SAP

SOCIEDAD ARGENTINA DE PEDIATRÍA

Delivery Room Care of the Preterm Infant

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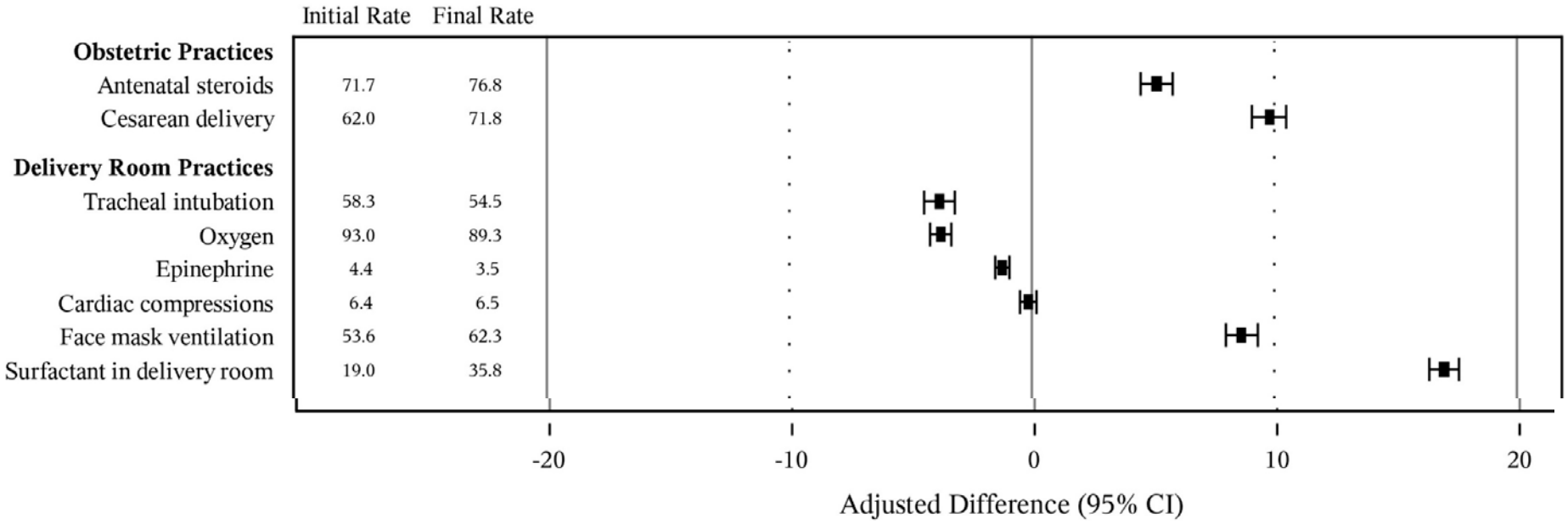
Delivery Room Care of the Preterm Infant

Disclosure: I have no actual or potential conflict of interest in relation to this program/presentation

Delivery Room Care of the Preterm Infant

Objective: to evaluate the evidence supporting delivery room resuscitation of preterm infants with a specific focus on respiratory support

Changes in Delivery Room Practice Vermont Oxford Network 2001 to 2009



Soll and coworkers. Obstetric and Neonatal Care Practices for Infants 501 to 1500 g From 2000 to 2009. Pediatrics 2013. 132. 10.1542/peds.2013-0501.

Vermont Oxford Network

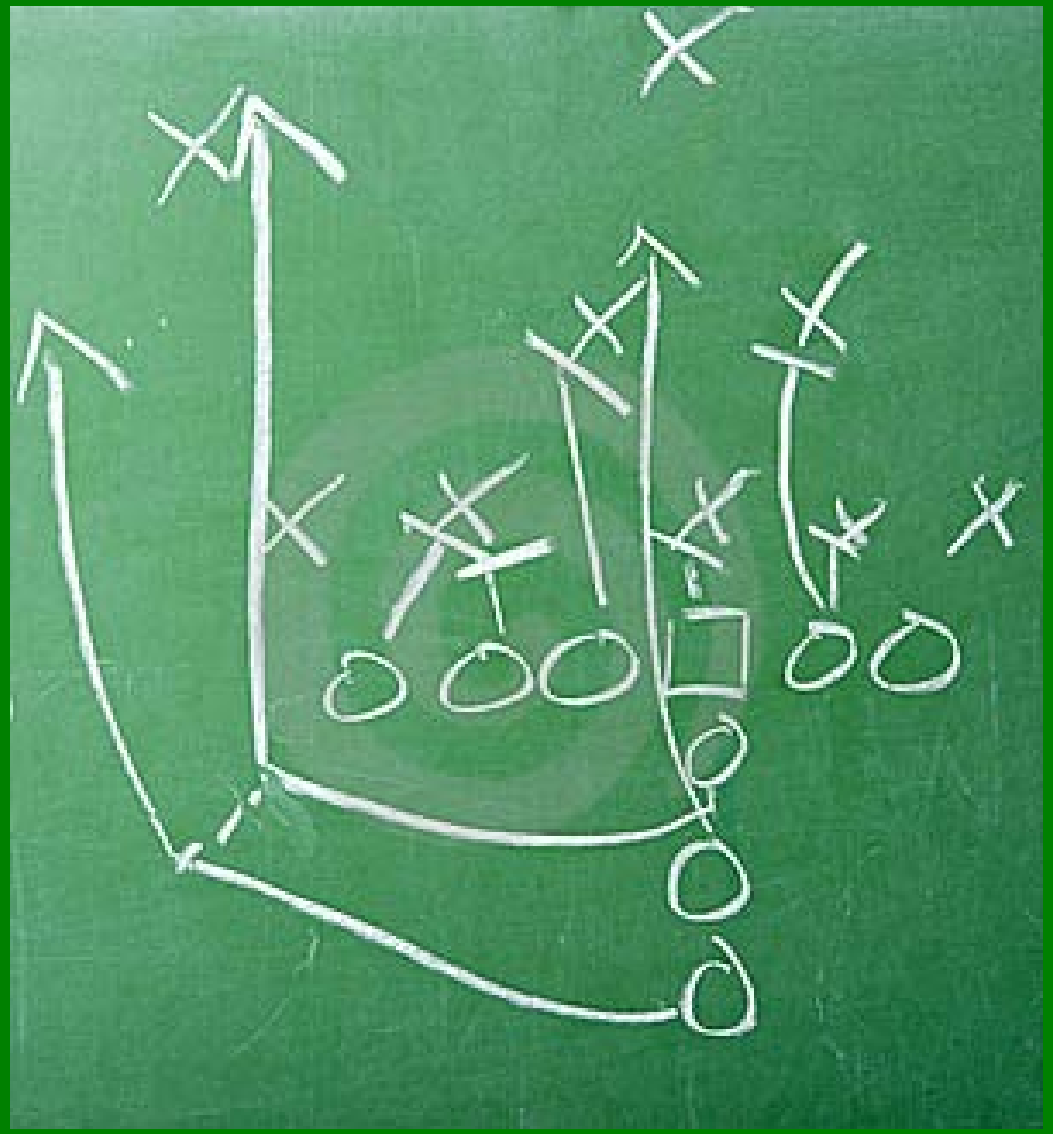
Infants Gestational Age 27 to 29 Weeks
Interquartile Ranges 2017

Intervention	Lowest Quartile	Highest Quartile
Antenatal Steroids	80%	97%
Caesarian Delivery	64%	83%
DR CPAP	40%	80%
Tracheal Intubation	22%	56%
DR Surfactant	0%	36%

Over 22,000 Infants at NICUs in the Vermont Oxford Network

Evidence Based Medicine

Evidence Based Medicine



If we are all reading the same information...

Why aren’t we operating from the same playbook?

Delivery Room Management of the Preterm Infant: Evidence Based Practice

1: Appropriate use of supplemental oxygen
2. Non invasive respiratory support
3. Timely administration of surfactant

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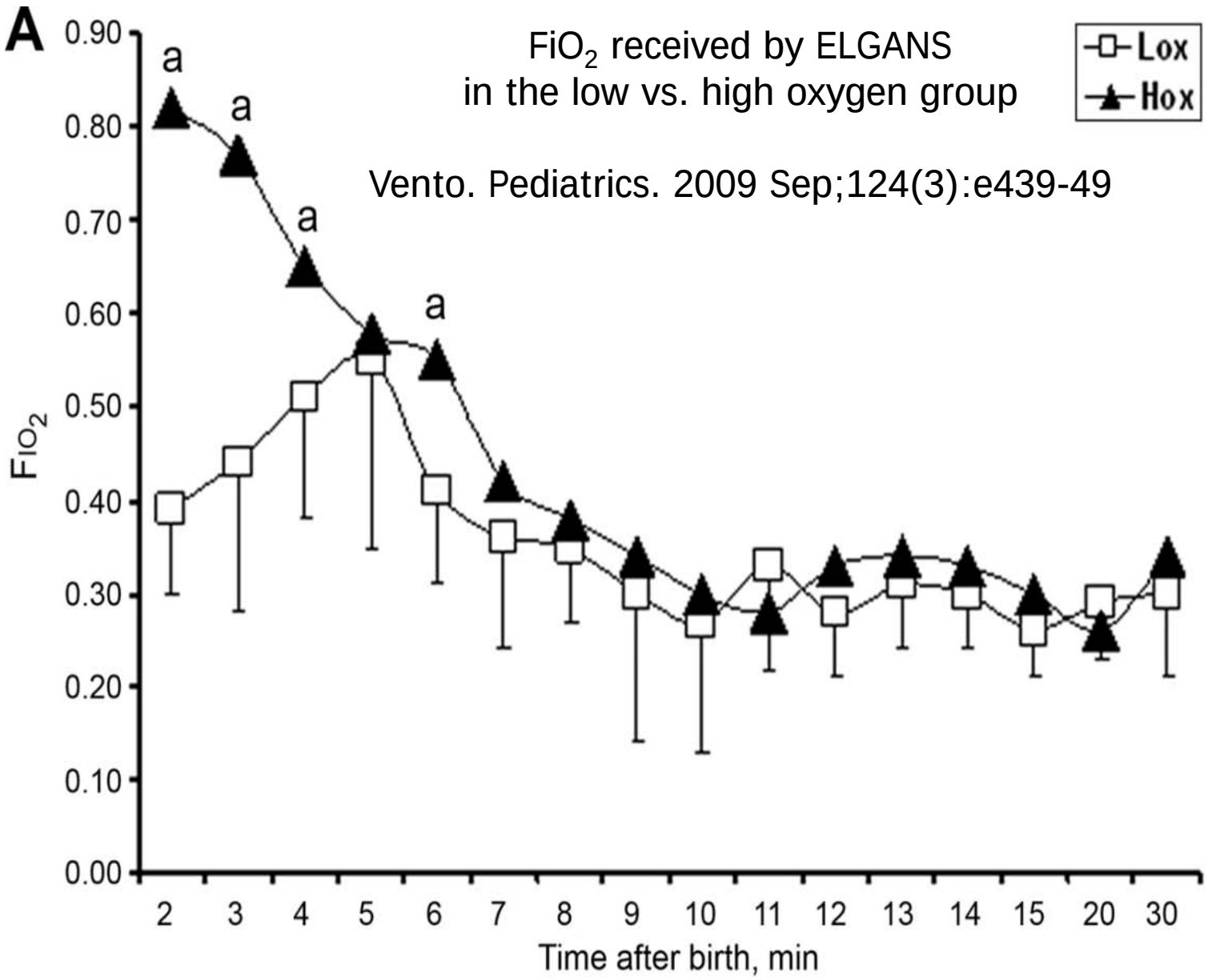
Preterm resuscitation with low oxygen causes less oxidative stress, inflammation, and chronic lung disease.

Vento M, Moro M, Escrig R, Arruza L, Villar G, Izquierdo I, Roberts LJ 2nd, Arduini A, Escobar JJ, Sastre J, Asensi MA.

Pediatrics. 2009 Sep;124(3):e439-49. doi: 10.1542/peds.2009-0434.
PMID: 19661049

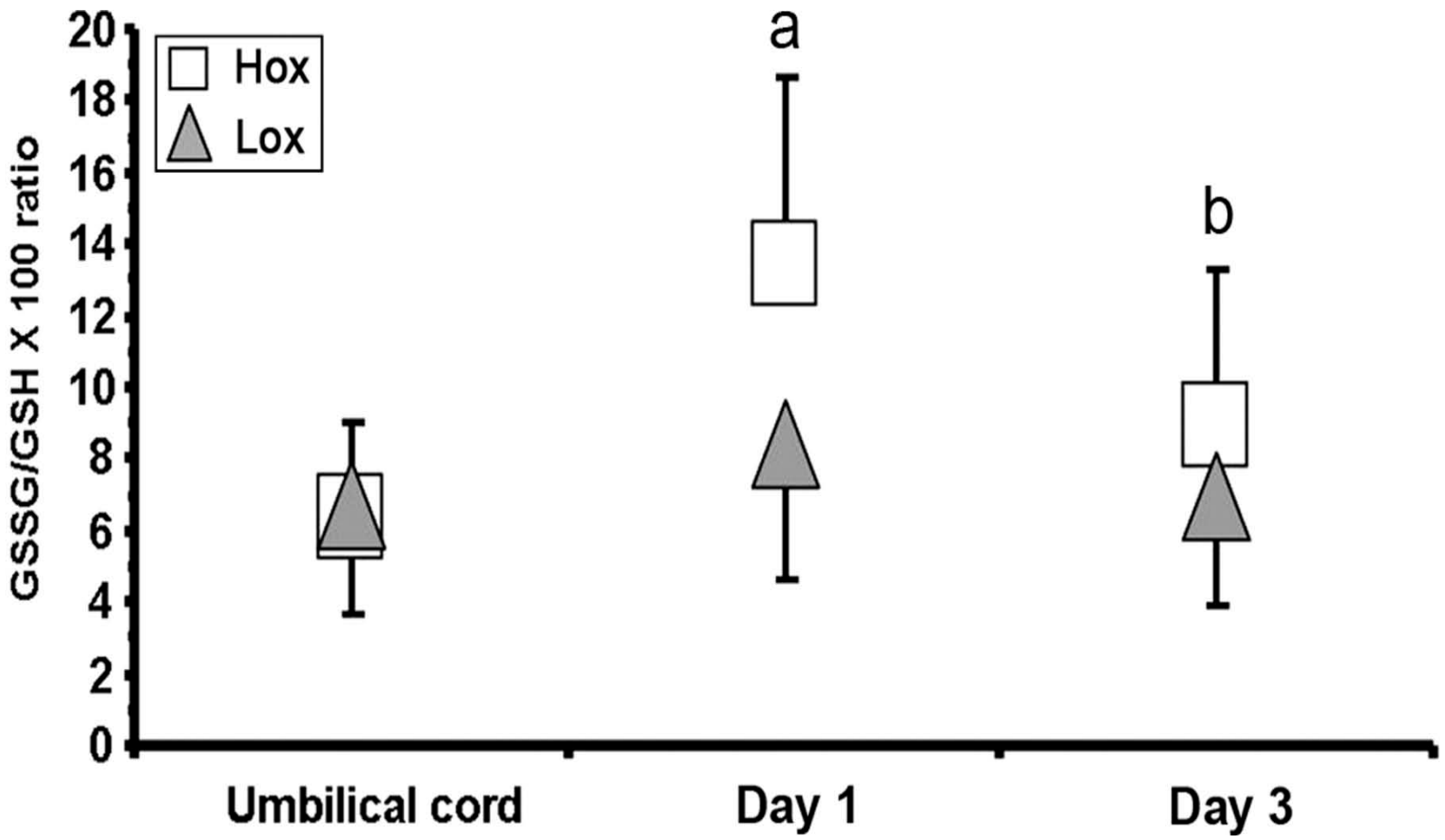
FiO_2 received by ELGANS
in the low vs. high oxygen group

