



How well do we do mask ventilation?

Conflicts of interest

- I am a consultant to:
- Fisher and Paykel Healthcare,
- Laerdal Global Health
- Acutronic Medical
- I have received honoraria for lectures from Dräger and Chiesi.

Mask ventilation

- Is the mainstay of neonatal resuscitation
- **Myth** – this is easy and can be done by anybody after a short training session
- **Reality** – its difficult and even experienced operators frequently get it wrong

AND

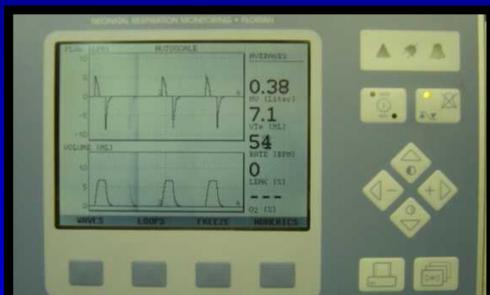
- This may lead to ineffective resuscitation.

We studied mask holding techniques & mask leak using a modified leak free manikin

- Participants:
 - Neonatal medical, nurses & midwives.
 - All trained in resuscitation.
- Participants gave PPV to manikin.
- Neopuff infant resuscitator :
 - Pressure 30/5 cm H₂O.
 - Gas flow 8 L/min.
- Florian respiratory monitor.
- Spectra software.



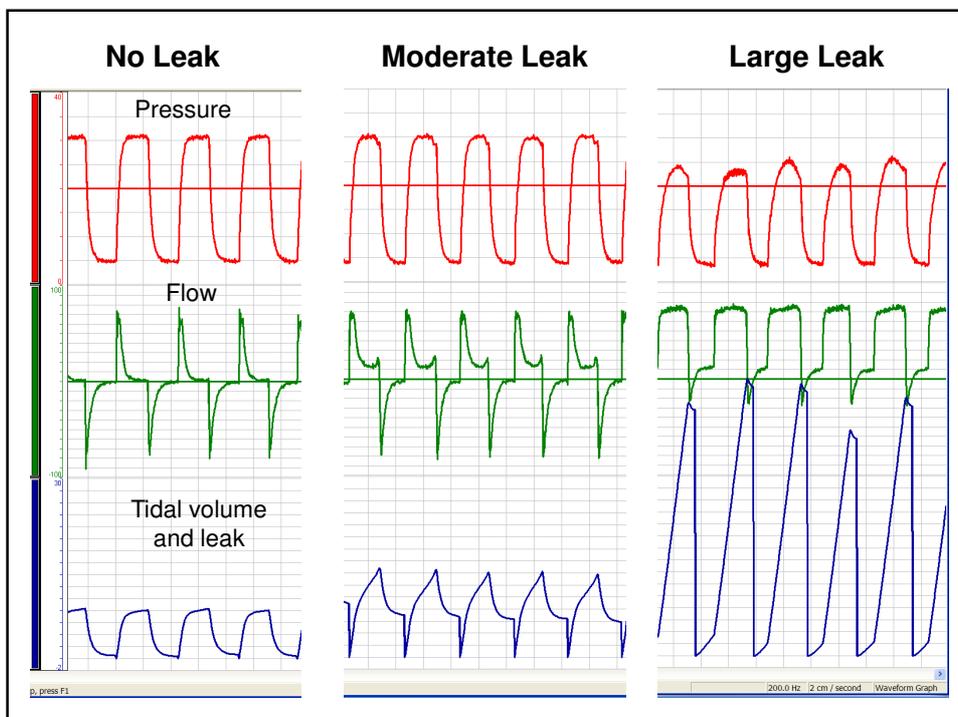
Respiratory function monitor during resuscitation



Florian respiratory function monitor

It displays & calculates:

- Flow through mask or ETT
- Leak around the mask or ETT
- Tidal volumes from inflation and spontaneous breathing.
- Minute volume
- Peak, mean and PEEP pressure and waveform



