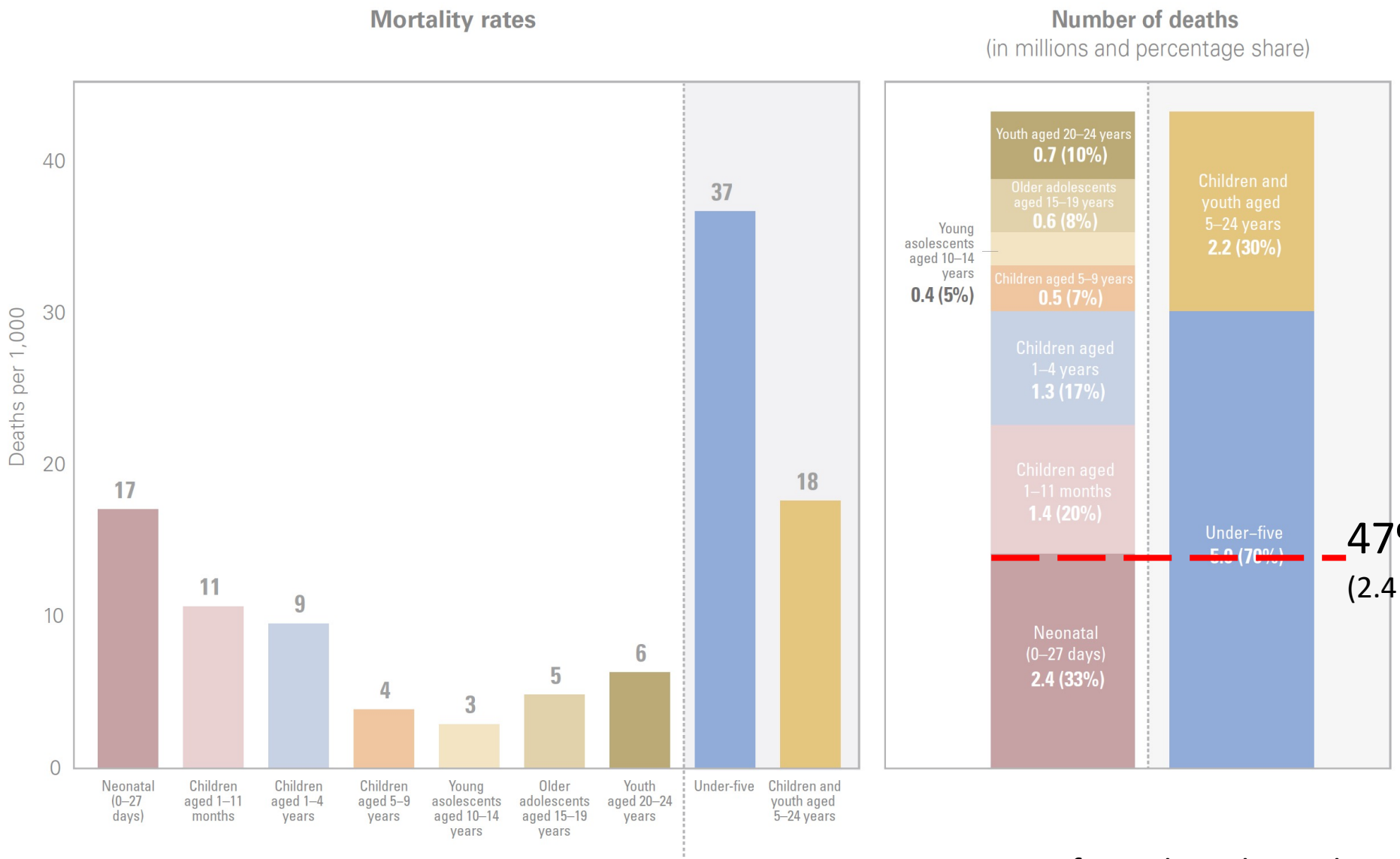
FIGURE 4 **Projected year to achieve the SDG target in neonatal mortality and under-five mortality if current trends continue in the countries that have not achieved the SDG targets**



Unicef, Levels and Trends in Child Mortality, Report 2021

FIGURE 2

Global mortality rates and number of deaths by age, 2020



Note: All figures are based on unrounded numbers.

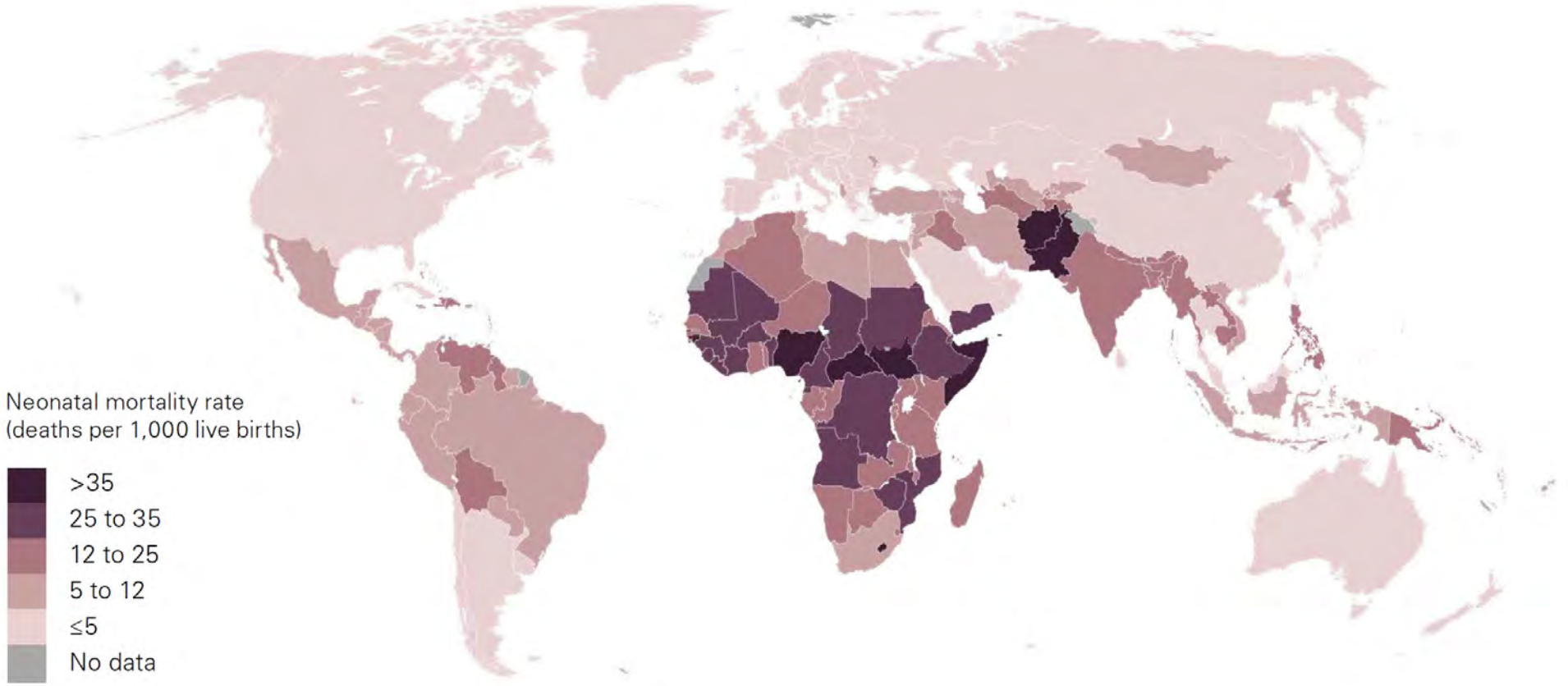
47%

(2.4 million neonatal deaths/year)

Unicef, Levels and Trends in Child Mortality, Report 2021

MAP 4

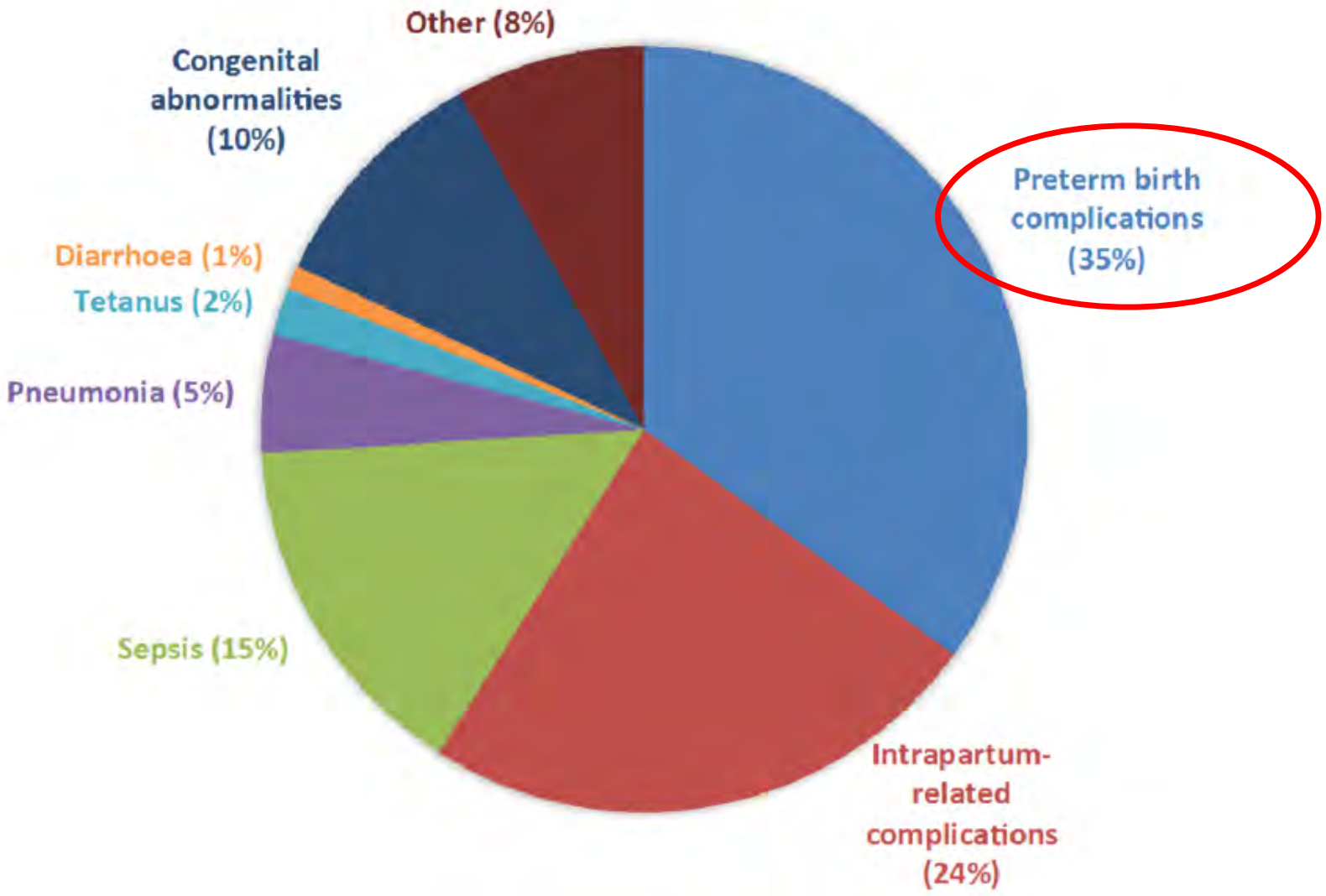
Neonatal mortality rate (deaths per 1,000 live births) by country, 2020



Note: This map does not reflect a position by UN IGME agencies on the legal status of any country or territory or the delimitation of any frontiers.

Unicef, Levels and Trends in Child Mortality, Report 2021

Causes of neonatal mortality



Levels & Trends in Child Mortality. Report 2020.
UNICEF, WHO, World Bank Group

World Prematurity Day 17 November

1 baby in 10 is born premature. Worldwide.

powered by EFCNI

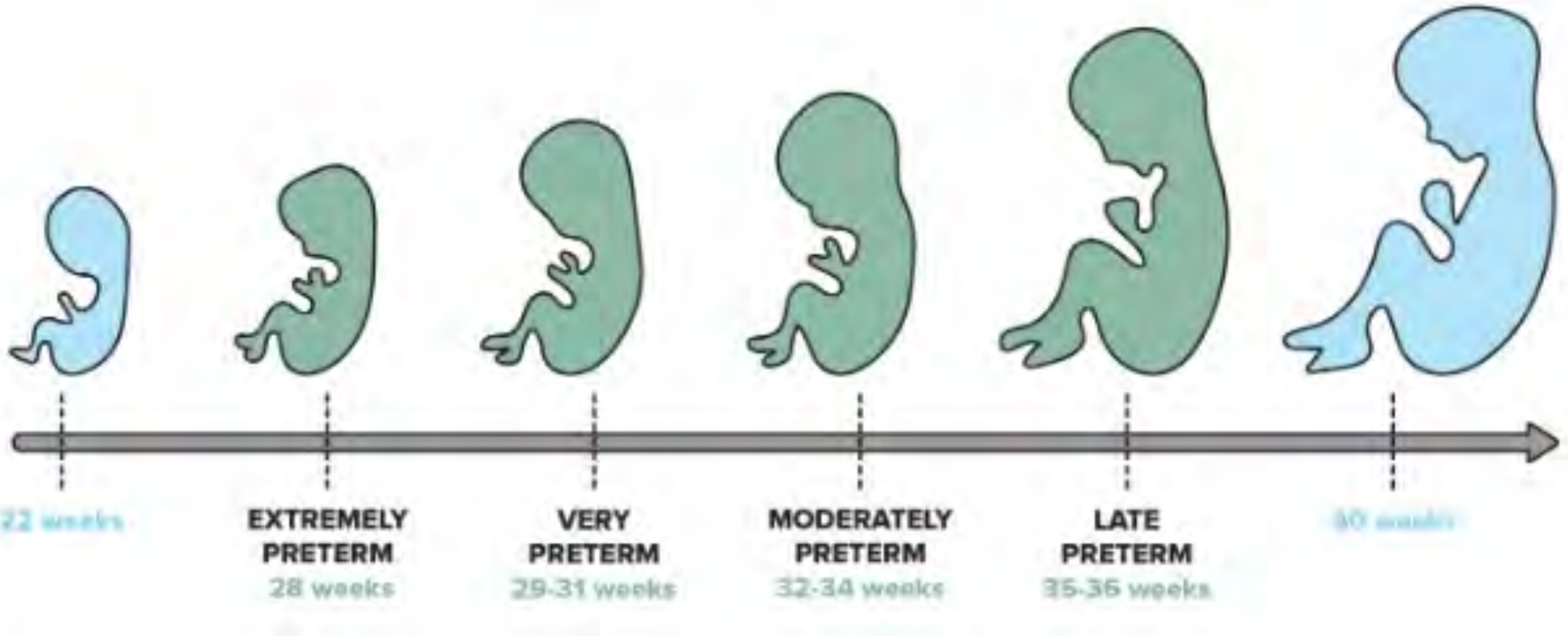
	Estimated preterm birth rate* (%, UI)	UNDP estimated number of livebirths	Proportion of global livebirths (%)	Estimated number of preterm births (n, UI)	Proportion of global preterm births (%)
Asia	10·4% (8·7–11·9)	75 441 991	53·9%	7 847 643 (6 579 297–8 987 184)	52·9%
Europe	8·7% (6·3–13·3)	7 927 034	5·7%	690 931 (497 738–1 051 737)	4·7%
Latin America and the Caribbean	9·8% (8·6–11·3)	10 814 139	7·7%	1 062 800 (931 611–1 220 105)	7·2%
North America	11·2% (9·5–13·2)	4 394 185	3·1%	491 297 (416 479–578 367)	3·3%
North Africa	13·4% (6·3–30·9)	5 771 560	4·1%	773 687 (365 845–1 782 375)	5·2%
Oceania	10·0% (7·9–12·7)	643 749	0·5%	64 227 (50 706–81 961)	0·4%
Sub-Saharan Africa	12·0% (8·6–16·7)	34 953 292	25·0%	4 182 440 (2 994 834–5 838 104)	28·2%
Global	10·6% (9·0–12·0)	139 945 950	100·0%	14 835 606 (12 654 938–16 728 926)	100·0%

Regions are based on the United Nations Standard Country or Area Codes for Statistical Use (M49) major regional groups. UI=uncertainty interval. UNDP=United Nations Development Programme. *Preterm births per 100 livebirths.

***Table 2*: Estimated preterm birth rates and numbers of preterm births in 2014**

Chawanpaiboon S, Lancet 2019

Types of prematurity



85%

Gestational age: 22_{+0} weeks; Birth weight: 391 g

Figure 1. Preterm infant with **A,** total body polyethylene wrap and **B,** wrap up to the shoulders.