Vento. Pediatrics. 2009 Sep;124(3):e439-49



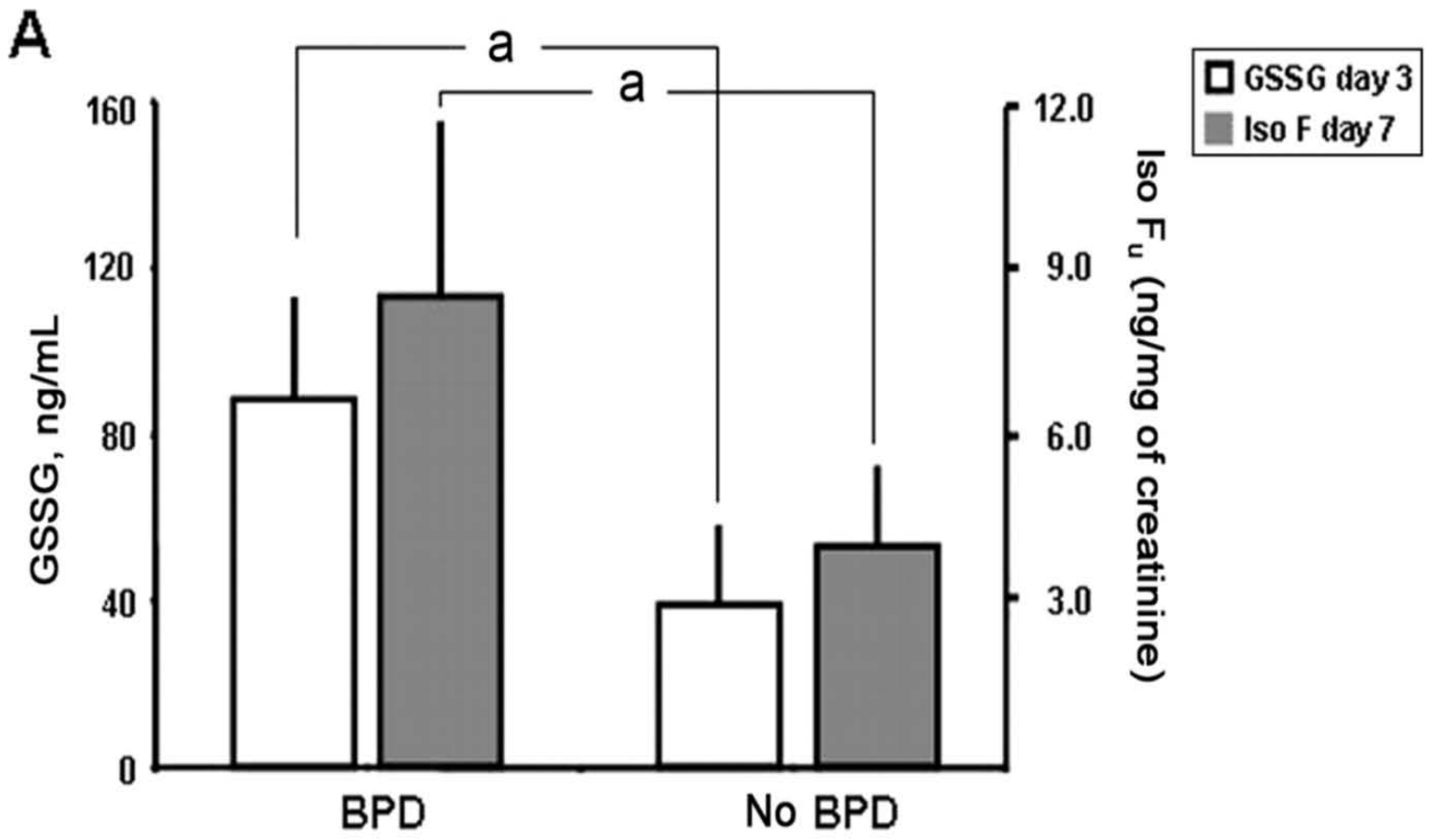
Biomarkers of oxidative stress in the low vs. high oxygen group

Vento. Pediatrics. 2009 Sep;124(3):e439-49



Association of oxidative stress markers with BPD

Vento. Pediatrics 2009



ACTA PÆDIATRICA
NURTURING THE CHILD

Systematic review and meta-analysis of optimal initial fraction of oxygen levels in the delivery room at ≤ 32 weeks.

Saugstad OD, Aune D, Aguar M, Kapadia V, Finer N, Vento M.

Systematic review and meta-analysis of low and high FiO2 during the resuscitation/stabilization of 677 newborn babies ≤ 32 weeks' gestation.

RESULTS: Ten randomized studies. 321 infants receiving low (0.21-0.30) FiO2 levels compared to 356 receiving high (0.60-1.00) levels.

Mortality:	0.62 (95% CI: 0.37 to 1.04)
Bronchopulmonary dysplasia:	1.11 (95% CI: 0.73 to 1.68)
Intraventricular hemorrhage:	0.90 (95% CI: 0.53 to 1.53)

Acta Paediatr. 2014 Jul;103(7):744-51. doi: 10.1111/apa.12656.

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Air/Oxygen: Preterm babies

Resuscitation of preterm infants less than 35 weeks gestation at birth should be initiated in air or low concentration oxygen (21 to 30%).

The administered oxygen concentration should be titrated to achieve acceptable pre-ductal oxygen saturations approximating to the 25th percentile in healthy term babies immediately after birth.

Jonathan Wyllie et al. European Resuscitation Council Guidelines for Resuscitation 2015. Section 7. Resuscitation and support of transition of babies at birth. Resuscitation 95 (2015) 249-263.

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Targeted Oxygen in the Resuscitation of Preterm Infants, a Randomized Clinical Trial

Ju Lee Oei, Ola D. Saugstad, Kei Lui, and colleagues. Pediatrics 2017; 139 (1): 1-11. DOI: 10.1542/peds.2016-1452

BACKGROUND/OBJECTIVES: Lower concentrations of oxygen (O2)(≤ 30%) are recommended for preterm resuscitation to avoid oxidative injury and cerebral ischemia. Effects on long-term outcomes are uncertain.

We aimed to determine the effects of using room air (RA) or 100% O2 on the combined risk of death and disability at 2 years in infants < 32 weeks' gestation.

METHODS: A randomized, unmasked study designed to determine major disability and death at 2 years in infants < 32 weeks' gestation after delivery room resuscitation was initiated with either RA or 100% O2 and which were adjusted to target pulse oximetry of 65% to 95% at 5 minutes and 85% to 95% until NICU admission.

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Targeted Oxygen in the Resuscitation of Preterm Infants, a Randomized Clinical Trial

Outcome	All infants	Infants < 28 weeks
	RR (95% CI)	RR (95% CI)
All Deaths	2.3 (0.9 to 5.7)	2.9 (0.9 to 8.7)
Neonatal Death	3.1 (0.9 to 11.1)	3.1 (0.9 to 11.1)
Death before hospital discharge	2.6 (0.9 to 7.1)	3.9 (1.1 to 13.4)

Pediatrics 2017; 139 (1): 1-11. DOI: 10.1542/peds.2016-1452

Cochrane Neonatal

Lower versus higher oxygen concentrations titrated to target oxygen saturations during resuscitation of preterm infants at birth.

Lui K, Jones LJ, Foster JP, Davis PG, Ching SK, Oei JL, Osborn DA.

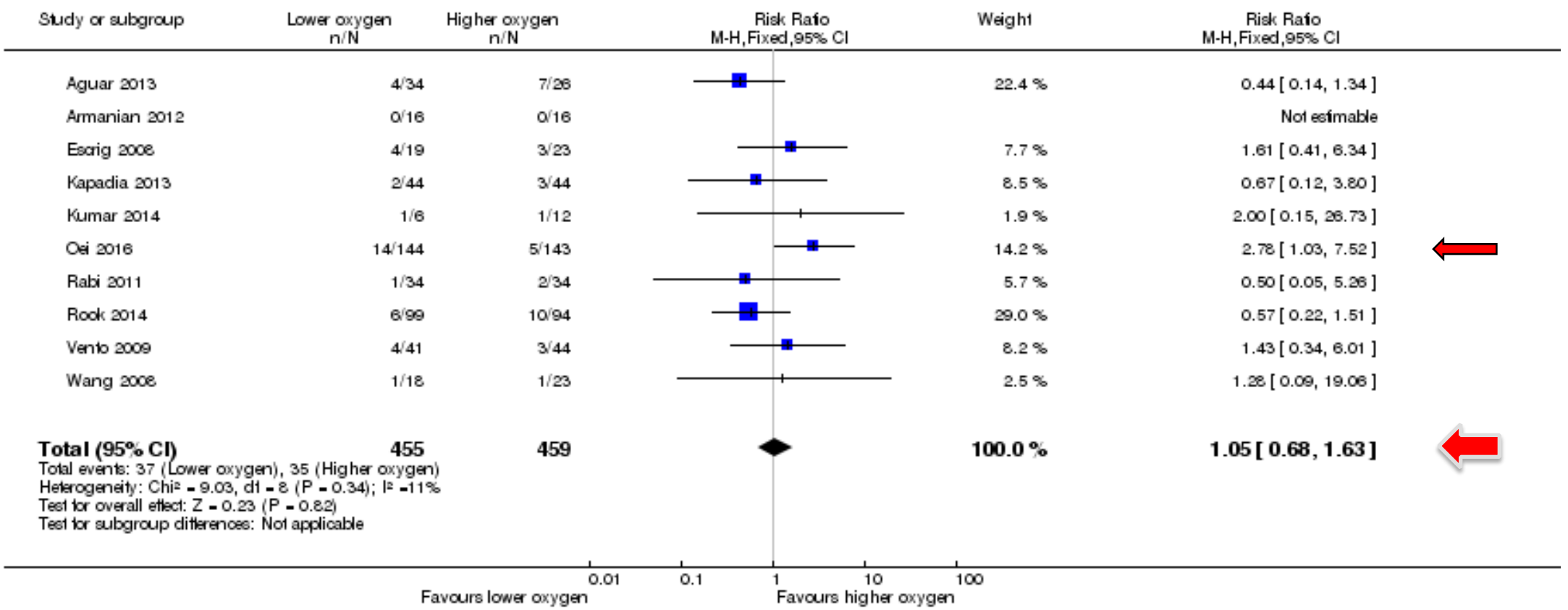
Cochrane Database Syst Rev. 2018 May 4;5:CD010239. doi: 10.1002/14651858.CD010239.pub2.

Lower vs. Higher Oxygen Concentration for Delivery Room Stabilization of Preterm Neonates

Study	N	Inclusion criteria	Comparisons	Oxygen adjustment criteria
Aguar (2013)	60	≤ 30 weeks' gestation	30% vs 60% oxygen	Target SpO_2 (both groups): > 75% at 5 min; > 85% at 10 min
Armanian (2012)	32	29 to 34 weeks' gestation	30% vs 100% oxygen	Target SpO_2 (both groups): > 85%
Escrig (2008)	42	≤ 28 weeks' gestation	30% vs 90% oxygen	Target SpO_2 (both groups): 85% to 90%
Kapadia (2013)	88	< 35 weeks' gestation	Air vs 100%	Target SpO_2 (higher oxygen group): 85% to 94% Target SpO_2 (lower oxygen group): interquartile values for healthy term neonates
Kumar (2014)	18	≤ 32 weeks' gestation	Air vs 100%	Target SpO_2 (both groups): 85% to 95% from 10 minutes
Oei 2016	290	< 32 weeks' gestation or ≤ 1250 grams birth weight	Air vs 100%	Target SpO_2 (both groups): 80% to 95% at 5 minutes
Rabi (2011)	106	≤ 32 weeks gestation	Air vs 100%	Target SpO_2 (both groups); 85% to 92%
Rook (2014)	200	≤ 32 weeks' gestation	30% vs 65% oxygen	Target SpO_2 (both groups): 88-94% at 10 min of life
Vento (2009)	78	24 to 28 weeks gestation	30% vs 90% oxygen	Both groups: FiO2 titrated to achieve target saturations 60 to 90 seconds allowed for response after each change. If HR < 60 oxygen concentration increased to 100%
Wang (2008)	41	23 to 32 weeks gestation	Air vs 100% oxygen	Lower group: FiO2 increased to 1.0 to 0.25 depending on clinical condition. Higher group: Decreased FiO2 at 5 min if SpO2 > 95%

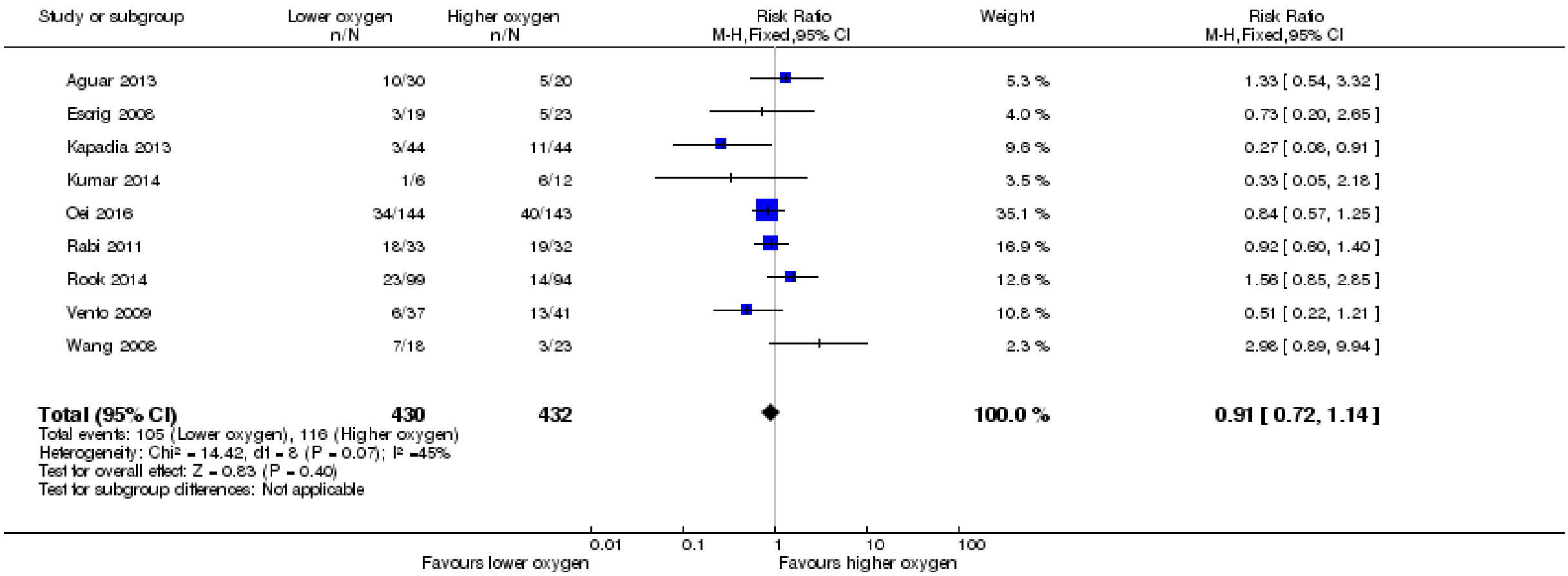
Lower versus higher oxygen concentrations titrated to target oxygen saturations during resuscitation of preterm infants at birth.