Mask leak during “ventilation” of leak free manikin

Mask leak **mean (SD)**

Consultants 62 (34)%

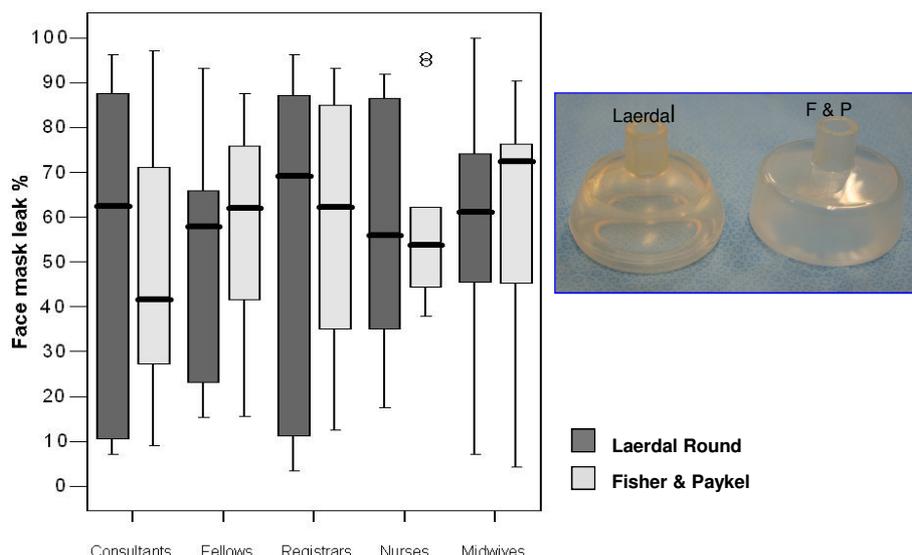
Fellows 59 (35)%

Registrars 81 (23)%

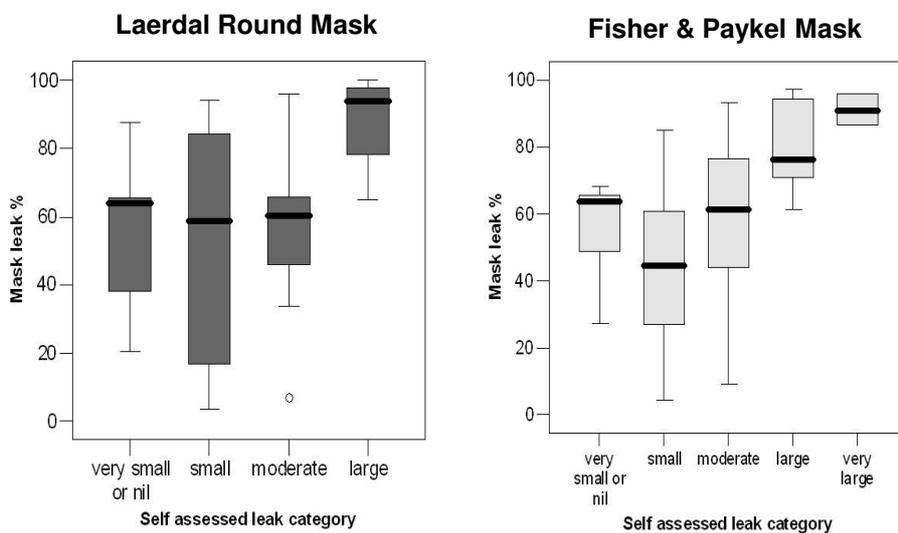
Nurses 59 (34)%

Mask leak is a big and unrecognised problem

% face mask leak for two mask designs, grouped by professional category



Self assessment of leak compared with actual leak



Investigated 3 techniques for mask placement and hold that minimised leak

- Three methods of holding the mask and the use of jaw lift.

