



Dipartimento di
Pediatria

L'urgenza formativa ... continua

Padova, 24-26 Ottobre 2013

Daniele Trevisanuto



Update sulla Rianimazione Neonatale



Qui si parla del luogo di nascita di Oliver Twist e delle circostanze che si riferiscono alla sua venuta al mondo.

Non voglio dichiarare che il nascere in un ospizio per poveri rappresenti una circostanza di favore per un essere umano; tuttavia, per Oliver Twist si rivelò come un colpo di fortuna.

I suoi polmoni si rifiutavano di lavorare e solo dopo notevoli sforzi si riuscì a convincerli a respirare...

... Così per qualche tempo egli rimase immobile nella sua cuccia, incerto se restare in questo basso mondo o volarsene verso uno migliore. *(to be continued)*



Charles Dickens,
Bentley's Miscellany, 1837-1839



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L'urgenza formativa *... continua*

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Update sulla Rianimazione Neonatale



News in Neonatal Resuscitation... 2013

- A Randomized Trial of Exothermic Mattresses for Preterm Newborns in Polyethylene
(*McCharty et al. Pediatrics 2013*)
- Oronasopharyngeal suction versus wiping of the mouth and nose at birth: a randomised equivalency trial
(*Kelleher et al. Lancet 2013*)
- Oxygen Delivery Using a Neonatal Self-inflating Resuscitation Bag: Effect of Oxygen Flow
(*Trevisanuto et al. Pediatrics 2013*)



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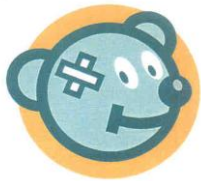
L'urgenza formativa *... continua*

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**Rianimazione Neonatale:
Metodologia, Ostacoli ed Opportunità**



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L'urgenza formativa ... continua

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**Rianimazione Neonatale:
Metodologia, Ostacoli ed Opportunità**



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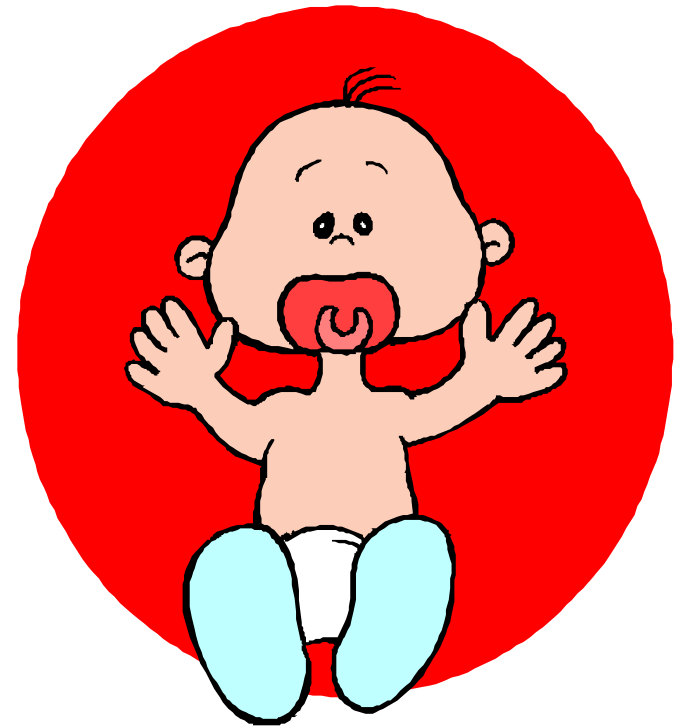
Oxygen supplementation at birth

Intrauterine (liquid) environment



[SaO₂=50%]

Extrauterine (air) environment



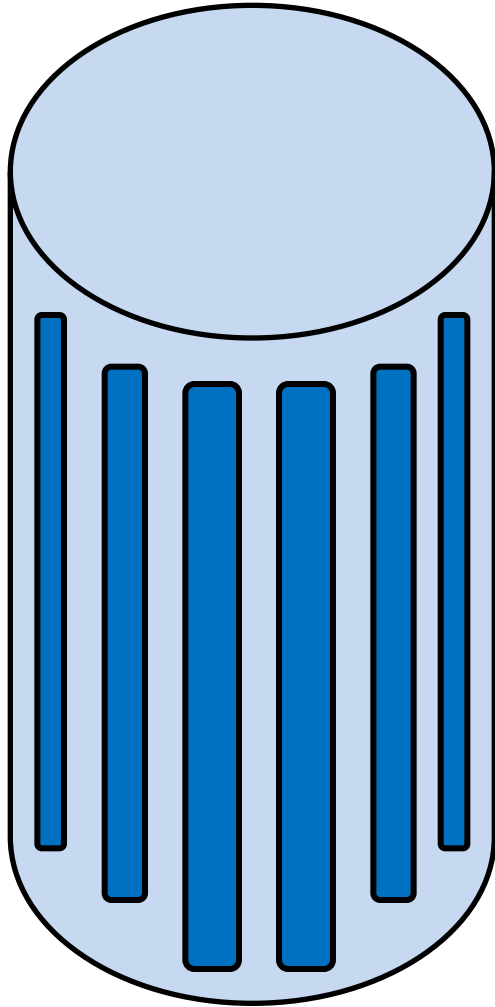
[SaO₂= 59% (1 min)
68% (2 min)
82% (5 min)
SaO₂= 90% (15 min)]

1992 International Liaison Committee on Resuscitation (ILCOR)

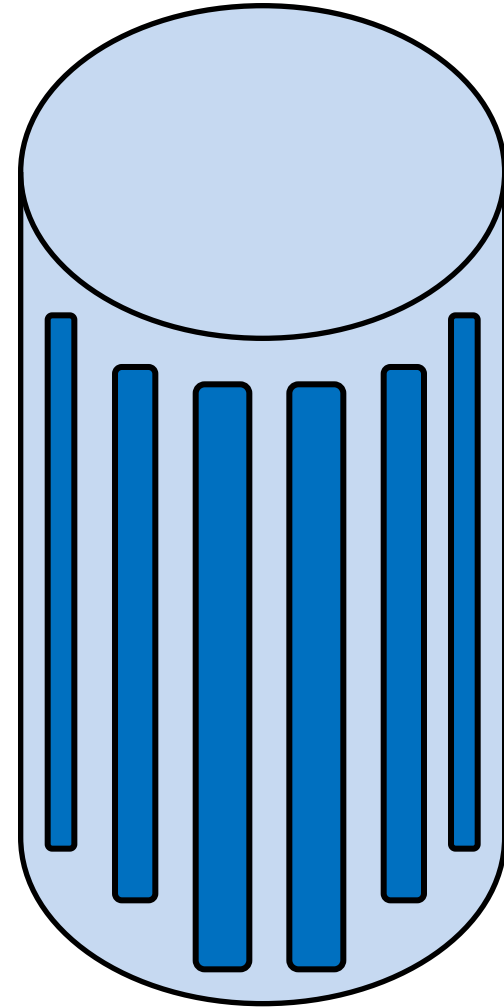
“...oxygen should be used, it is not toxic
and there is no reason to be concerned.”

AHA, JAMA 1992

100% Oxygen-therapy: Why?



Pulmonary hypertension

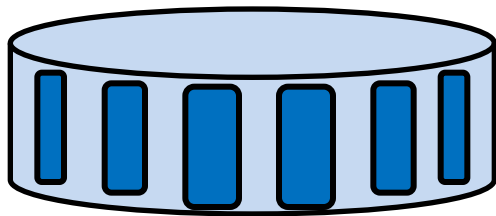


Cerebral oxygenation

100% Oxygen-therapy: Why?

Campbell AGM, Cross KW, Dawes GS, Hyman AI. A comparison of air and O₂ in a hyperbaric chamber by positive pressure ventilation, in the resuscitation of newborn rabbits.

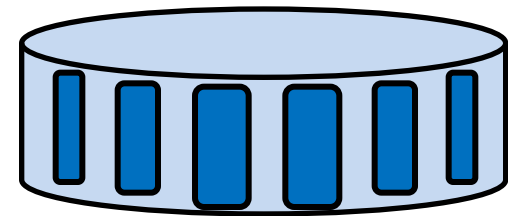
J Pediatr 1966; 68: 153–163



Pulmonary hypertension

Perez-de-Sa V, Cunha-Goncalves D, Nordh A, Hansson S, Larsson A, Ley D et al. High brain tissue oxygen tension during ventilation with 100% oxygen after fetal asphyxia in newborn sheep.

Pediatr Res 2009; 65: 57–61



Cerebral oxygenation

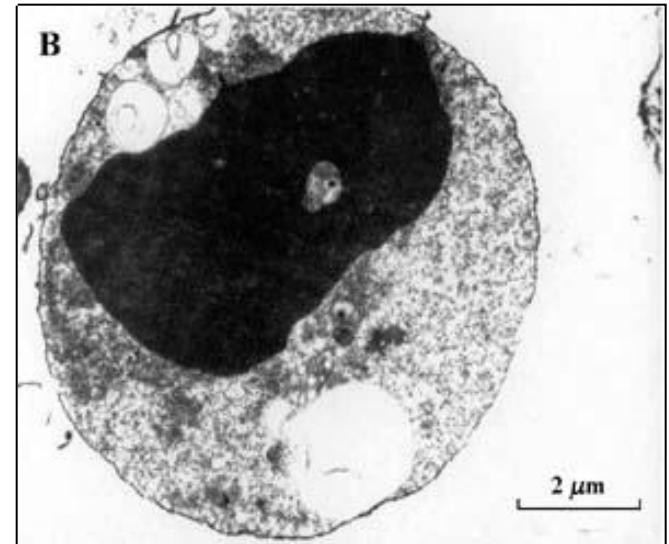
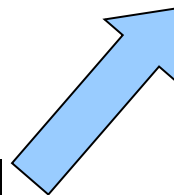
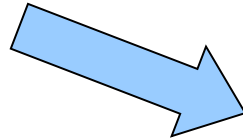
Neuronal damage

Excito-toxicity' (\downarrow ATP
and \uparrow glutammate in
synaptic space)

Accumulation of
intracellular Calcium

Free radical formation

Pro-inflammatory cytokines
production





100% oxygen vs room air: clinical studies

- Prospective, international, controlled, multicenter (n. 11) study**
- 609 neonates with BW > 999g**
- Even dates: room air**
- Odd dates: 100% oxygen**

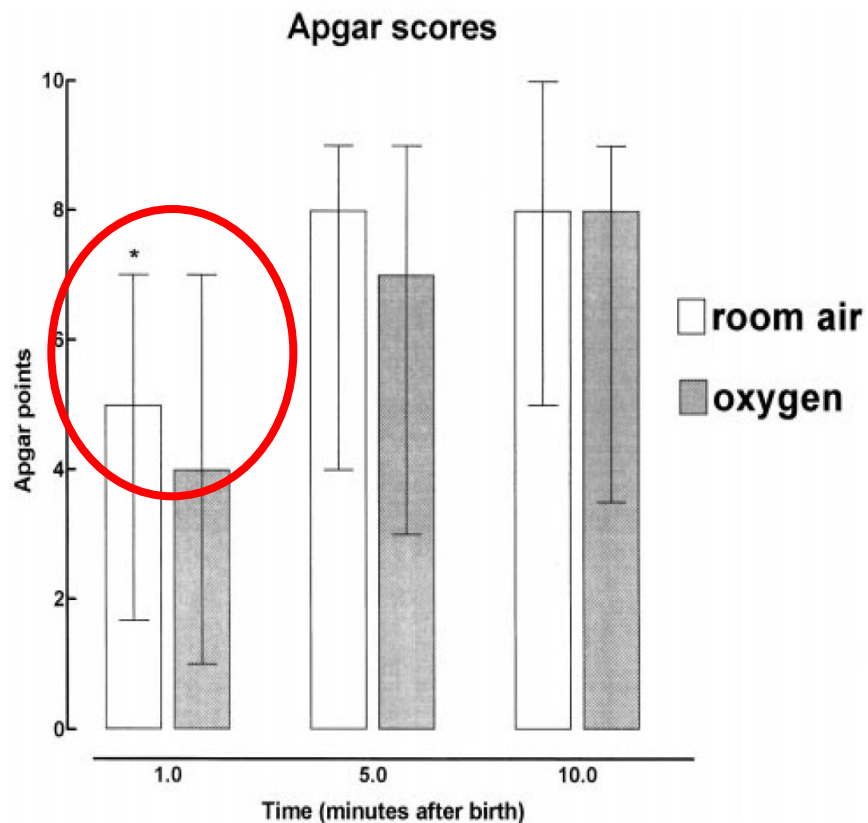


Fig 3. Apgar scores at 1, 5, and 10 minutes after birth in infants resuscitated with room air or 100% oxygen. Median values and 5 to 95 percentiles are given. Open bars indicate room air group; hatched bars indicate oxygen group. * $P = .004$.

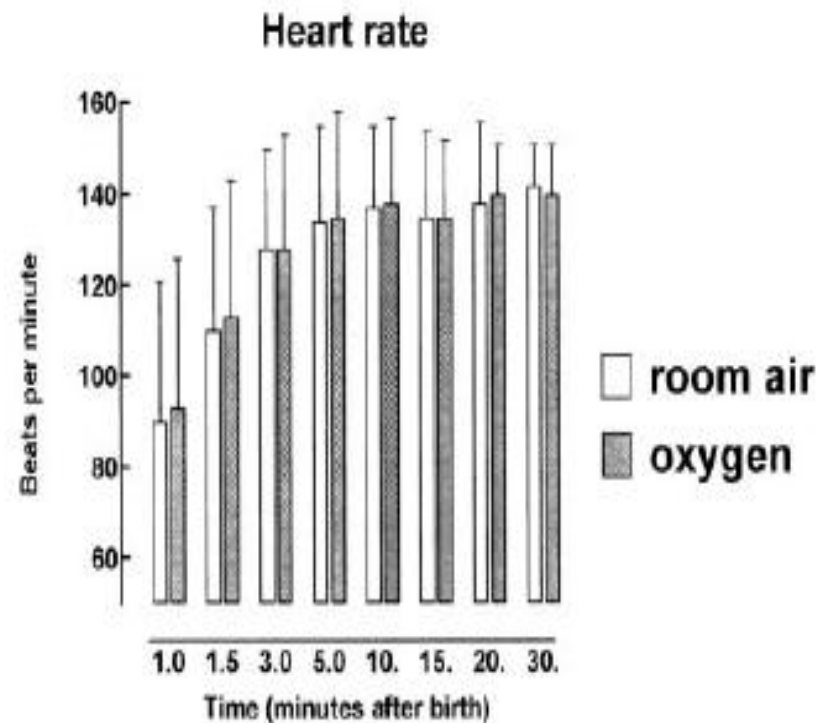


Fig 2. Heart rates between 1 and 30 minutes after birth in infants resuscitated with room air or 100% oxygen. Mean and SD are given. Open bars indicate room air group; hatched bars, oxygen group. No significant differences between the two groups were found.

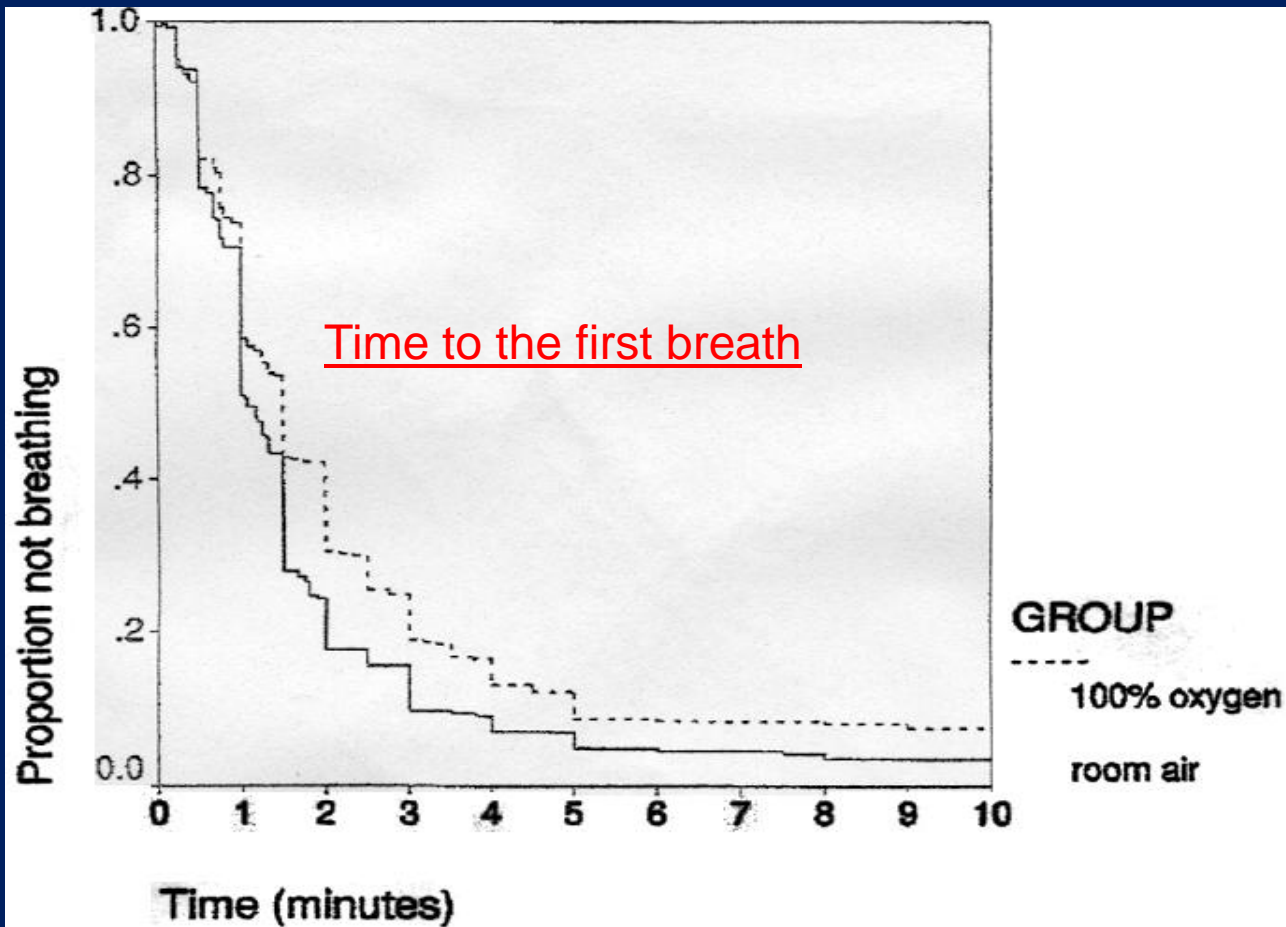


Fig 4. Kaplan-Meier plot showing the proportion that had not taken the first breath in room air- and oxygen-resuscitated newborn infants. Time to first breath was significantly longer in the oxygen-resuscitated group compared with the room air-resuscitated group. In the oxygen group, 60/313 (19.2%) required >3 minutes to take the first breath compared with 28/284 (9.9%) in the room air group (OR = 0.47; 95% CI = 0.29–0.76).