Mortality (all studies)



Lower versus higher oxygen concentrations titrated to target oxygen saturations during resuscitation of preterm infants at birth.

Bronchopulmonary dysplasia (survivors only)



Lower versus higher oxygen concentrations titrated to target oxygen saturations during resuscitation of preterm infants at birth. Author's Conclusions

There is uncertainty as to whether initiating post birth resuscitation in preterm infants using lower (FiO2 < 0.4) or higher (FiO2 ≥ 0.4) oxygen concentrations, targeted to oxygen saturations in the first 10 minutes, has an important effect on mortality or major morbidity, intubation during post birth resuscitation, other resuscitation outcomes, and long-term outcomes including neurodevelopmental disability.

Further large, well designed trials are needed to assess the effect of using different initial oxygen concentrations and the effect of targeting different oxygen saturations.

Lui K, Jones LJ, Foster JP, Davis PG, Ching SK, Oei JL, Osborn DA. Lower versus higher oxygen concentrations titrated to target oxygen saturations during resuscitation of preterm infants at birth. Cochrane Database Syst Rev. 2018 May 4;5:CD010239. doi: 10.1002/14651858.CD010239.pub2.

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Survival and Neurodevelopmental Outcomes of Preterms Resuscitated With Different Oxygen Fractions

Boronat N, Aguar M, Rook D, and colleagues. Pediatrics. 2016 Dec;138(6). pii: e20161405.

BACKGROUND AND OBJECTIVES: We aimed to compare neurodevelopmental outcomes of extremely preterm infants at 24 months corrected age randomly assigned to be stabilized after birth with an initial Fio2 of 0.3 versus 0.6 to 0.65 in 3 academic centers from Spain and the Netherlands.

METHODS: Randomized, controlled, double-blinded, multicenter, international clinical trial enrolling preterm infants <32 weeks' gestation assigned to an initial Fio2 of 0.3 (LowOx group) or 0.6 to 0.65 (HiOx group).

A total of 253 infants were recruited and 206 (81.4%) completed follow-up.

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Survival and Neurodevelopmental Outcomes of Preterms Resuscitated With Different Oxygen Fractions

RESULTS: A total of 253 infants were recruited and 206 (81.4%) completed follow-up. No differences in perinatal characteristics, oxidative stress, or morbidities during the neonatal period were assessed.

Mortality at hospital discharge or when follow-up was completed did not show differences between the groups.

No differences regarding Bayley-III scale scores (motor, cognitive, and language composites), neurosensorial handicaps, cerebral palsy, or language skills between groups were found.

Pediatrics. 2016 Dec;138(6). pii: e20161405.

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Survival and Neurodevelopmental Outcomes of Preterms Resuscitated With Different Oxygen Fractions

Overall Rates of Disabilities in Preterm Infants Resuscitated with an Initial FiO2 of 0.3 (LowOx) vs. 0.6 to 0.65 (HiOx) at 24 months corrected age

Variable	Lowox Total, *n* (%)	Hiox Total, *n* (%)	OR (95% CI)	*P*
Disability			1.17 (0.60–2.30)	.64
No disability	67 (75.3)	61 (71.8)		
Mild	14 (15.7)	16 (18.8)		
Moderate	6 (6.7)	7 (8.2)		
Severe	2 (2.3)	1 (1.2)		

Pediatrics. 2016 Dec;138(6). pii: e20161405.

Journal of Perinatology
The Official Journal of the Section on Perinatal Pediatrics, American Academy of Pediatrics
Official Publication of the National Perinatal Association

Neurodevelopmental outcomes of preterm infants resuscitated with different oxygen concentration at birth.

Soraisham AS, Rabi Y, Shah PS, Singhal N, Synnes A, Yang J, Lee SK, Lodha AK.

J Perinatol. 2017 Oct;37(10):1141-1147. doi: 10.1038/jp.2017.83. Epub 2017 Jun 8.

Journal of Perinatology

Neurodevelopmental outcomes of preterm infants resuscitated with different oxygen concentration at birth.

OBJECTIVE: To compare the neurodevelopmental outcomes at 18 to 21 months corrected age (CA) of infants born at < 29 weeks that received room air, an intermediate oxygen concentration or 100% oxygen at the initiation of resuscitation.

STUDY DESIGN: In this retrospective cohort study, we compared neonatal and neurodevelopmental outcomes at 18 to 21 months CA among inborn infants born before 29 weeks' gestation that received room air, intermediate oxygen concentration or 100% oxygen at the initiation of resuscitation.

RESULTS: Of 1509 infants, 445 received room air, 483 received intermediate oxygen concentrations and 581 received 100% oxygen.

Compared to infants that received room air, the primary outcome of death or neurodevelopmental impairment (NDI) was not different in intermediate oxygen (adjusted odds ratio (aOR) 1.01; 95% confidence interval (CI) 0.77, 1.34) or 100% oxygen (aOR 1.03; 95% CI 0.78, 1.35).

Compared to room air, there was no difference in odds of death or severe NDI in intermediate oxygen (aOR 1.14; 95% CI 0.82, 1.58) or 100% oxygen group (aOR 1.22; 95% CI 0.90, 1.67). The odds of severe NDI among survivors were significantly higher in infants that received 100% oxygen as compared to room air (aOR 1.57, 95% CI 1.05, 2.35).

Soraisham AS et al. J Perinatol. 2017 Oct;37(10):1141-1147. doi: 10.1038/jp.2017.83.

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Oxygen Concentration for Resuscitating Premature Newborns - Intervention (NRP 864)

Knowledge Gaps

The most appropriate time-specific oxygen targets for premature newborns need to be defined.

Neurodevelopmental outcomes for preterm newborns resuscitated with low- and high-oxygen concentrations need to be determined.

Circulation. 2015;132(suppl 1): S204–S241.

Delivery Room Management of the Preterm Infant: Evidence Based Practice

1: Appropriate use of supplemental oxygen
2. Non invasive respiratory support
3. Timely administration of surfactant

What is the best approach to take in the stabilization of preterm infants at high risk of developing respiratory distress syndrome?

- delivery room intubation and prophylactic surfactant administration with continued ventilator support

- delivery room intubation and prophylactic surfactant administration without continued ventilator support

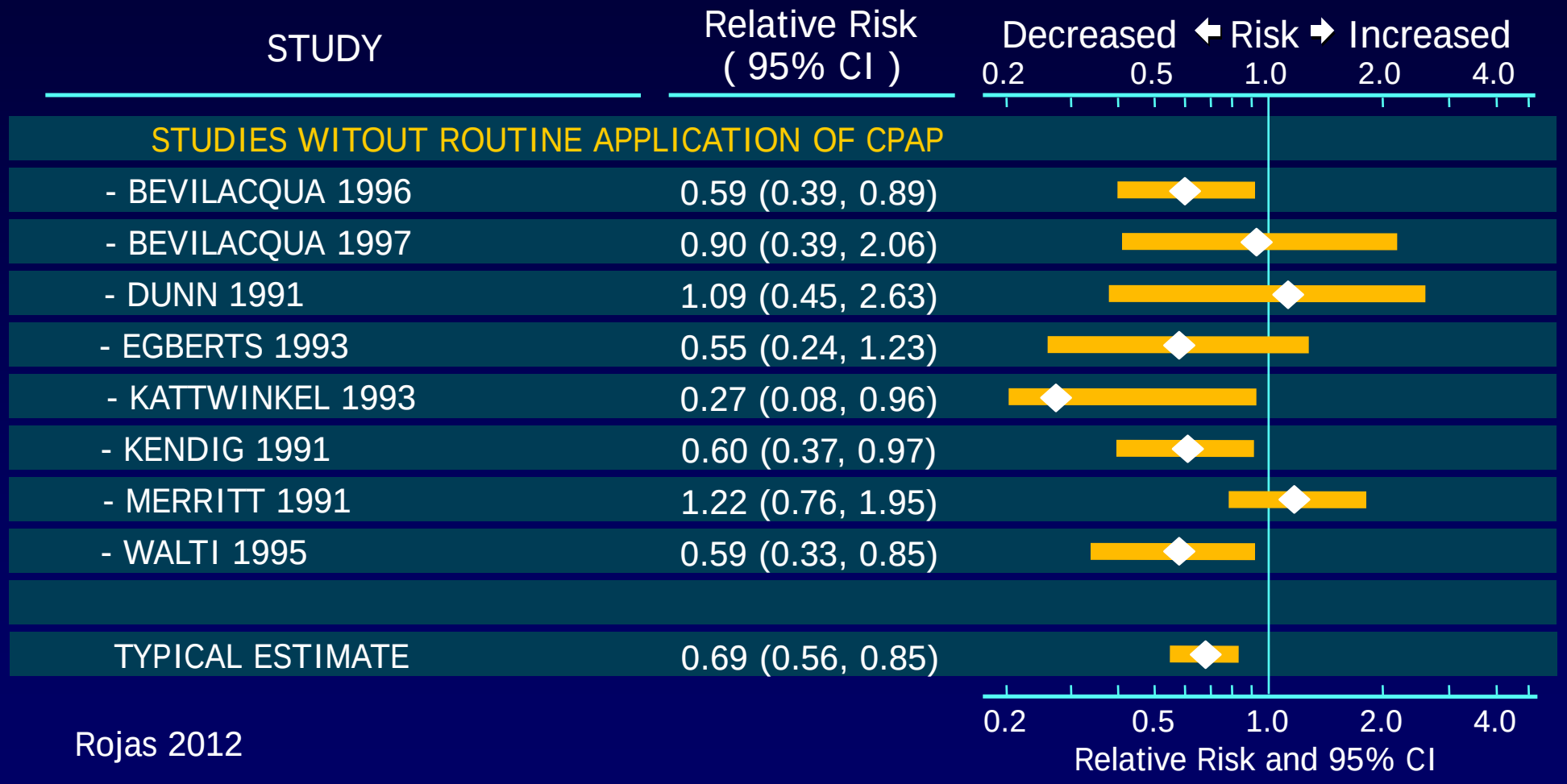
- early stabilization on nasal continuous positive airway pressure

DELIVERY ROOM vs. SELECTIVE SURFACTANT TREATMENT

Study	N	Inclusion criteria	Intervention
Dunn 1991	182	< 30 weeks gestational age	Control: instillation of air given at birth Early surfactant: surfactant given at birth Late surfactant: surfactant given at < six hours of age
Kendig 1991	479	< 30 weeks gestational age	Prophylaxis group: calf lung surfactant extract at the time of delivery, Rescue therapy group: surfactant several hours after delivery if the FiO2 was at least 0.40 or if the mean airway pressure (MAP) was at least 7 cm H2O, or both.
Merritt 1991		24 to 29 weeks gestational age	Prophylactic treatment: human amniotic fluid surfactant soon after birth Rescue treatment: human amniotic fluid surfactant if FiO2 > 0.5, and MAP > 7 cm H2O from 2-12 hours after birth.
Egberts 1993	147	26 to 29 weeks gestational age	Prophylactic treatment: Porcine surfactant within 10 minutes Rescue eligible neonates: initially subjected to a sham maneuver. After 6-24 hours, a similar dose of surfactant was given to the neonates of both the prophylaxis and the rescue eligible group, if they needed mechanical ventilation with an FiO2 > 0.6.
Kattwinkel 1993	1248	29 to 32 weeks gestational age	Prophylactic treatment: calf lung surfactant extract (CLSE) at birth Rescue treatment: wait until development of mild RDS.
Walti 1995	256	25 and 31 weeks gestational age	Prophylactic versus selective surfactant treatment
Bevilacqua 1996	287	24 to 30 weeks gestational age	Prophylactic treatment with porcine surfactant or to a control group receiving no surfactant treatment in the delivery room. Infants in both groups were eligible for rescue surfactant treatment if they developed clinical symptoms of RDS and required mechanical ventilation.
Bevilacqua 1997	93	26 to 30 weeks gestational age	Prophylactic treatment: delivery room administration of porcine surfactant Rescue treatment: routine assistance in delivery room. Infants developing RDS requiring mechanical ventilation and an FiO2 ≥ 0.4 to maintain PaO2 of 50 mmHg were allowed receive surfactant treatment.
Iarŭkova 1999		< 32 weeks gestational age	Prophylactic treatment: intubated within the first 20 minutes of life and received porcine surfactant Rescue treatment: received porcine surfactant if they need a FiO2 was > 40% to maintain a PaO2 > 50mmHg

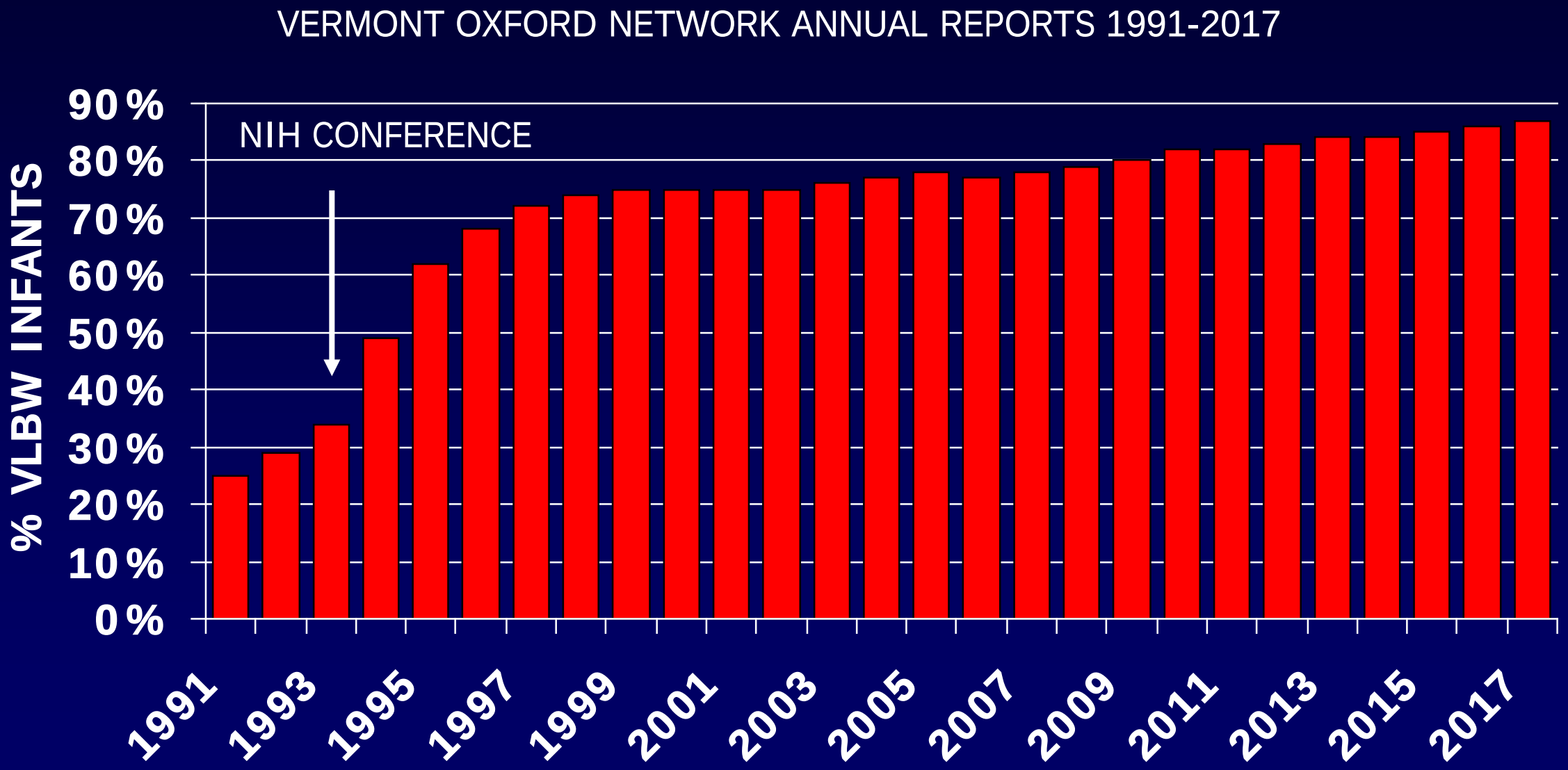
Prophylactic Surfactant vs. Selective Treatment of RDS