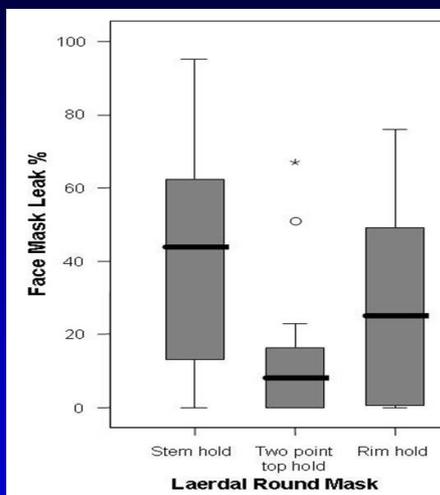


The stem hold

The two point top hold

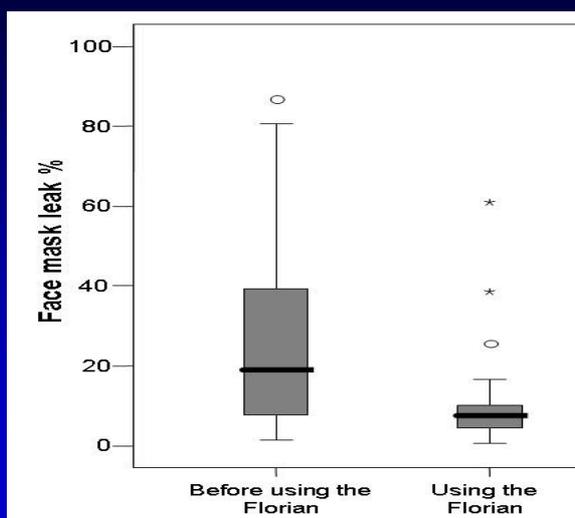
The OK rim hold

Mask technique matters



Wood Arch Dis Child 2008

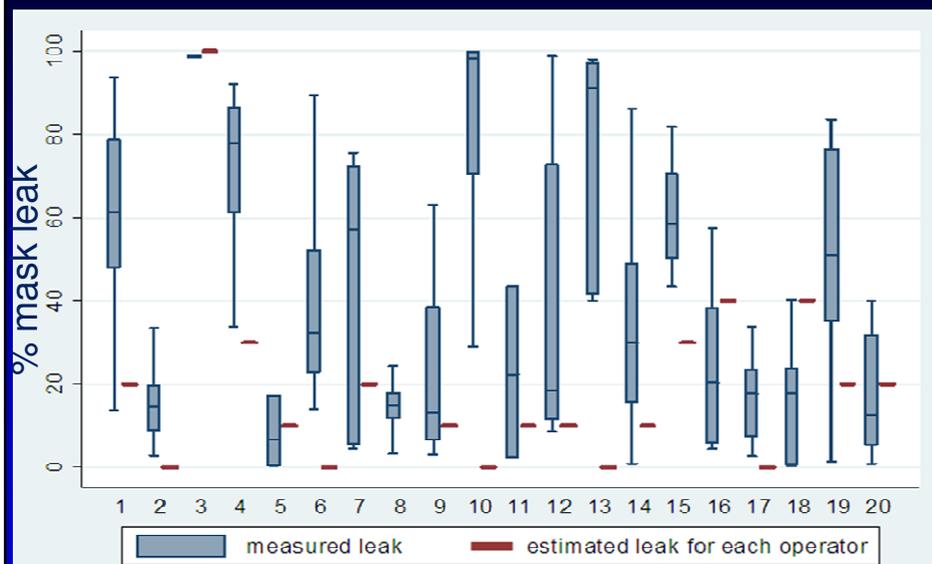
Seeing the Respiratory Function Monitor significantly reduced mask leak



Wood et al. Arch. Dis. Child. Fetal Neonatal Ed. 2008;93:F380-F381

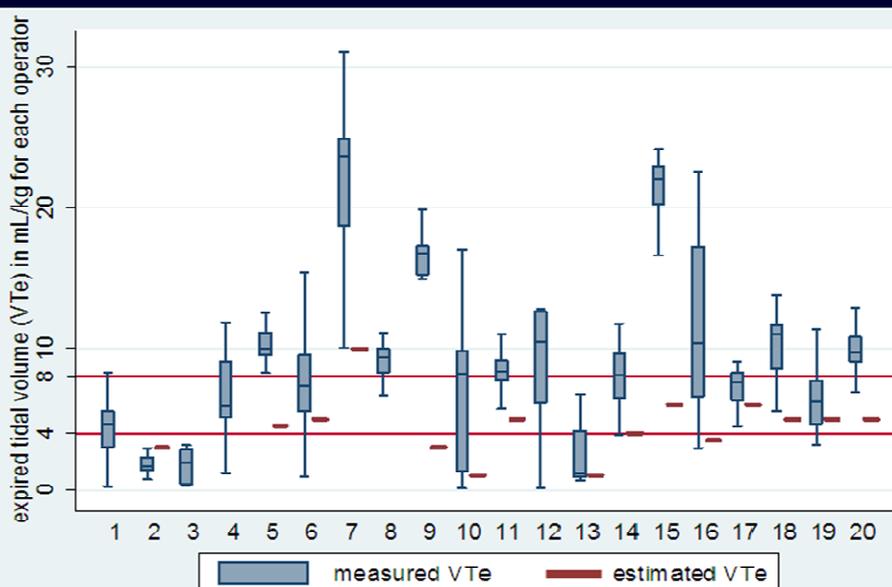
Can doctors estimate mask leak and tidal volume during resuscitation?

Mask leak as % of inspired tidal volume during 30 s of PPV



With a variable mask leak and spontaneous breathing tidal volume will change

Measured & estimated expired tidal volume during 30 sec PPV



“I don't worry about mask leak, tidal volume, or pressure because I can see chest wall rise.”

High tidal volumes: damage the lungs and cause hypocarbia.

Low tidal volume lead to inadequate ventilation and atelectrauma.

Can people accurately assess chest rise?