“... data is insufficient to justify a change from the recommendation that 100% oxygen be used if assisted ventilation is required.”

AHA, AAP, Pediatrics 2000



Time needed for the onset of a sustained respiratory pattern

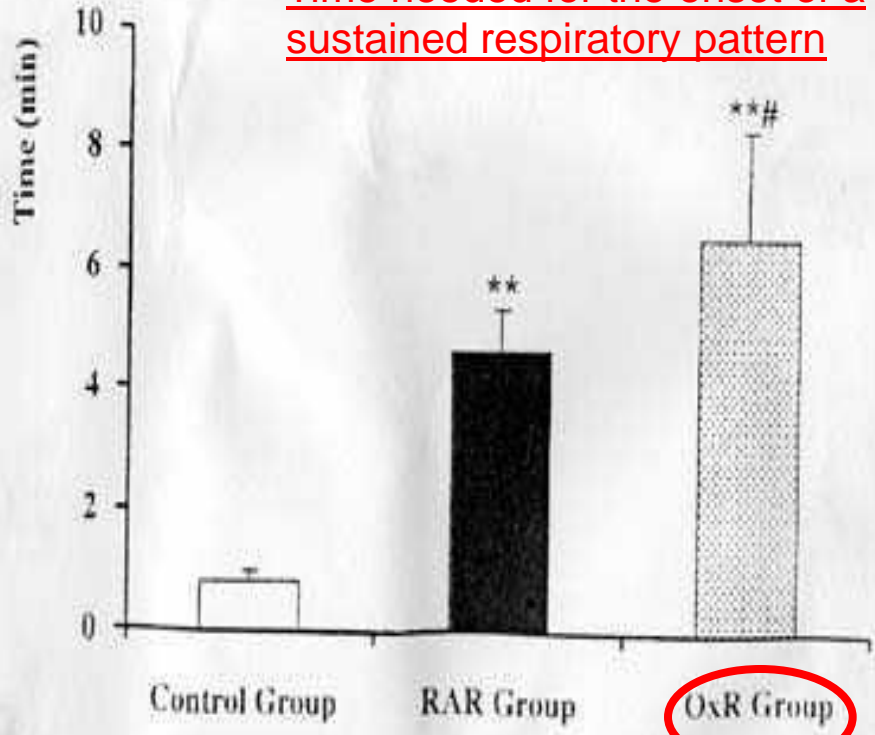


Fig 1. Time needed for the onset of a sustained respiratory pattern in moderately asphyxiated neonates resuscitated with either room air or 100% oxygen compared with the nonasphyxiated control group. Statistical significance is indicated as follows: ** $P < .01$ versus control; # $P < .05$ versus RAR.

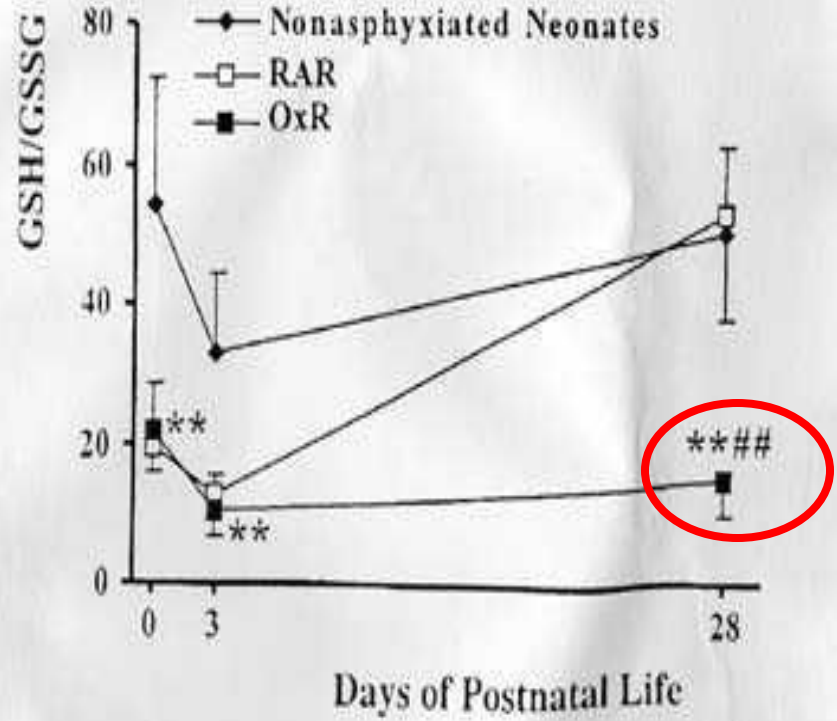


Fig 2. GSH/GSSG ratio in asphyxiated neonates resuscitated with 100% oxygen or room air. Statistical significance is indicated as follows: ** $P < .01$ versus control; ## $P < .01$ versus RAR.



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“ The standard approach to resuscitation is to use 100% oxygen.”

AHA, AAP, Pediatrics 2006



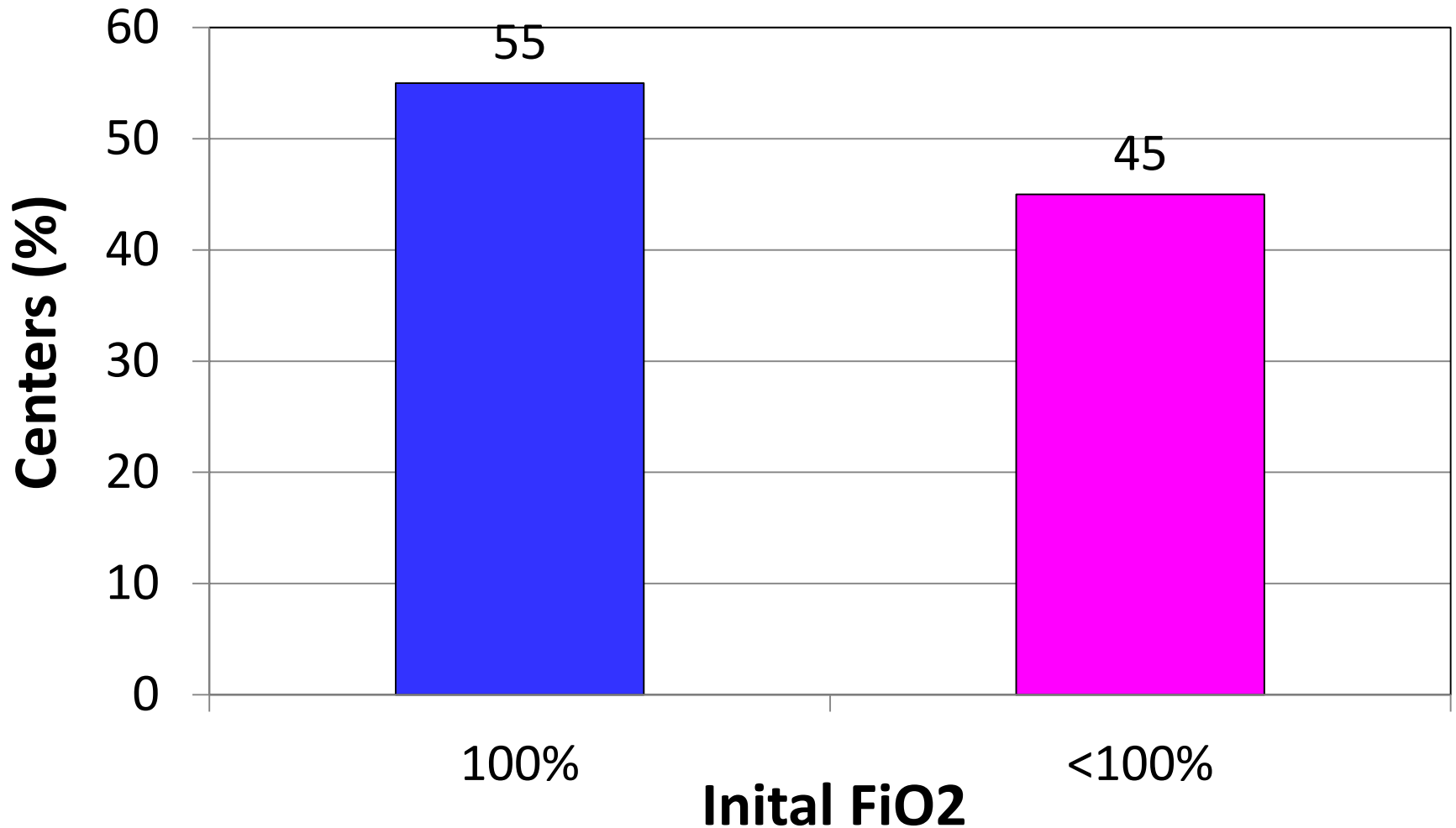
Some clinicians may begin resuscitation with an oxygen concentration of less than 100%, and some may start with no supplementary oxygen (ie, room air). There is evidence that employing either of these practices during resuscitation of neonates is reasonable.

AHA, AAP, Pediatrics 2006



FiO₂ during initial PPV

Neonatal resuscitation of ELBWI in Italy (76 centers)



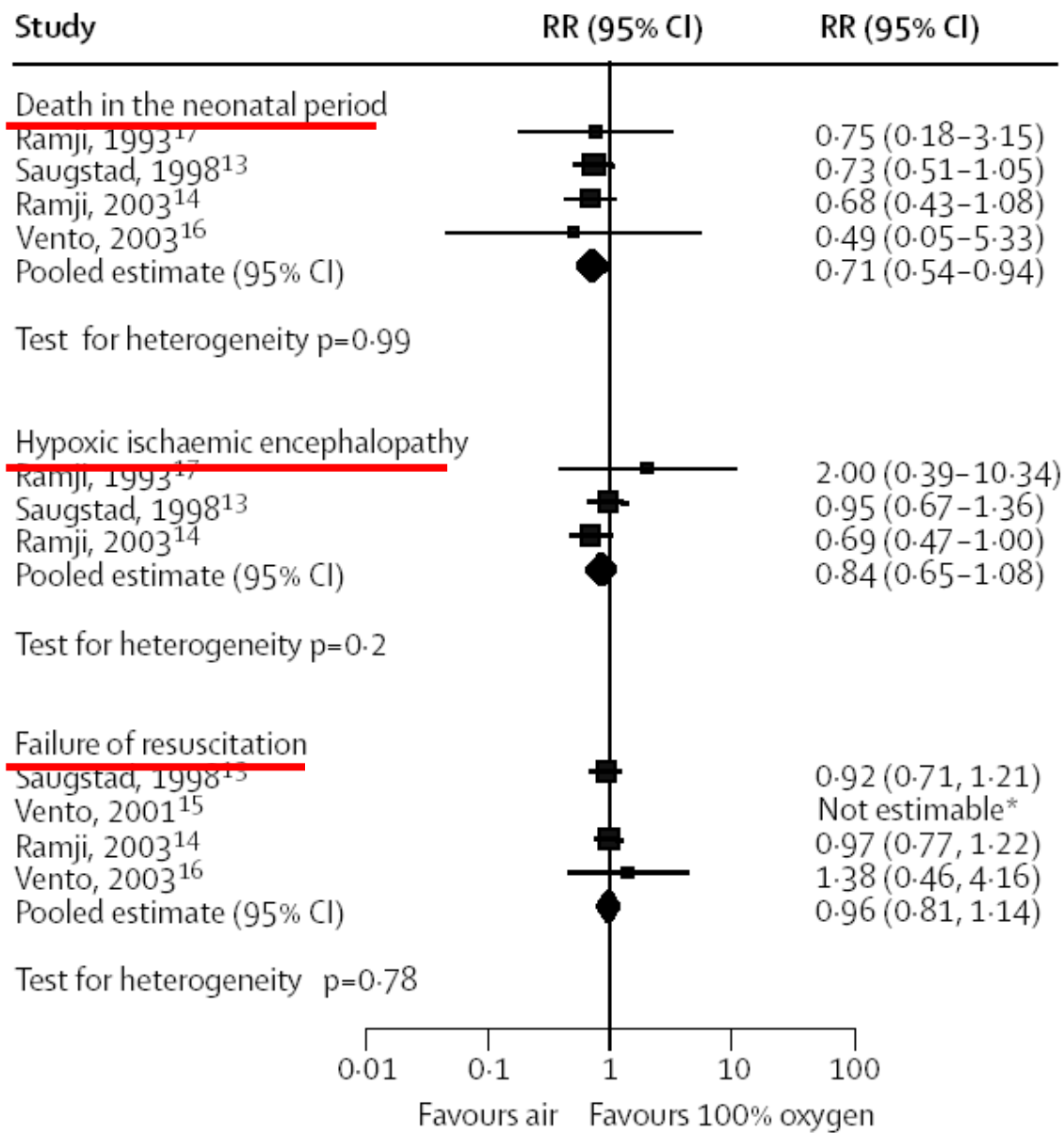


Figure: Pooled analyses

Relative risks assessed with fixed-effects model. *No events in either group.



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Mortality rate: relative risk 0.69,
(95% CI 0.54–0.88)

“The use of 100% oxygen for newborn resuscitation probably will be remembered as one of the most dangerous therapies inflicted on newborns”.

Saugstad OD, Lancet 2010

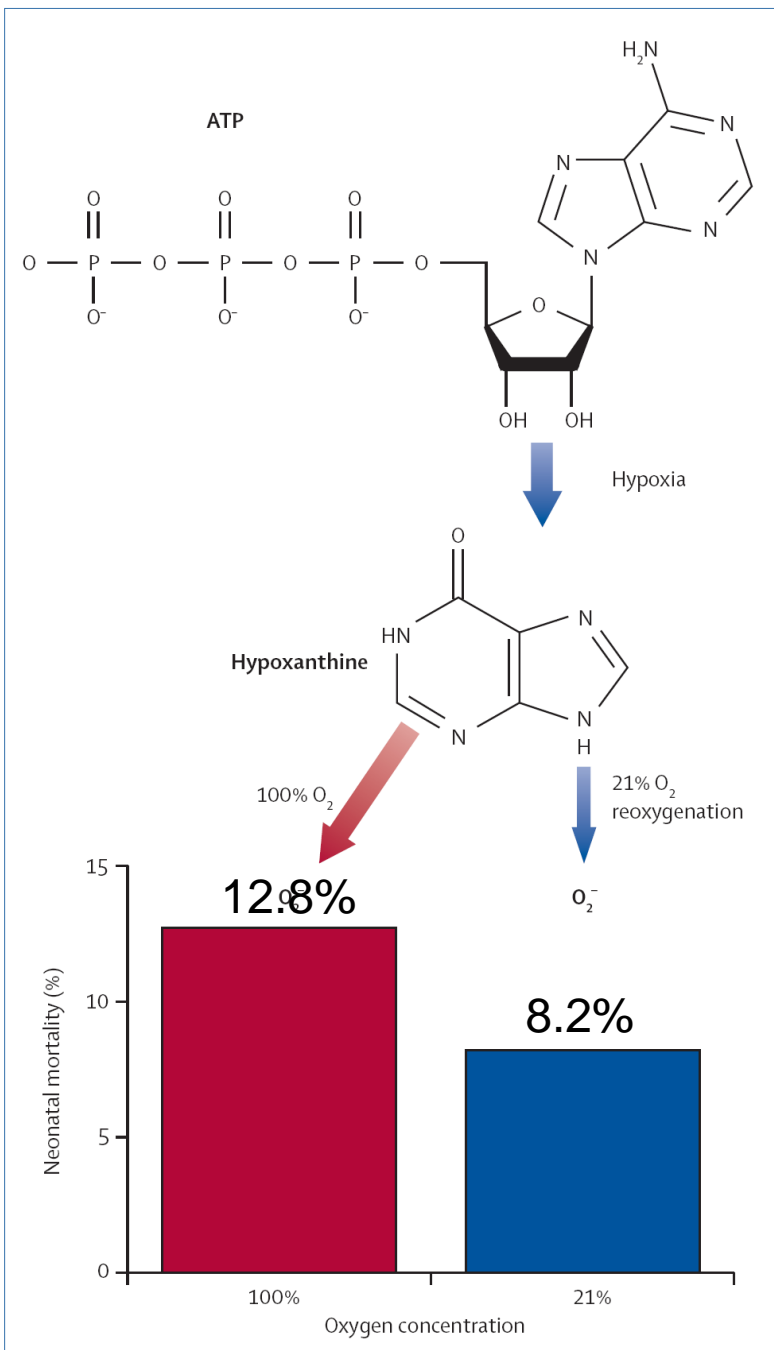


Figure: From molecular understanding to clinical practice in newborn resuscitation