Doglioni N. J Pediatr 2014

The Boston Globe

MORNING EDITION

BABY SPED TO BOSTON

Has Trouble Breathing; Kennedy Stands by Here

Infant Arrives at Children's Medical Center

After Visiting Baby

Whole World Taken By Littlest Kennedy

They Helped — And Hoped

'He's a Kennedy --He'll Make It'

King Names FBI Agent

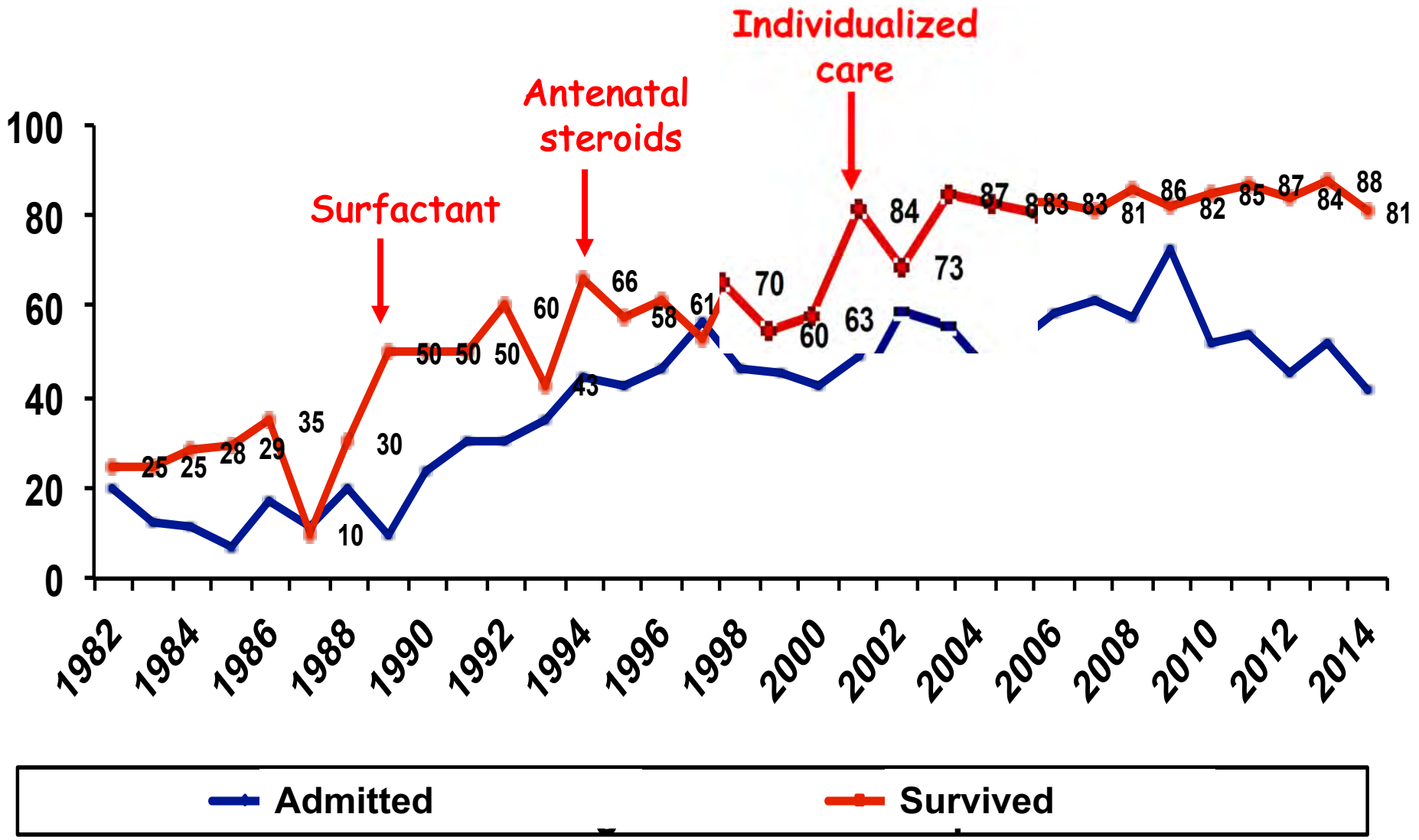
Powers to Head N.H. Sweeps

FIG. 2.6 The News of Death of Prematurely

Patrick Bouvier Kennedy
(August 7, 1963 – August 9, 1963)

Gestational age: 34 weeks
Birth weight: 2,100 g

SURVIVAL RATE (infants with BW< 1000 g)
NICU, Pediatric Dpt. Padua University



Outcome of Extremely Preterm Infants

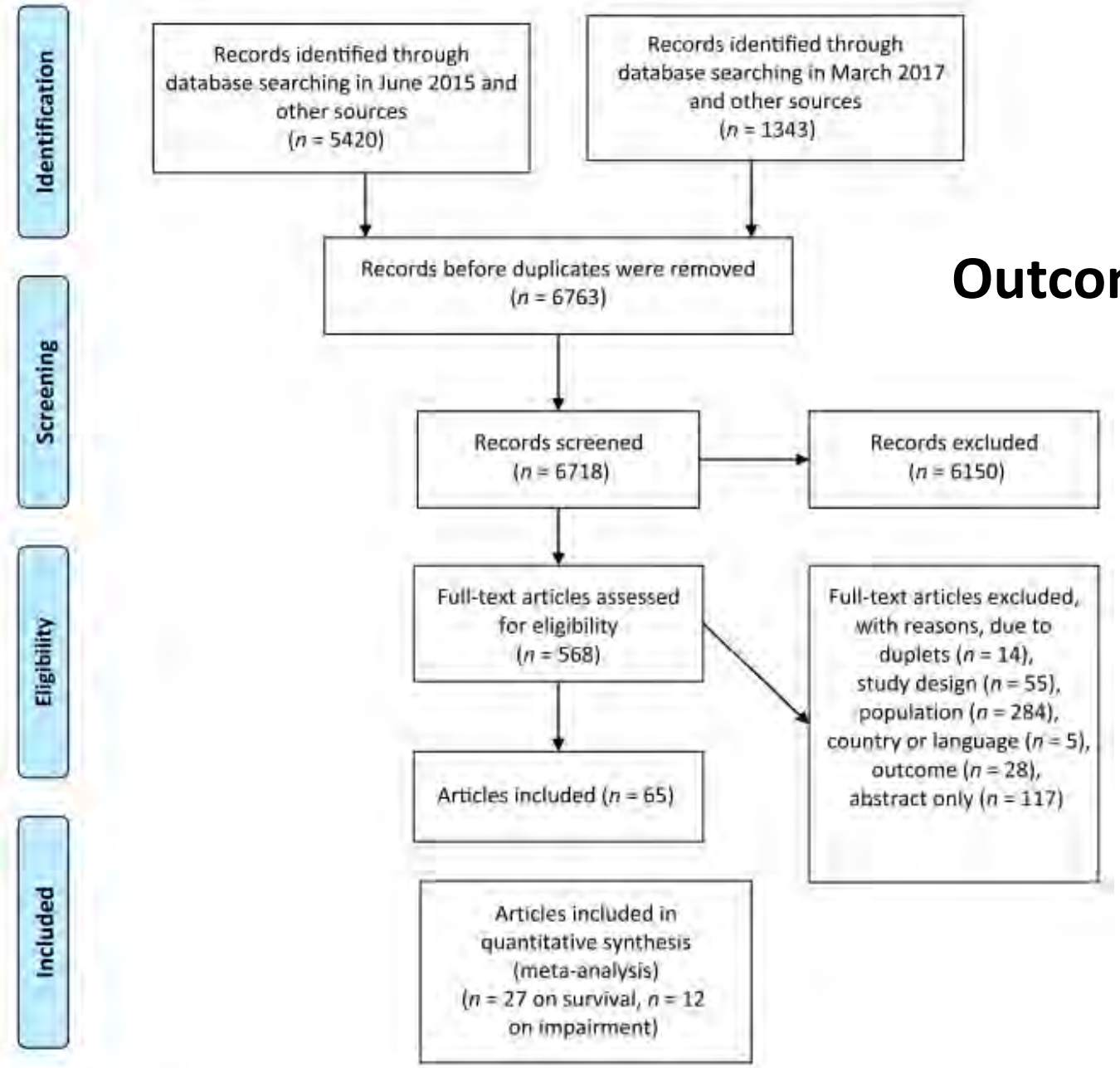


FIGURE 1

Myrhaug HT, Pediatrics 2019

Survival

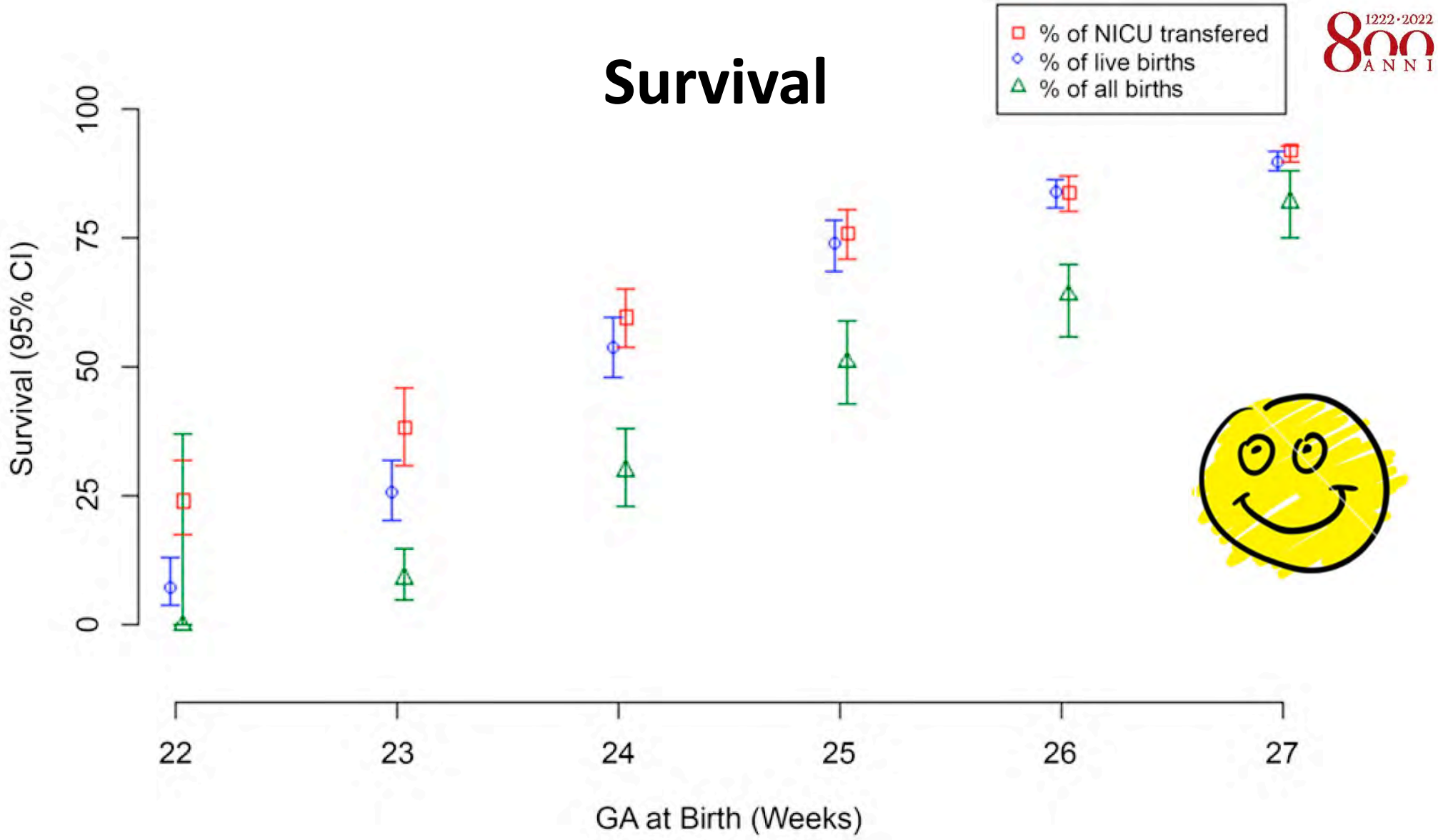


FIGURE 2

The overall prognosis of survival (risk and 95% CI) for children born at 22 to 27 weeks' GA calculated as proportions of all births, live-born infants, and infants transferred to a NICU nursery.

Myrhaug HT, Pediatrics 2019

Neurodevelopmental impairment

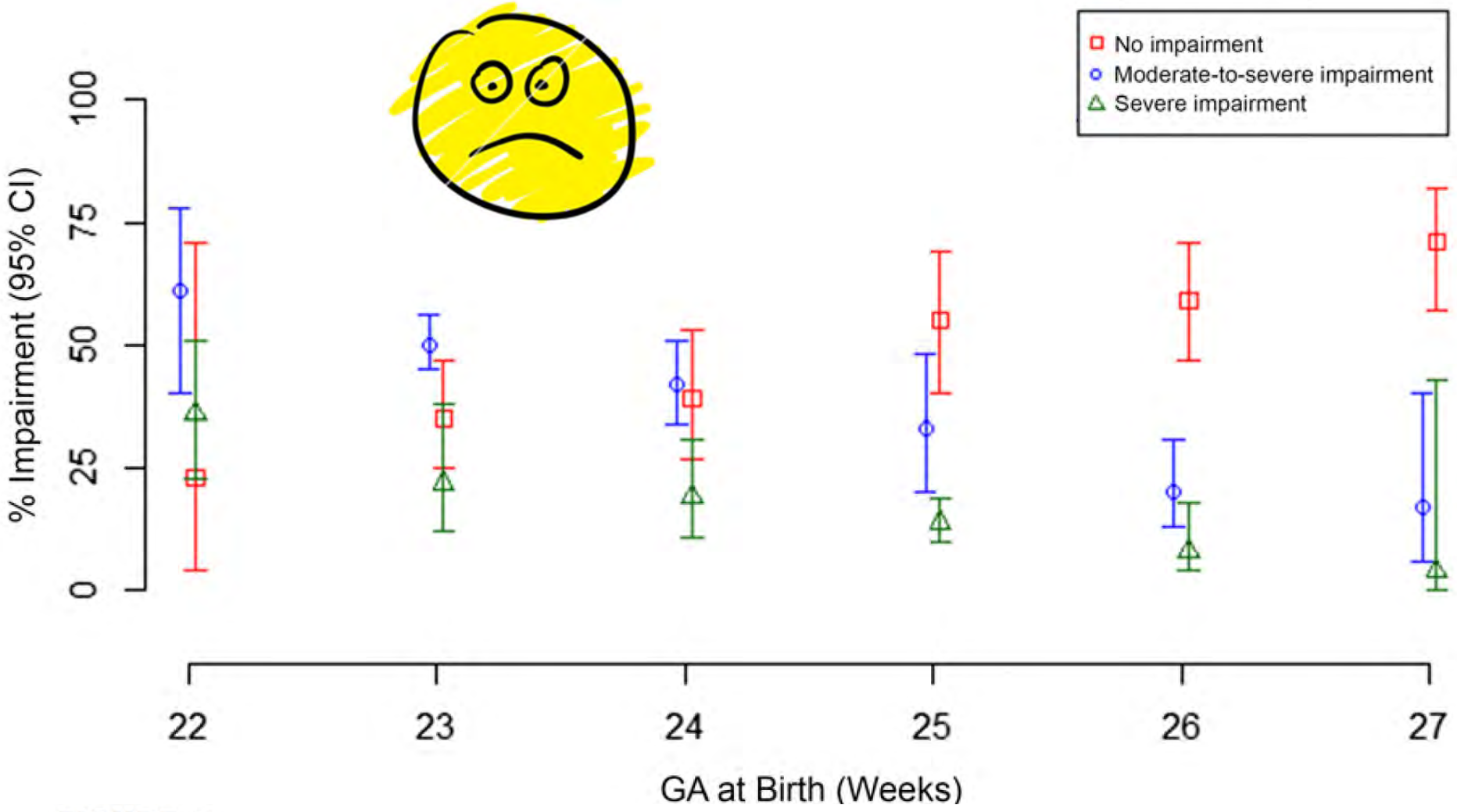


FIGURE 3

The overall risk of no, moderate-to-severe, and severe neurodevelopmental impairment according to GA of survivors at 18 to 36 months of age.