EFFECT ON NEONATAL MORTALITY

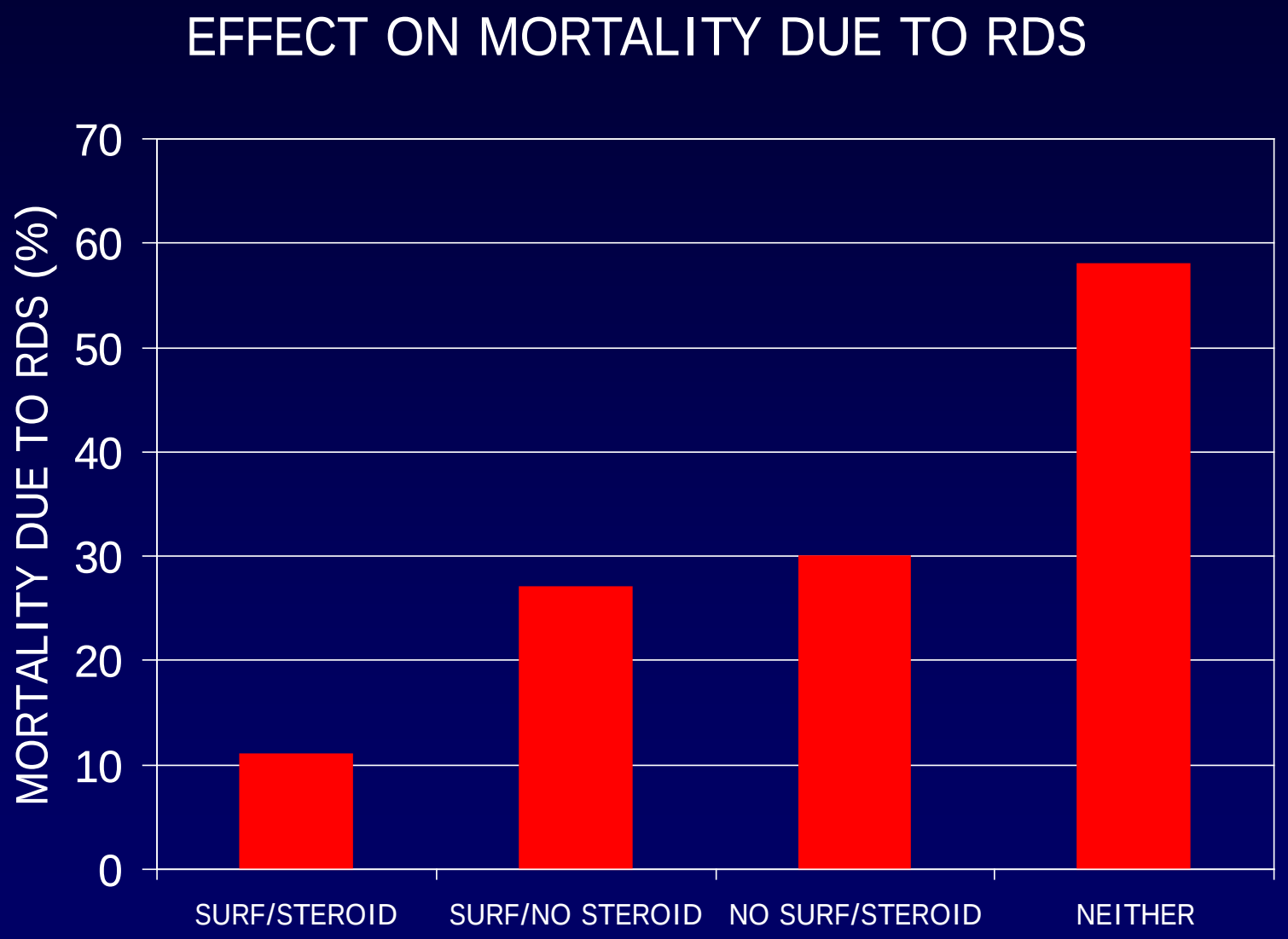


Rojas 2012

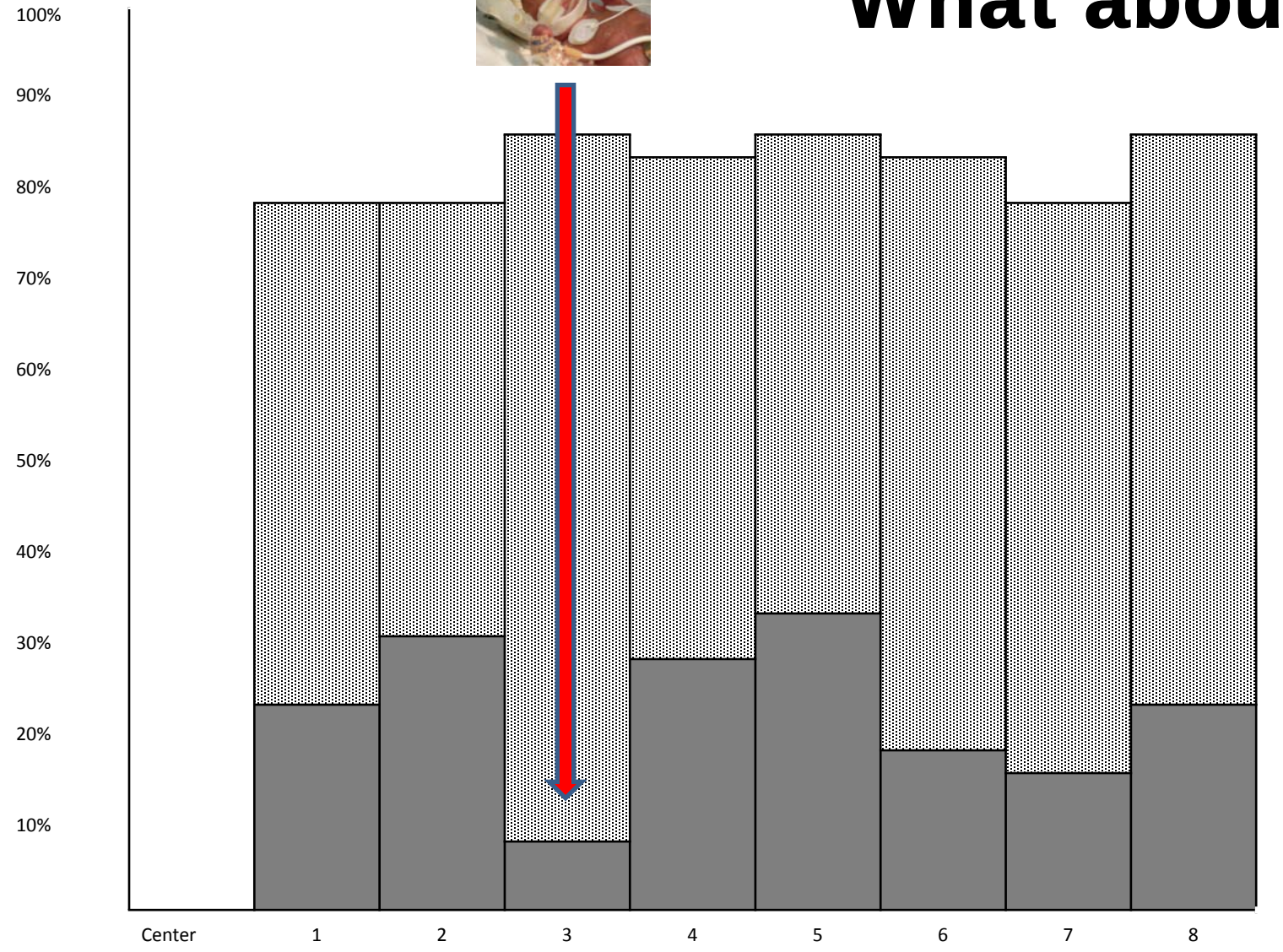
Antenatal Corticosteroids



Prophylactic Surfactant and Antenatal Steroids



What about CPAP?



% survivors at 28 days

% survivors in O2 at 28 days

Avery ME, Tooley WH, Keller JB, et al. Is chronic lung disease in low birth weight infants preventable? A survey of eight centers. Pediatrics. 1987;79(1):26–30pmid:3797169

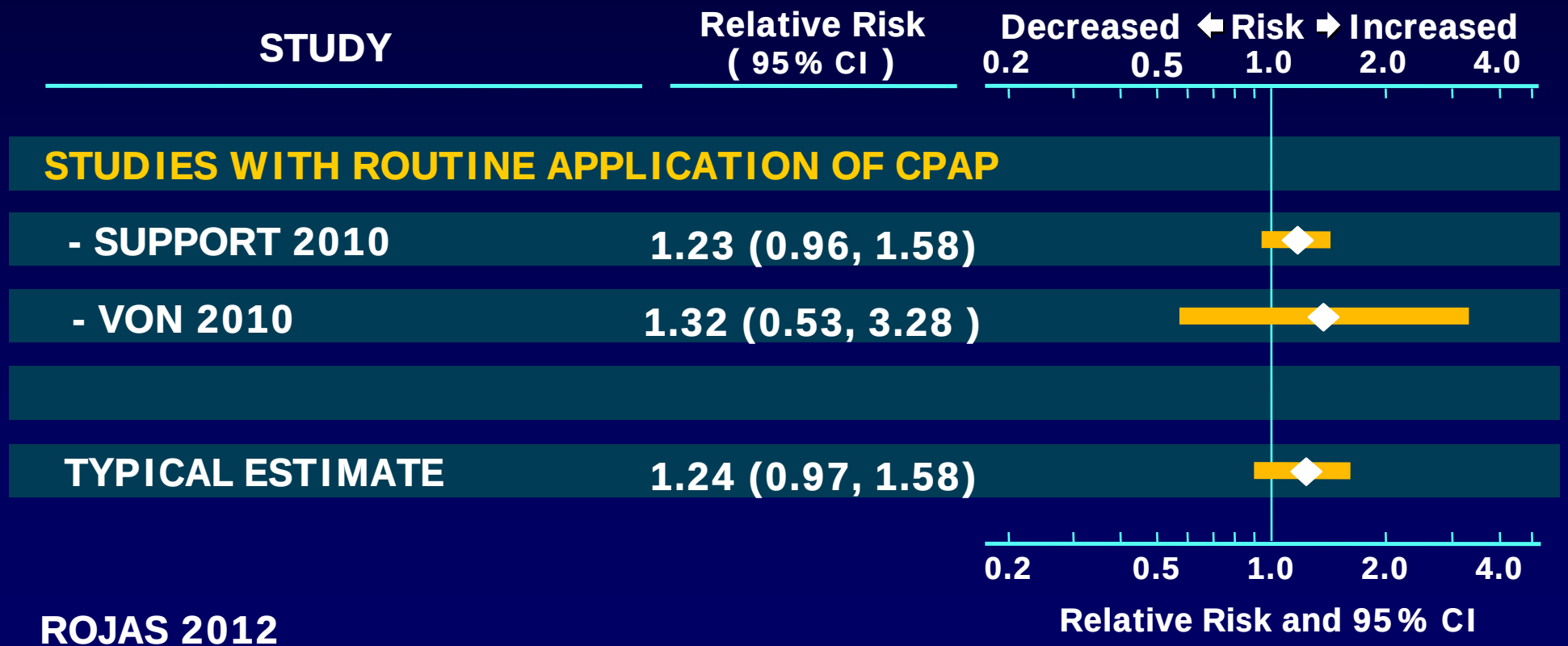
WHAT DO THE RECENT TRIALS OF DELIVERY ROOM MANAGEMENT TELL US?