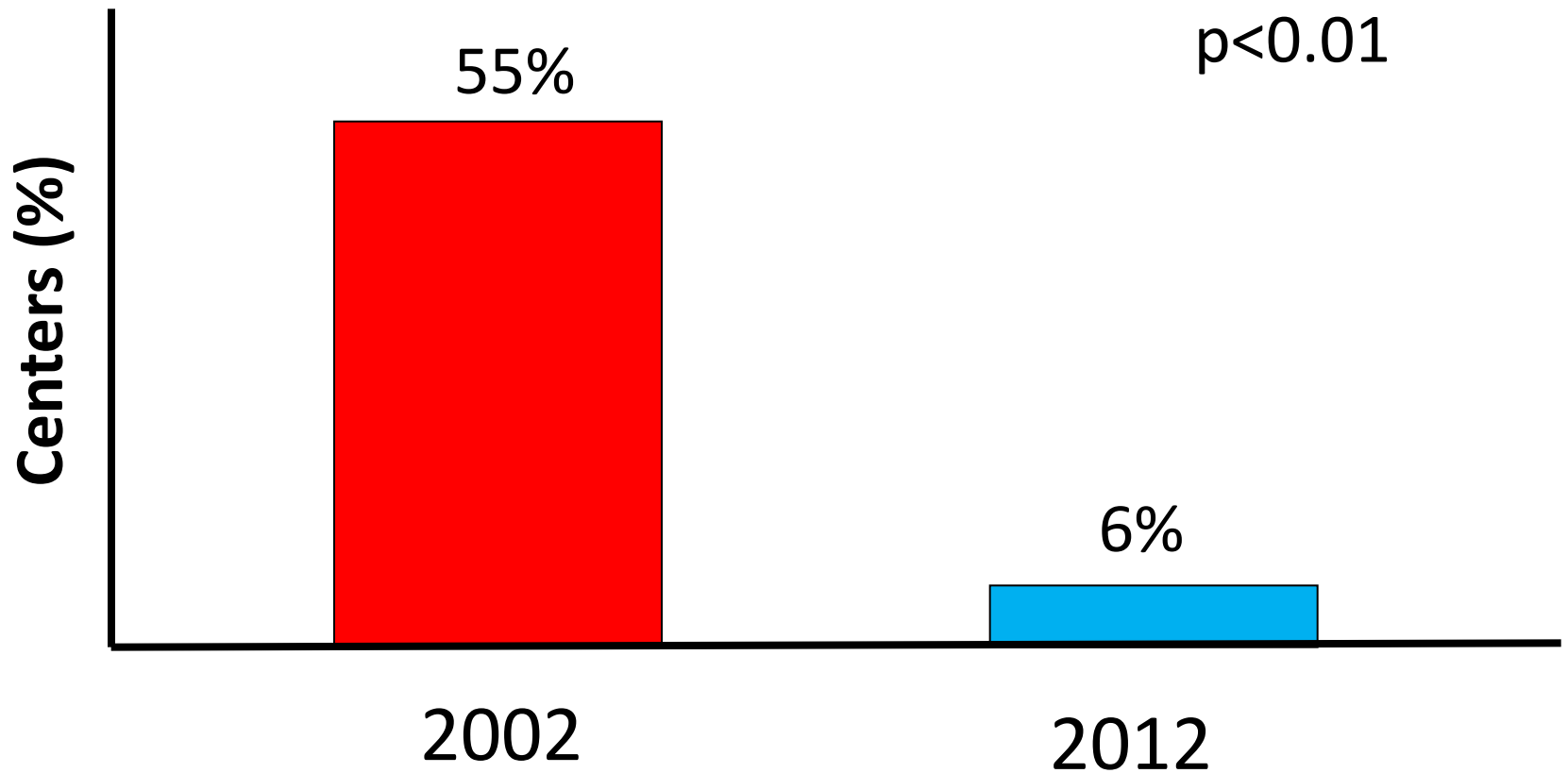


For babies born at term it is best to
begin resuscitation with air rather
than 100% oxygen.

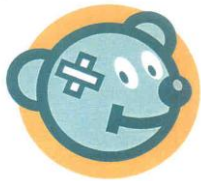


100% oxygen to initiate resuscitation

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Trevisanuto D et al, 2013 (submitted)



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**Rianimazione Neonatale:
Metodologia, Ostacoli ed Opportunità**



**Faccio le cose che ho
sempre visto fare!**

**Lo so, ma non ci
credo!**

**Lo so, ma questa
è l'evidenza
disponibile...**



Ostacoli



**Faccio le cose che ho
sempre visto fare!**

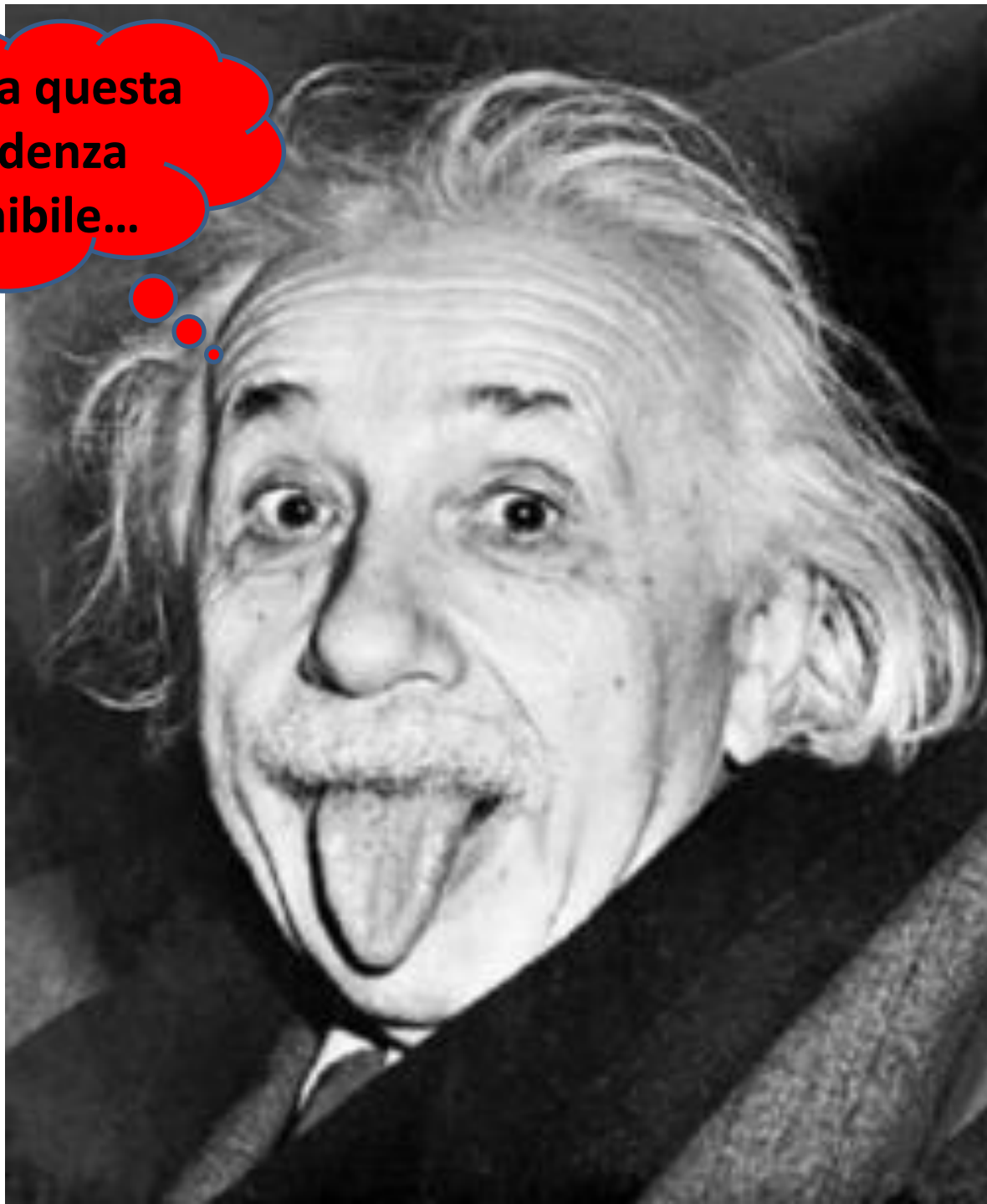
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Ostacoli

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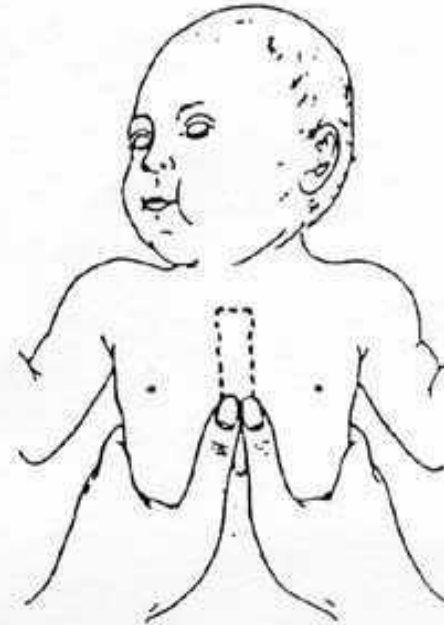


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Chest compressions



AHA, AAP, Pediatrics 2000



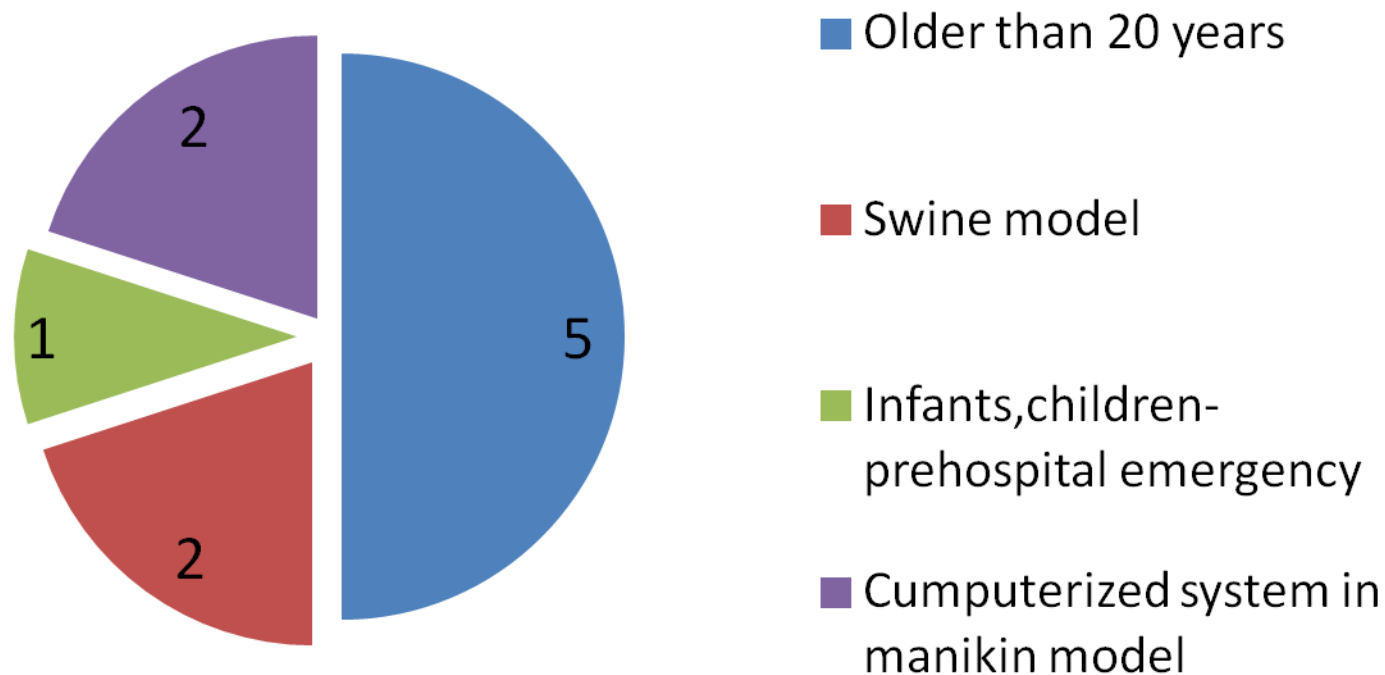
76. Menegazzi JJ, Auble TE, Nicklas KA, Hosack GM, Rack L, Goode JS. Two-thumb versus two-finger chest compression during CRP in a swine infant model of cardiac arrest. *Ann Emerg Med.* 1993;22:240–243
77. Hourii PK, Frank LR, Menegazzi JJ, Taylor R. A randomized, controlled trial of two-thumb vs two-finger chest compression in a swine infant model of cardiac arrest. *Prehosp Emerg Care.* 1997;1:65–67



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Chest compressions

REFERENCES: 10



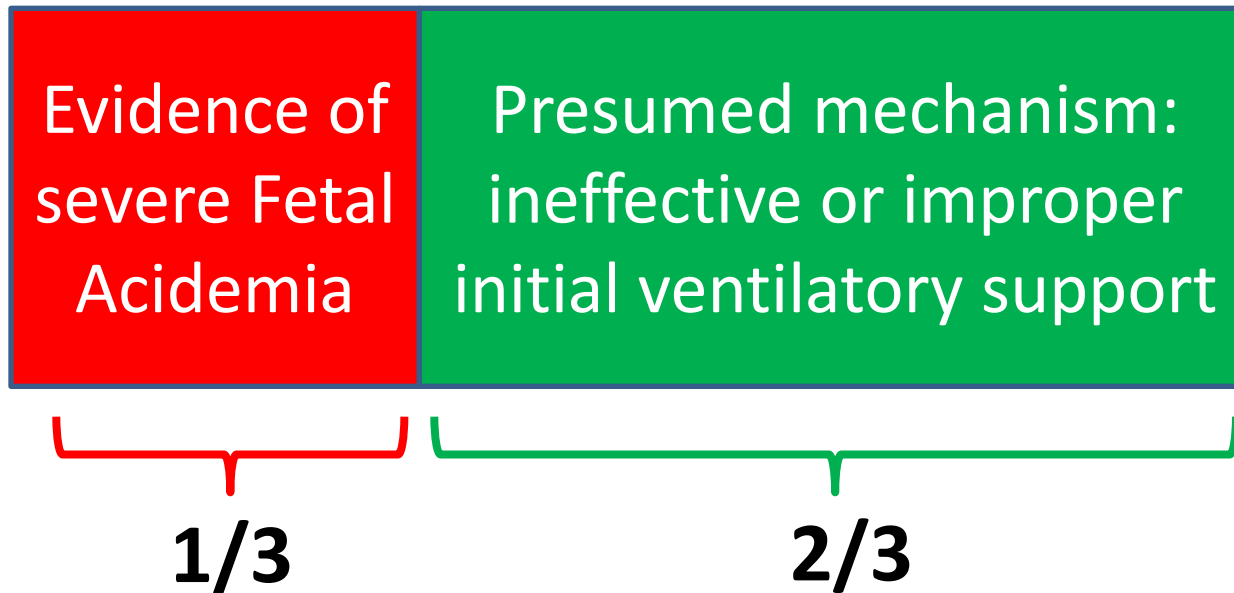
(Class IIb)