Myrhaug HT, Pediatrics 2019

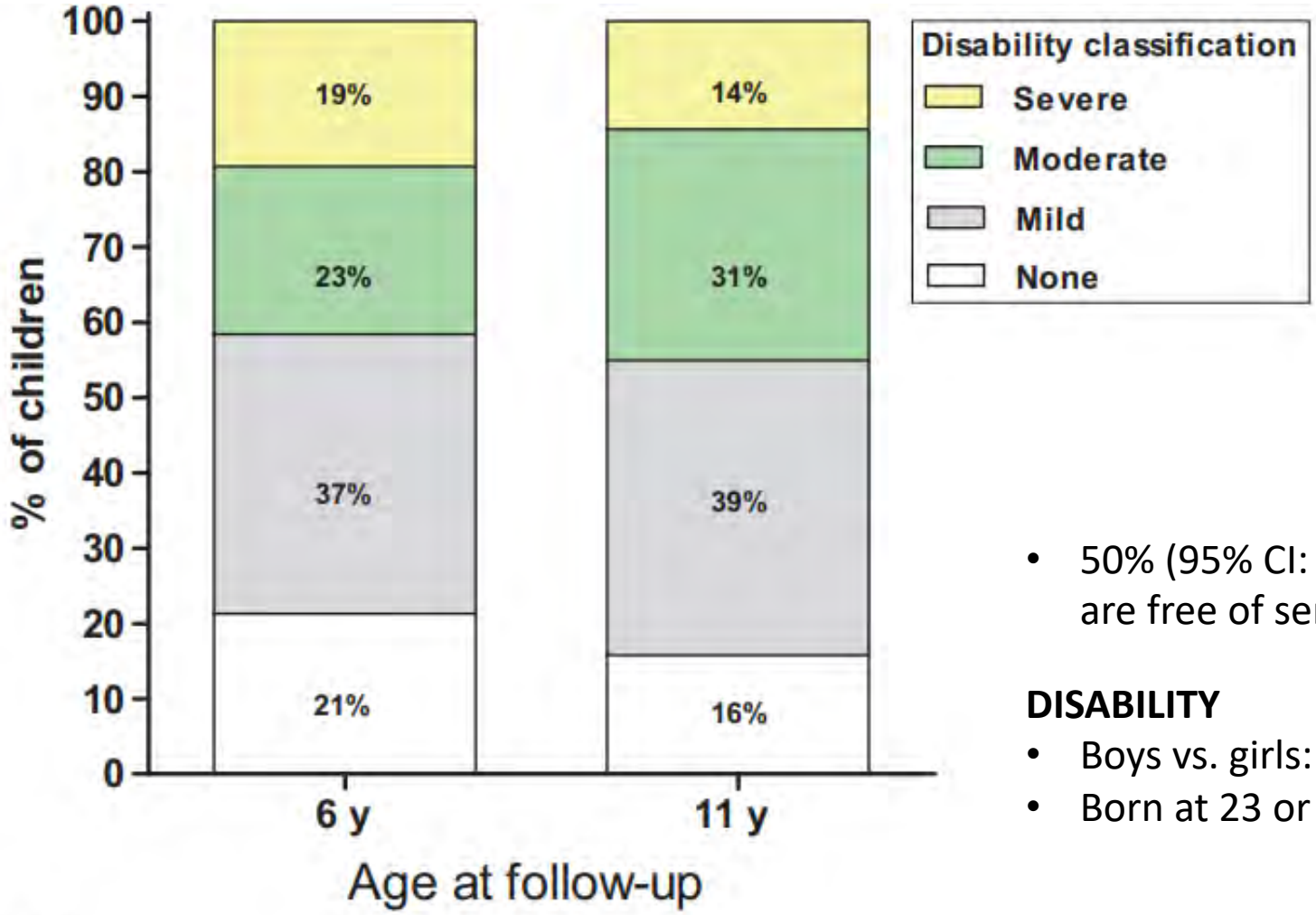


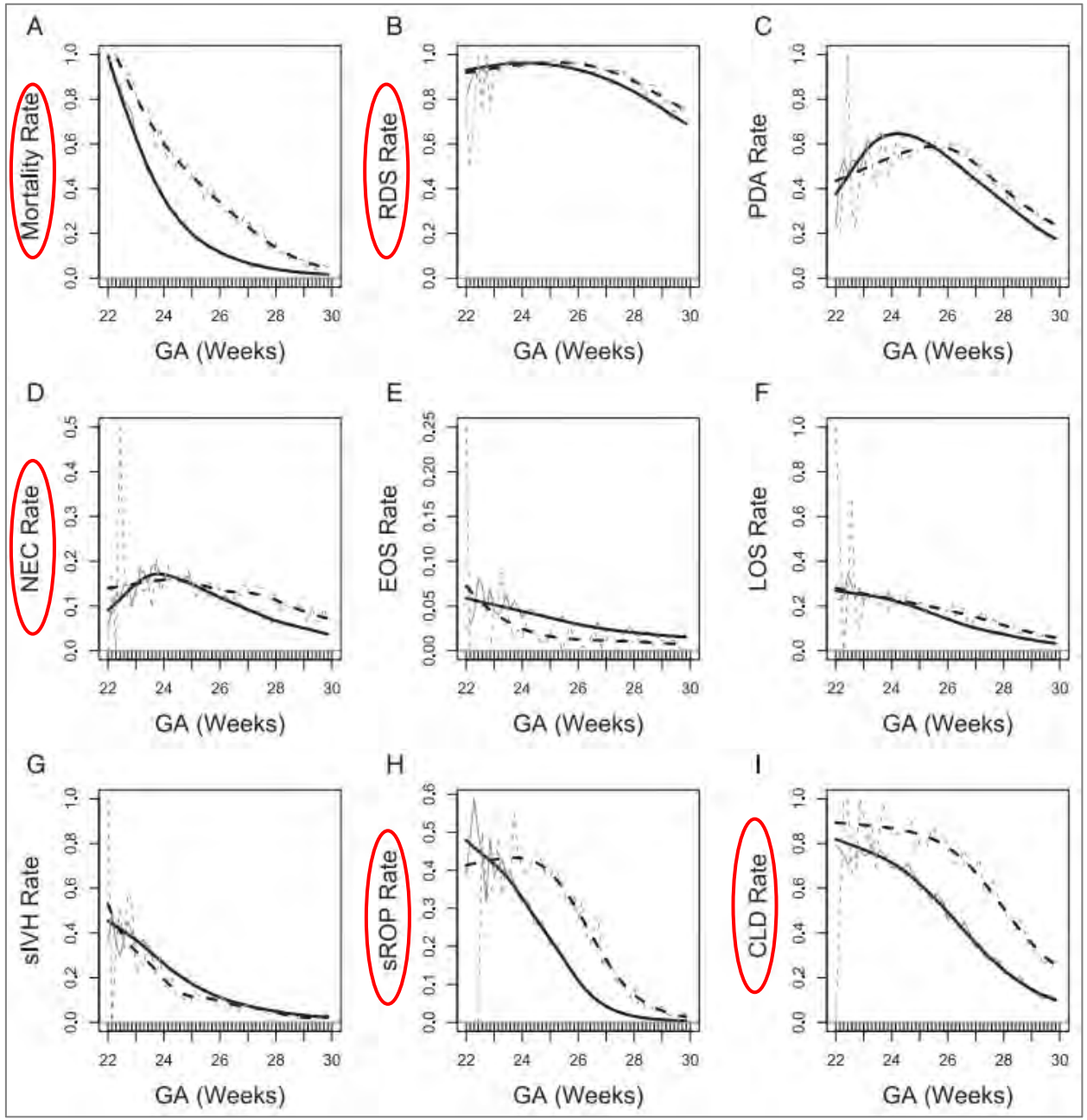
FIGURE 1
Distribution of composite disability in extremely preterm children assessed at both 6 and 11 years of age ($N = 202$).

- 50% (95% CI: 44%–57%) of extremely preterm children are free of serious disability at 11 years of age

DISABILITY

- Boys vs. girls: OR: 1.8 [95% CI: 1.0 –3.1])
- Born at 23 or 24 wks vs. 25 wks: OR: 1.8 [95% CI: 1.0 –3.1]

Johnson S, Pediatrics 2009



Morbidity and Mortality in Small for Gestational Age Infants at 22 to 29 Weeks' Gestation

Nansi S. Boghossian, PhD, MPH,[a] Marco Geraci, PhD,[a] Erika M. Edwards, PhD, MPH,[b,c,d] Jeffrey D. Horbar, MD[b,c]

FIGURE 3 Rates of outcomes among SGA and non-SGA infants by GA. A, Mortality rate. B, RDS rate. C, PDA rate. D, NEC rate. E, EOS rate. F, LOS rate. G, sIVH rate. H, sROP rate. I, CLD rate. The dashed line represents SGA infants and the solid line represents non-SGA infants. Note that rates for different outcomes are plotted on different scales.

Boghossian NS. Pediatrics 2018

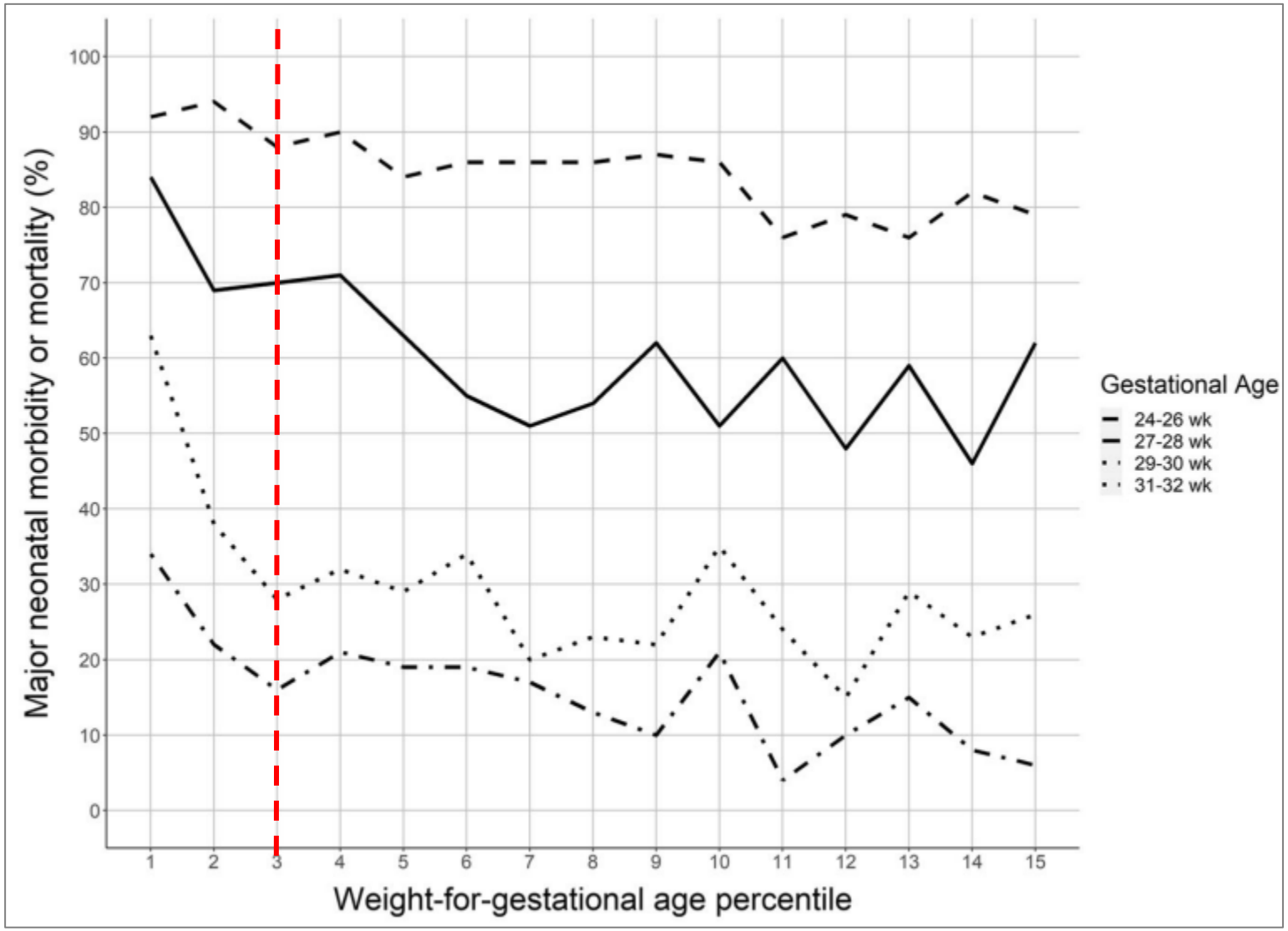
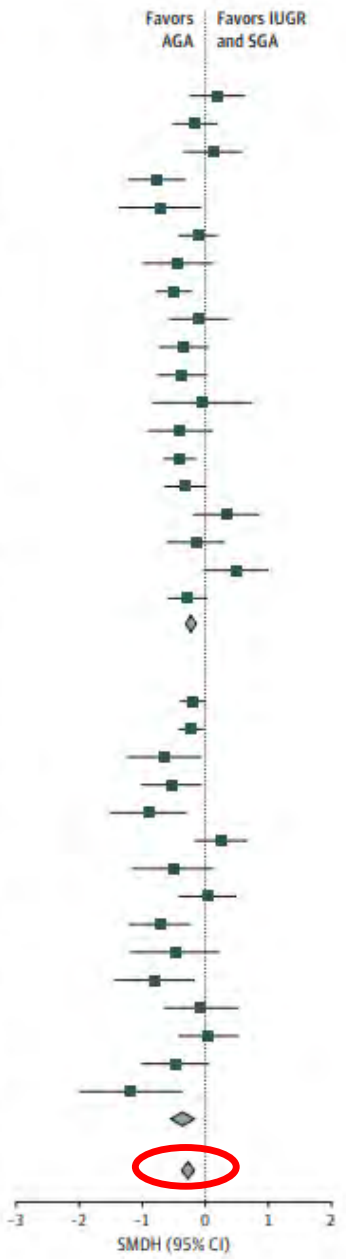


Fig. 1 Major neonatal morbidity or mortality as a function of weight for gestational age percentile. Incidence of major neonatal morbidity or mortality by weight for gestational age percentile among 4,771 early preterm (<32 weeks' gestation) infants after stratifying by gestational age.

Minor KC. J Perinatol 2022

Figure 2. Forest Plot for Cognitive Scores in Preterm Individuals Who Had Intrauterine Growth Restriction (IUGR) and Were Small for Gestational Age (SGA)

Study	Cognitive score, mean (SD) Control (AGA)	Target (IUGR and SGA)	SMDH (95% CI)
SGA			
Ballot et al,[22] 2017	92.4 (16.4)	95.4 (14.4)	0.19 (-0.25 to 0.63)
Koivisto et al,[23] 2015	92.2 (19.1)	88.9 (20.8)	-0.16 (-0.52 to 0.19)
Nogel et al,[24] 2015	89.8 (15.9)	91.4 (9.8)	0.12 (-0.34 to 0.58)
Feldman et al,[25] 2006	90.6 (11.0)	82.3 (10.2)	-0.77 (-1.23 to -0.31)
Geva et al,[26] 2009	115.3 (13.8)	105.1 (13.8)	-0.72 (-1.37 to -0.07)
Leppanen et al,[27] 2014	101.0 (16.9)	99.0 (17.6)	-0.12 (-0.43 to 0.20)
Tamaru et al,[28] 2011	94.4 (13.7)	88.4 (14.1)	-0.43 (-0.99 to 0.14)
Bickle Graz et al,[29] 2015	-0.4 (NA)	-0.6 (NA)	-0.50 (-0.79 to -0.21)
Mukhopadhyay et al,[30] 2010	80.8 (9.7)	79.7 (12.0)	-0.10 (-0.58 to 0.38)
Claas et al,[31] 2011	-0.1 (1.0)	-0.5 (1.0)	-0.35 (-0.74 to 0.05)
Claas et al,[72] 2011	98.0 (14.1)	92.5 (15.1)	-0.37 (-0.76 to 0.03)
Mikkola et al,[32] 2007	98.0 (15.0)	97.0 (24.0)	-0.05 (-0.84 to 0.74)
Batalle et al,[33] 2012	108.8 (12.5)	104.3 (9.4)	-0.40 (-0.93 to 0.13)
Gutbrod et al,[34] 2000	104.1 (18.2)	96.8 (17.2)	-0.41 (-0.67 to -0.15)
Tanis et al,[12] 2015	102.5 (9.9)	99.3 (10.4)	-0.31 (-0.65 to 0.02)
Filipouski et al,[35] 2013	83.1 (10.8)	87.6 (15.9)	0.33 (-0.20 to 0.86)
Raz et al,[36] 2012	101.9 (15.9)	99.2 (19.3)	-0.15 (-0.62 to 0.31)
Lahat et al,[37] 2015	94.5 (12.3)	100.3 (11.6)	0.48 (-0.03 to 1.00)
Ayoubi et al,[38] 2016	92.4 (10.7)	89.2 (10.7)	-0.28 (-0.59 to 0.03)
Random-effects model for subgroup SGA (Q_{18} = 33.09, P = .02; I^2 = 44.9%)			-0.23 (-0.36 to -0.10)
IUGR			
Cartwright et al,[39] 2019	100.5 (16.2)	97.5 (14.3)	-0.20 (-0.41 to 0.01)
Cartwright et al,[39] 2019	101.0 (16.1)	97.3 (16.1)	-0.23 (-0.43 to -0.02)
Morsing et al,[40] 2018	90.0 (13.0)	80.0 (17.0)	-0.65 (-1.24 to -0.06)
Scherjon et al,[41] 2000	96.0 (17.0)	87.0 (16.0)	-0.54 (-1.02 to -0.06)
Wienerroither et al,[42] 2001	95.5 (9.6)	86.7 (9.6)	-0.90 (-1.51 to -0.29)
Procianoy et al,[43] 2009	77.8 (3.3)	78.5 (2.0)	0.25 (-0.17 to 0.68)
Roelants-van Rijn et al,[44] 2004	104.0 (10.0)	99.0 (9.0)	-0.52 (-1.17 to 0.14)
Padilla et al,[45] 2010	98.4 (13.1)	98.8 (9.0)	0.04 (-0.42 to 0.49)
Morsing et al,[46] 2011	90.1 (14.2)	78.9 (16.6)	-0.72 (-1.21 to -0.22)
Padilla et al,[47] 2011	105.7 (10.3)	100.8 (9.3)	-0.48 (-1.19 to 0.22)
Leppanen et al,[48] 2010	106.2 (12.7)	94.1 (16.8)	-0.80 (-1.44 to -0.17)
Chen et al,[49] 2013	82.9 (15.6)	81.9 (13.7)	-0.07 (-0.66 to 0.52)
Chen et al,[49] 2013	82.9 (15.6)	83.6 (14.2)	0.05 (-0.44 to 0.53)
Morsing et al,[50] 2014	90.1 (14.0)	83.3 (14.0)	-0.48 (-1.02 to 0.06)
Morsing et al,[50] 2014	90.1 (14.0)	70.1 (19.0)	-1.18 (-2.00 to -0.35)
Random-effects model for subgroup IUGR (Q_{14} = 29.21, P = .01; I^2 = 58.3%)			-0.36 (-0.55 to -0.18)
Random-effects model for all studies (Q_{33} = 62.53, P < .001; I^2 = 48.1%)			-0.27 (-0.38 to -0.17)



Preterm-born individuals

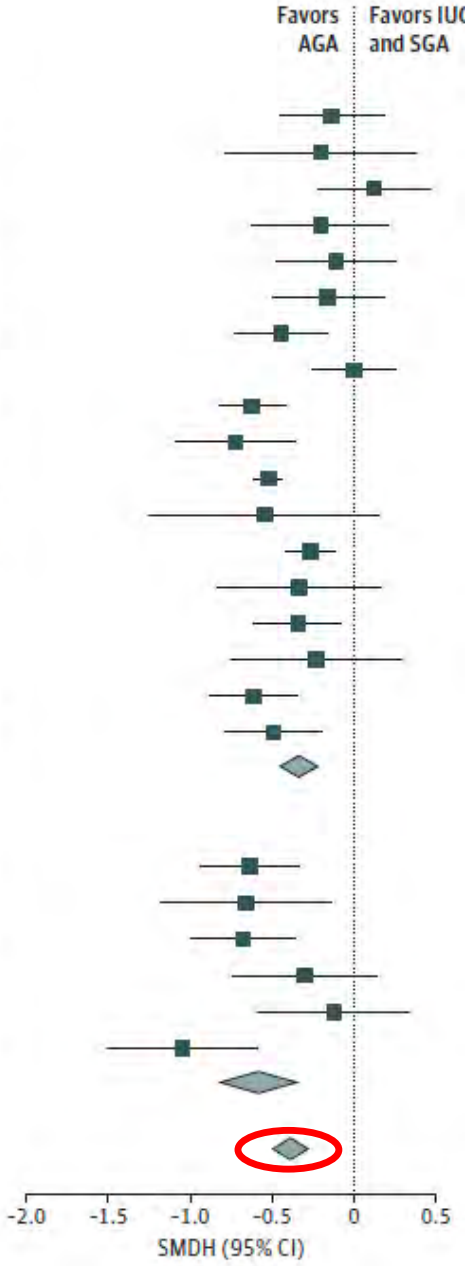
Cognitive scores:

IUGR/SGA vs AGA

Sacchi C. JAMA Pediatr 2020

Figure 3. Forest Plot for Cognitive Scores in Term-Born Individuals Who Had Intrauterine Growth Restriction (IUGR) and Were Small for Gestational Age (SGA)