Delivery room vs. selective surfactant treatment

Study	N	Inclusion criteria	Intervention
Trials that enrolled all high risk infants			
Support 2010	1316	Gestational age 24+0 – 27+6 weeks	Early CPAP Early surfactant
Dunn 2011	648	Gestational age 26+0 to 29+6 week	Intubation, prophylactic surfactant administration with subsequent stabilization on ventilator support (PS Group) Intubation, prophylactic surfactant administration and rapid extubation to NCPAP (ISX Group) Early stabilization on NCPAP and selective intubation and surfactant administration for clinical indications (NCPAP Group)
Trials that enrolled infants with early respiratory distress			
COIN 2008	610	Gestational age 25+0 to 28+6 weeks	Stabilize on NCPAP 8 cmH2O Intubate and ventilate
Sandri 2010	208	Gestational age 25+0 to 28+6 weeks	Prophylactic surfactant NCPAP

Prophylactic Surfactant Administration vs. Selective Treatment of RDS

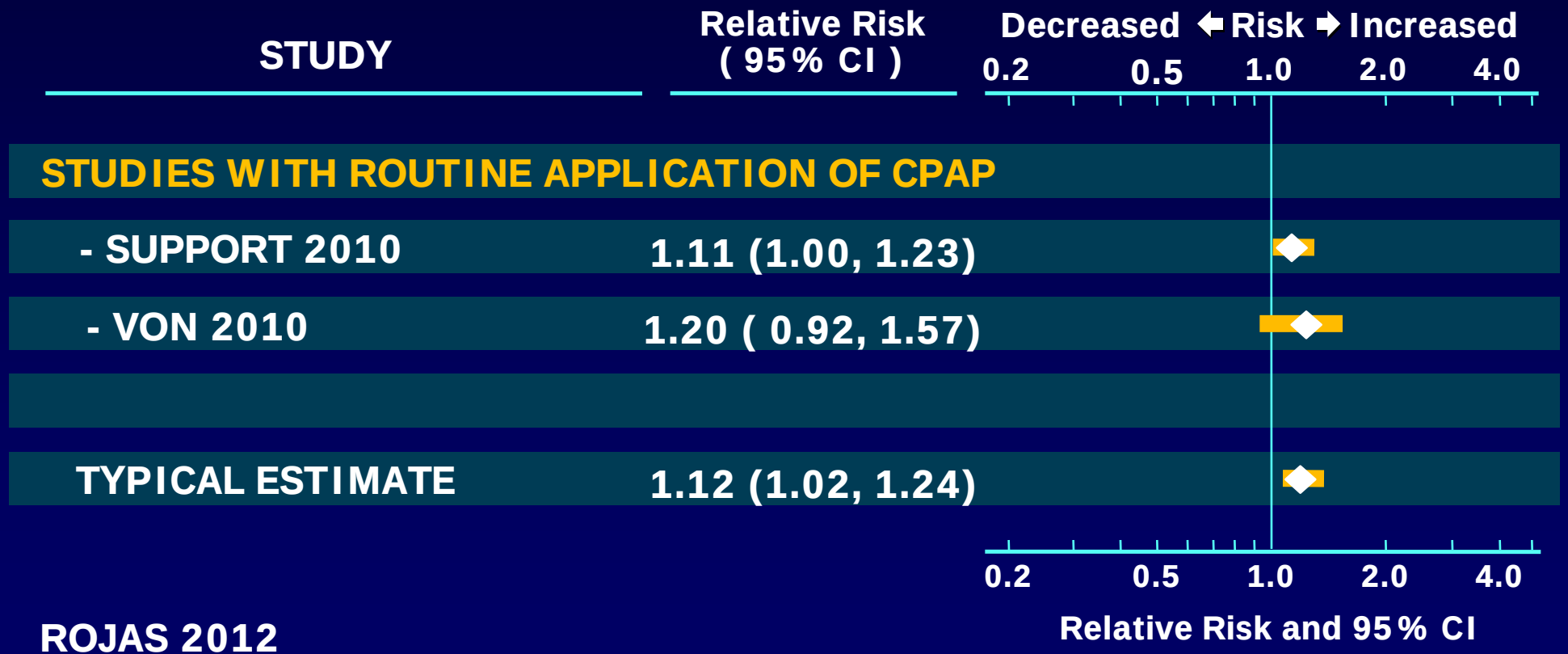
Neonatal Mortality



ROJAS 2012

Prophylactic Surfactant Administration vs. Selective Treatment of RDS

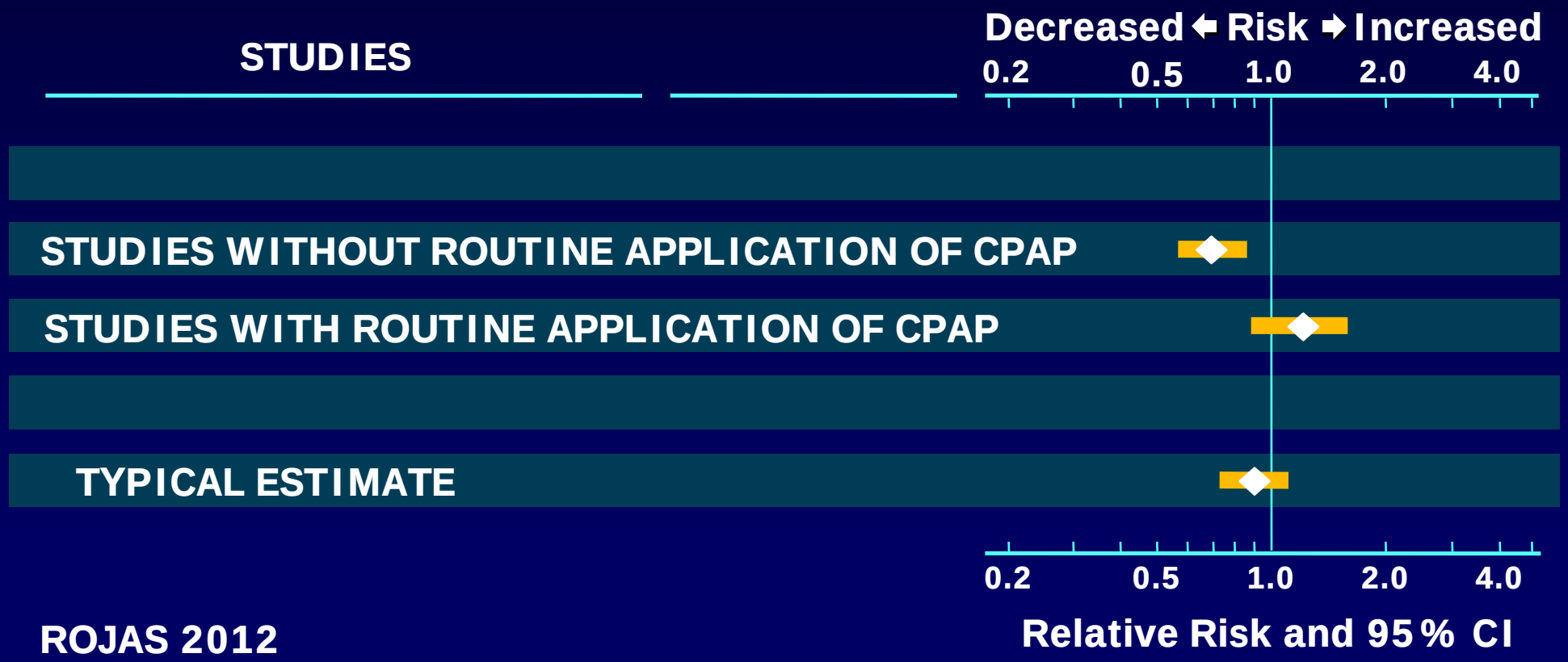
Death or BPD at 36 weeks PMA



ROJAS 2012

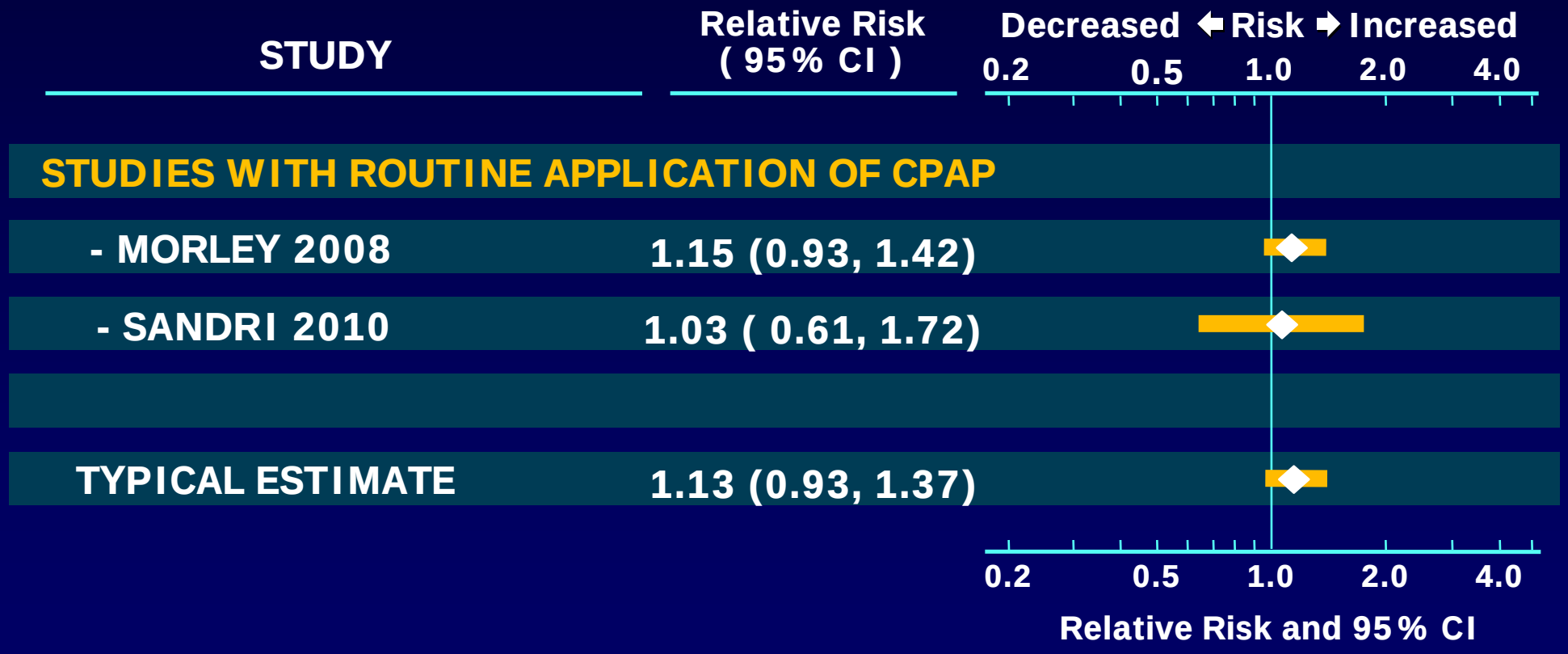
Prophylactic Surfactant Administration vs. Selective Treatment of RDS

Neonatal Mortality

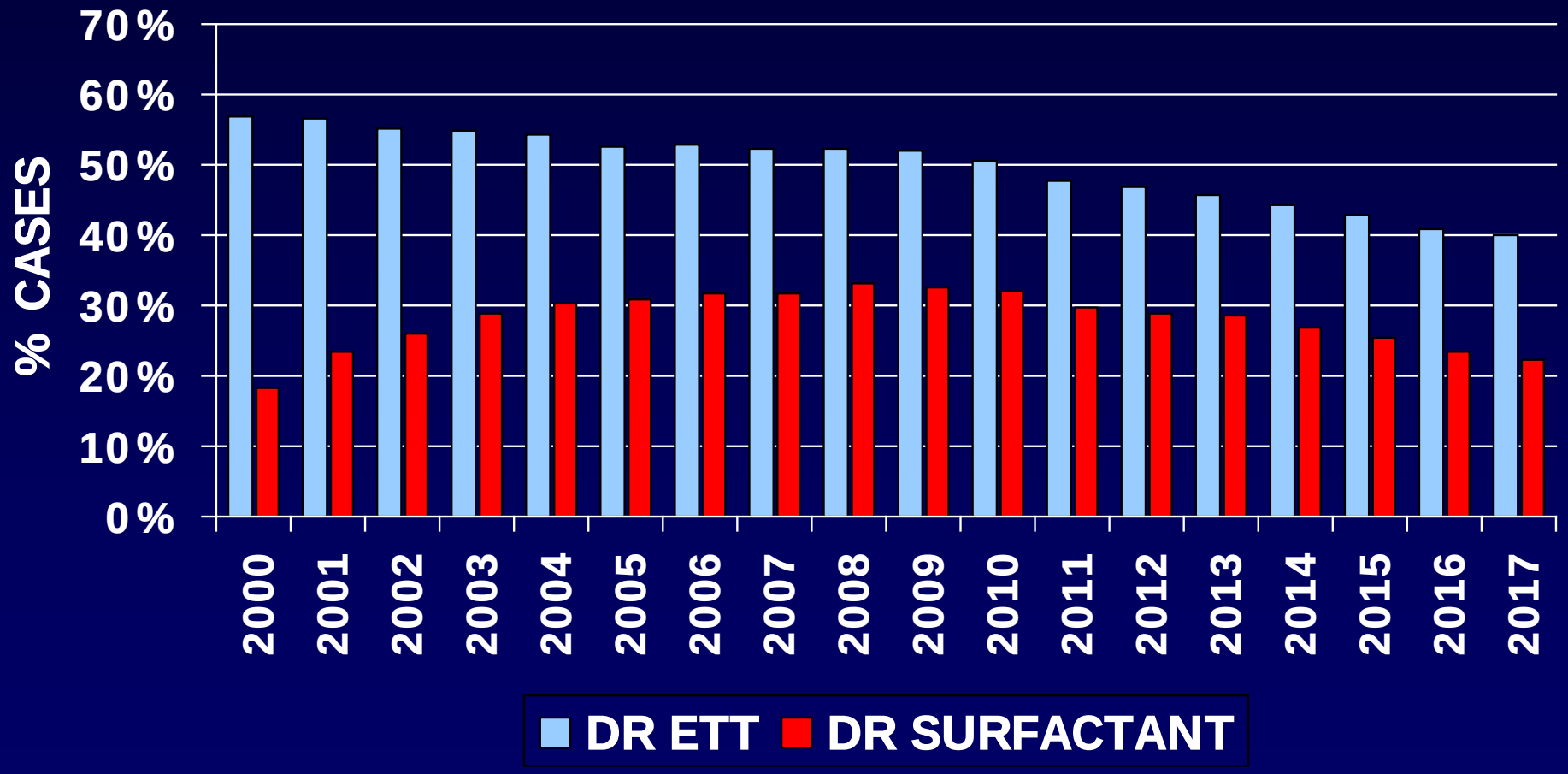


Delivery Room Surfactant vs. NCPAP In Spontaneously Breathing Preterm Infants

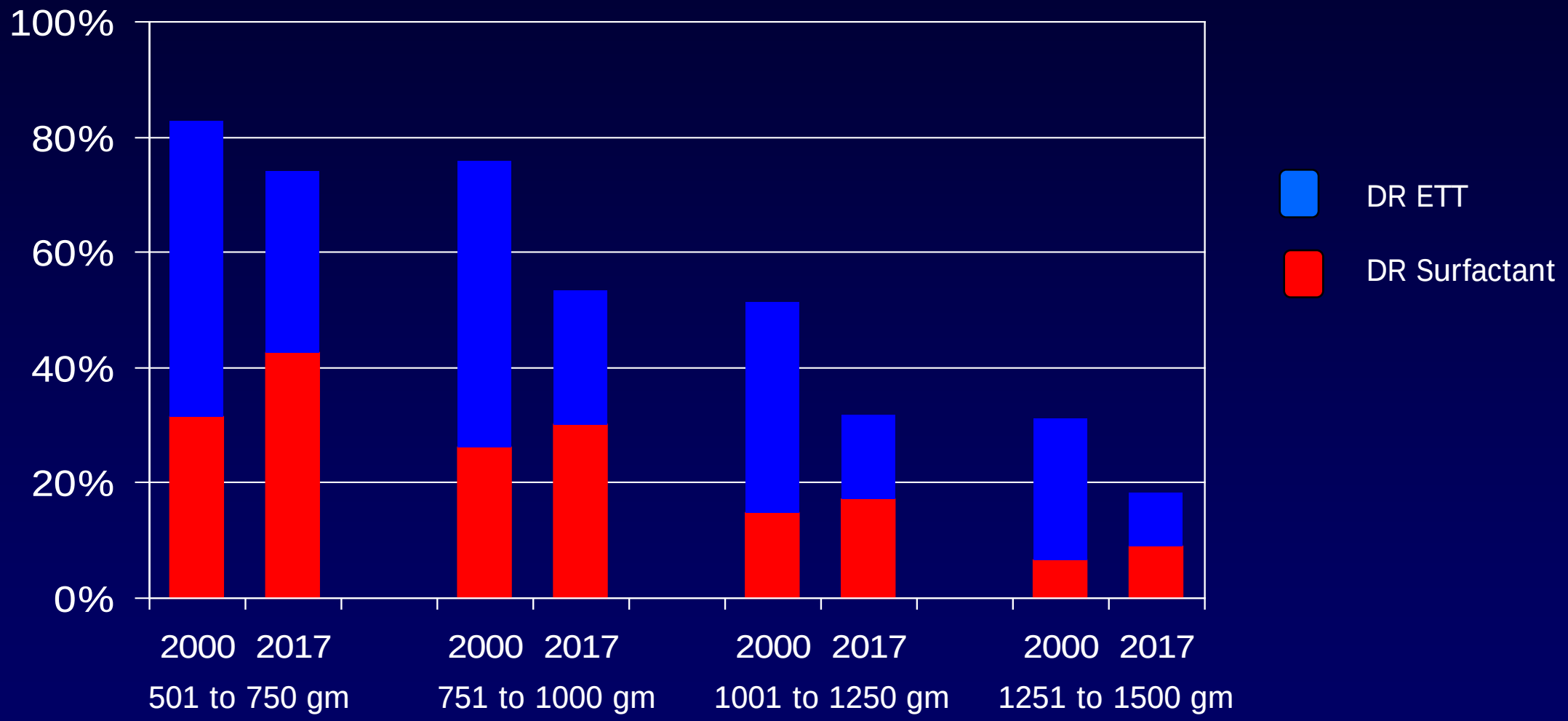
Death or BPD at 36 weeks PMA



Delivery Room Practices in VLBW Infants



Delivery Room Practices: 2000 to 2017



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Continuous positive airway pressure (CPAP) and intermittent positive-pressure ventilation (IPPV) (NRP 590)

For spontaneously breathing preterm infants with respiratory distress requiring respiratory support in the delivery room, we suggest initial use of CPAP rather than intubation and IPPV

(weak recommendation, moderate-quality evidence).