Kattwinkel, Pediatrics 2010



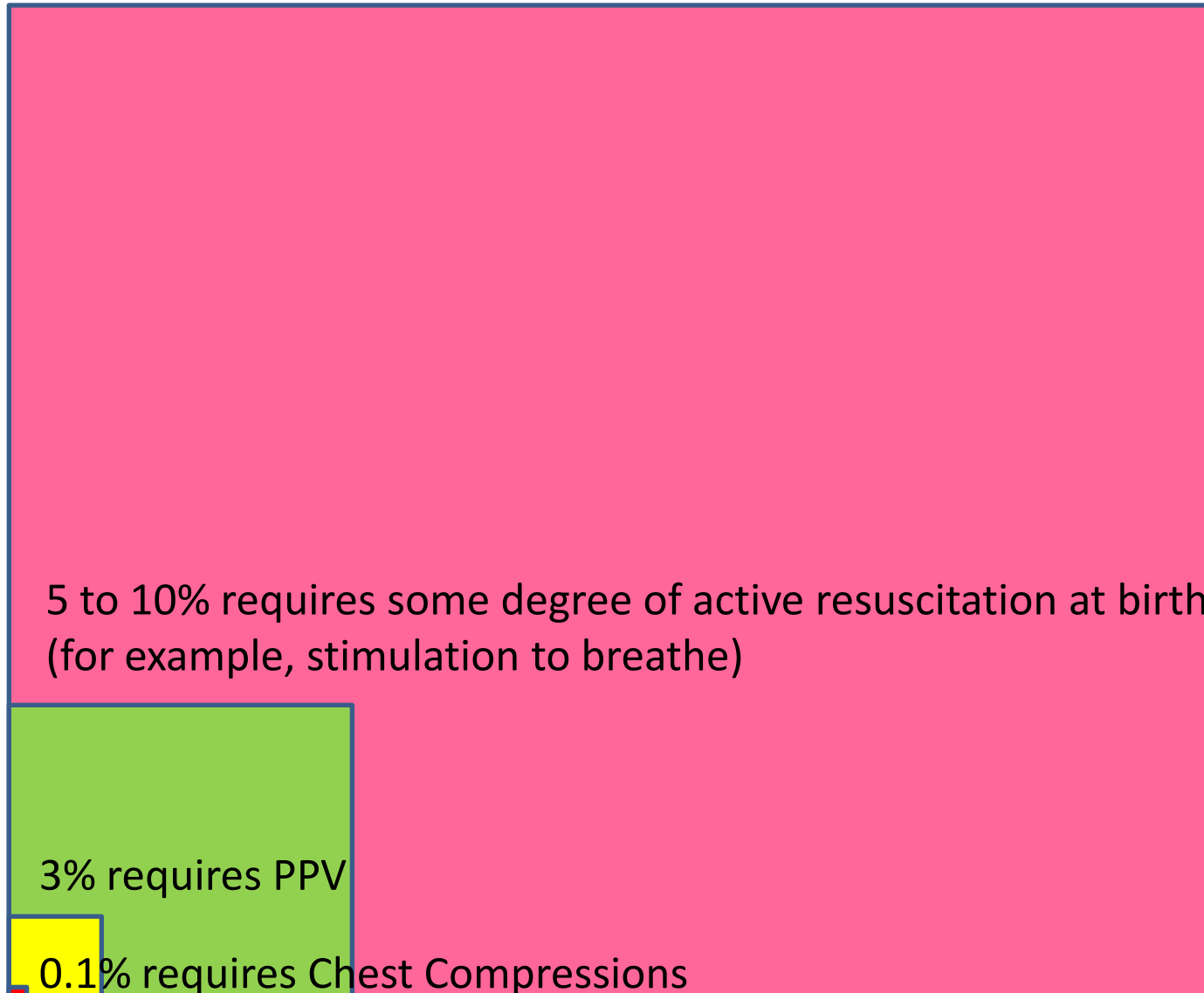
Chest compressions and/or epinephrine in delivery room

39 (0.12%) of 30,839 infants





Total newly born population (100)





**Faccio le cose che ho
sempre visto fare!**

**Lo so, ma non ci
credo!**

**Lo so, ma questa
è l'evidenza
disponibile...**



Ostacoli

A photograph of a man on the left and a sloth on the right, both shown in profile and looking towards each other. The man has short dark hair and is wearing a patterned jacket. The sloth is covered in thick brown fur. A green thought bubble is positioned above the sloth's head.

Faccio le cose che ho
sempre visto fare!

Scritto
in faccia

Stretta
parentela



BACKGROUND

At birth, infants needing neonatal resuscitation are positioned under a radiant infant warmer (RIW).



BACKGROUND

The radiant warmers were preheated by using a 5% dextrose intravenous bag as a “phantom” and set to manual control with maximum output.

Vohra et al. J Pediatr 2004

A polyurethane bag (DeRoyal REF30-5510, sterile isolation transport bag 19'' × 18'') was placed on the radiant warmer bed prior to delivery for infants randomized to the intervention group.

Knobel et al. J Perinatol 2005

All infants were cared for in the delivery room with radiant warmers (Babytherm 8004/8010, Drager Medizintechnik GmbH, Lubeck, Germany), which were turned on approximately 10 minutes before birth and set to manual control with maximum output.

Trevisanuto et al. J Pediatr 2010



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Radiant Infant Warmers



GE Healthcare Panda
i-RES



Drager Babytherm 8010



Fisher & Paykel, IW 930

Trevisanuto et al. Resuscitation 2011



Setting

Room temperature:

- 22, 24, $26 \pm 0.4^{\circ}\text{C}$
(Umidity: $32\% \pm 3\%$)

Measurements:

radiant, convective, conductive
and evaporative temperature
(Incu Fluke Biomedical, Bio-Tek
Instruments, USA)

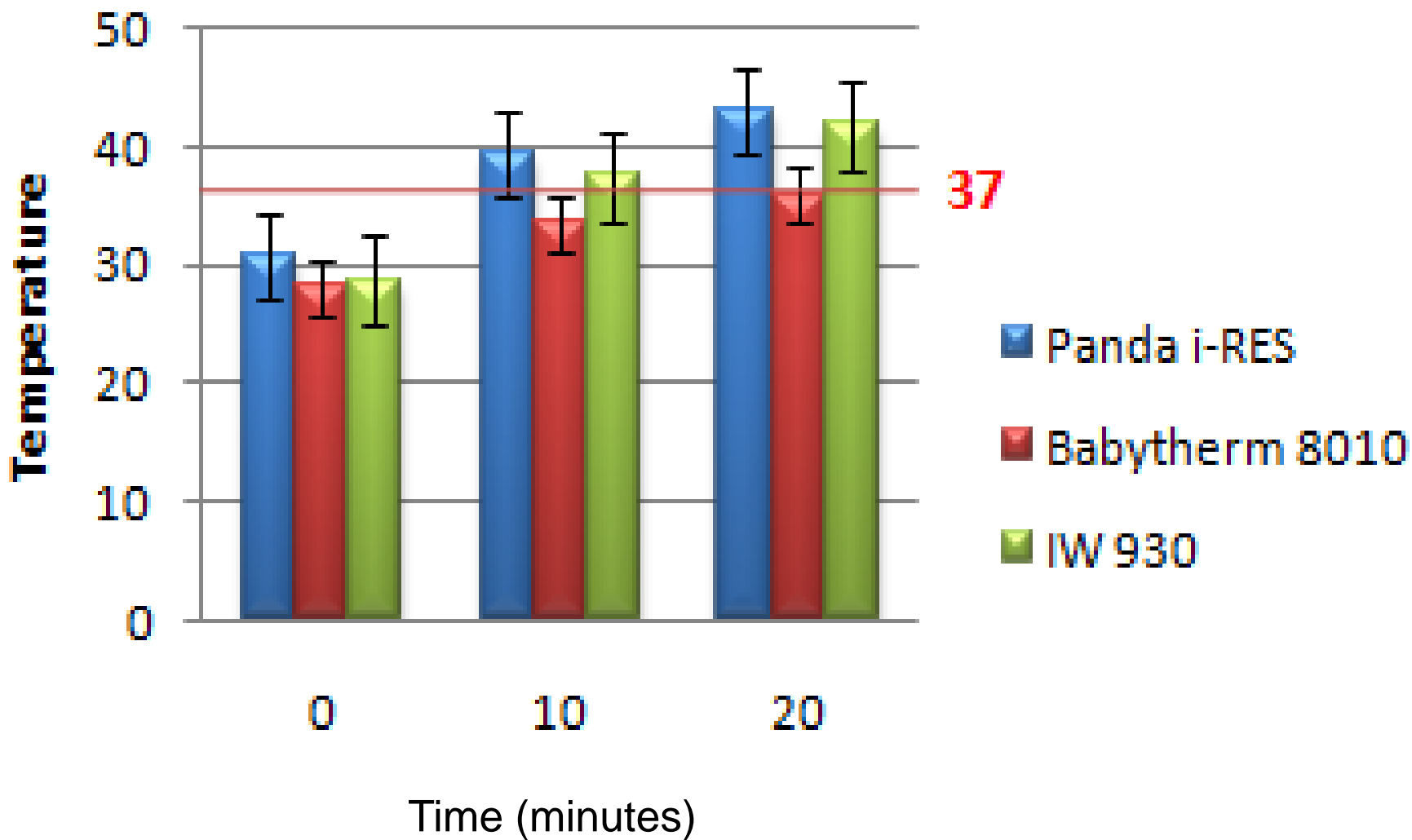
Design:

POWER:

0-33%; 0-100%; 33-100%



(power 33-100%)



Room temperature: 24 °C

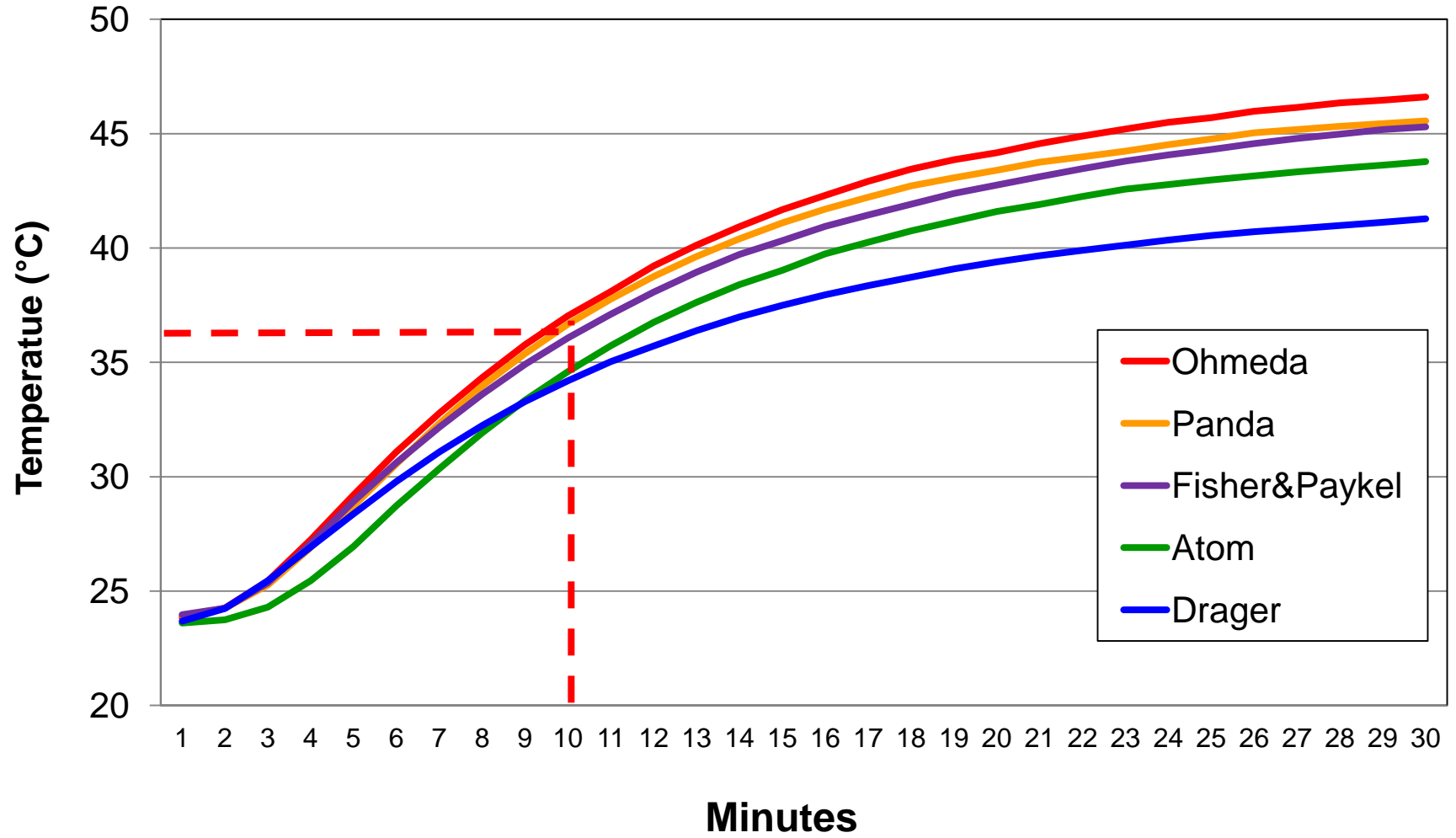
Trevisanuto et al. Resuscitation 2011



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- 36 RIW
- 12 Hospitals

Power 0-100%



Conti A et al. 2013 (submitted)



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**How much oxygen
are
we administering?**



ASSISTED-VENTILATION DEVICES

Effective ventilation can be achieved with either a flow-inflating or self-inflating bag or with a T-piece mechanical device designed to regulate pressure.^{60–63}



Oxygen administration for the resuscitation of term and preterm infants

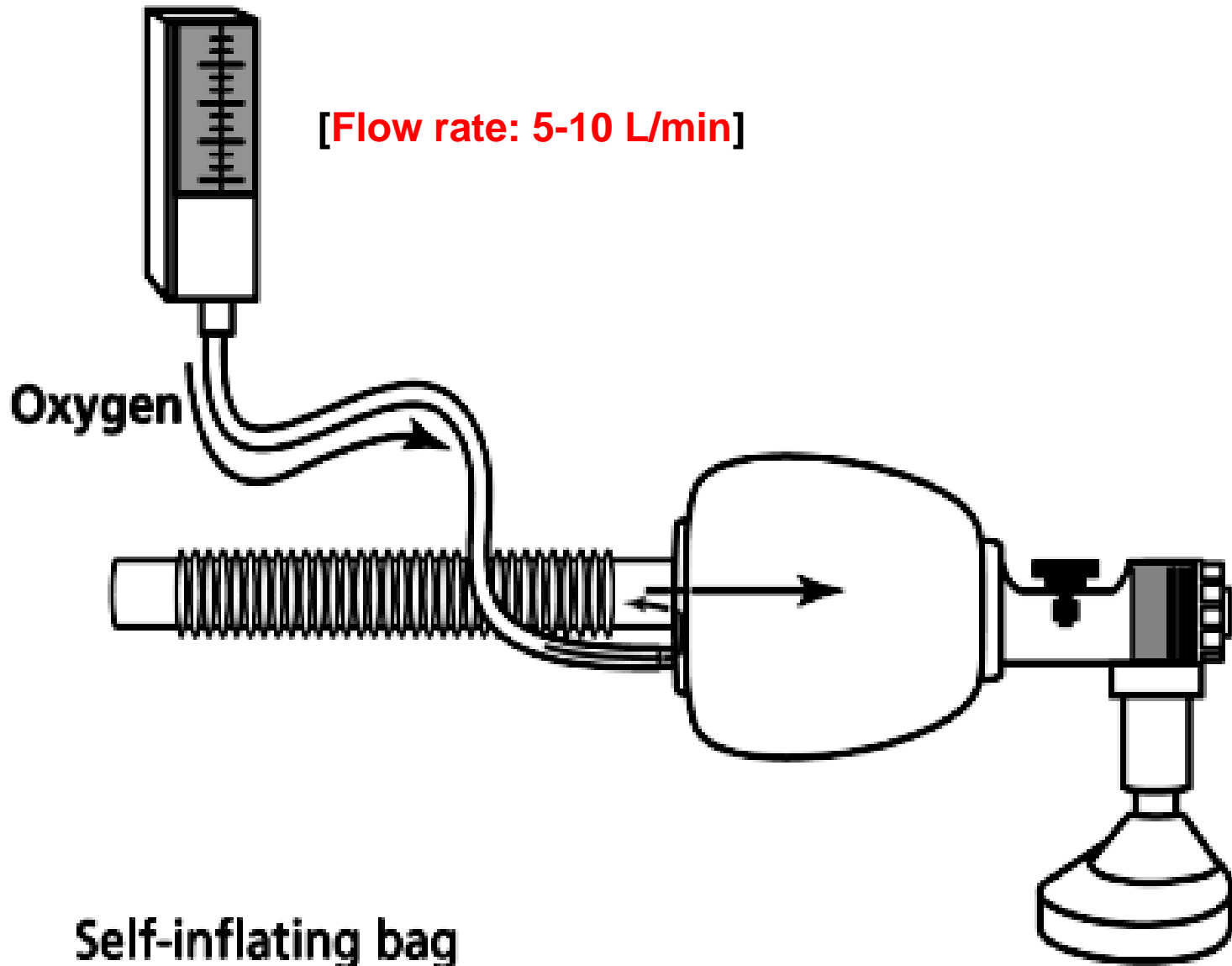
Daniele Trevisanuto¹, Camilla Gizzi², Claudio Martano³, Valentina Dal Cengio¹, Fabrizio Ciralli⁴, Flaminia Torielli⁵, Paolo Ernesto Villani⁶, Sandra Di Fabio⁷, Lorenzo Quartulli⁸ & Luigi Giannini⁹, on Behalf of Neonatal Resuscitation Study Group, Italian Society of Neonatology

Babies <32 weeks' gestation

- Start PPV with FiO_2 at 30% until pulse oximetry provides an accurate signal and HR is in normal range.