Study	Cognitive score, mean (SD) Control (AGA)	Target (IUGR and SGA)	SMDH (95% CI)
SGA			
Bischoff et al,[51] 2017	98.5 (10.4)	97.0 (11.5)	-0.14 (-0.46 to 0.18)
Hartkopf et al,[52] 2018	103.0 (13.0)	100.0 (16.0)	-0.20 (-0.79 to 0.38)
Drews-Botsch et al,[53] 2011	76.3 (10.0)	78.1 (18.1)	0.12 (-0.22 to 0.47)
Drews-Botsch et al,[53] 2011	75.2 (13.6)	72.6 (11.5)	-0.20 (-0.62 to 0.21)
Drews-Botsch et al,[53] 2011	101.8 (15.3)	100.1 (15.4)	-0.11 (-0.48 to 0.26)
Drews-Botsch et al,[53] 2011	95.7 (14.3)	93.1 (18.0)	-0.16 (-0.50 to 0.18)
Hollo et al,[54] 2002	96.9 (10.5)	92.0 (11.3)	-0.45 (-0.73 to -0.16)
Rao et al,[55] 2002	109.0 (15.0)	109.0 (16.2)	0.00 (-0.25 to 0.25)
Rao et al,[55] 2002	109.0 (15.0)	100.0 (13.8)	-0.62 (-0.83 to -0.42)
Peng et al,[56] 2005	114.5 (9.8)	104.2 (17.4)	-0.72 (-1.09 to -0.36)
Pylipow et al,[57] 2009	97.2 (14.3)	90.0 (13.6)	-0.52 (-0.61 to -0.43)
Gagliardo et al,[58] 2006	90.0 (11.6)	84.0 (9.8)	-0.55 (-1.24 to 0.15)
Sommerfelt et al,[59] 2000	110.0 (15.0)	106.0 (15.0)	-0.27 (-0.42 to -0.11)
Leitner et al,[60] 2000	107.0 (13.9)	102.5 (12.5)	-0.34 (-0.83 to 0.16)
Nomura et al,[61] 2009	93.4 (11.8)	89.2 (12.7)	-0.34 (-0.61 to -0.08)
Batalle et al,[62] 2013	102.8 (15.5)	99.1 (16.5)	-0.23 (-0.75 to 0.29)
Savchev et al,[63] 2013	102.2 (16.2)	92.9 (14.0)	-0.61 (-0.88 to -0.34)
Mello et al,[64] 2014	91.4 (9.8)	86.4 (10.0)	-0.49 (-0.79 to -0.20)
Random-effects model for subgroup SGA (Q_{17} = 48.51, P <.001; I^2 = 66.6%)			-0.34 (-0.45 to -0.22)
IUGR			
Geva et al,[65] 2006	107.3 (10.5)	99.4 (13.9)	-0.64 (-0.94 to -0.34)
Zuk et al,[66] 2003	96.0 (4.0)	90.0 (12.0)	-0.66 (-1.18 to -0.14)
Leitner et al,[67] 2007	107.5 (10.4)	99.8 (12.1)	-0.68 (-1.00 to -0.36)
Leitner et al,[60] 2000	107.0 (13.9)	102.5 (15.5)	-0.30 (-0.75 to 0.14)
Bellido-Gonzalez et al,[68] 2017	103.3 (13.2)	101.6 (14.2)	-0.12 (-0.58 to 0.34)
Bellido-Gonzalez et al,[68] 2017	103.3 (13.2)	89.3 (13.1)	-1.05 (-1.51 to -0.59)
Random-effects model for subgroup IUGR (Q_5 = 9.85, P = .08; I^2 = 50.0%)			-0.58 (-0.82 to -0.35)
Random-effects model for all studies (Q_{23} = 63.18, P <.001; I^2 = 67.6%)			-0.39 (-0.50 to -0.28)



Term-born individuals

Cognitive scores:

IUGR/SGA vs AGA

Sacchi C. JAMA Pediatr 2020

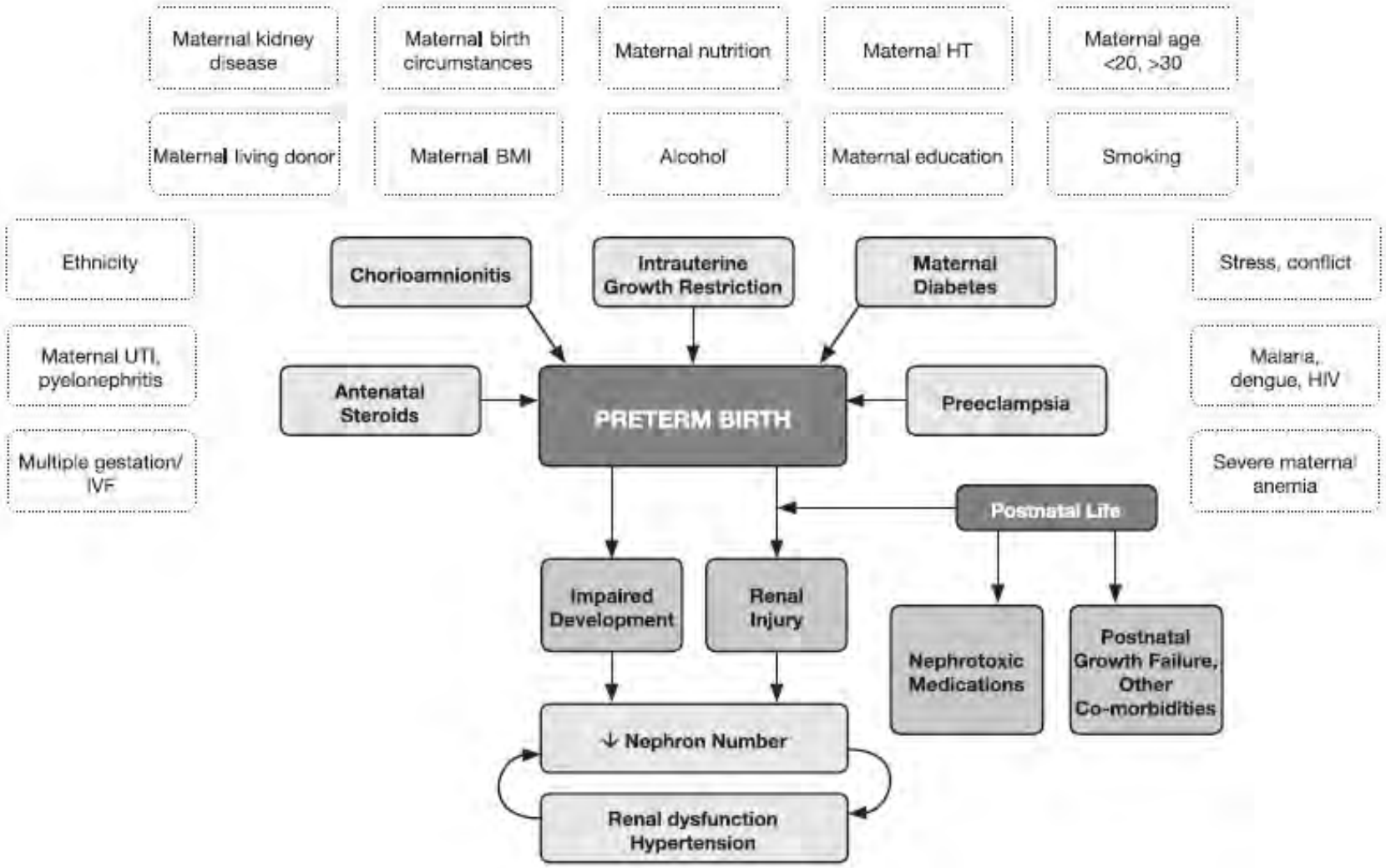


Figure 1. Risk factors for preterm birth and factors impacting renal programming in the infant. Adapted with permission from Sutherland et al.[15] BMI, body mass index; HIV, human immunodeficiency virus; HT, hypertension; IVF, in vitro fertilization; UTI, urinary tract infection.

Luyckx VA, Seminars in Nephrol 2017

Glomerular count in relation to gestational age

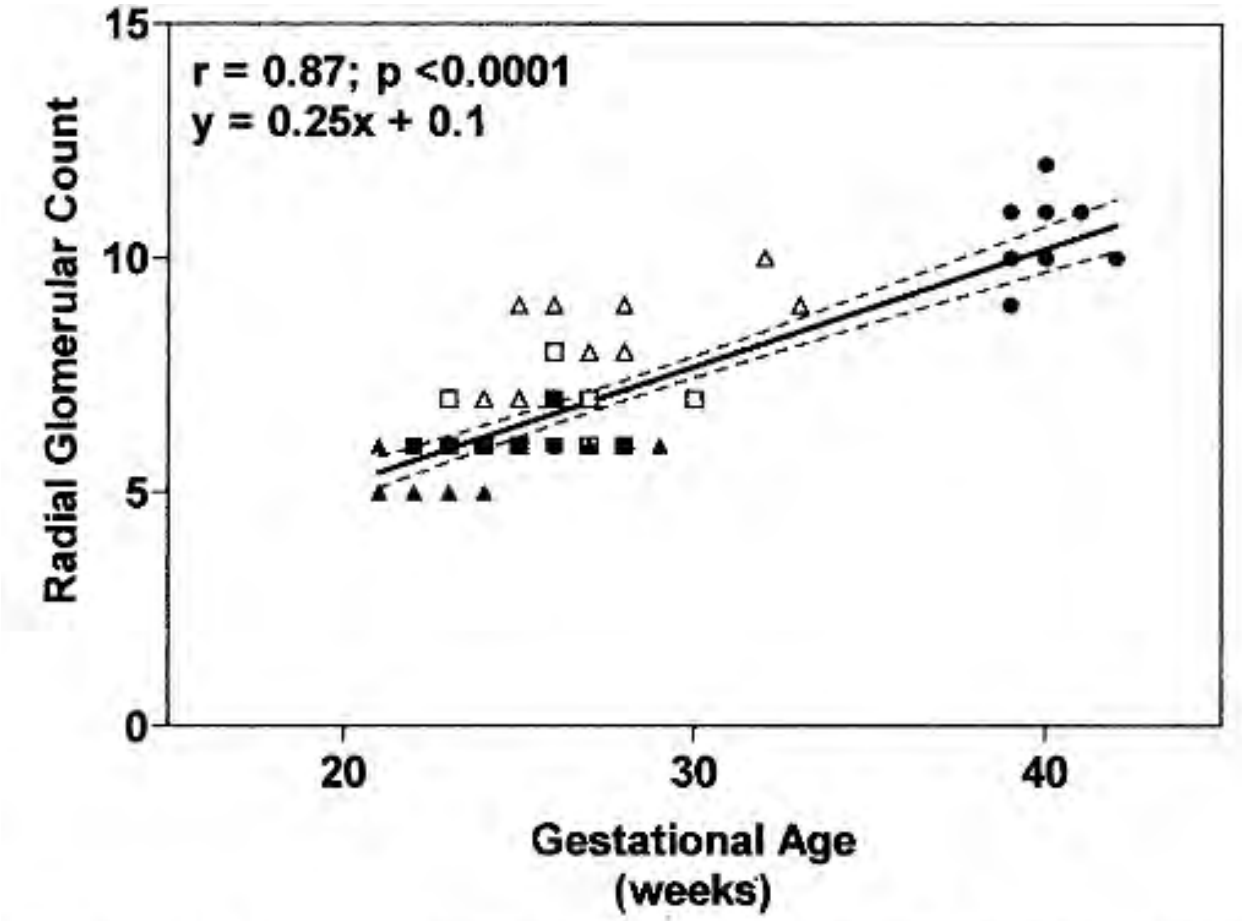


Figure 3 Linear regression analysis of radial glomerular counts with increasing gestational age; $r = 0.87$; $n = 66$; $P < 0.0001$; $y = 0.25x + 0.1$. Closed triangles, group 1A; closed squares, group 1B; open squares, group 2A; open triangles, group 2B; and closed circles, group 3.

Rodriguez MM. Pediatr Dev Pathol 2004

THE JOURNAL OF PEDIATRICS • www.jpeds.com ORIGINAL ARTICLES

Preterm Birth as a Risk Factor for Metabolic Syndrome and Cardiovascular Disease in Adult Life: A Systematic Review and Meta-Analysis

Panagiota Markopoulou, MD, MSc[1], Eleni Papanikolaou, PhD[2], Antonis Analytis, PhD[3], Emmanouil Zoumakis, PhD[1], and Tania Siahanidou, MD, PhD[1]

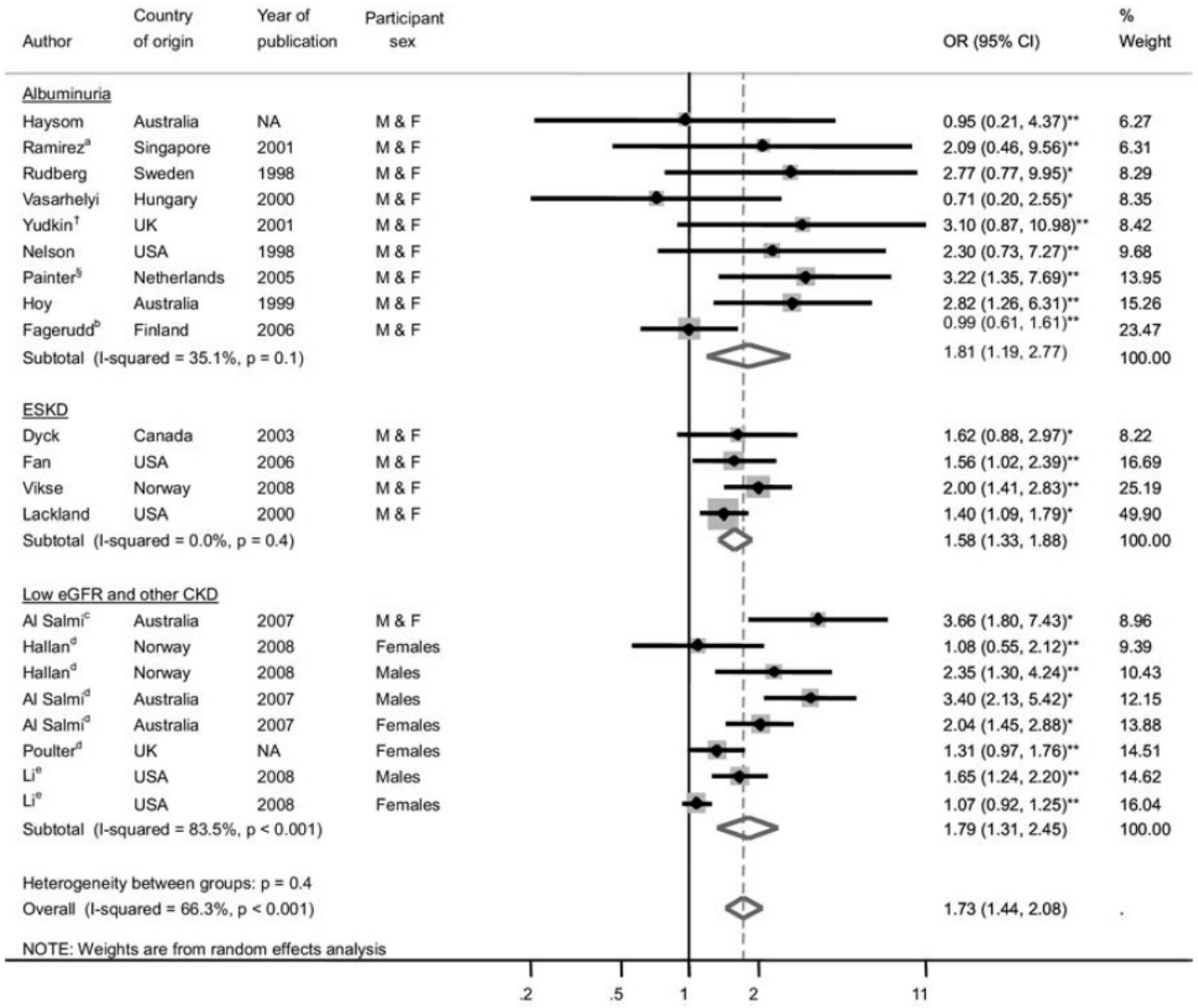
Fat mass	p=.03
SBP	p<.0001
DBP	p<.0001
24-hour SBP	p<.001
24-hour DBP	p<.001
Fasting glucose	p<.01
Insulin	p<.002