Circulation. 2015;132(suppl 1): S204–S241.

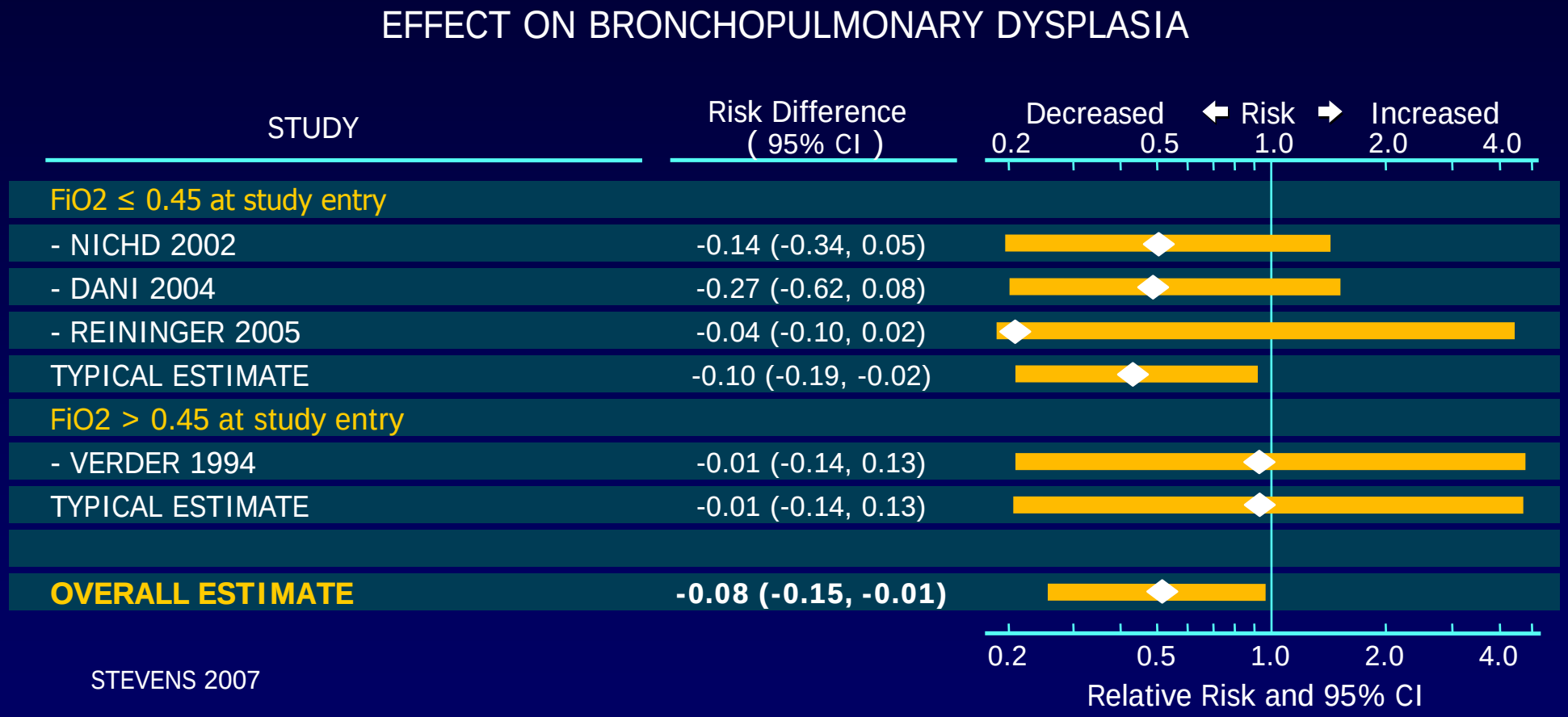
Delivery Room Management of the Preterm Infant: Evidence Based Practice

1: Appropriate use of supplemental oxygen
2. Non invasive respiratory support
3. Timely administration of surfactant

Delivery Room Management of the Preterm Infant: Evidence Based Practice

Innovative approaches to surfactant administration in the delivery room

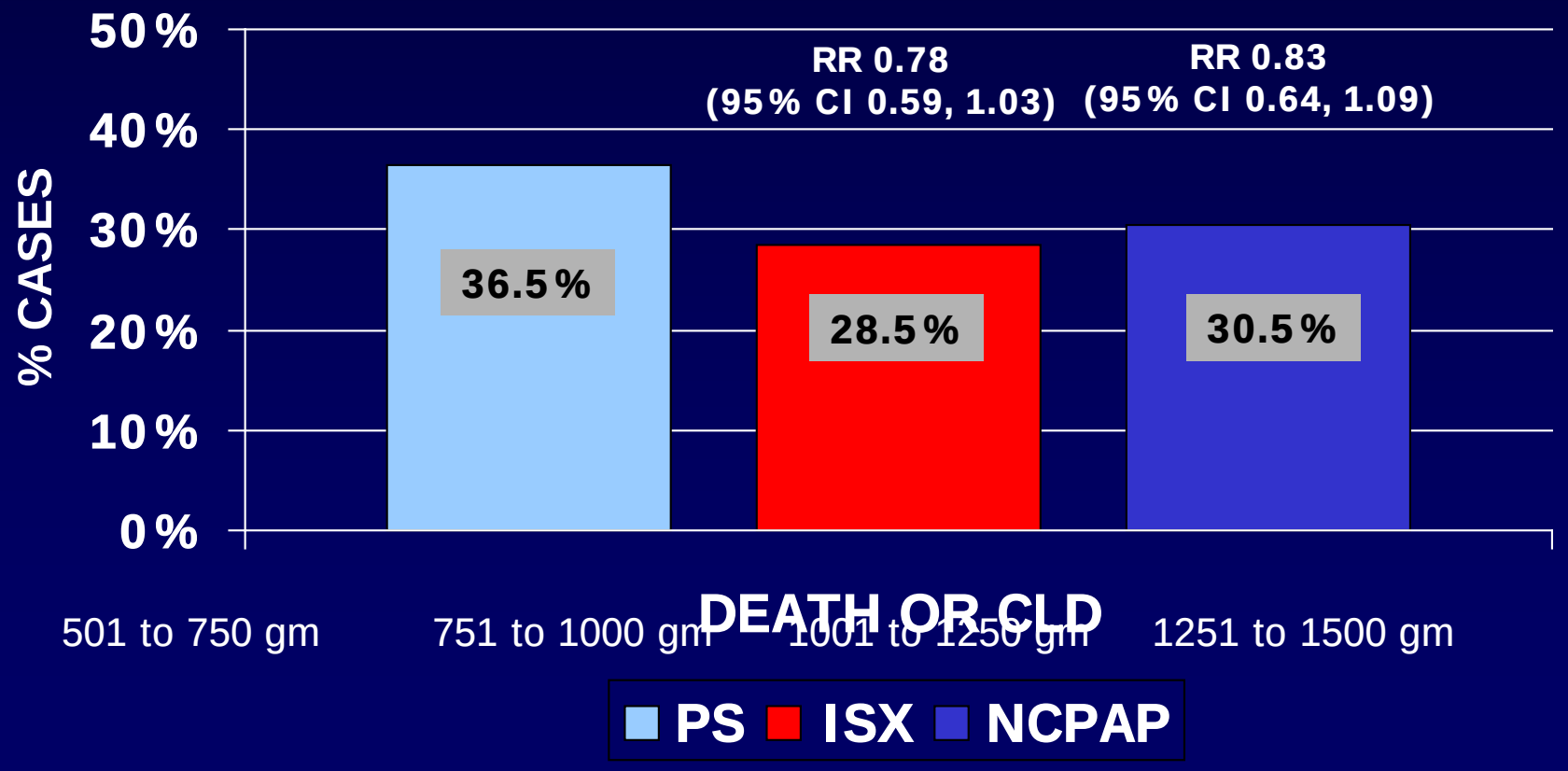
Intubation, Surfactant Administration and Rapid Extubation



STEVENS 2007

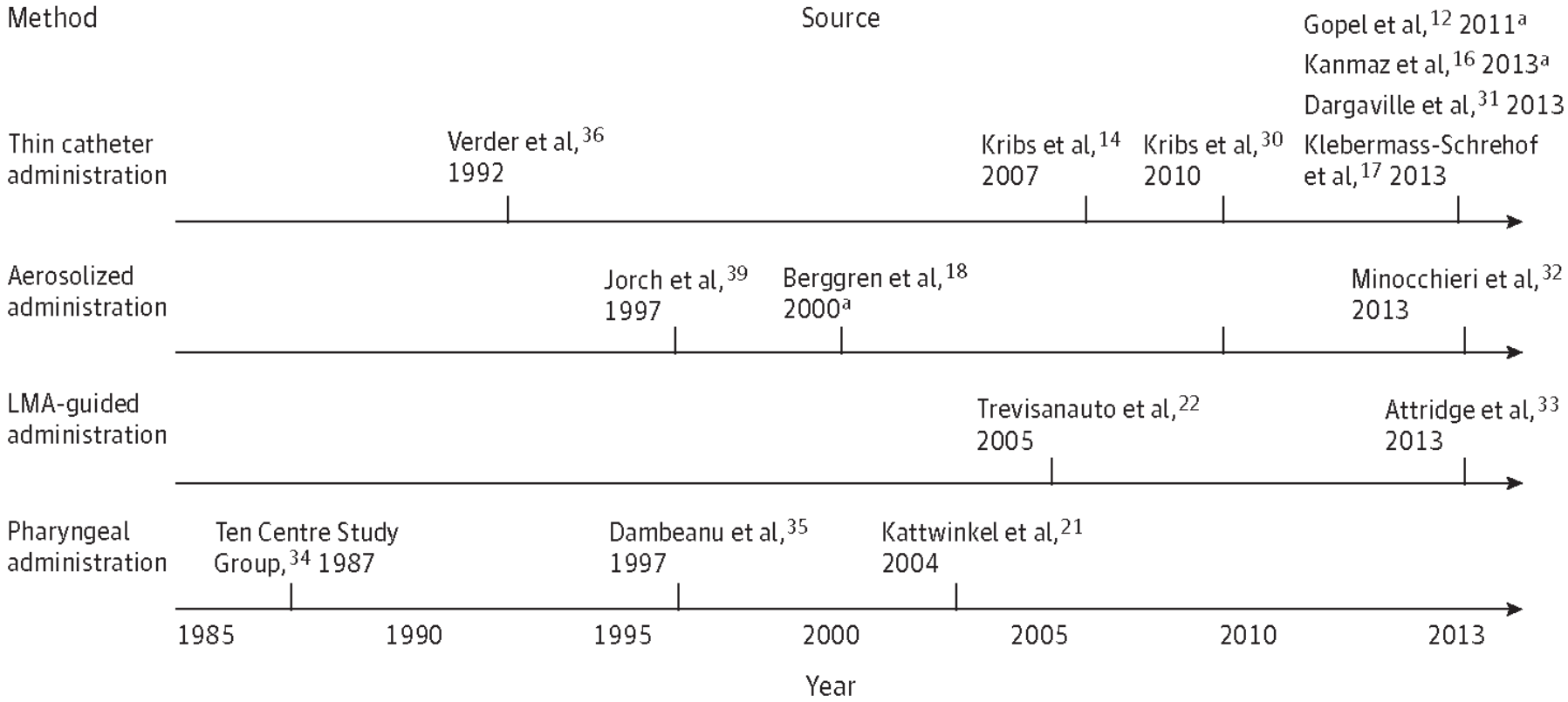
VON Delivery Room Management Trial

DEATH OR CLD at 36 WEEKS POSTMENSTRUAL AGE



From: **Minimally Invasive Surfactant Administration in Preterm Infants: A Meta-narrative Review**

JAMA Pediatr. 2014;168(10):901-908. doi:10.1001/jamapediatrics.2014.1148



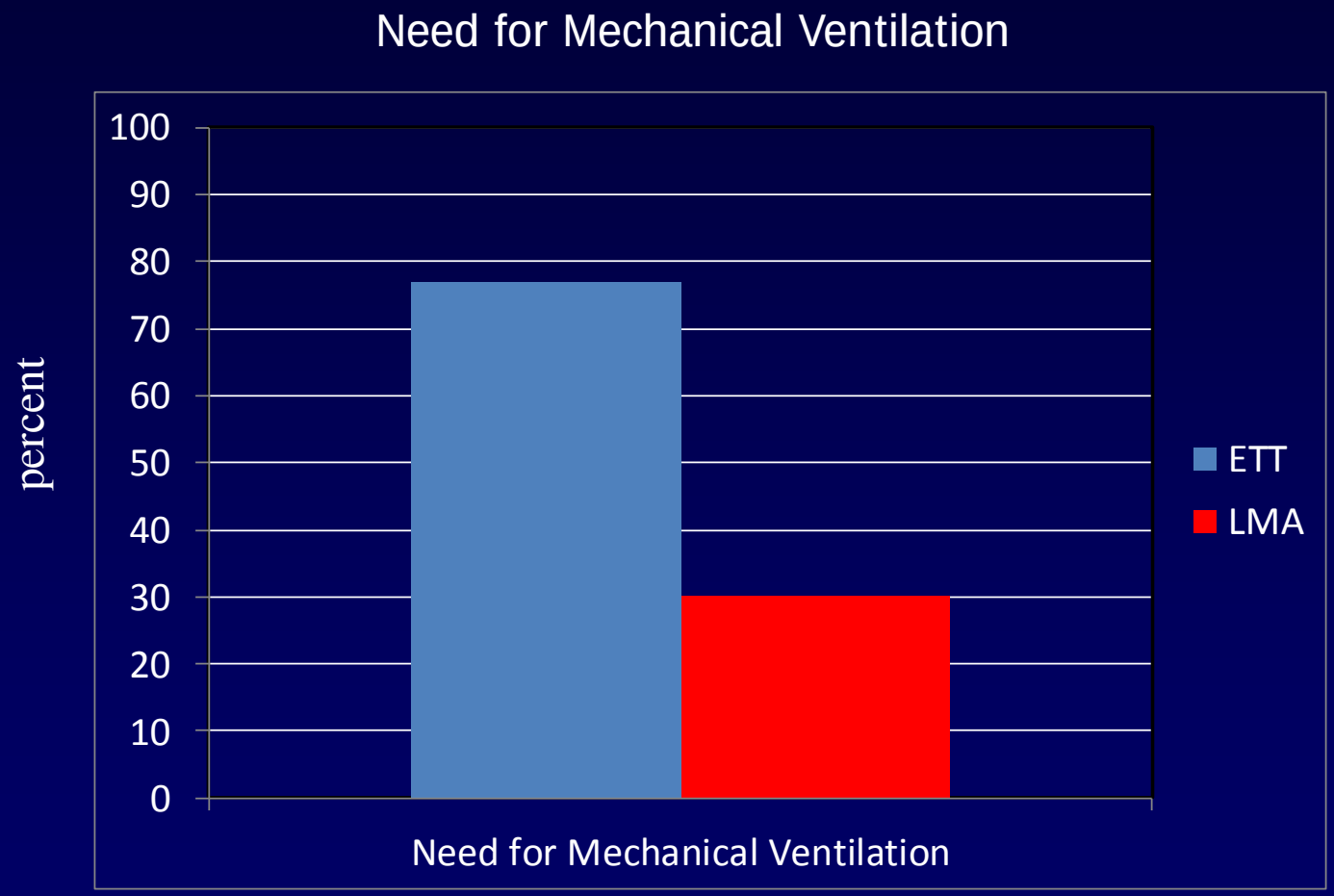
Timeline for Evolution of Techniques for Surfactant Administration While Maintaining Spontaneous BreathingLMA indicates laryngeal mask airway.
[a]Indicates randomized clinical trial.