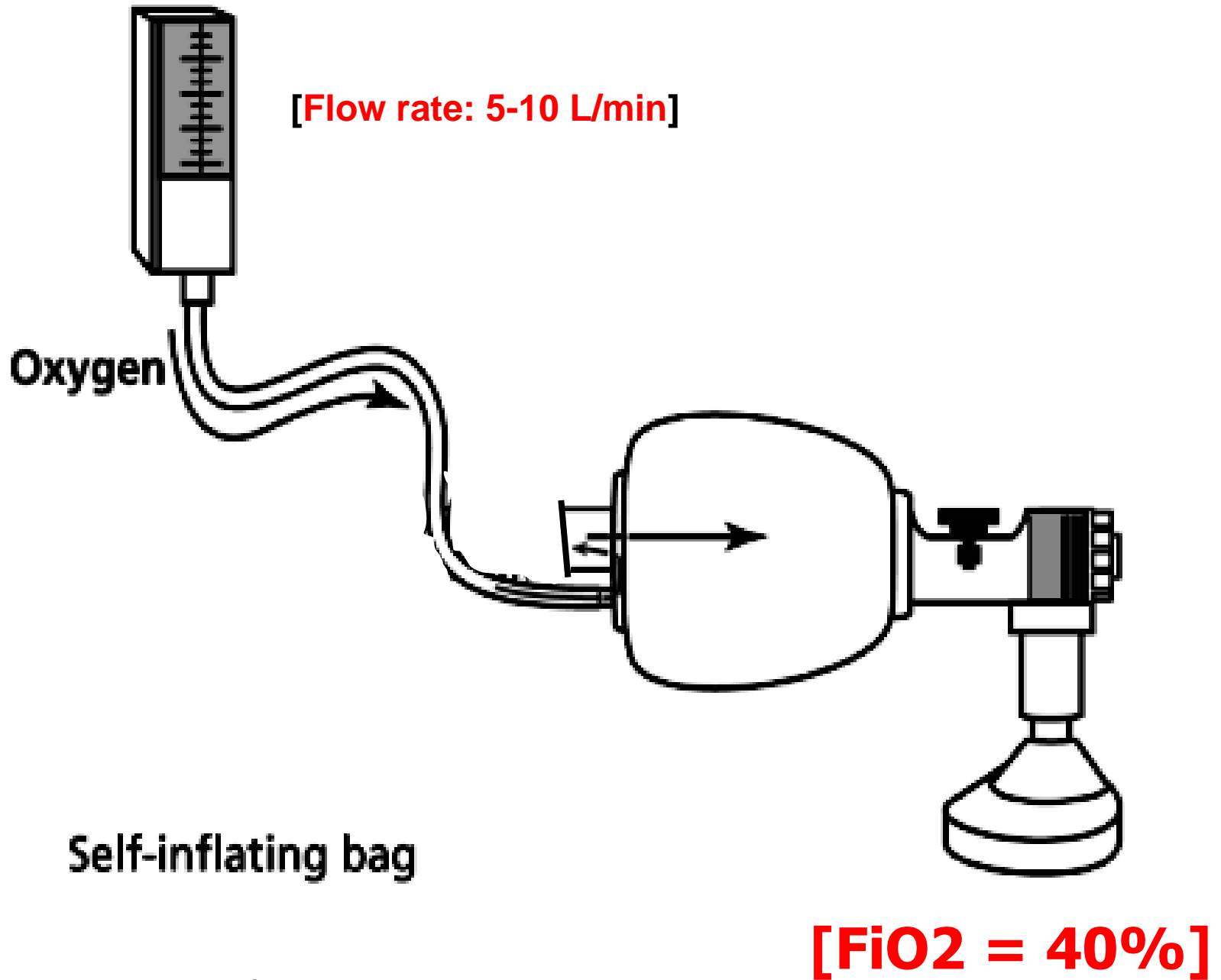
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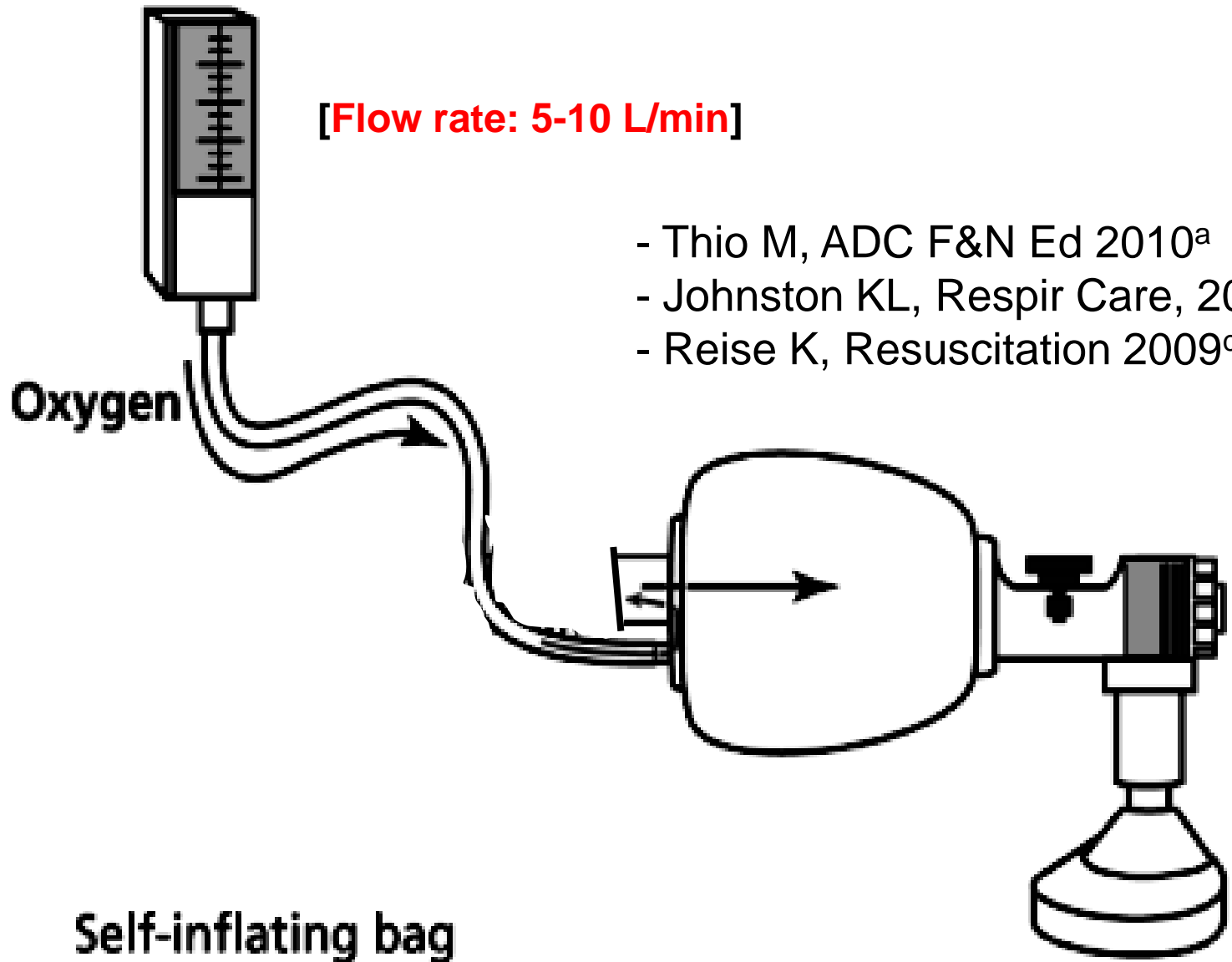


[FiO₂ = 100%]



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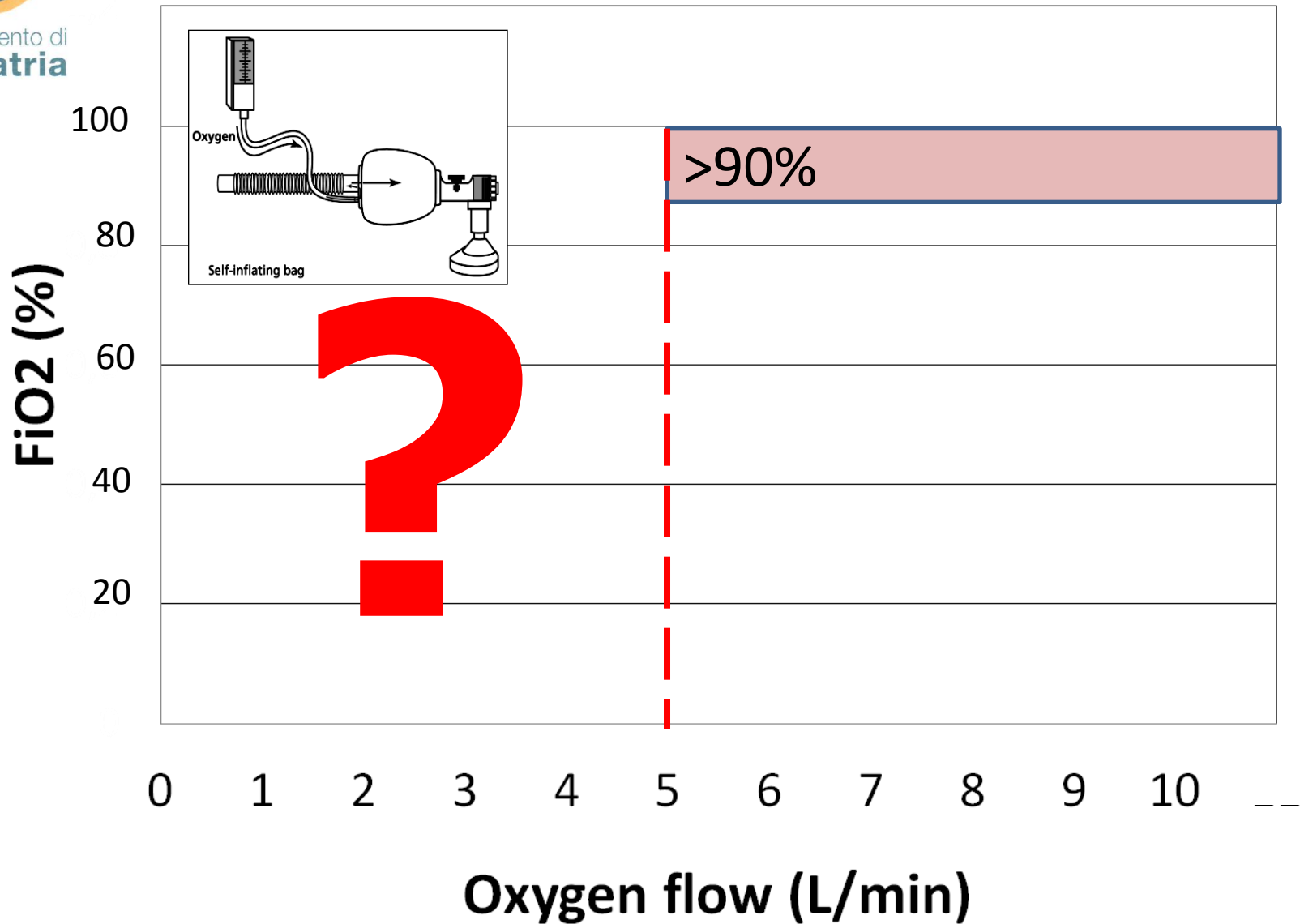




[Flow rate: 5-10 L/min]

- Thio M, ADC F&N Ed 2010^a
- Johnston KL, Respir Care, 2009^b
- Reise K, Resuscitation 2009^c

[FiO₂ >70%^a - >95%^{b,c}]

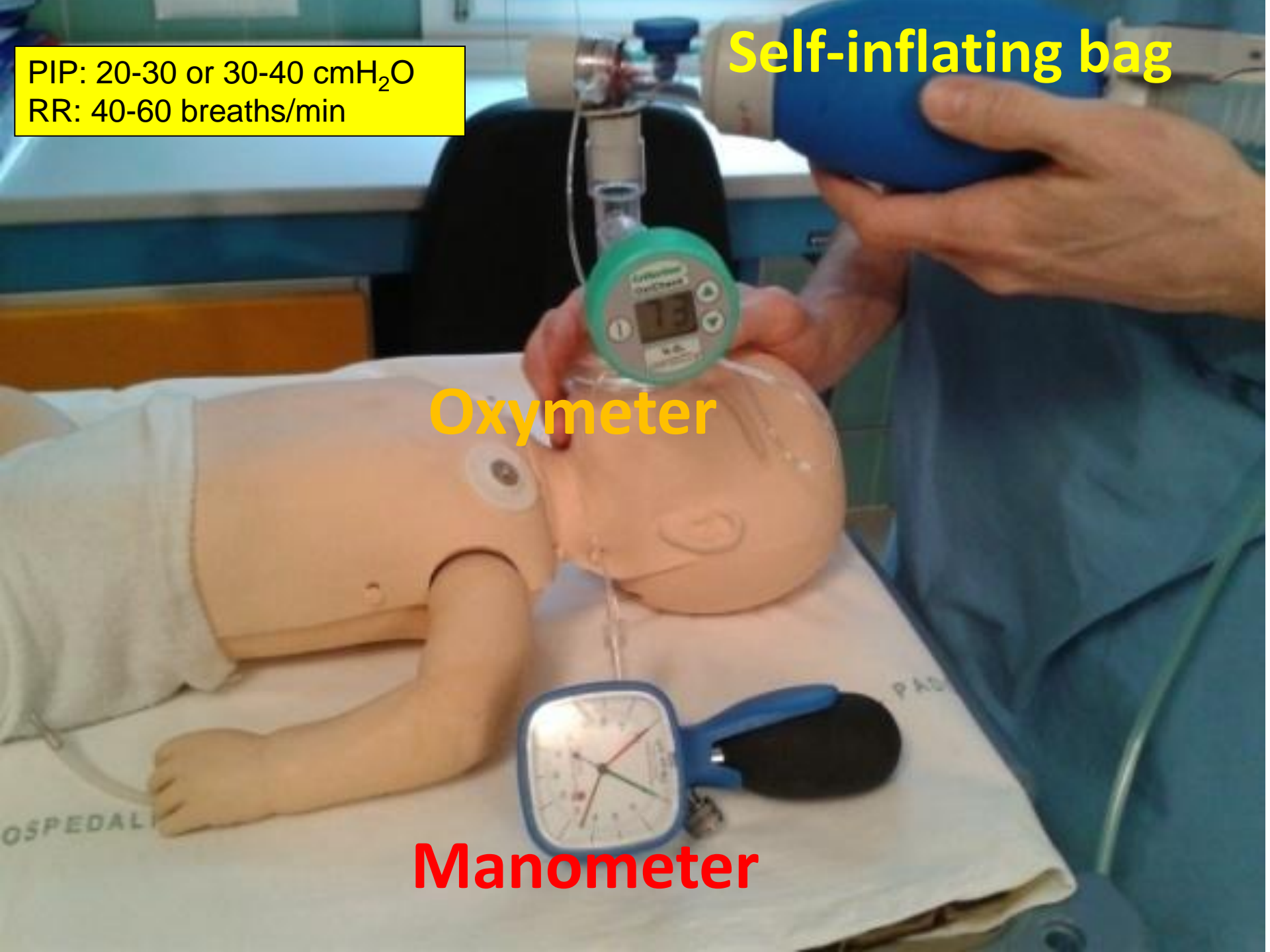


PIP: 20-30 or 30-40 cmH₂O
RR: 40-60 breaths/min

Self-inflating bag

Oxymeter

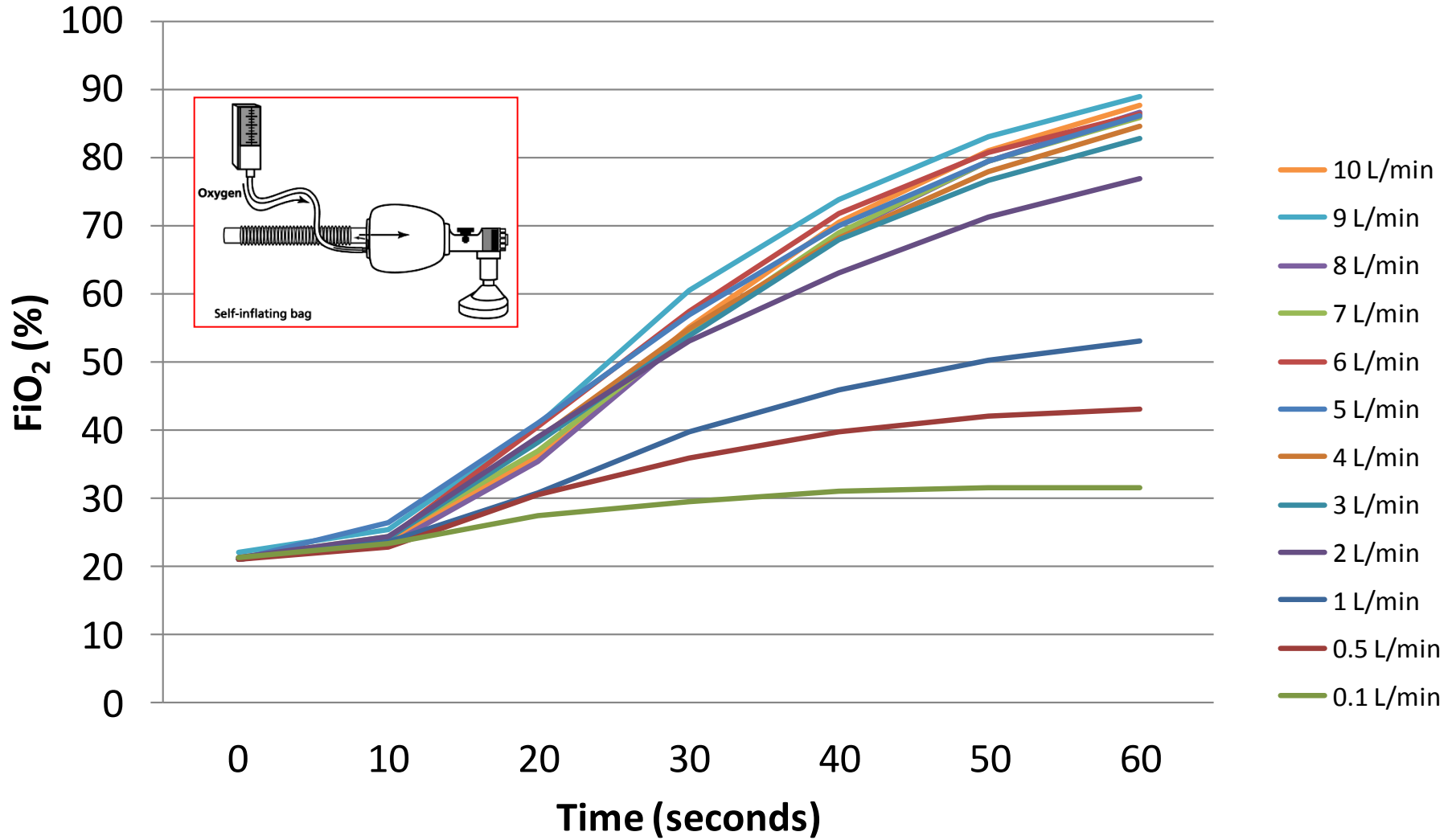
Manometer





Relationship between O₂-flow and FiO₂

[PIP 25cmH₂O; RR 40-60/min]





Faccio le cose che ho
sempre visto fare!