43 studies

Preterm adults	Vs	Term born adults
n. 18 295		n. 294 063

Markopoulou P. J Pediatr 2019

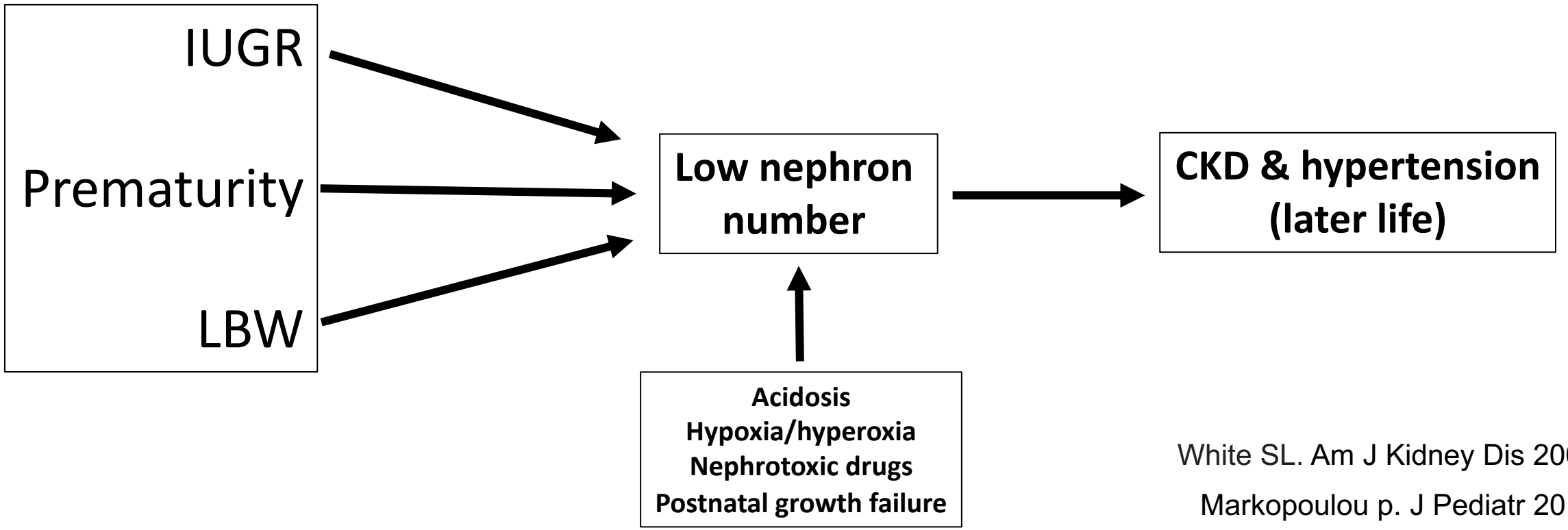
Low Birth Weight and Risk of CKD



31 relevant cohort or case-control studies

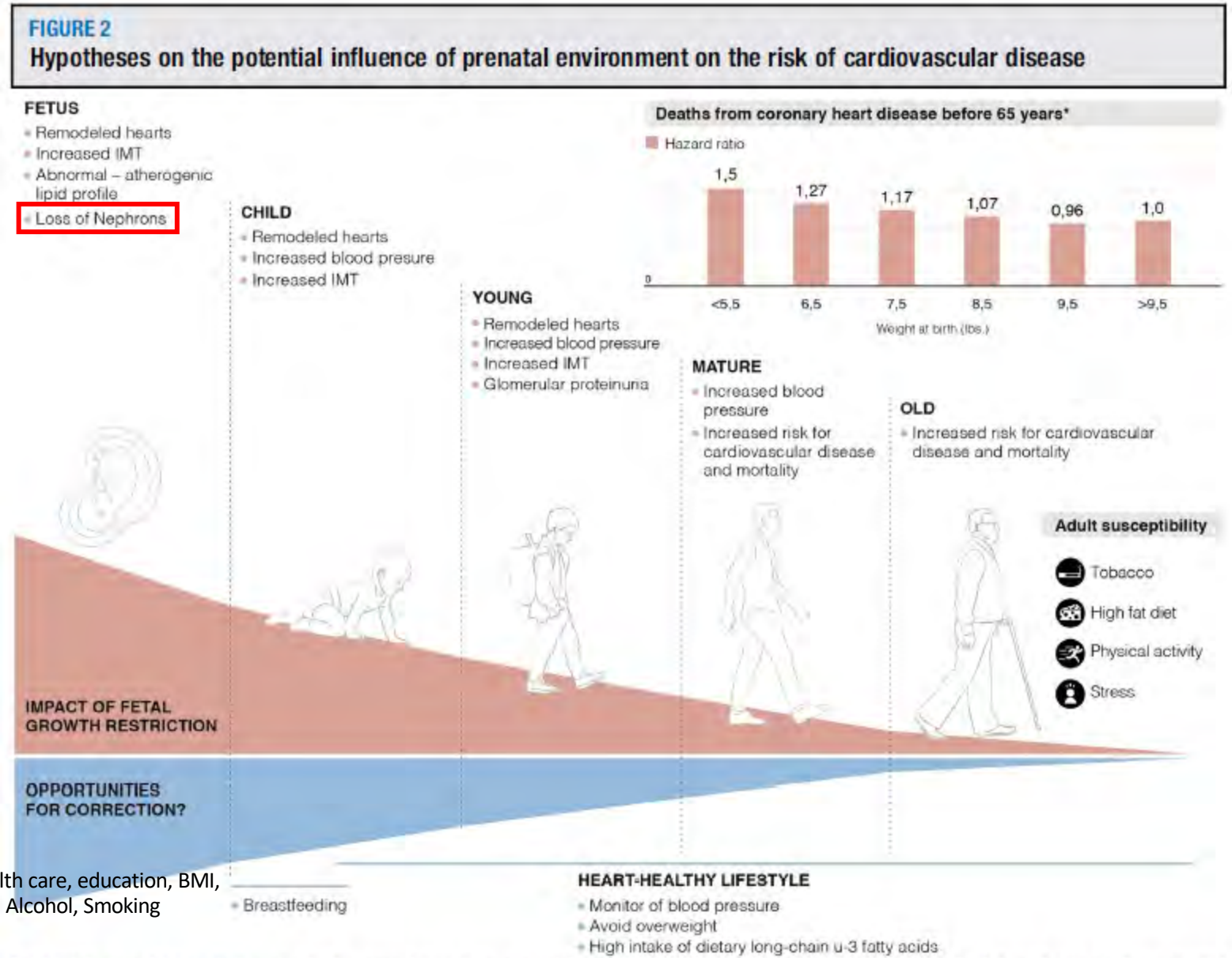
Figure 2. Odds ratios (ORs) and 95% confidence intervals (CIs) for risk of chronic kidney disease (CKD) associated with low versus normal birth weight.

White SL. Am J Kidney Dis 2009



White SL. Am J Kidney Dis 2009
Markopoulou p. J Pediatr 2019
Rodrıguez MM. Pediatr Dev Pathol 2004
Luyckx VA. Lancet. 2017
Piccoli GB. J Clin Med 2022

PRECONCEPTIONAL PERIOD



Maternal health care, education, BMI, nutrition, IPT, Alcohol, Smoking

Epidemiologic evidence that supports the association between fetal growth and cardiovascular risk (**upper panel**). A hypothesis on the potential combination of the prenatal effects of fetal growth restriction with cardiovascular health and risk factors during lifetime and the potential influence of preventive strategies. *Calculated from[4].

IMT, intima media thickness.

Crispi F, AJOG 2017 (modified)

Prematurity
in low-resource settings

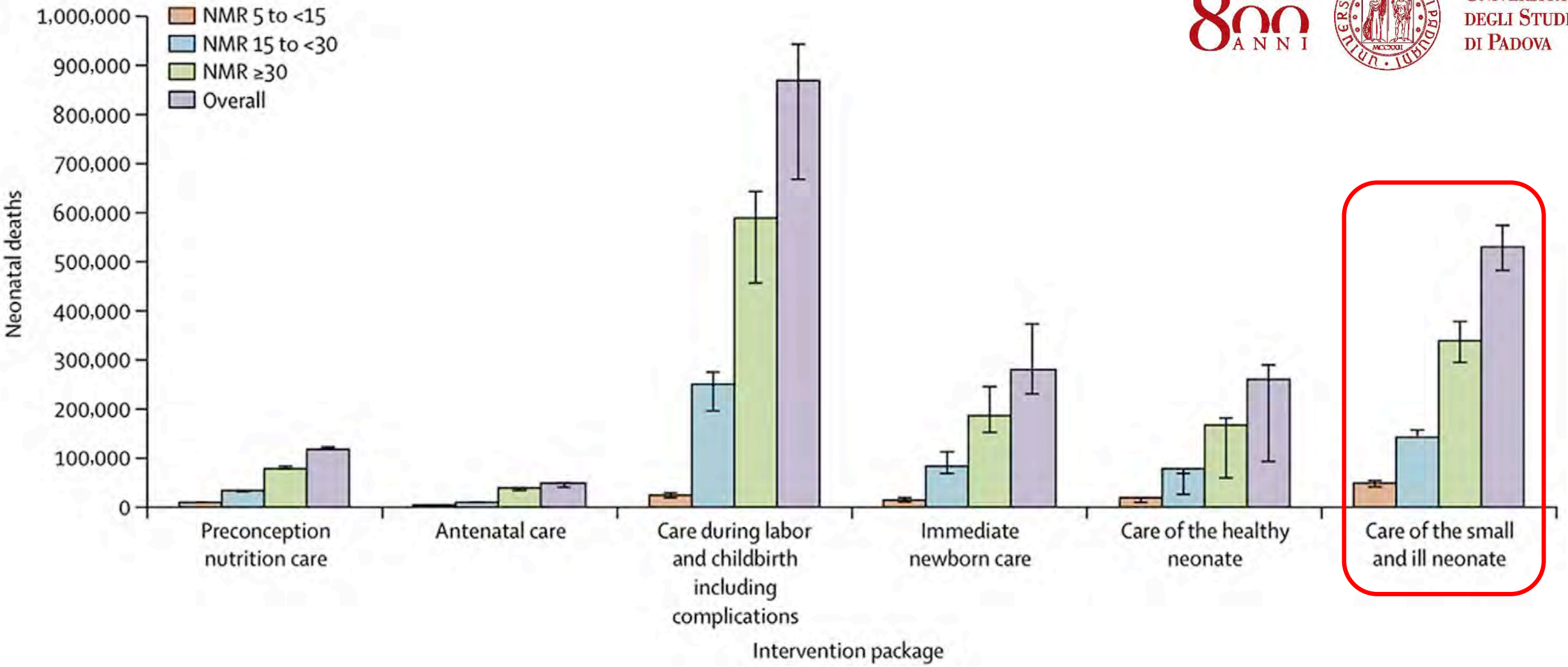


Fig. 1. Estimated impact of interventions on the intrapartum-related neonatal deaths. NA, not applicable. (*From* Bhutta ZA, Das JK, Bahl R, et al. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? Lancet 2014;384(9940):362; with permission.)

PERINATAL LESSONS FROM THE PAST

Dr Mary Crosse, OBE, MD (1900–1972) and the premature baby

P M Dunn

Arch Dis Child Fetal Neonatal Ed 2007;**92**:F151–F153. doi: 10.1136/adc.2005.077529

Figure 1 Dr Victoria Mary Crosse (1900–1972).

Sorrento Prematurity Baby Unit
1929 (Birmingham, UK)

Dunn PM, ADC Fetal Neonatal Ed 2007

Neo-natal Mortality according to Birth-weight (Grammes)

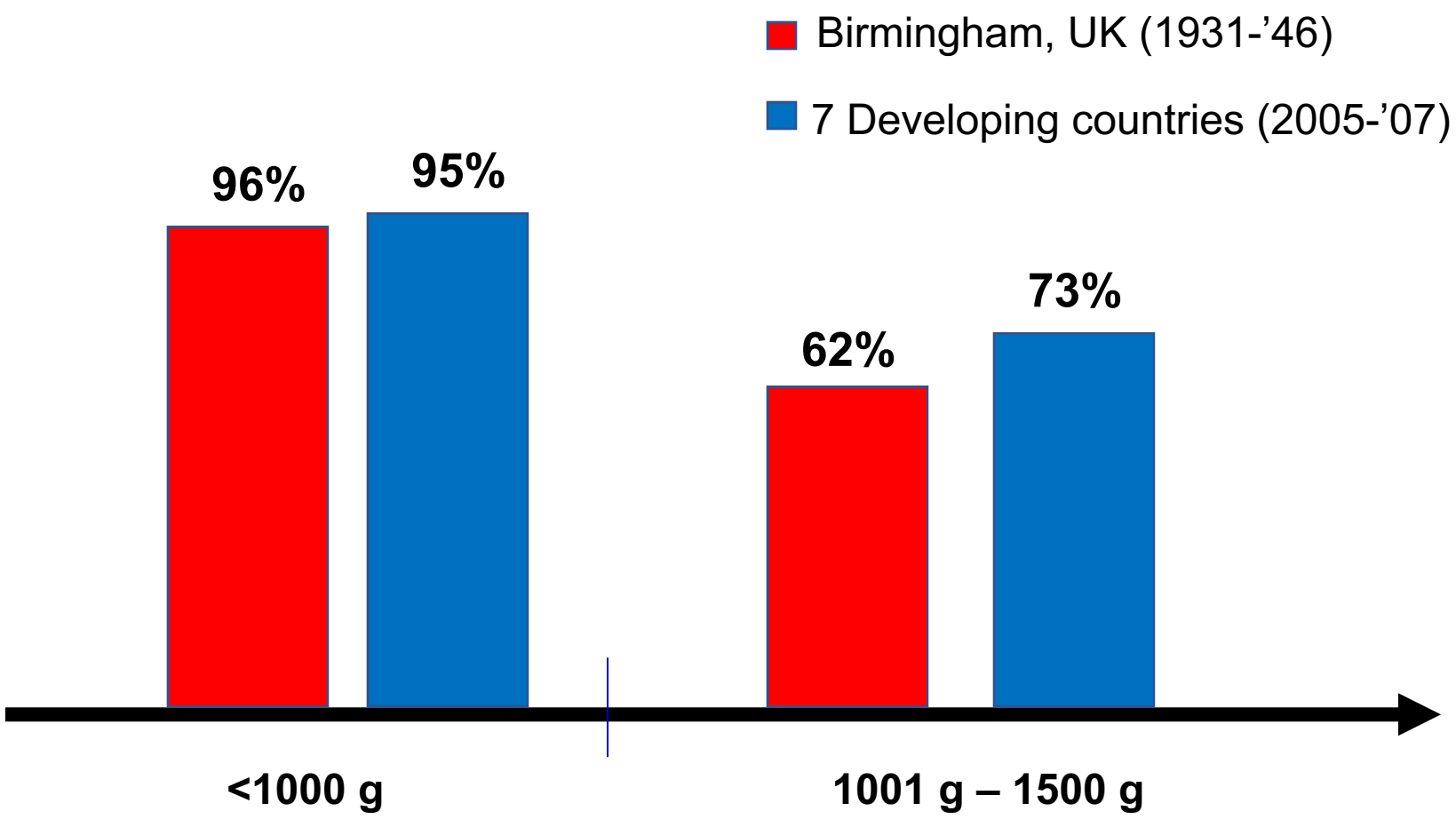
Birth-weight (in Grammes)	Premature Baby Unit, 1931–46		Premature Babies Born Alive in Sorrento Maternity Home, 1931–46	
	Cases	Mortality per Cent.	Cases	Mortality per Cent.
Up to 1,000 g. (2 lbs. 3 oz.) .	141	95·0	21	96·6
1,000–1,500 g. (3 lbs. 4 ozs.) .	677	61·2	94	62·7
1,500–2,000 g. (4 lbs. 6 ozs.) .	1,465	26·7	238	20·1
2,000–2,500 g. (5 lbs. 8 ozs.) .	932	16·7	788	3·8
All weights	3,215	32·9	1,141	13·4

Figure 2 Neonatal mortality for the Sorrento Premature Baby Unit, 1931–1946.

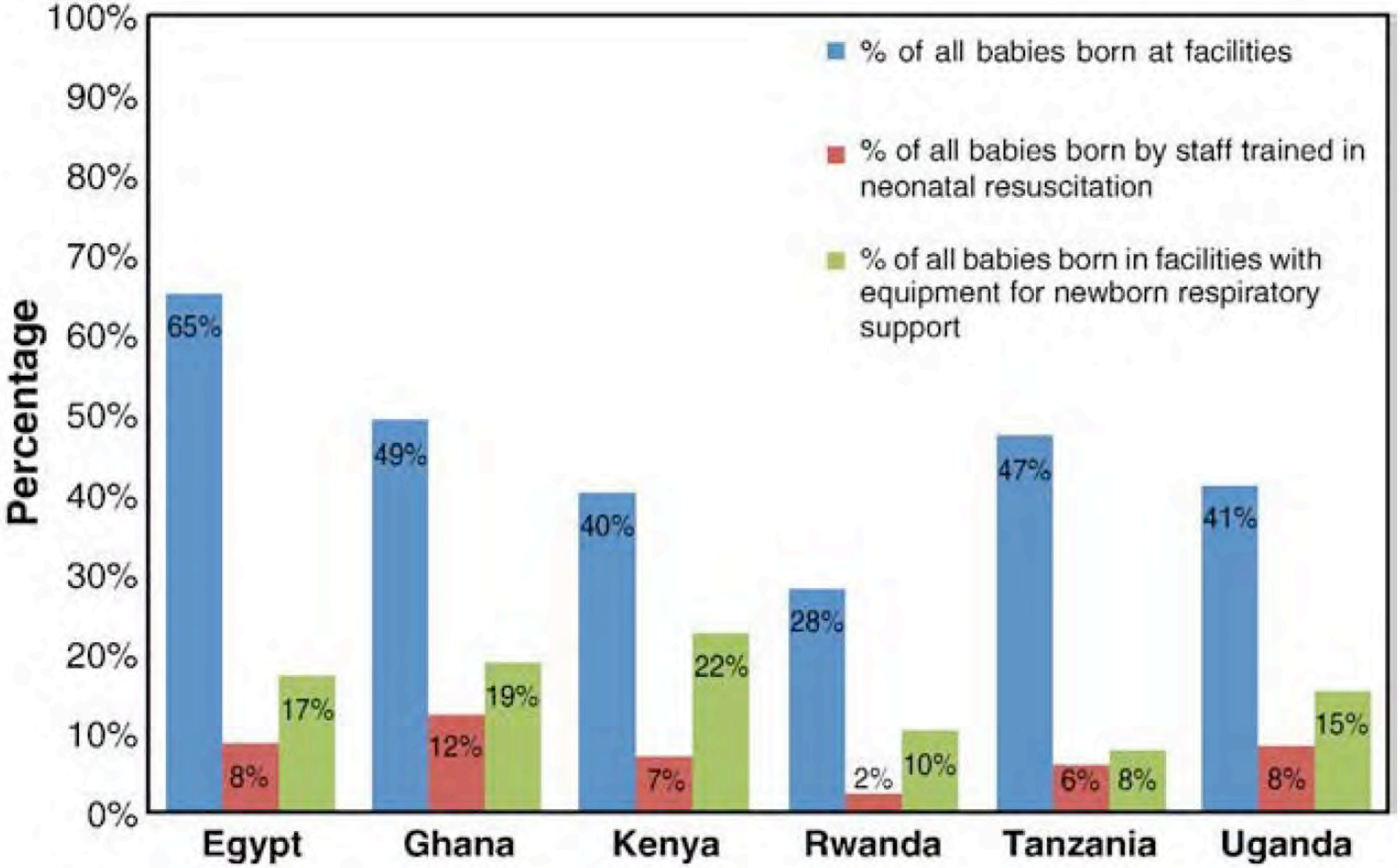
Dunn PM, ADC Fetal Neonatal Ed, 2007

PRETERM BABIES: what is our goal ?

Mortality rate:



Dunn PM, ADC Fetal Neonatal Ed 2007
Carlo W, Pediatrics 2010



Wall SN, Int J Obstet Gynecol 2009

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NICU, Padua, Italy

Panel 1: WHO's 11 new recommendations and good practice statement for care of preterm or low birthweight infants

Recommendation on immediate KMC
KMC for preterm or LBW infants should be started as soon as possible after birth

Recommendation on probiotics
Probiotics may be considered for human-milk-fed preterm infants <32 weeks' gestation

Recommendation on emollients
Application of topical oil to the body of preterm or LBW infants may be considered

Recommendation c
CPAP therapy may b
very preterm infants
respiratory distress

Recommendation c
For preterm infants
therapy, bubble CPA
pressure sources (eg, ventilator CPAP)

Recommendation on methylxanthines for apnoea treatment
Caffeine is recommended for the treatment of apnoea in preterm infants <37 weeks' gestation

Recommendation on methylxanthines for extubation
Caffeine is recommended for the extubation of preterm infants <34 weeks' gestation

Recommendation on methylxanthines for apnoea prevention
Caffeine may be considered for the prevention of apnoea in preterm infants <34 weeks' gestation

Recommendation on family involvement
Family involvement in the routine care of preterm or LBW infants in health-care facilities is recommended

Recommendation on family support

- Kangaroo Mother Care
- Continuous positive airway pressure (CPAP)
- Caffeine
- Family involvement
- Family support

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Good practice statement on parental leave and entitlements
Parental leave and entitlements should address the special needs of mothers, fathers, and other primary caregivers of preterm or LBW infants

KMC=kangaroo mother care. LBW=low birthweight. CPAP=continuous positive airway pressure.