Randomized trial of laryngeal mask airway versus endotracheal intubation for surfactant delivery. Pinheiro and coworkers. J Perinatol. 2016;36(3):196-201.

Study design: Moderately preterm infants diagnosed with RDS, receiving nasal continuous positive airway pressure with FiO2 0.30 to 0.60, were randomized to two groups at age 3 to 48 h. Those in the ETT group were intubated following premedication with atropine and morphine, whereas the LMA group received only atropine.

Both groups received calfactant before a planned reinstitution of nasal continuous positive airway pressure, and had equivalent pre-specified criteria for subsequent mechanical ventilation and surfactant retreatment.

Randomized trial of laryngeal mask airway vs. endotracheal intubation for surfactant delivery.



Pinheiro and coworkers. J Perinatol. 2016 Mar;36(3):196-201.

Neonatology

Novel Surfactant Application Techniques: Will they change outcome?

Whittney D. Barkhuff, MD, Roger F. Soll, MD

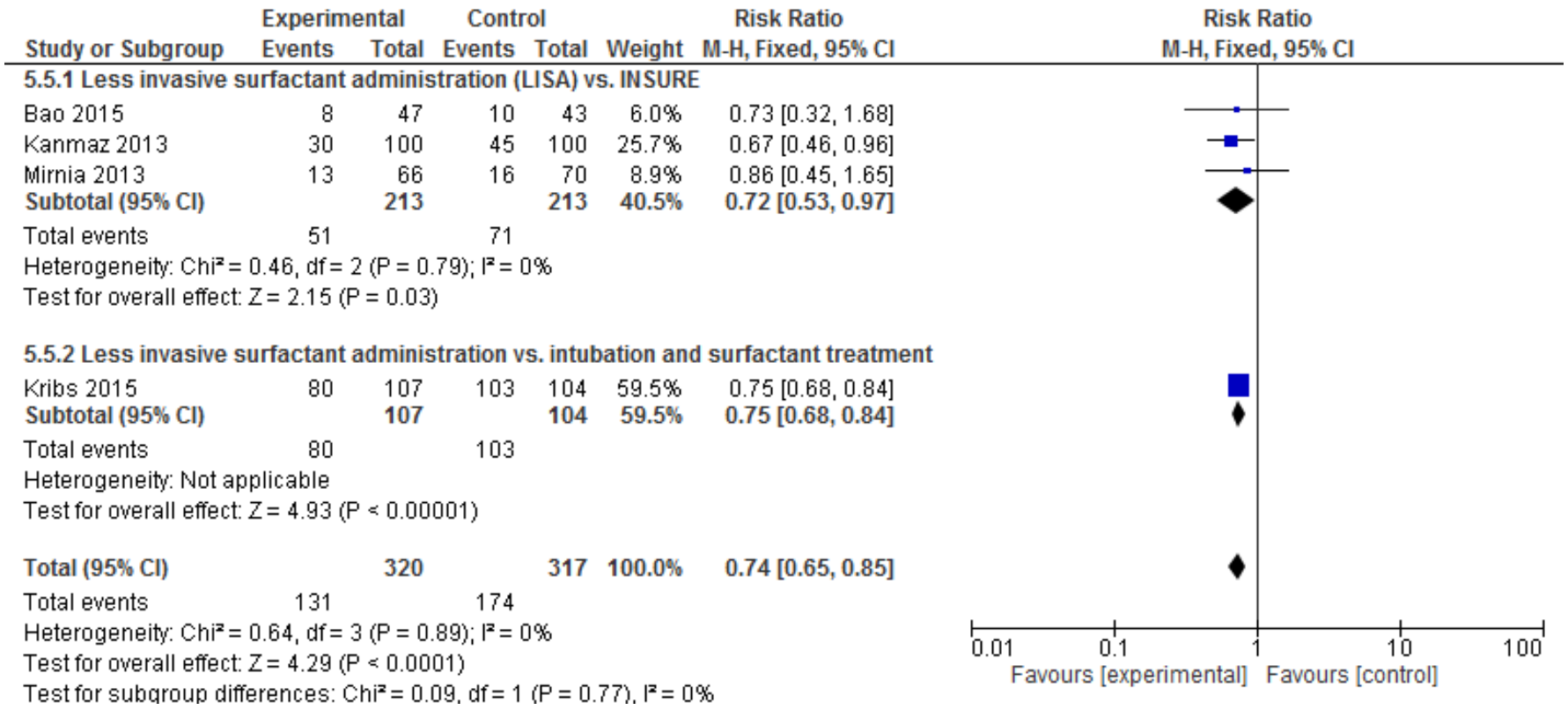
Randomized Controlled Trials of TCA: Less invasive surfactant administration compared to INSURE

Studies / Setting	Population	TCA	Other surfactant administration	Outcomes	Comments
Bao 2015 Single center, China	Infants 28 to 32 weeks' gestational age	Poractant alpha 200 mg/kg administered via a 16G angiocath (n=47)	Poractant alfa 200 mg/kg administered via InSurE (n=43)	No difference in rate of mechanical ventilation (MV) in the first 72 hours, BPD, pneumothorax, death, difference in duration of MV	
Kanmaz 2013 **Take Care Trial** Single center, Turkey	Infants ≥ 32 weeks' gestational age on CPAP receiving FiO2 ≥ 0.40	Poractant alpha 100 mg/kg administered via 5F feeding tube (n=100)	Poractant alfa 100 mg/kg administered via InSurE method (n=100)	Rate of MV in the first 72 hrs of life and BPD lower in TCA group, no difference in rate of death or pneumothorax	Second dose of surfactant administered by same method if met criteria
Mirnia 2013 **TEC (Thin Endotracheal Catheter) Trial** Iran, 3 centers	Infants 27 to 32 weeks' gestational age stabilized on CPAP and requiring FiO2 ≥ 0.30	Poractant alfa 200 mg/kg via 5F feeding tube (n=66)	Poractant alfa 200 mg/kg via InSurE technique (n=70)	Mortality lower in the TCA group; no difference in BPD, pneumothorax, or MV w/in the first 72 hours	High mortality rate in InSurE group (15.7%) compared to expected, possibly related to reliance on kangaroo care
Mohammadadizade 2015 **CATH (Thin Endotracheal Catheter) Trial** Iran, 2 centers	Infants ≤ 34 weeks' gestational age and 1000 to 1800 grams on CPAP and FiO_2 ≥ 0.30 within the first hour of life	Poractant alpha 200 mg/kg administered via a 6F feeding tube (n=19)	Poractant alpha 200 mg/kg alfa administered via InSurE technique (n=19)	Lower rate of adverse events and shorter duration of oxygen therapy in the LISA group than the InSurE group, no difference in death, BPD, MV within 72 hours	

Randomized Controlled Trials of TCA:
Less invasive surfactant therapy compared to selective intubation and surfactant administration

Studies / Setting	Population	TCA	Other surfactant administration	Outcomes	Comments
Gopel 2011 AMV (Avoiding Mechanical Ventilation) Trial 12 hospitals, Germany	Infants 26 to 28 weeks' gestation and less than 1500 grams were enrolled within 12 hours of birth.	Poractant alfa 100 mg/kg via a 2.5 to 5F catheter with the help of McGill forceps. (n=108)	CPAP, rescue intubation, and surfactant treatment "if needed" via endotracheal tube. (Poractant alfa 100 mg/kg)(n=112)	Lower rate of intubation at 2-3 days of life in TCA group than selective intubation group, no difference in mortality, pneumothorax, or BPD	Many patients in both groups were intubated shortly after birth
Kribs 2015 NINSAPP Trial (Nonintubated Surfactant Application) 13 Hospitals, Germany	Infants born at 23 to 26 6/7 weeks' gestational age who were spontaneously breathing on CPAP with FiO2 $\geq$ 0.30 or Silverman score $\geq$ 5	Poractant alfa 100 mg/kg administered via 4F feeding tube (n=107)	Poractant alfa 100 mg/kg administered via endotracheal tube after intubation and mechanical ventilation (n=104)	Reduction in absolute risk of survival without BPD and pneumothorax in the TCA group compared with the selective intubation group	Comparison of surfactant administration by TCA with surfactant by intubation and mechanical ventilation (rather than InSurE method)
Olivier 2017 3 Hospitals, Canada	Infants 32 to 36 6/7 weeks' gestational age stable on CPAP 6 and $FiO_2 \geq 0.35$ in the first 24 hours of life	Beractant 100 mg/kg via 5F feeding tube (n=24)	Beractant 100 mg/kg after intubation and mechanical ventilation at the discretion of the attending neonatologist (n=21)	Absolute risk reduction in the in the need for mechanical ventilation or pneumothorax requiring chest tube placement in the TCA group vs. the selective intubation group	Did not report death or BPD rates

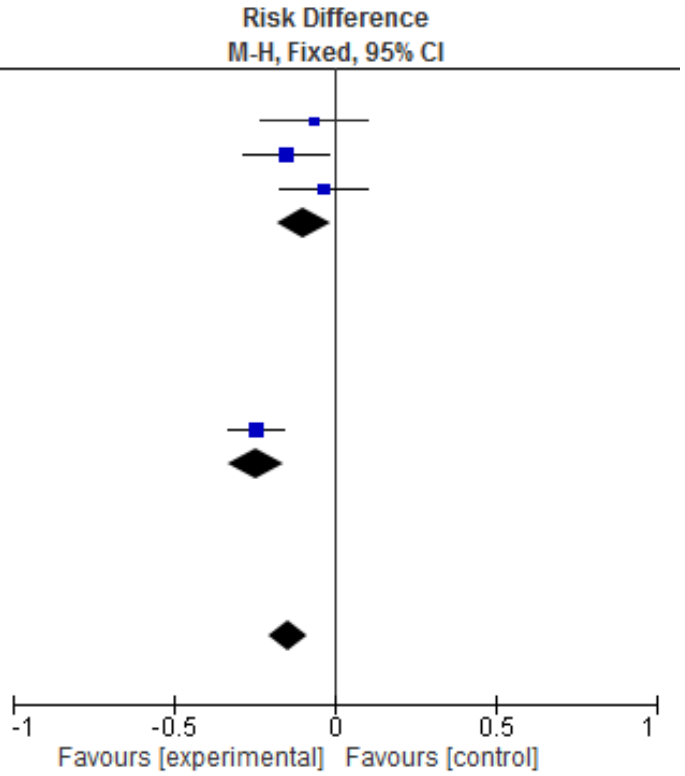
Less Invasive Surfactant Administration
Effect on Mechanical Ventilation in the first 72 hours



Typical risk ratio 0.74 95% CI 0.65 to 0.85

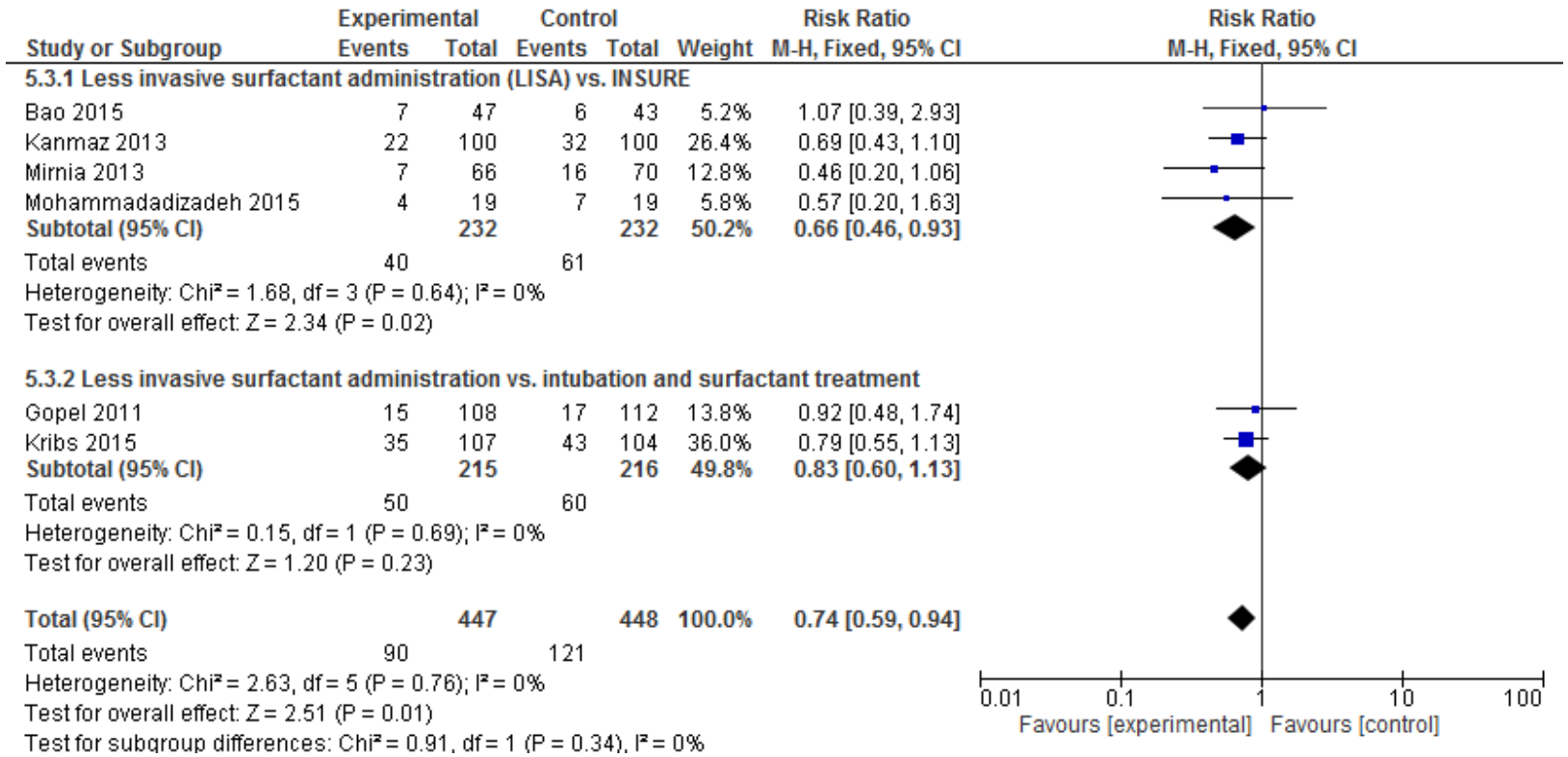
Less Invasive Surfactant Administration
Effect on Mechanical Ventilation in the first 72 hours