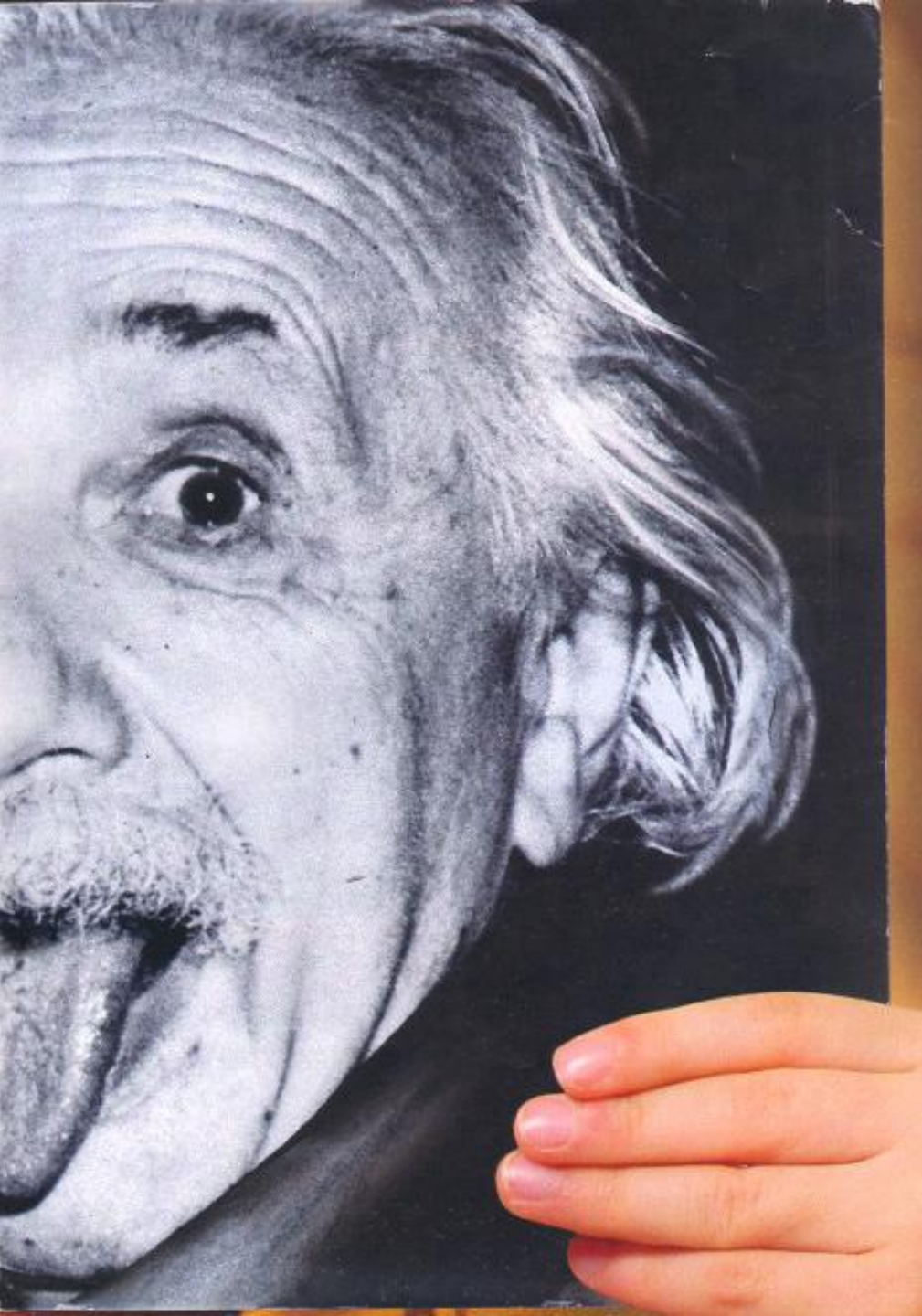
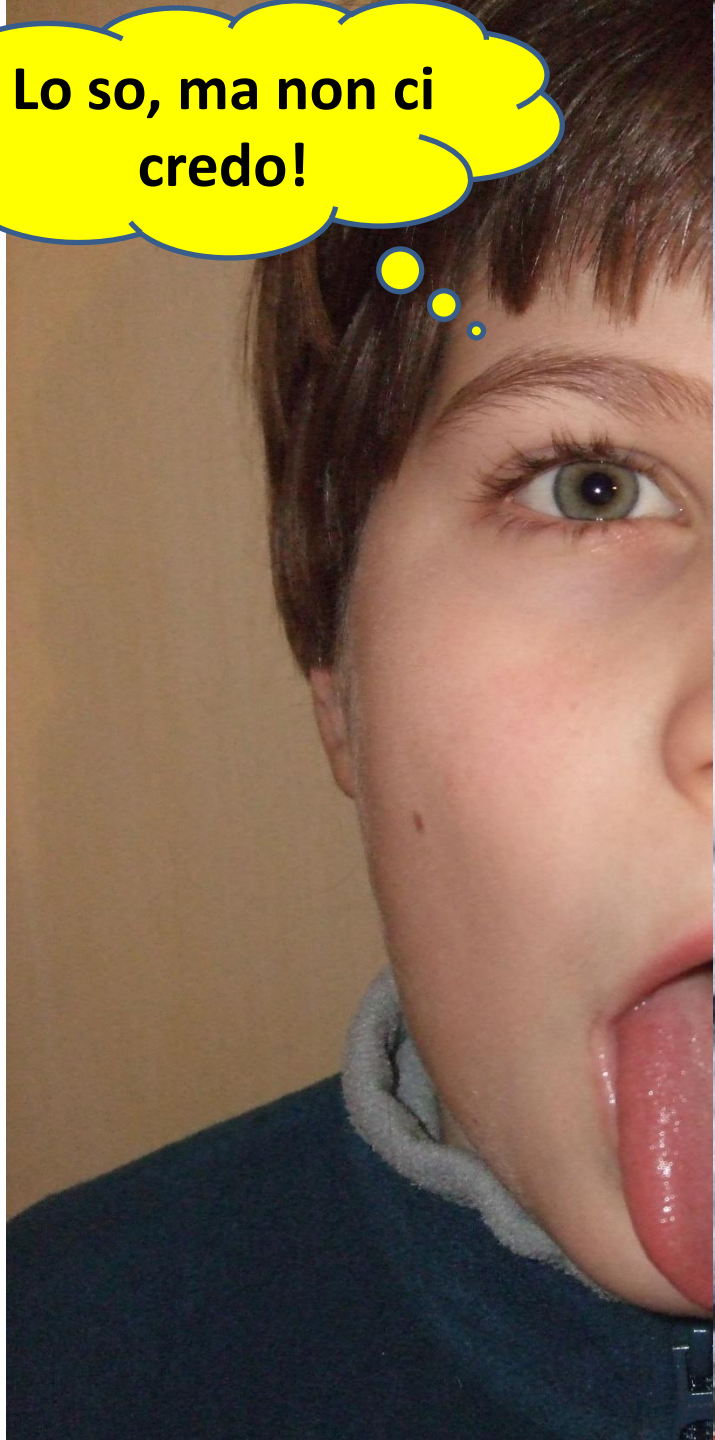
Lo so, ma non ci
credo!

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Ostacoli

**Lo so, ma non ci
credo!**



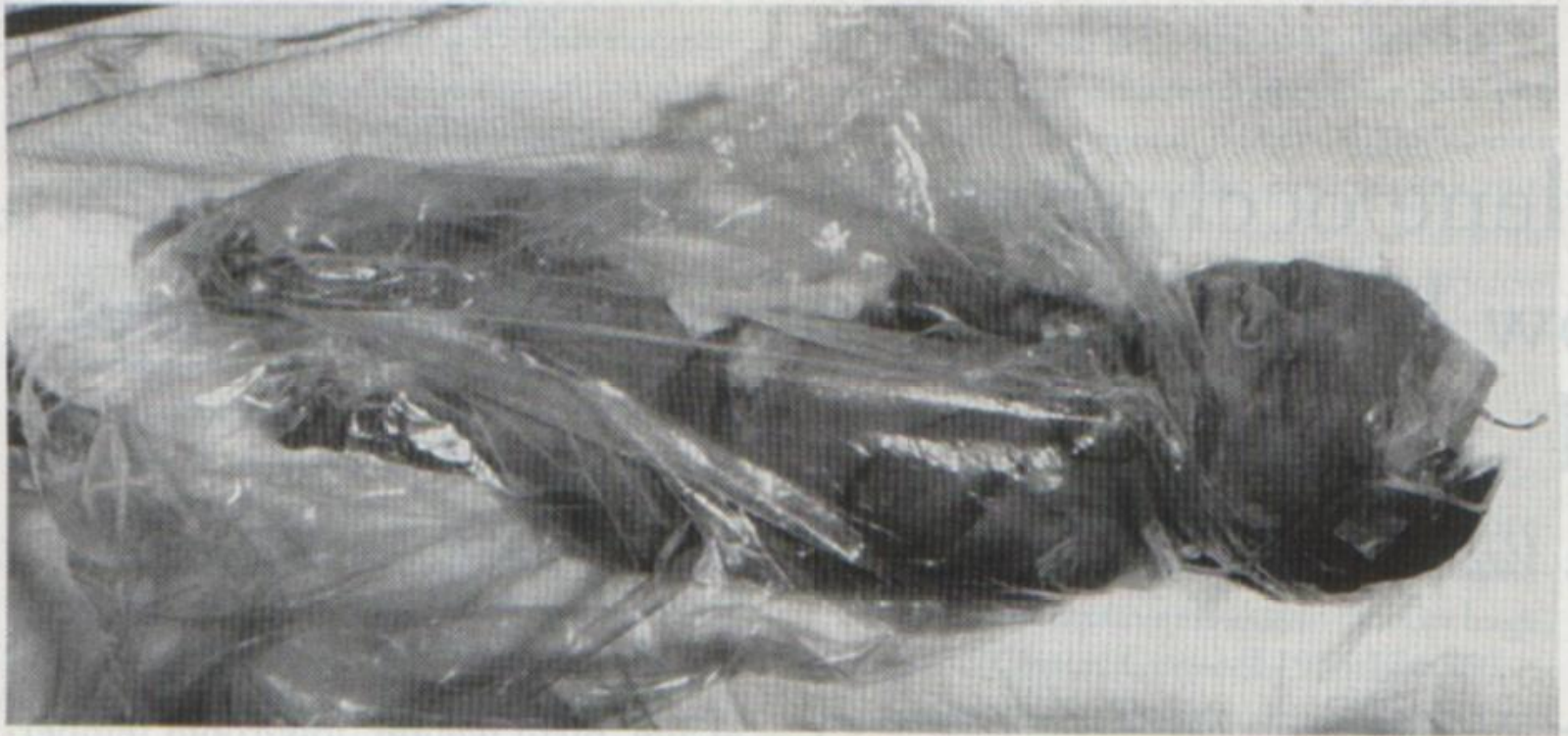


Fig 1. Photograph of premature infant in polyethylene bag wrap.

- Rectal temperature at admission (GA<28 weeks' gestation): 19.9-20.9°C

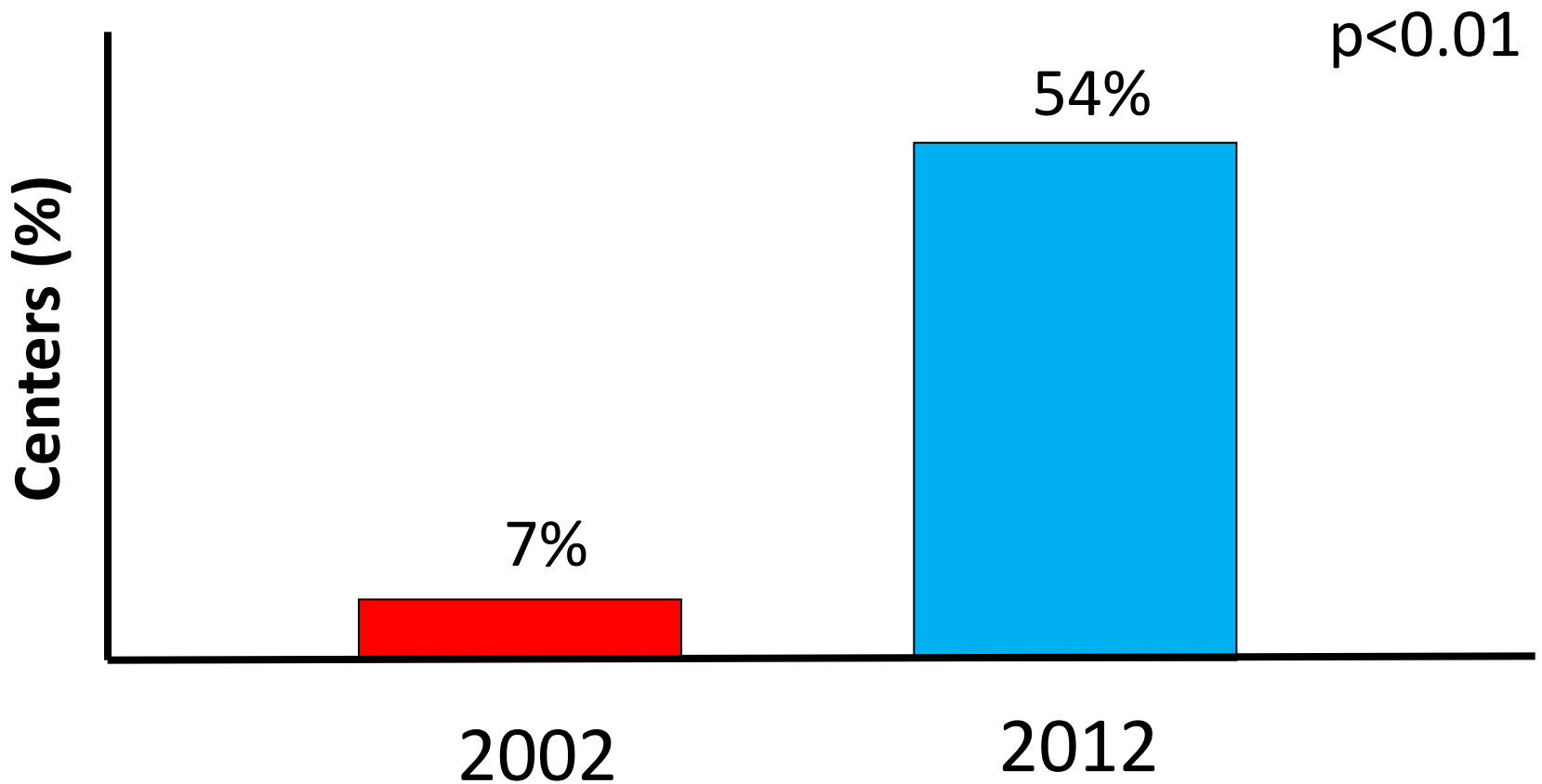
Vohra, J Pediatr 1999, J Pediatr 2003



Very low birth weight preterm infants remain at risk for hypothermia. Consider the use of plastic bags or plastic wrapping under radiant heat as well as standard techniques to maintain temperature.