New WHO Recommendations, Lancet 2022

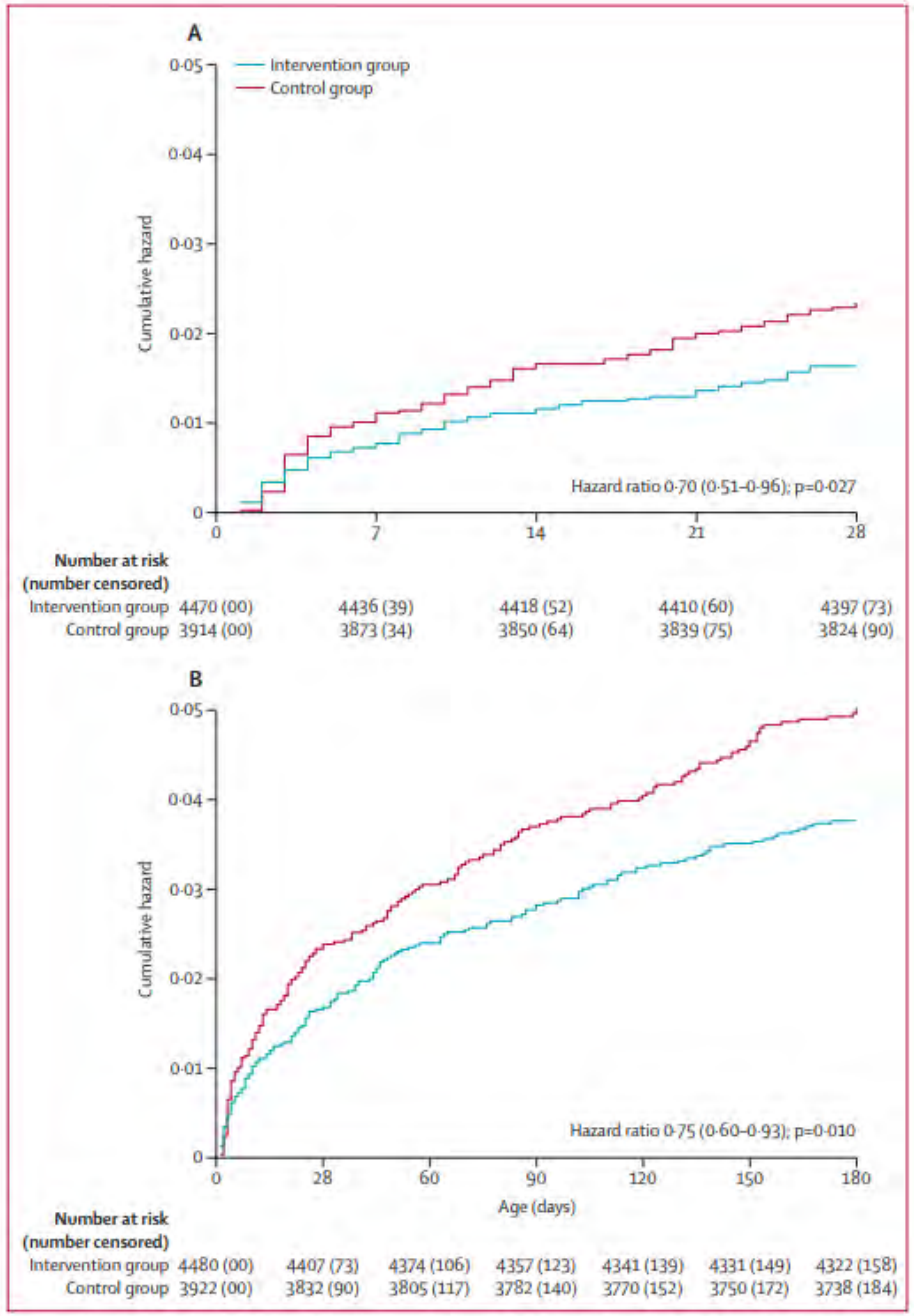


Figure 2: **Cumulative hazard of death from enrolment to age 28 days (A) and from enrolment to age 180 days (B)**

Effect of community-initiated kangaroo mother care on survival of infants with low birthweight: a randomised controlled trial

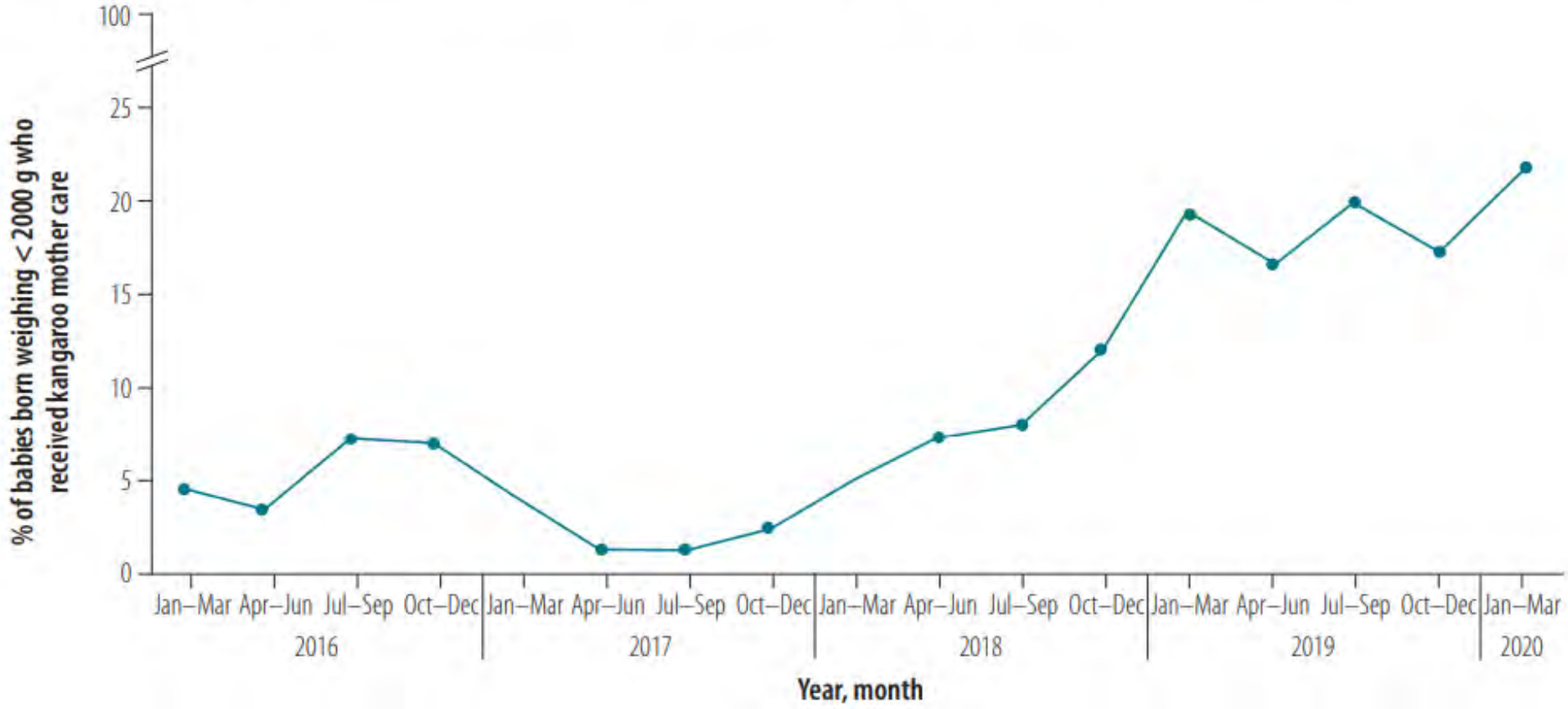
Sarmila Mazumder, Sunita Taneja, Brinda Dube, Kiran Bhatia, Runa Ghosh, Medha Shekhar, Bireshwar Sinha, Rajiv Bahl, Jose Martines, Maharaj Kishan Bhan, Halvor Sommerfelt, Nita Bhandari

Mazumder S, Lancet 2019

Implementation research on kangaroo mother care, Bangladesh

ANM Ehtesham Kabir,[a] Sharmin Afroze,[b] Zubair Amin,[c] Agnihotri Biswas,[c] Sabina Ashrafee Lipi,[d] Mahbuba Khan,[e] Khaleda Islam,[d] Shamsul Haque,[f] MAK Azad Choudhury[g] & Mohammod Shahidullah[h]

Fig. 3. **Percentage of eligible babies who received kangaroo mother care, Bangladesh, January 2016 to March 2020**



Ehtesham Kabir, Bull World Health Organ 2022

Continuous positive airway pressure (CPAP)

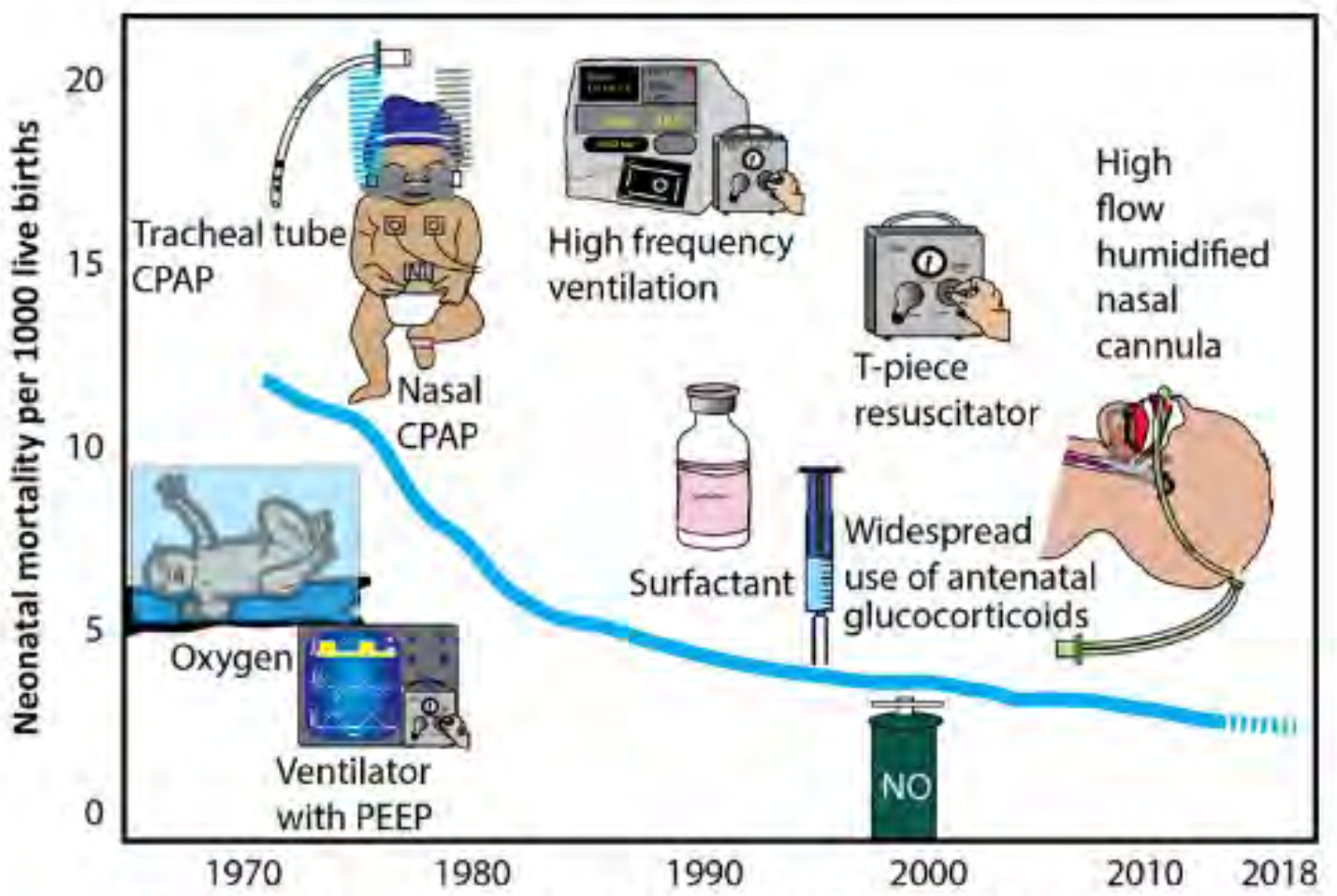


FIG. 2.8 Graph Showing Neonatal Mortality Rate and Various Innovations in Neonatal Respiratory Care.

CPAP, Continuous positive airway pressure. Copyright: Satyan Lakshminrusimha.

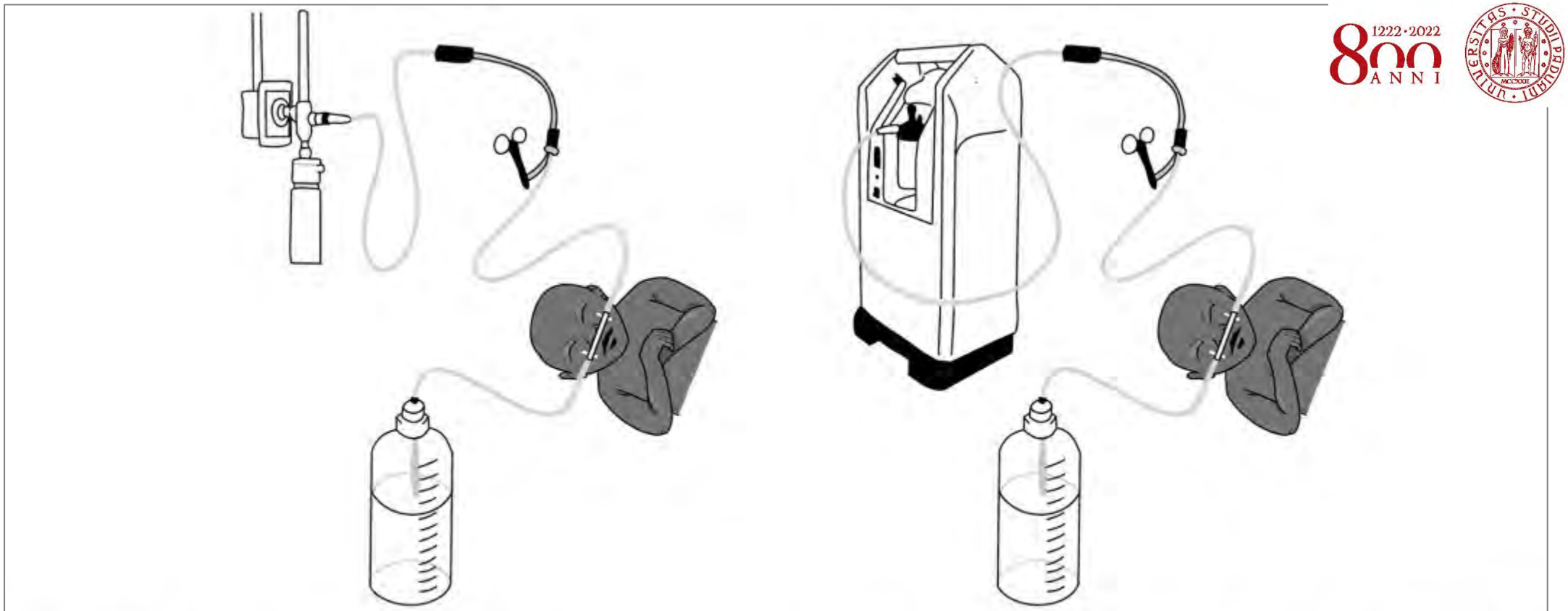


FIGURE 4 Improvised bubblecontinuous positive airway pressure based on inexpensive nasal prongs and a cylinder (left) or an oxygen concentrator (right).

TABLE 2 Characteristics of bCPAP systems specifically designed for LMICs

	Baby CPAP	Dolphin CPAP	Pumani	Vayu
Price	2400$[a]	3300$[b]	950$[b]	NA

Poletto S, Trevisanuto D, Pediatr Pulmonol 2022

Implementation of the bubble CPAP in a low-resource setting neonatal unit: technology is not enough

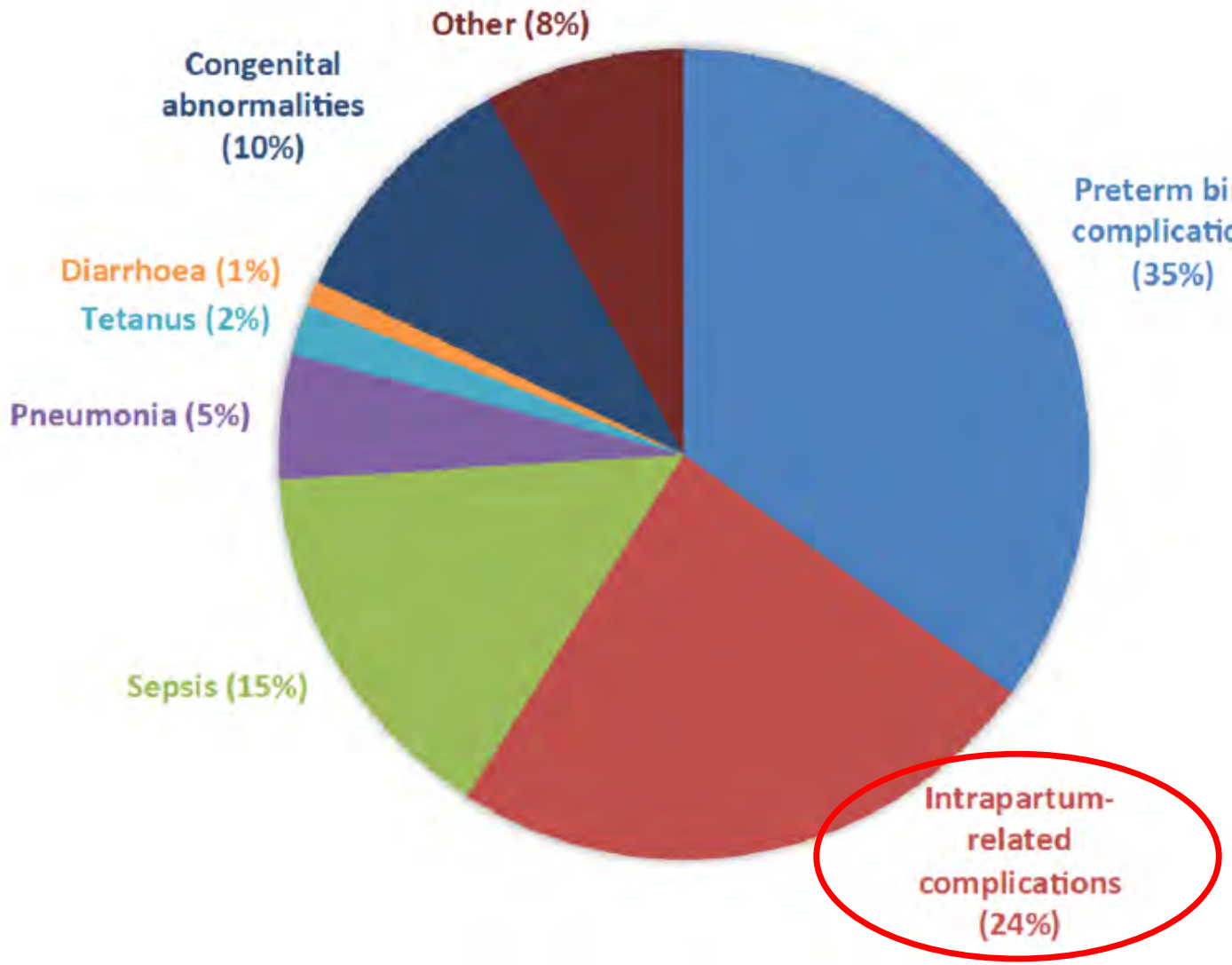
Table. Admissions and mortality before (2016-2018) and after (2019-2020) CPAP introduction at HOSCO