Expired tidal volume (V_{Te}) measured during 20 resuscitations.

After 60s PPV, resuscitators at infants' head and side asked to assess chest rise and estimate V_{Te} .

Their assessment compared with V_{Te} .

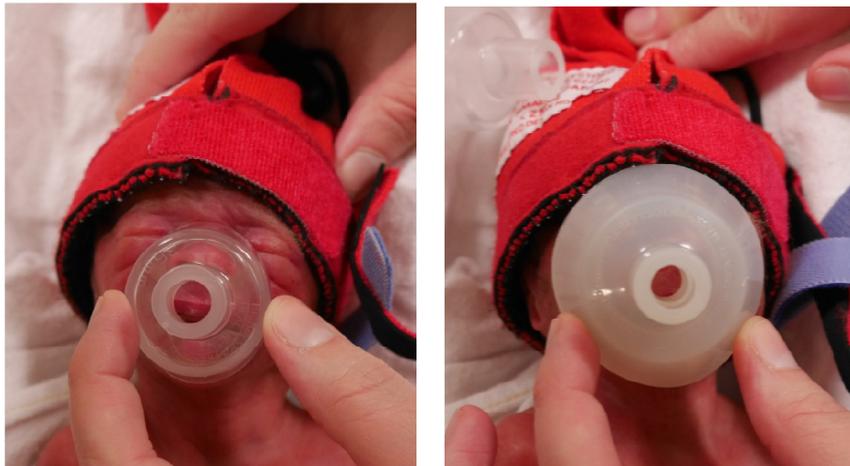
ml/kg	Resuscitator's assessment			
	No chest rise	Not sure	Appropriate chest rise	Too much chest rise
V_{Te} estimated at head	3.5 (2.3-6.8)	3.7 (3.0-5.6)	3.0 (1.2-8.2)	5.4 (4-13)
V_{Te} estimated at side	4.4 (3.0-7.0)	3.7 (3.0-5.6)	5.2 (2.9-8.9)	7.8 (3.6-10.3)

Resuscitators can't accurately assess chest wall movements

Pressure will not give a set tidal volume

- The baby may be apnoeic, breathe, cry, gasp, or obstruct the inflation.
- It changes as the lung aerates and compliance and resistance improve
- Mask leak changes
- Tidal volume will vary from baby to baby
- Must change the PIP to maintain appropriate expired tidal volume

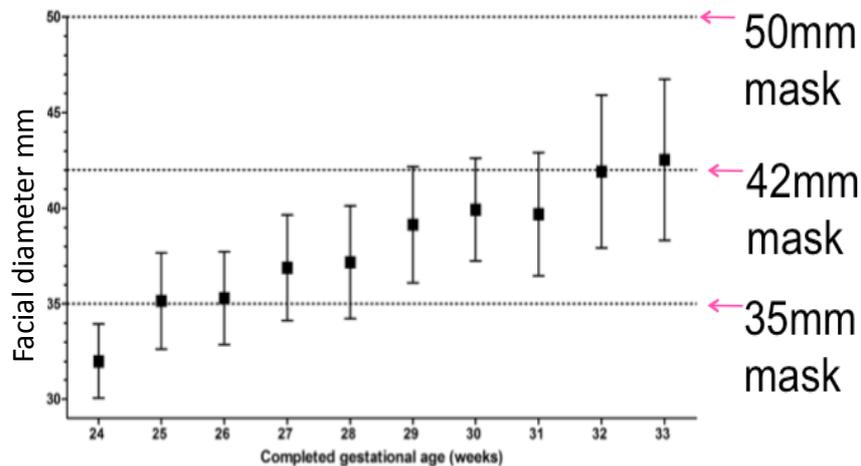
Which is the right sized mask for prems?



26+0w GA, 805g day 1,
35 mm F&P mask versus 50 mm re-sterilised Laerdal mask

O'Shea, in press J Pediatr

Measured facial diameter weekly of 107 babies 24 - 33 wk
Mask sizes shown



This is a reference guide for mask sizes for prems.
A 50 mm mask is too large for very prem babies.

O'Shea, in press ADC 2014

Summary

- Face mask leak is often large and may result in inadequate ventilation.
- Operators are unable to reliably detect % leak.
- Teaching mask technique significantly reduces leak when tested with a modified mannequin.
- Mask leak and variable tidal volume is similar in DR.
- Using a respiratory monitor to see tidal volume and leak reduced mask leak and improved technique.
 - Measures tidal volume and pressure delivery.
 - Immediately applicable in resuscitation training.
 - In the delivery room can also see baby's breathing.

Thank you for listening

How good you are at using a face mask ?