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Difference M-H, Fixed, 95% CI
5.5.1 Less invasive surfactant administration (LISA) vs. INSURE						
Bao 2015	8	47	10	43	14.1%	-0.06 [-0.23, 0.10]
Kanmaz 2013	30	100	45	100	31.4%	-0.15 [-0.28, -0.02]
Mirnia 2013	13	66	16	70	21.3%	-0.03 [-0.17, 0.11]
Subtotal (95% CI)		**213**		**213**	**66.9%**	**-0.09 [-0.18, -0.01]**
Total events	51		71			
Heterogeneity: Chi² = 1.61, df = 2 (P = 0.45); I² = 0%						
Test for overall effect: Z = 2.19 (P = 0.03)						
5.5.2 Less invasive surfactant administration vs. intubation and surfactant treatment						
Kribs 2015	80	107	103	104	33.1%	-0.24 [-0.33, -0.16]
Subtotal (95% CI)		**107**		**104**	**33.1%**	**-0.24 [-0.33, -0.16]**
Total events	80		103			
Heterogeneity: Not applicable						
Test for overall effect: Z = 5.64 (P < 0.00001)						
Total (95% CI)		**320**		**317**	**100.0%**	**-0.14 [-0.21, -0.08]**
Total events	131		174			
Heterogeneity: Chi² = 8.80, df = 3 (P = 0.03); I² = 66%						
Test for overall effect: Z = 4.48 (P < 0.00001)						
Test for subgroup differences: Chi² = 6.03, df = 1 (P = 0.01), I² = 83.4%						



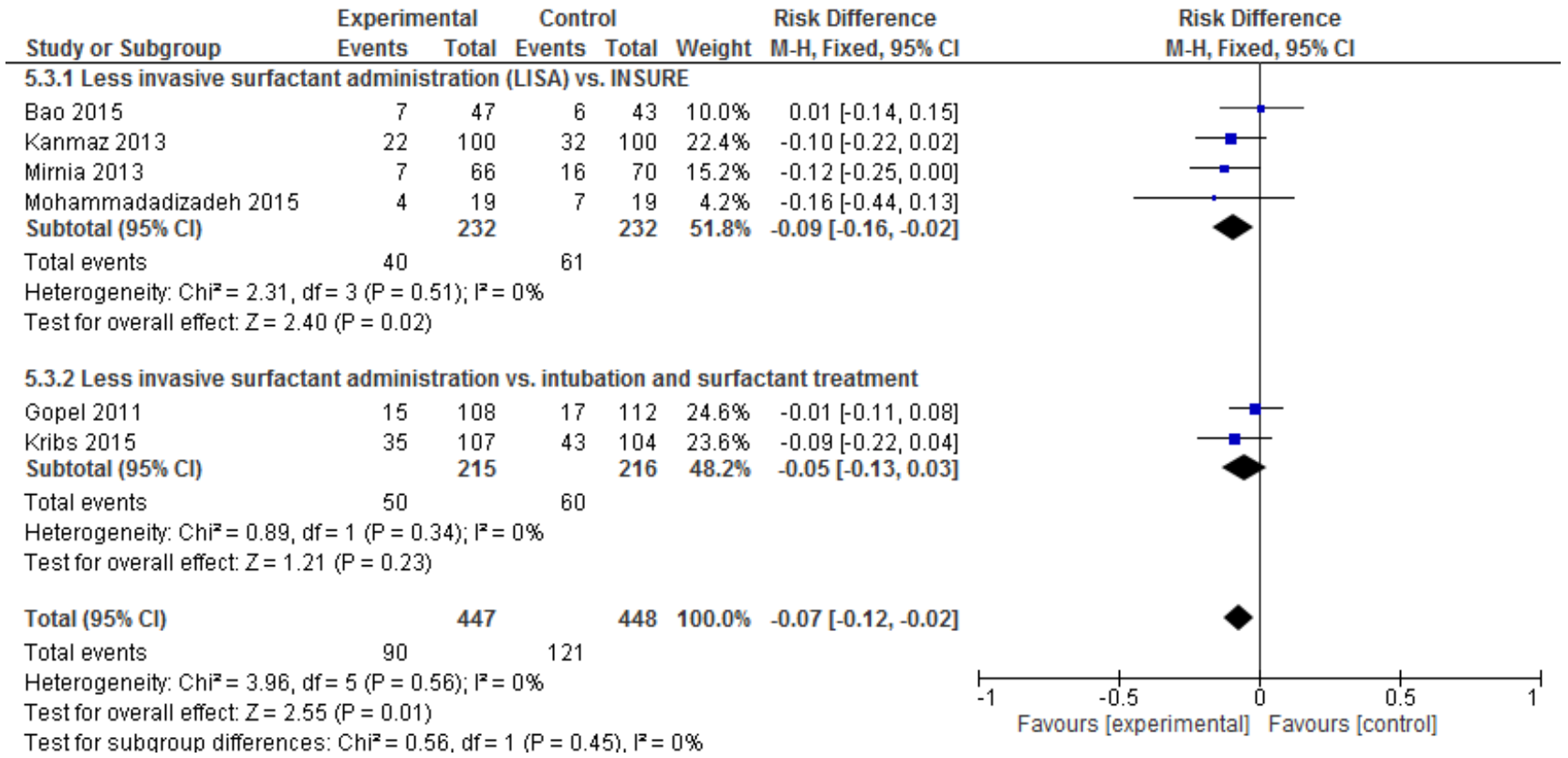
Typical risk difference -0.14 95% CI -0.21 to -0.08

Less Invasive Surfactant Administration
Effect on Bronchopulmonary Dysplasia or Death



Typical risk ratio 0.74 95% CI 0.59 to 0.94

Less Invasive Surfactant Administration
Effect on Bronchopulmonary Dysplasia or Death



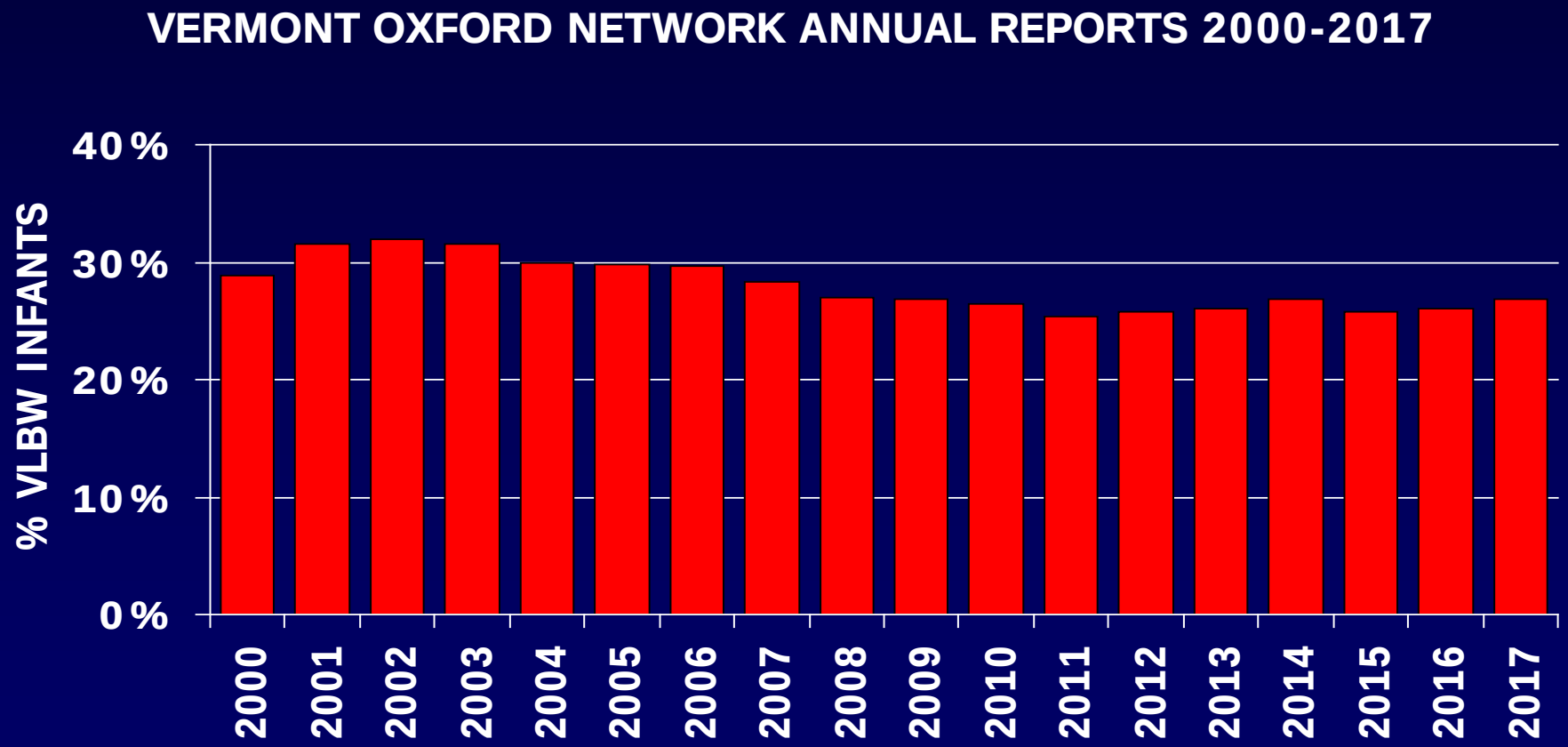
Typical risk difference -0.07 95% CI -0.12 to -0.02

Surfactant via brief tracheal catheterization

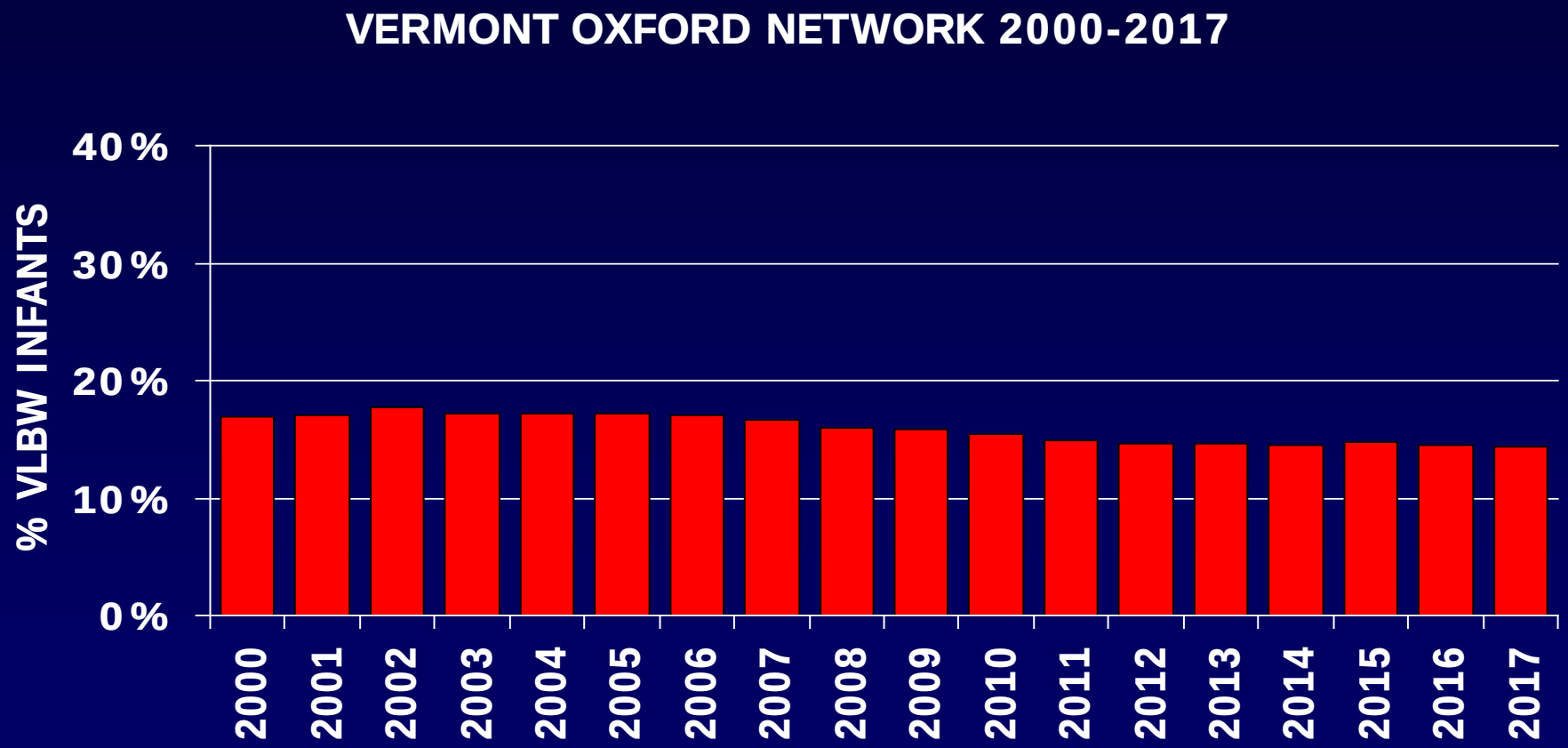
Early experience with less invasive surfactant therapy is extremely positive in lessening the need for mechanical ventilation, BPD and quite possibly even mortality.

We need to gain greater experience with non invasive respiratory support of high risk infants in the delivery room and consider further trials of less invasive methods of surfactant administration to determine the correct patient population, timing of treatment, technical issues (type of catheter, need for premedication).

CHRONIC LUNG DISEASE IN VLBW INFANTS



MORTALITY IN VLBW INFANTS



Our Changing Practice....
Is it Evidence Based?

Has all this practice change influenced outcome?

Yes...but probably not as much as we had hoped!

Questions/Discussion?