Birth weight	Admissions in 2016-2018		Admissions in 2019-2020			
	Admissions	Deaths among admitted	Admissions	Received CPAP	Deaths among admitted	CPAP treated deaths
<1500 grams	1,043	640/1,040 (62%)	673	151/654 (23%)	427/669 (64%)	135/150 (90%)
1500-2500 grams	616	140/616 (23%)	365	11/353 (3%)	94/365 (26%)	10/11 (91%)
>2500 grams	534	98/533 (18%)	480	17/463 (4%)	86/479 (18%)	15/17 (88%)
Total	2,204	886/2,200 (40%)	1,518	179/1,470 (12%)	607/1,513 (40%)	160/178 (90%)

In 2019, **9 CPAP machines** were introduced at Saint Camille Hospital Ouagadougou (HOSCO), Burkina Faso

Villani PE. (unpublished data)

Causes of neonatal mortality



Levels & Trends in Child Mortality. Report 2020.
UNICEF, WHO, World Bank Group

Multi-system Organ Injuries

	Vulnerability	Clinical presentation	Recoverability
Brain	++++	Apnea, hypoxia, encephalopaty Coma, seizures	+
Kidneys	+++	Acute renal failure	+++
Lungs	+++	PPHN, ALI, ARDS	++++
Liver	++	Transaminase derangement, coagulapy	++++
Heart	++	Cardiogenic shock, valvular regurgitation	++++
Heme	++	Thrombocytopenia, DIC	++++
Vascular	++	Caplillary leak, sclerema	++++
GI tract	++	Feeding intolerance, NEC	++++

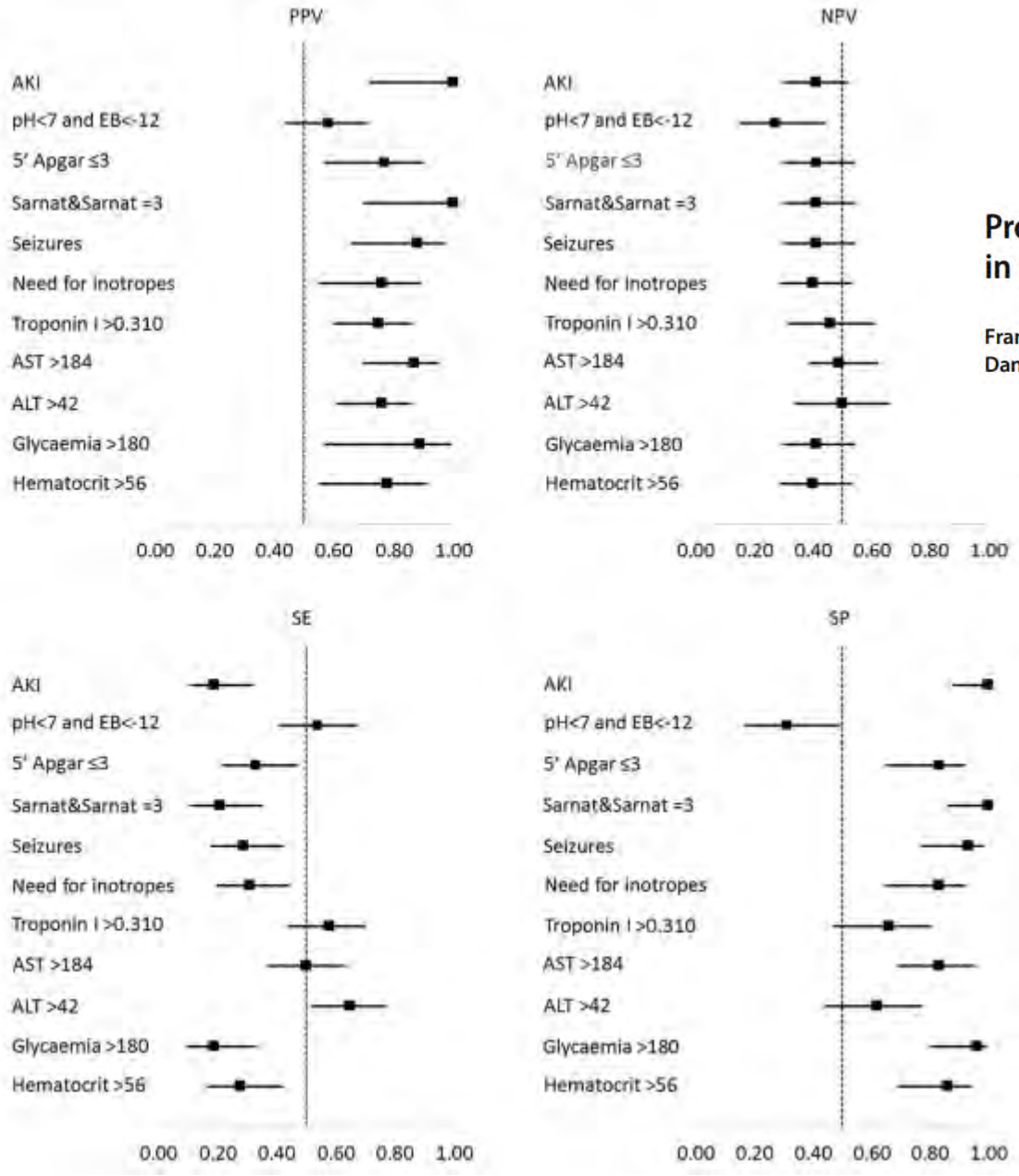


Fig. 3 Diagnostic performance (estimate with 95% CI) of AKI and other clinically relevant variables on unfavorable outcome (disability or death) at 24 months. PPV, positive predictive value; NPV, negative predictive value; SE, sensitivity; SP, specificity

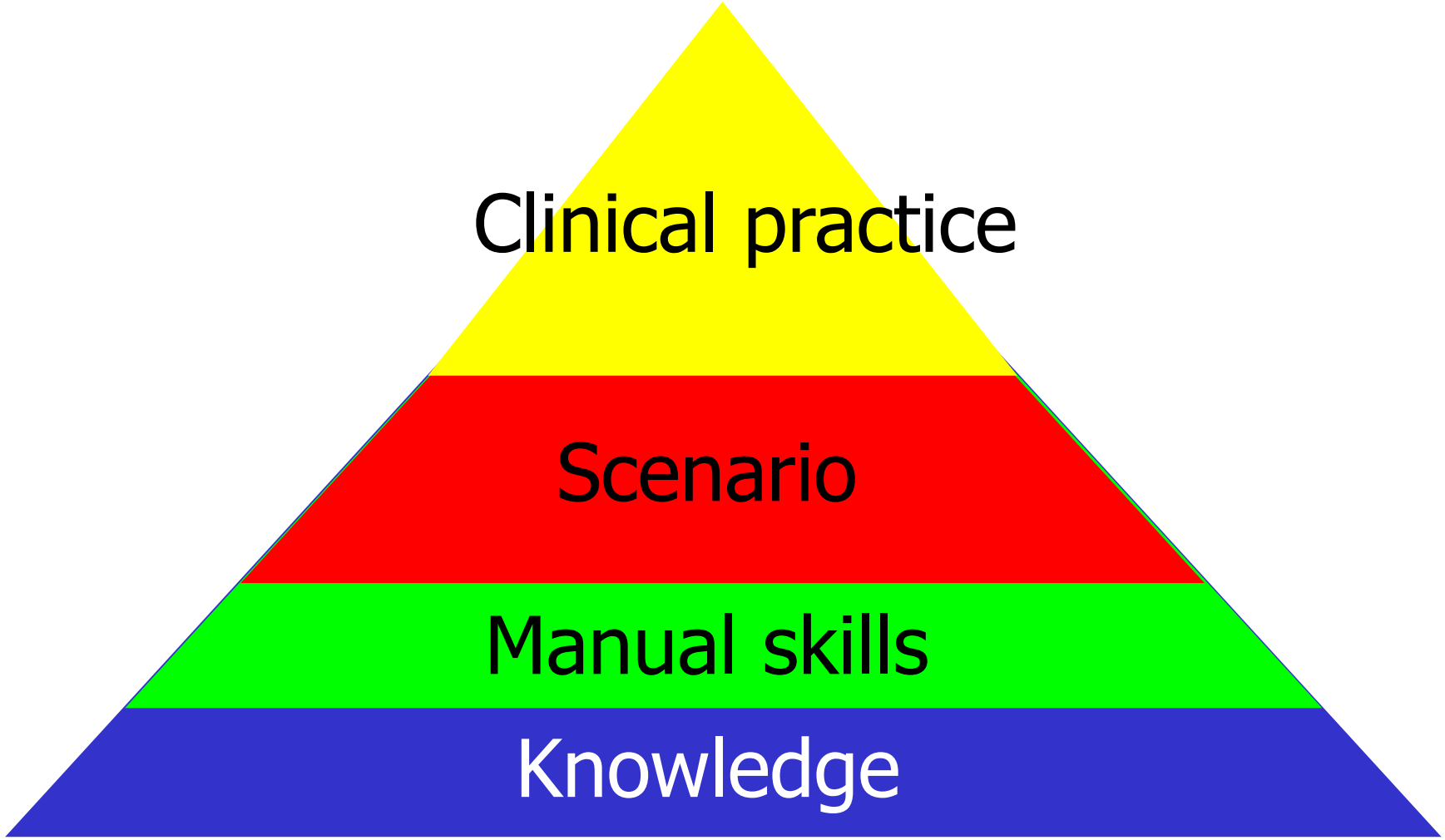
Prognostic role of acute kidney injury on long-term outcome in infants with hypoxic-ischemic encephalopathy

Francesco Cavallin[1] · Giulia Rubin[2] · Enrico Vidal[3] · Elisa Cainelli[4] · Luca Bonadies[2] · Agnese Suppiej[2,5] · Daniele Trevisanuto[2]

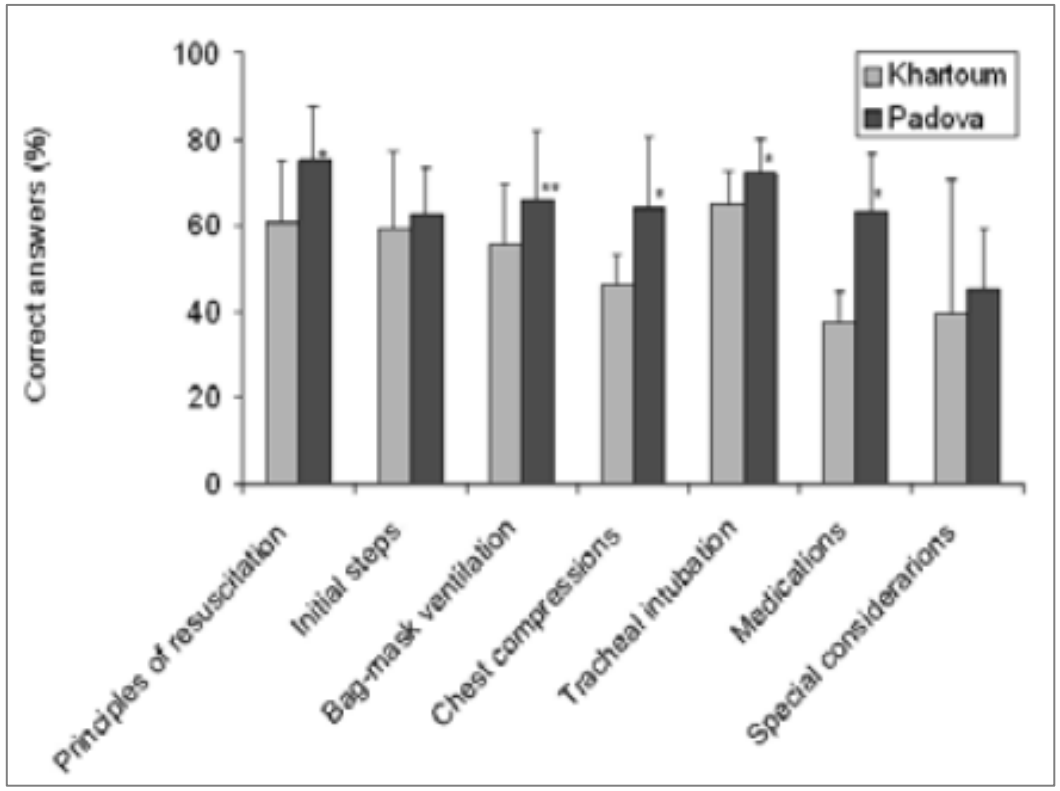
Cavallin F et al. Pediatr Nephrol 2020

Central Beira Hospital,
Beira, Mozambique

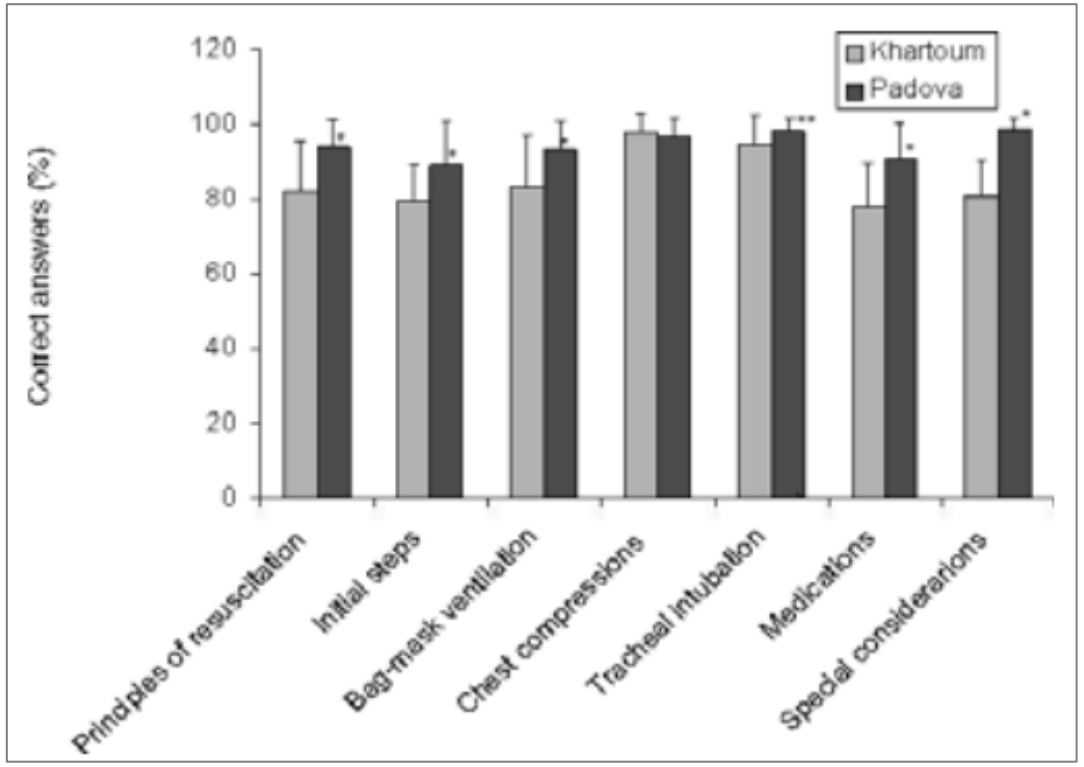
Education



Knowledge



Before



After

Trevisanuto D et al. Pediatr Anesth 2007

Manual skills

Baghdad, Iraq, March 2009

Trevisanuto D et al. J Pediatr 2010

Manual skills

Table. Percentage of items performed correctly on the performance evaluation (skills evaluation) immediately after course participation (post-test)

	Carlo et al[1]	Trevisanuto et al
Overall performance evaluation	88 (9)	78 (35)
A. Initial steps	87 (11)	75 (21)
1. Indicates use of (universal) standard precautions	78 (42)	25 (41)
2. Prepares for warming	98 (12)	84 (33)
3. Prepares for positioning or for clearing airway	93 (26)	74 (39)
4. Prepares for ventilation	98 (15)	84 (31)
5. Prepares medications	72 (45)	79 (35)
6. Determines need for the initial steps of resuscitation	76 (43)	90 (28)
7. Places baby on preheated radiant warmer or on mother with neck slightly extended	90 (30)	96 (18)
8. Clears mouth and nose	94 (23)	100 (0)
9. Dries the baby	98 (15)	71 (46)
10. Removes wet linen	84 (37)	61 (49)
11. Slaps foot, flicks heel, or rubs back briefly	72 (45)	61 (49)
B. Ventilation	88 (12)	83 (11)
12. Chooses correct size mask or positions the bag	92 (27)	89 (31)
13. Checks the seal	86 (35)	75 (47)
14. Positions the head and applies the face mask	96 (20)	93 (26)
15. Checks for and removes secretions	92 (27)	89 (31)
16. Ventilates with mouth slightly open	79 (41)	68 (47)
17. Increases ventilation pressure	75 (44)	61 (49)
18. Ventilates 30 seconds at a rate of 40-60 times/min	87 (34)	96 (18)
19. Achieves visible rise and fall of the chest	90 (30)	79 (41)
20. Asks for help to administer chest compressions	94 (24)	75 (44)
21. Continues positive pressure ventilation	95 (21)	82 (39)
22. Checks the heart rate by palpation or stethoscope	85 (36)	93 (26)
23. Checks to ensure adequate chest movement	87 (34)	86 (36)
24. Coordinates ventilations and chest compressions appropriately	81 (39)	93 (26)
C. Chest compressions	93 (14)	71 (19)
25. Locates appropriate position on lower one-third of baby's sternum	95 (21)	89 (31)
26. Provides firm support for baby's back	93 (26)	79 (42)
27. Uses fingertips or ring fingers or distal portion of both thumbs	94 (24)	39 (50)
28. Compresses sternum approximately one-third of the anterior-posterior diameter of the chest	92 (27)	75 (44)
29. Maintains cadence of "one- and two- and three- and breathe- and..".	92 (27)	75 (44)

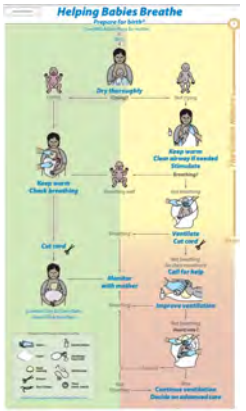
Data are expressed as means (SD).