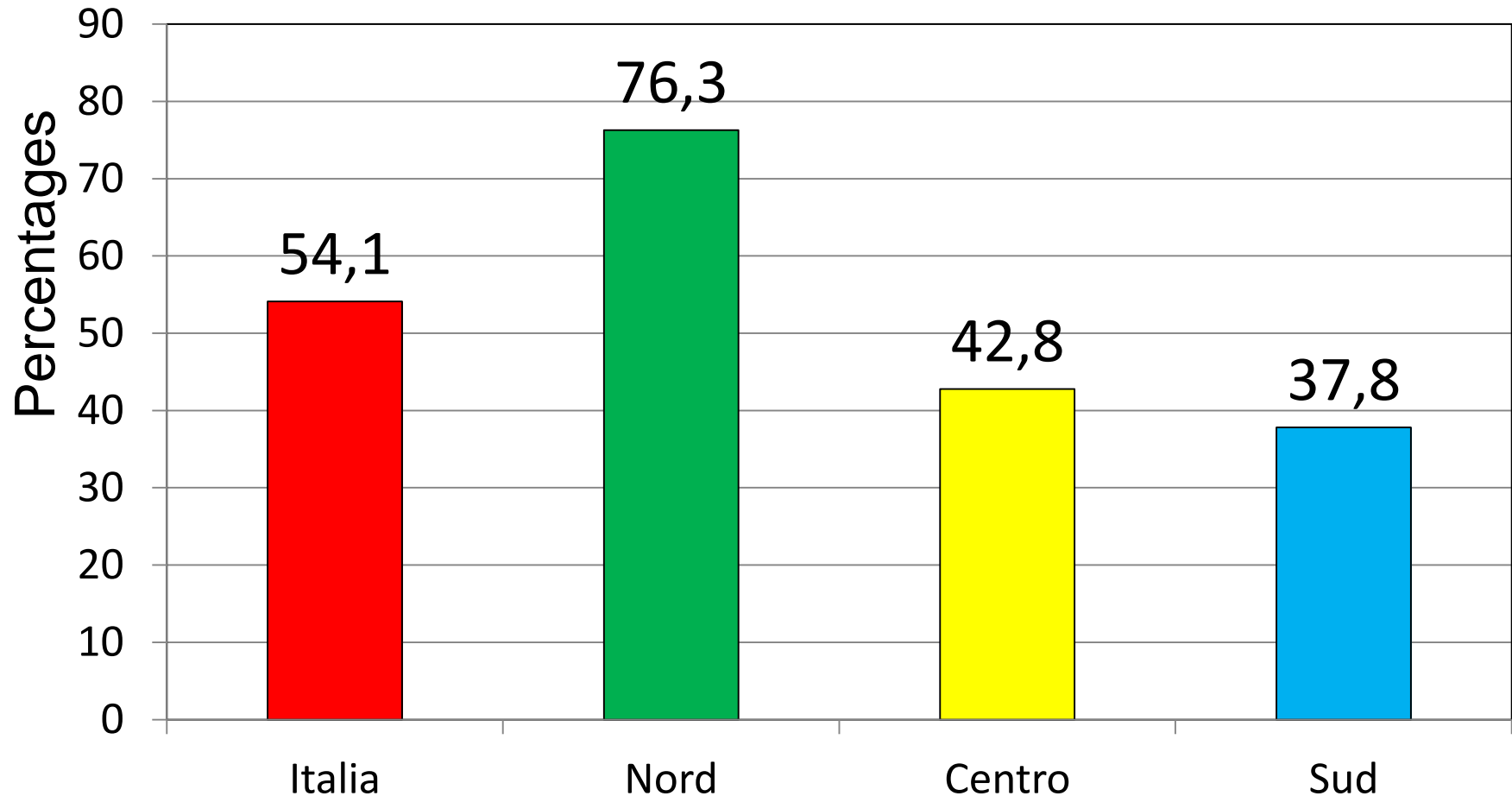
Use of polyethylene bags for thermal loss prevention in Italy





Centers using a polyethylene wrap in DR

Neonatal resuscitation of ELBWI in Italy (2012)
[96 level III centres]





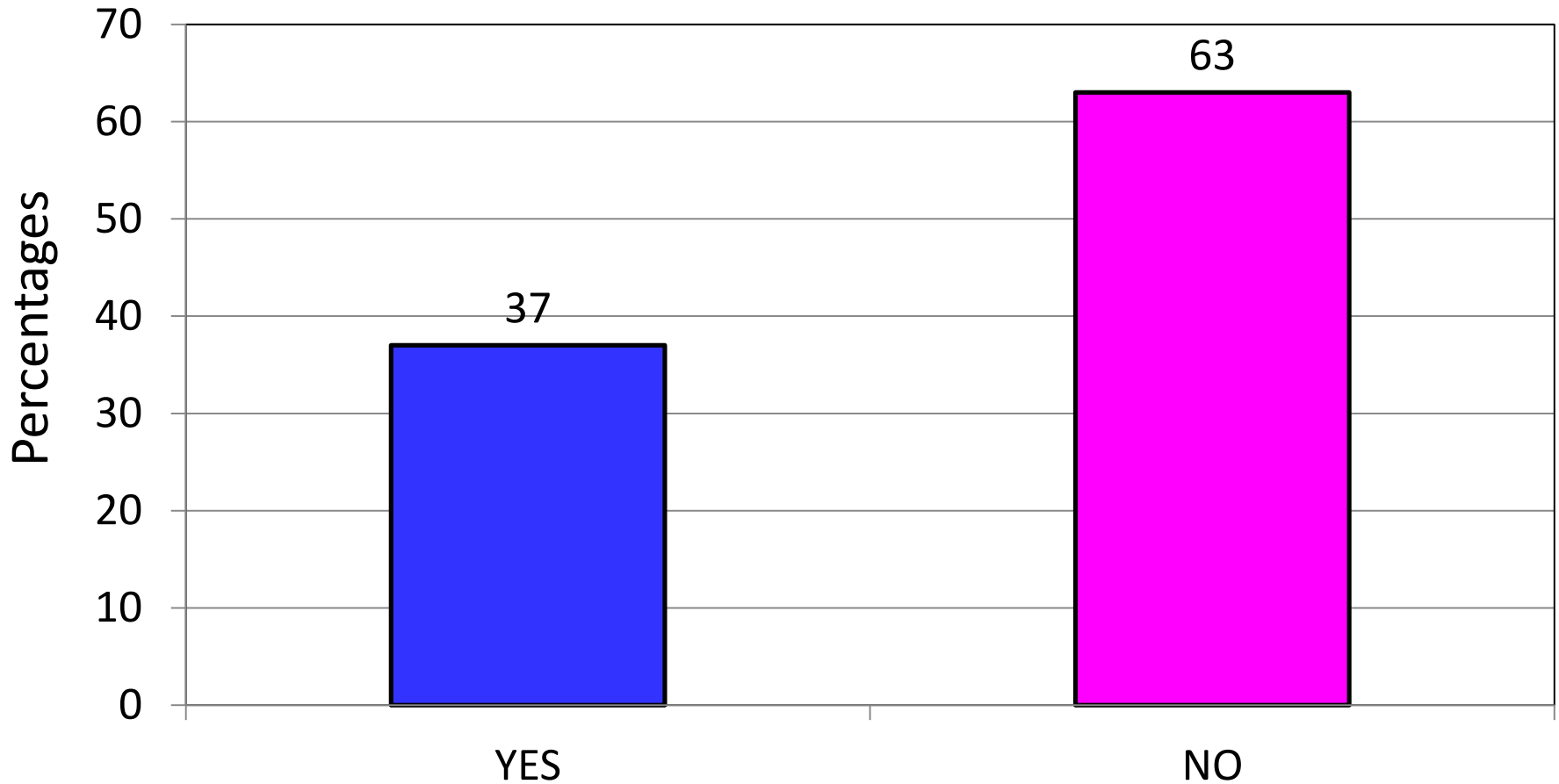
Treatment Recommendation

Delay in umbilical cord clamping for at least 1 minute is recommended for newborn infants not requiring resuscitation.



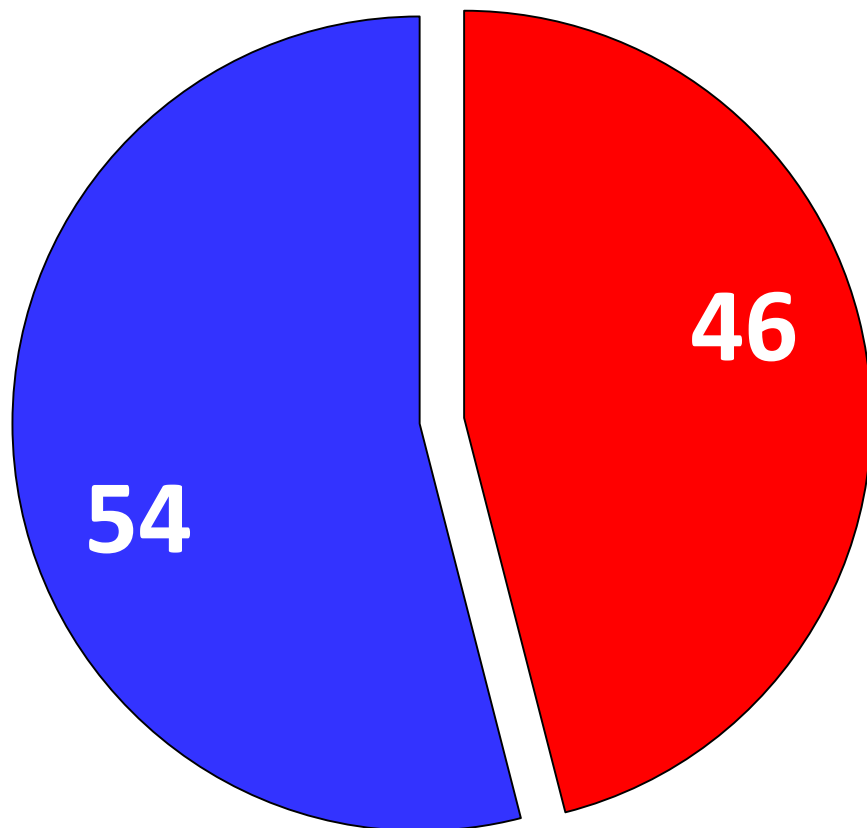
Delay in umbilical cord clamping

Neonatal resuscitation of ELBWI in Italy (2010)
[51 level III centres]





Video recording as a means of evaluating neonatal resuscitation performance



(S. Diego Hospital, USA)

- Deviations from the NRP guidelines
- Correct performance



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Study Protocol

Video Recording as a Means of Evaluating Neonatal Resuscitation
Performance in Low Resource Settings



Federica Bertuola, Beira, Mozambique



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Padova, 24-26 Ottobre 2013

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**Rianimazione Neonatale:
Metodologia, Ostacoli ed Opportunità**



**Metodo
scientifico**

Tenacia

Curiosità



Opportunità



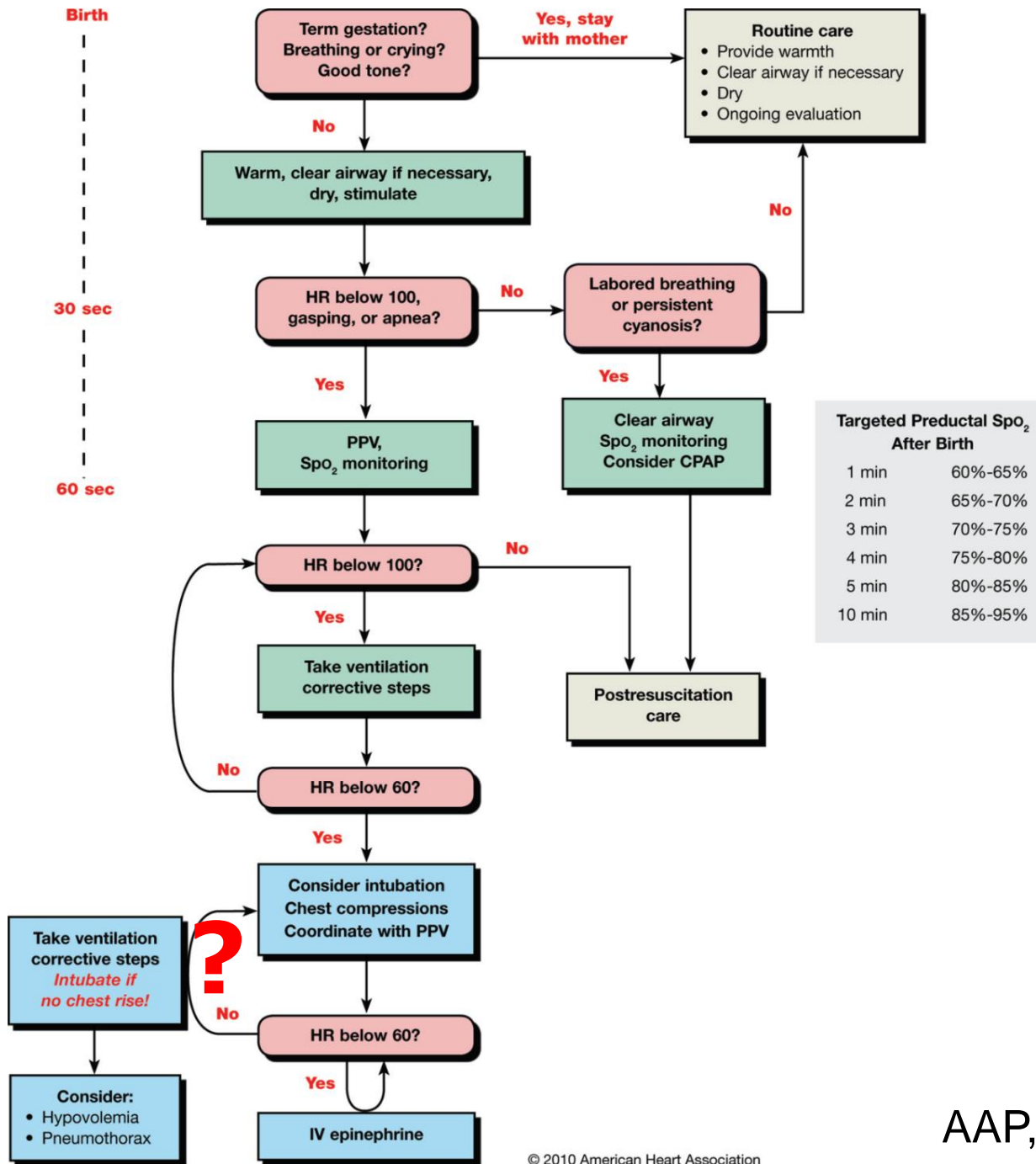
**Metodo
scientifico**

Tenacia

Curiosità



Opportunità



**Targeted Preductal SpO₂
After Birth**

1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%



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PEDIATRICS[®]

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

2010 Guidelines for Neonatal Resuscitation: Does the Algorithm Require a Clarification?

Daniele Trevisanuto, Claudio Martano, Luigi Giannini, Fabrizio Ciralli, Sandra Di Fabio, Camilla Gizzi, Lorenzo Quartulli, Flaminia Torielli and Paolo Ernesto Villani