Trevisanuto D et al. J Pediatr 2010

Clinical practice

DOCTORS WITH AFRICA CUAMM

1-day
HBB course



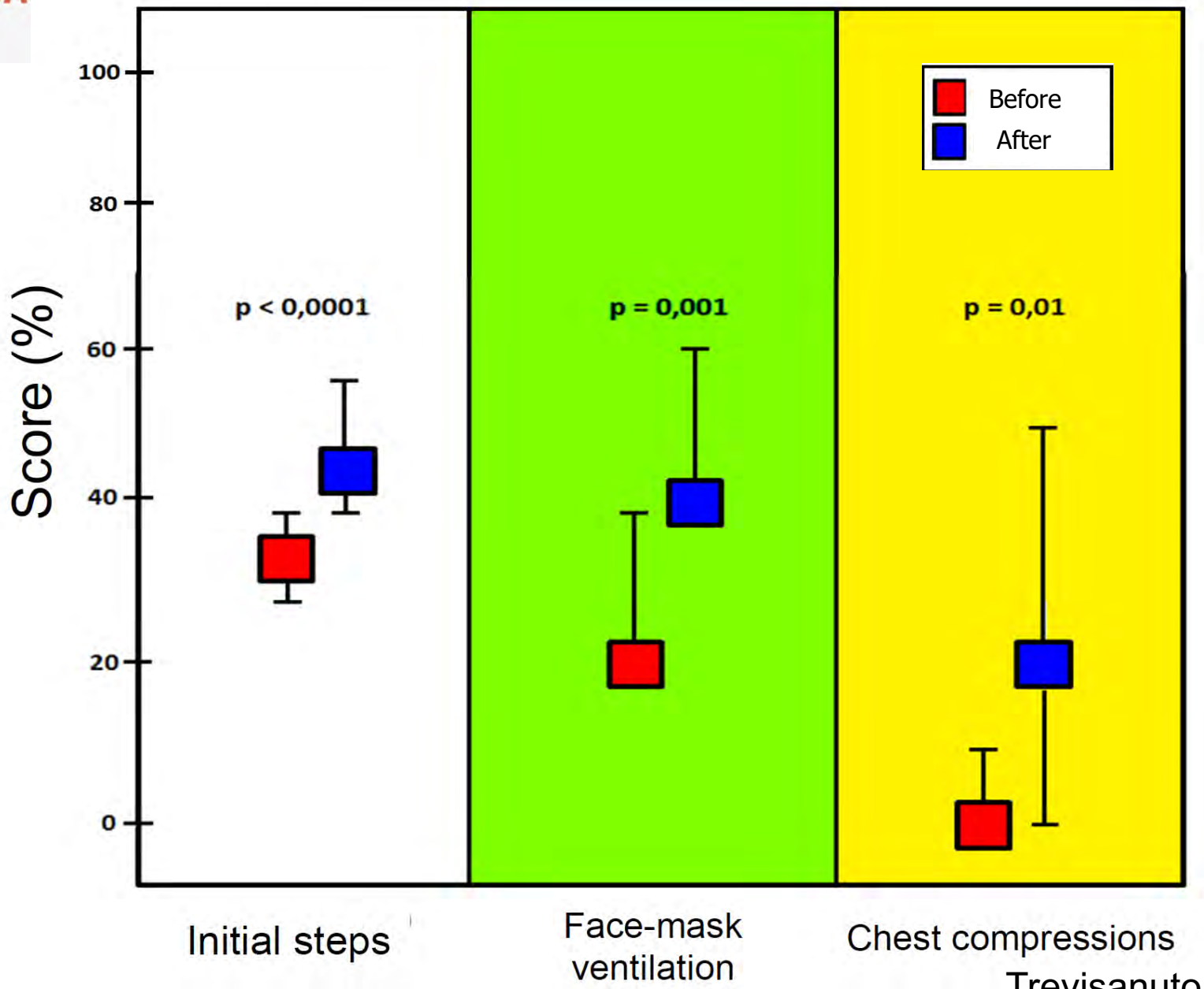
Assessment 1
Baseline
(50 resuscitations)

Assessment 2
Immediately after the
HBB course
(50 resuscitations)

Time

Trevisanuto D et al. PlosOne 2015

Clinical practice



Trevisanuto D et al. PlosOne 2015

DOCTORS WITH AFRICA CUAMM

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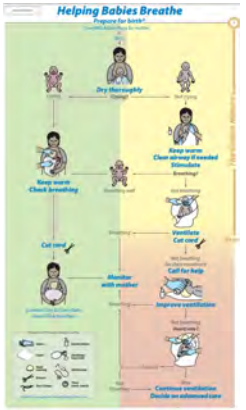
1-day
HBB course



Assessment 1
Baseline
(50 resuscitations)

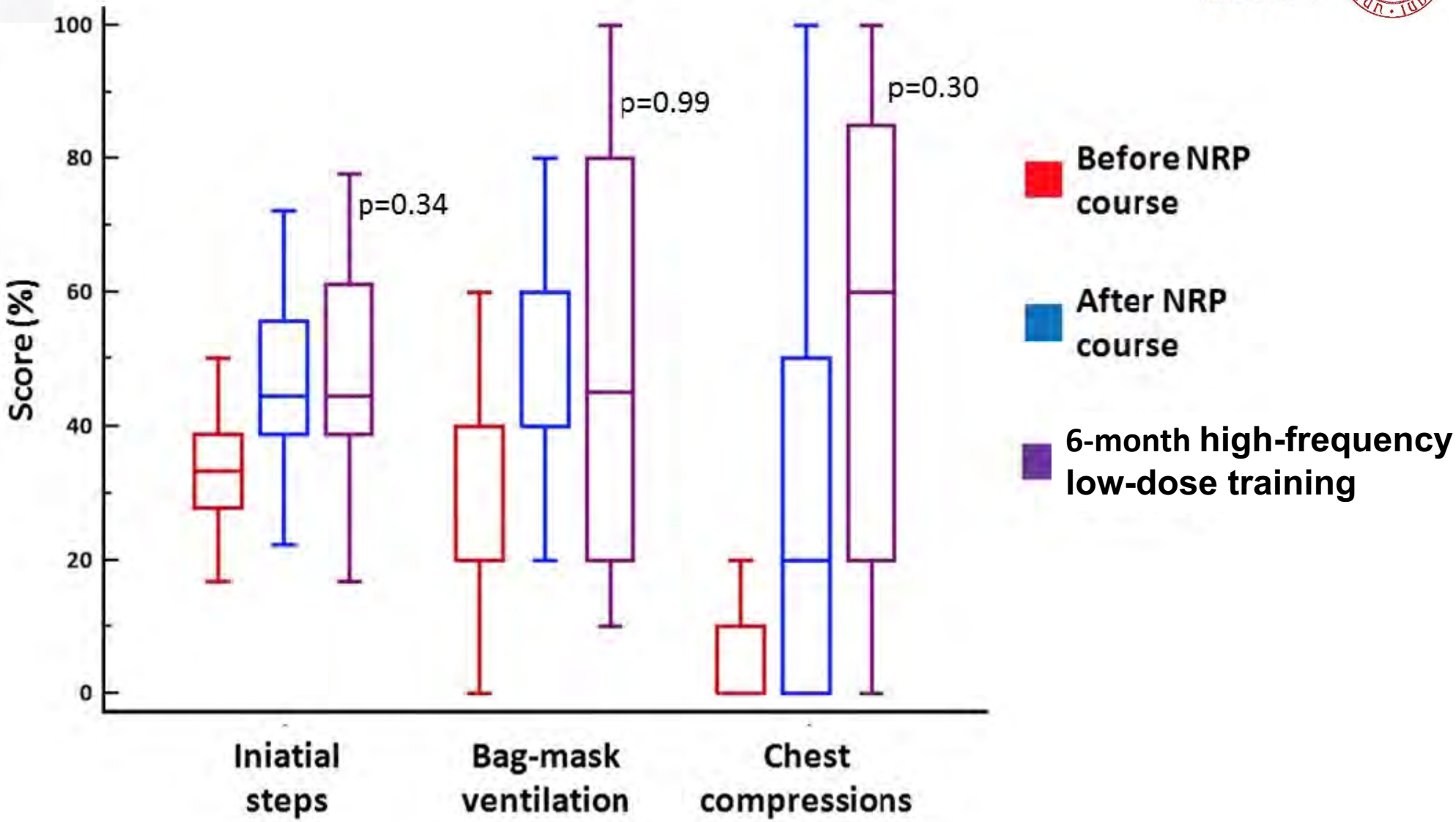
Assessment 2
Immediately after the
HBB course
(50 resuscitations)

6-month
High-frequency
Low-dose training

Assessment 3
after the High-frequency
Low-dose training
(50 resuscitations)

Time

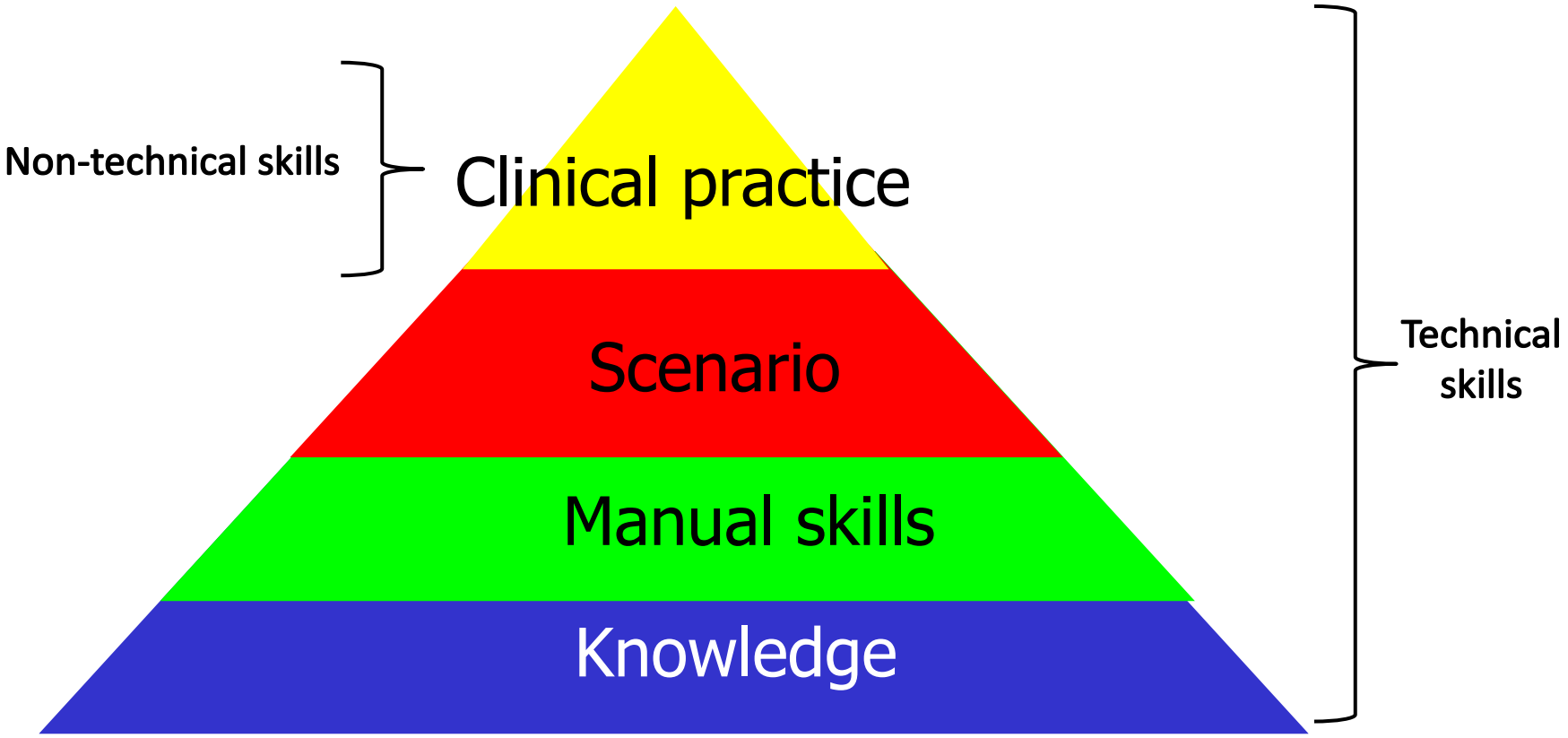
Trevisanuto D et al. PlosOne 2015



Cavicchiolo ME, Neonatology 2018

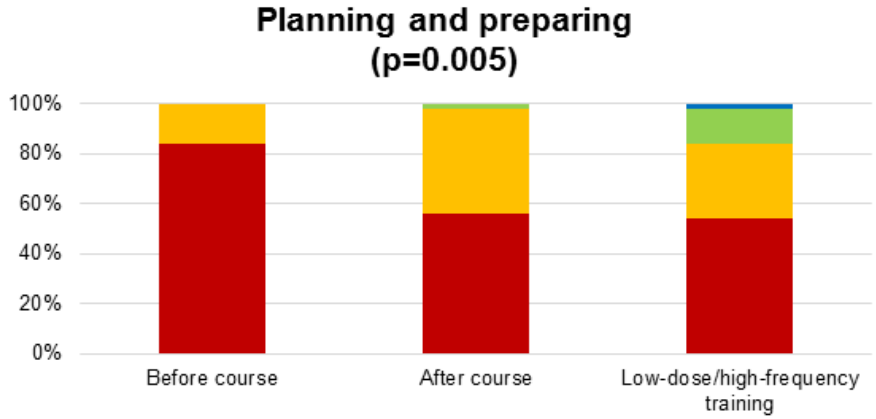
Trevisanuto D et al. PlosOne 2015
Cavicchiolo ME et al. Neonatology 2018
Cavicchiolo ME et al. Resuscitation 2018

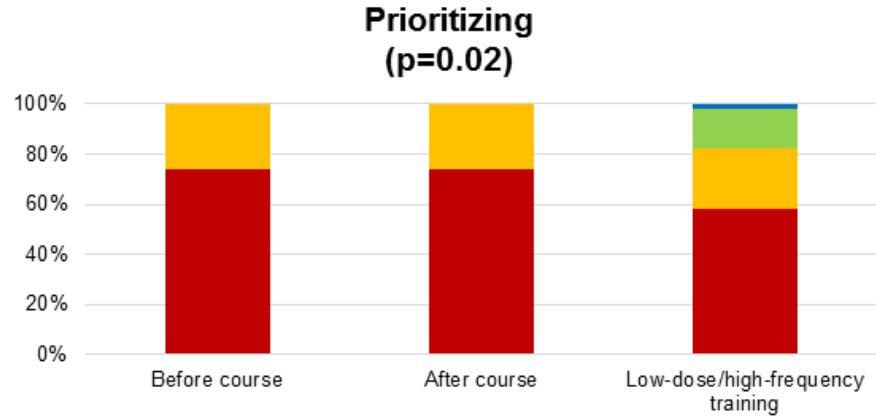
Education

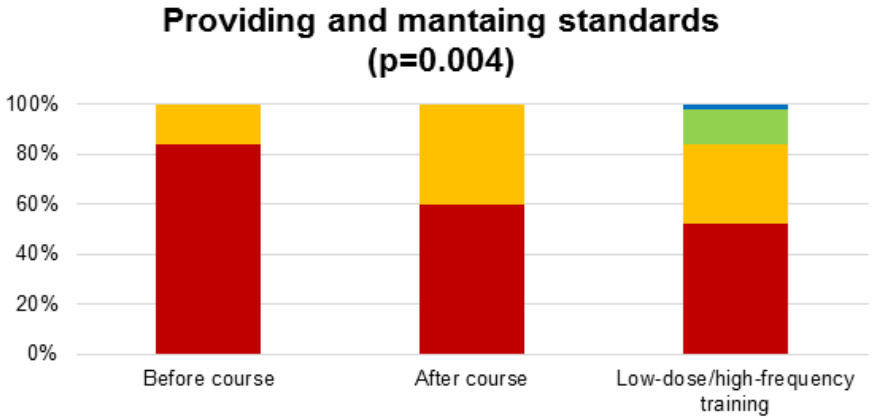

Non-technical skills
Clinical practice
Scenario
Manual skills
Knowledge
Technical skills

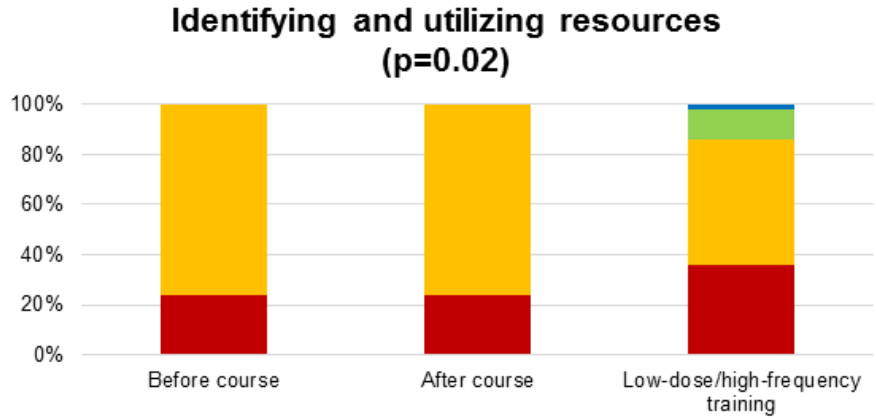
Education

Task management









Poor Marginal Acceptable Good

Cavicchiolo ME et al. Resuscitation 2018

Conclusions

- 2.4 million neonates die every year (99% in middle- and low-resource settings)
- 75% of these deaths can be prevented
- 3 main causes of neonatal deaths: prematurity, asphyxia and sepsis/infections
- PTB, IUGR and LBW are well-known risk factors for neurodevelopmental impairment and later-life hypertension and CKD
- Programs and interventions aiming to improve the lifestyle of pregnant women, children and adults are important opportunities to prevent renal and cardiovascular diseases
- While the goal (neonatal health!) is the same in both high- and low-resource settings, interventions should be tailored according to local needs and resources
- Family involvement and support are crucial

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Thank you!