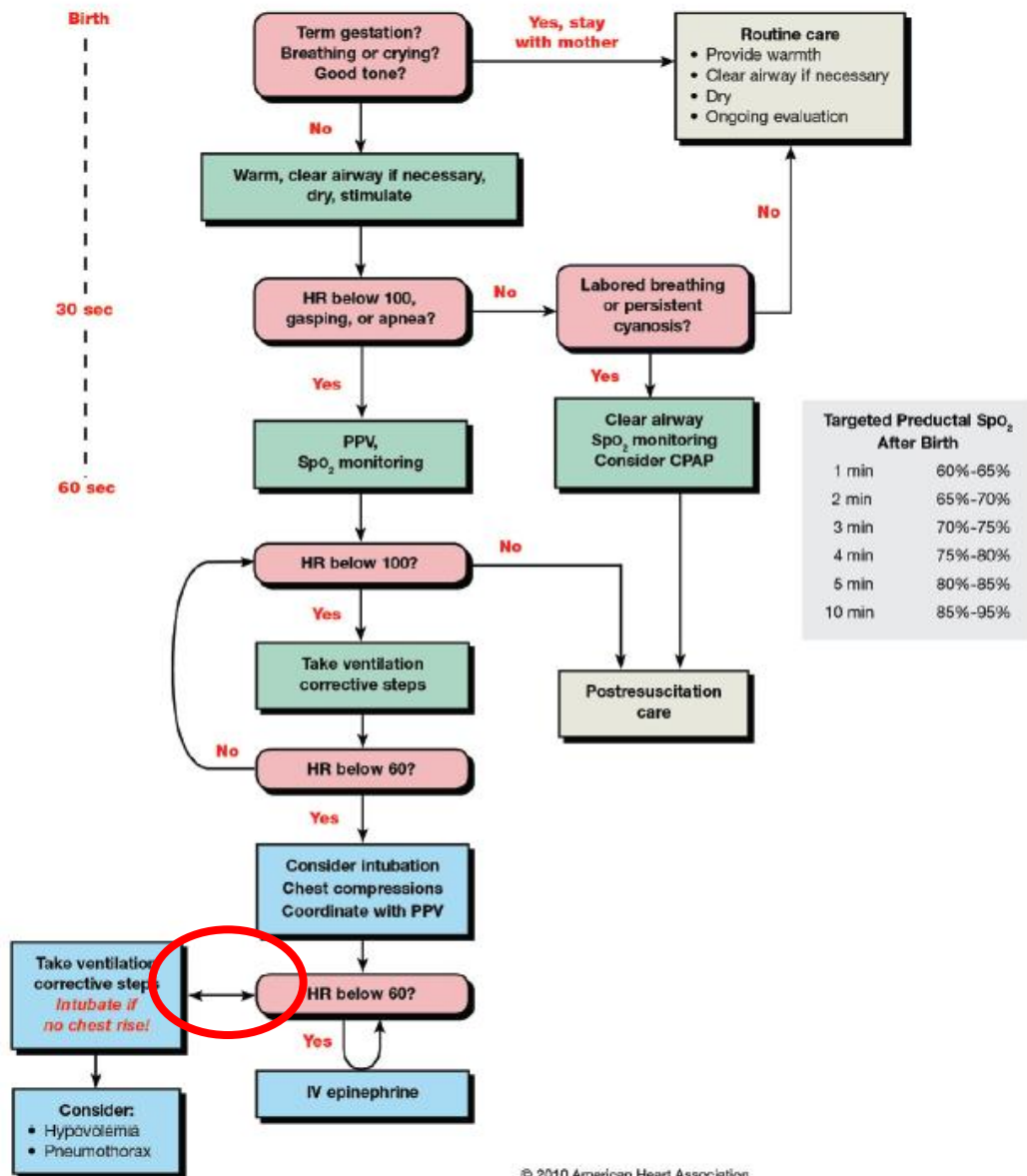
Pediatrics 2011;128;e471

DOI: 10.1542/peds.2011-1909A

Newborn Resuscitation



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FIGURE



**Metodo
scientifico**

Tenacia

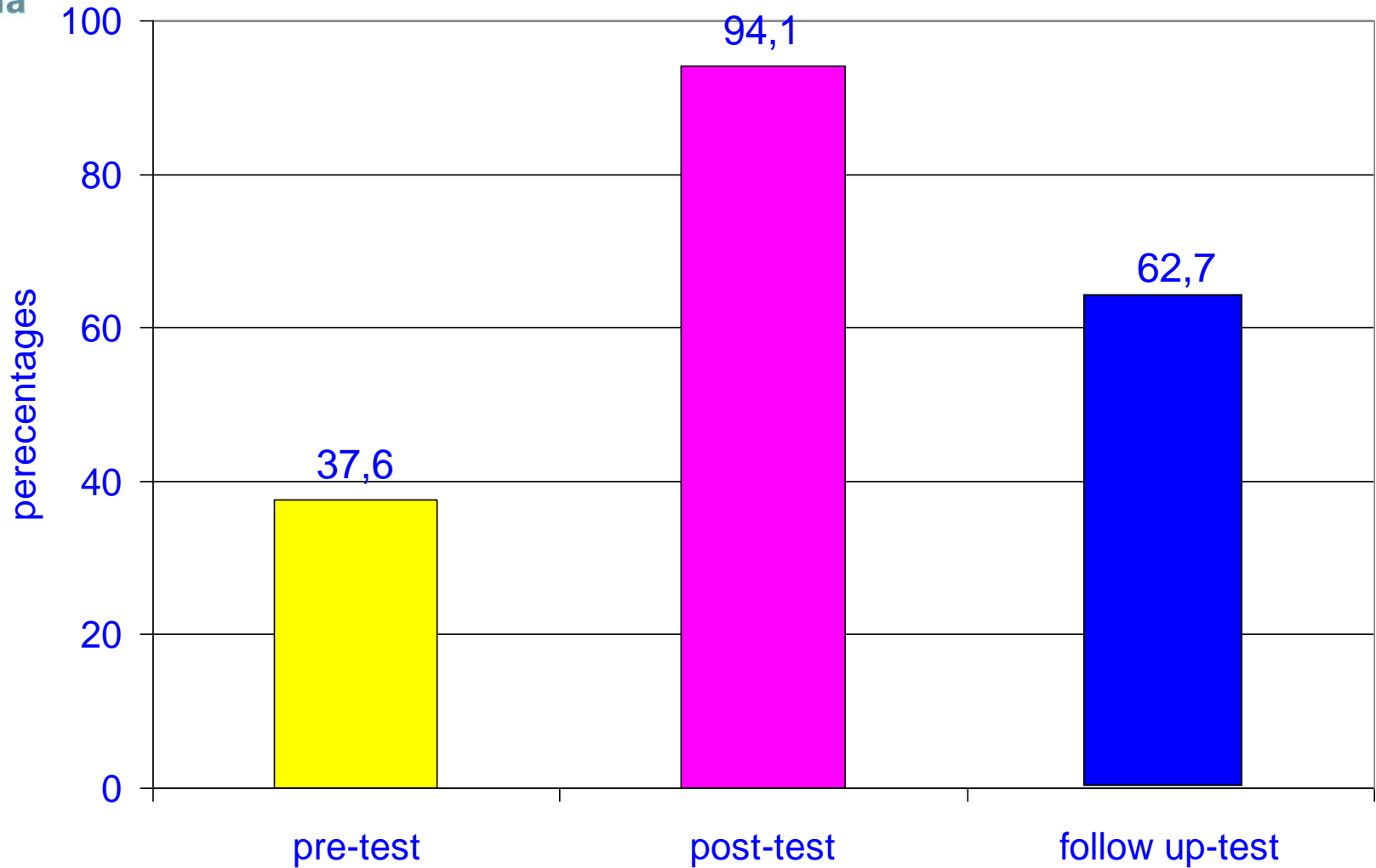
Curiosità



Opportunità



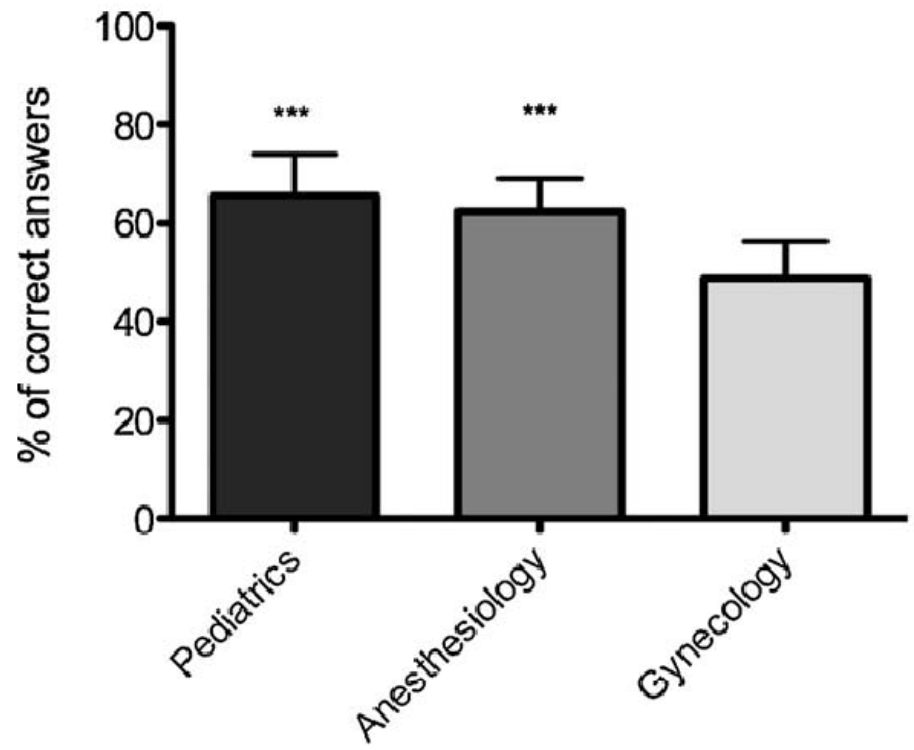
Neonatal resuscitation course for Pediatric Residents (CORRECT ANSWERS)



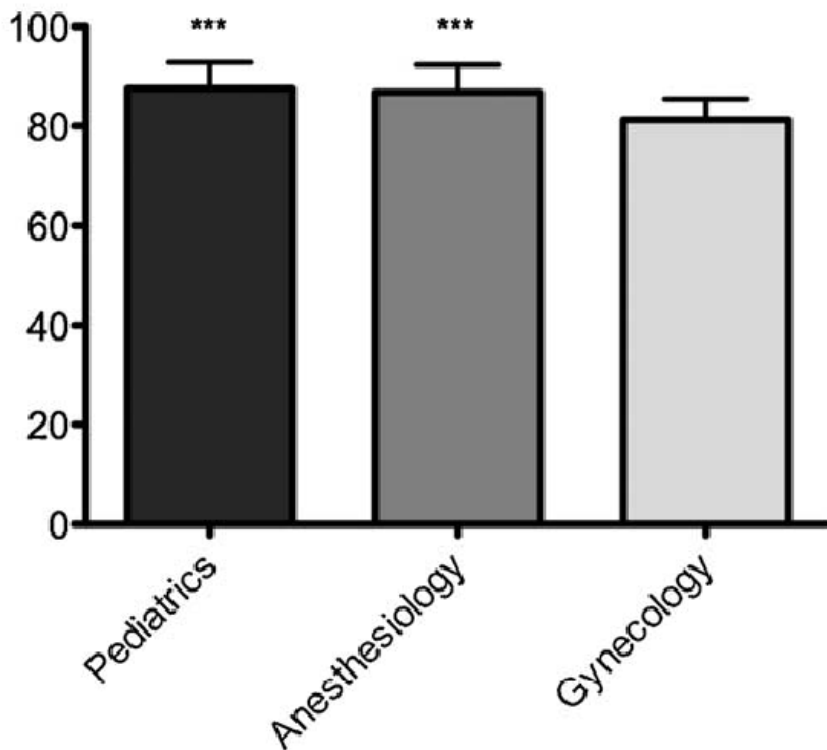


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PRE-TEST



POST-TEST

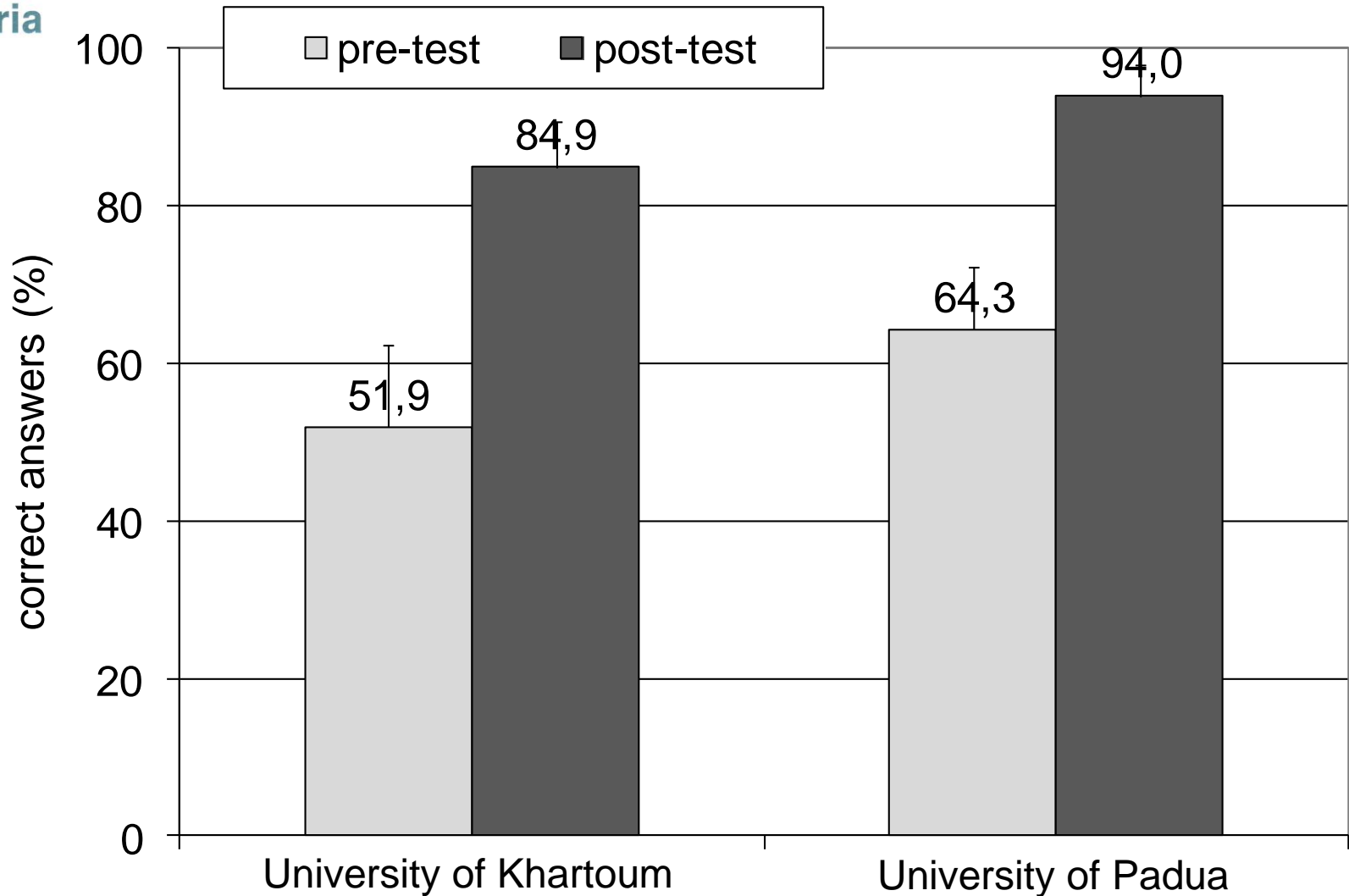


Parotto M. et al. Resuscitation 2010



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Neonatal resuscitation course for Pediatric Residents



Higher success rate and operator satisfaction with I-gel™ laryngeal mask airway compared to face mask: a mannequin study of neonatal resuscitation in Uganda

Nicolas J Pejovic,¹ Daniele Trevisanuto,² Jolly Nankunda J,³ Thorkild Tylleskär⁴

¹ Neonatal Unit Q2:07, Sachs's Children and Youth Hospital, Stockholm, Sweden,

² Dept of Woman and Child Health, Padua University, Padua, Italy,

³ Mulago National Referral Hospital, Kampala, Uganda,

⁴ Centre for International Health, University of Bergen, Bergen, Norway



European Pediatric Society Meeting,
Oporto, 2013



"Gap of Knowledge"

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Problema

Domanda (PICO)

Gestione postnatale del neonato
flaccido con meconio

Nel neonato a termine non vigoroso con meconio
denso (**P**) l'intubazione tracheale (**I**) vs. non intubazione (**C**)
migliora l'outcome (morte/complicanze) (**O**)?

Uso di ossigeno in sala parto

Che concentrazione di ossigeno somministrare in corso di
bradicardia ($FC < 60$ bpm) nonostante ventilazione efficace?
Quale è l'effetto della somministrazione di aria ambiente in
confronto con ossigeno durante arresto circolatorio sul flusso
cerebrale e sul futuro danno cerebrale?

Ventilazione

Durante la ventilazione in maschera facciale, dovrebbero
essere misurate le pressioni o i volume polmonari?
Quale interfaccia per ventilare efficacemente?
Quale è il miglior device per somministrare la PEEP/CPAP?
Il monitoraggio dell'attività respiratoria alla nascita migliora
l'outcome respiratorio (air-leak, BPD)?

Temperatura

Nei VLBWI, l'uso di sacchetti in polietilene associati a
materassini riscaldati migliora la temperatura d'ingresso in
NICU (mortalità, outcome neurologico) rispetto ai soli
sacchetti?
La temperatura della sala parto/sala operatoria influenza la
temperatura d'ingresso in NICU?
Quanto rapidamente riscaldare un VLBWI con temperatura
<35°C?

(Perlman, Resuscitation 2012)



**Metodo
scientifico**

Tenacia

Curiosità



Opportunità



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LMA for Neonatal Resuscitation

Trial 1: ProSeal. (Madras, India) **COMPLETED** (140 patients)

Trial 2: Supreme. (Hanoi, Vietnam) **RECRUITING** (137/142 patients)

Trial 3: I-Gel. (Kampala, Uganda) **IRB submission**

Supreme-LMA for Neonatal Resuscitation: a Prospective, Randomized Single-center Study (www.Clinicaltrials.gov: NCT01963936)



- 1-teaching day in Hanoi
- 3 Skype conferences with the hospital staff (24 members)
- Videos of personal performance (Youtube)
- Weekly monitoring of activities in neonates



www.clinicaltrials.gov : NCT01671241

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Heat Loss Prevention in Delivery Room by Using a Polyethylene Cap Associate to a Wrap: A Multicenter, Prospective, Randomized, Controlled Trial

Università degli Studi di Padova
Ospedale S. Bortolo Vicenza
Ospedale di Camposampiero

Doglioni N. et al. 2013 (submitted)



Standard of care

“Total body”





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Conclusioni

La rianimazione neonatale è...

- Un evento frequente
- Linee Guida = metodo scientifico

La rianimazione neonatale è...

Faccio le cose che ho
sempre visto fare!

Lo so, ma non ci
credo!

Lo so, ma questa è
l'evidenza
disponibile...



Ostacolo



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La rianimazione neonatale è...

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Se fosse stato circondato da uno stuolo di nonne, di zie, di cugine, di infermiere e di medici sarebbe certo morto nello spazio di ventiquattro ore, ma non essendoci a occuparsi di lui che una povera vecchietta che amava un po' troppo la birra e un solo medico condotto, Oliver e la Natura combatterono nel migliore dei modi la loro battaglia.

Il piccino si agitò, lottò, starnutì e infine, lanciando uno strillo che nessuno si sarebbe atteso da un esserino che possedeva il dono della voce solo da qualche minuto, diede avviso agli abitanti dell'ospizio che un nuovo cittadino doveva essere iscritto nei registri del comune.



Charles Dickens,
Bentley's Miscellany, 1837-1839

SAVE THE DATE

Seguici su
www.padovaperlapediatria futura.it



Dipartimento per la Salute
della Donna e del Bambino



Padova per la Pediatria Futura

Il benessere del bambino
e della sua famiglia

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FONDAZIONE
SALUS PUERI



One Day Course on Neonatal Resuscitation



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