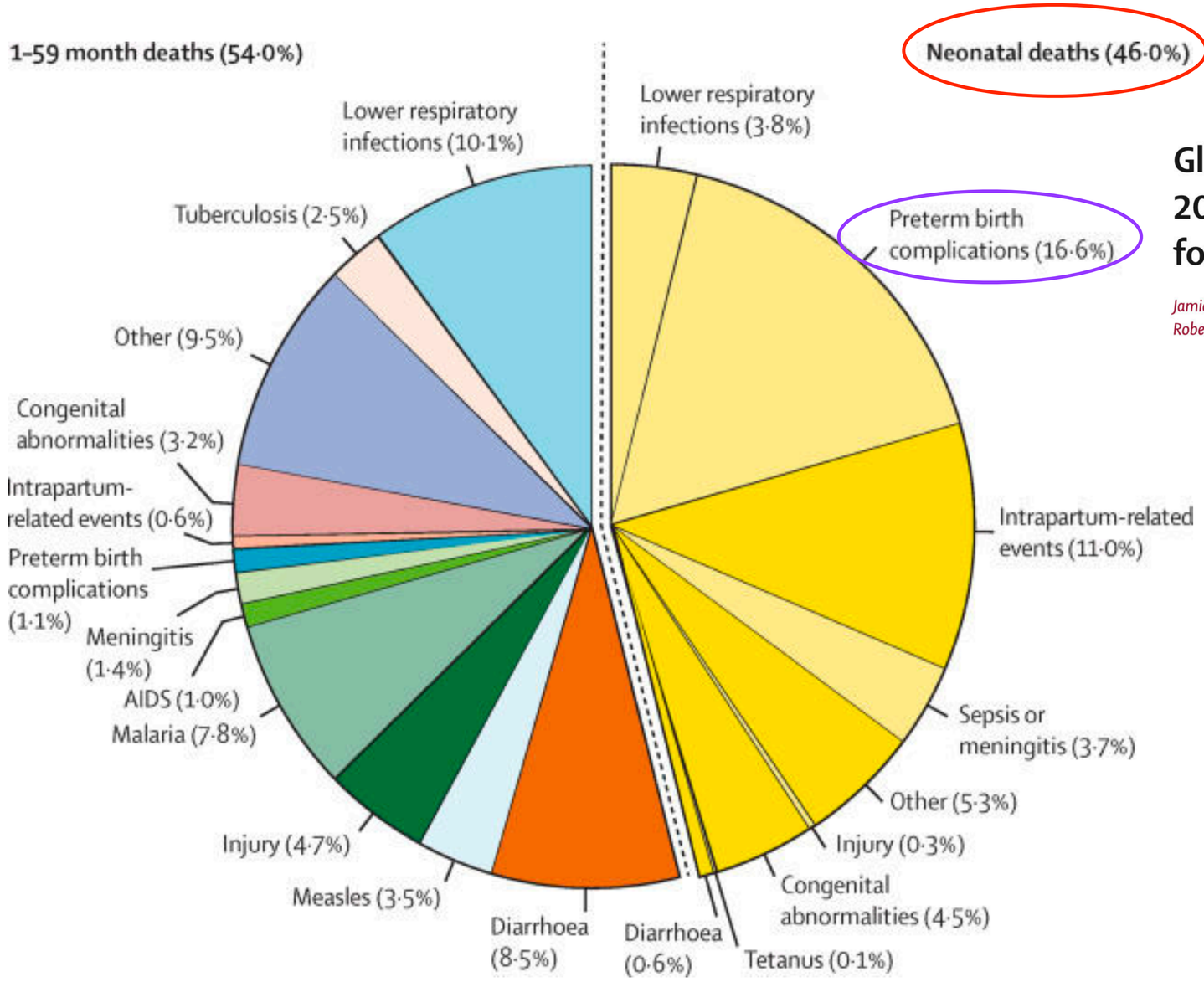
Thở máy tần số cao không xâm lấn - từ bằng chứng đến ứng dụng lâm sàng

BSCK2. Nguyễn Thanh Thiện
Khoa HSSS - BV Nhi Đồng 2



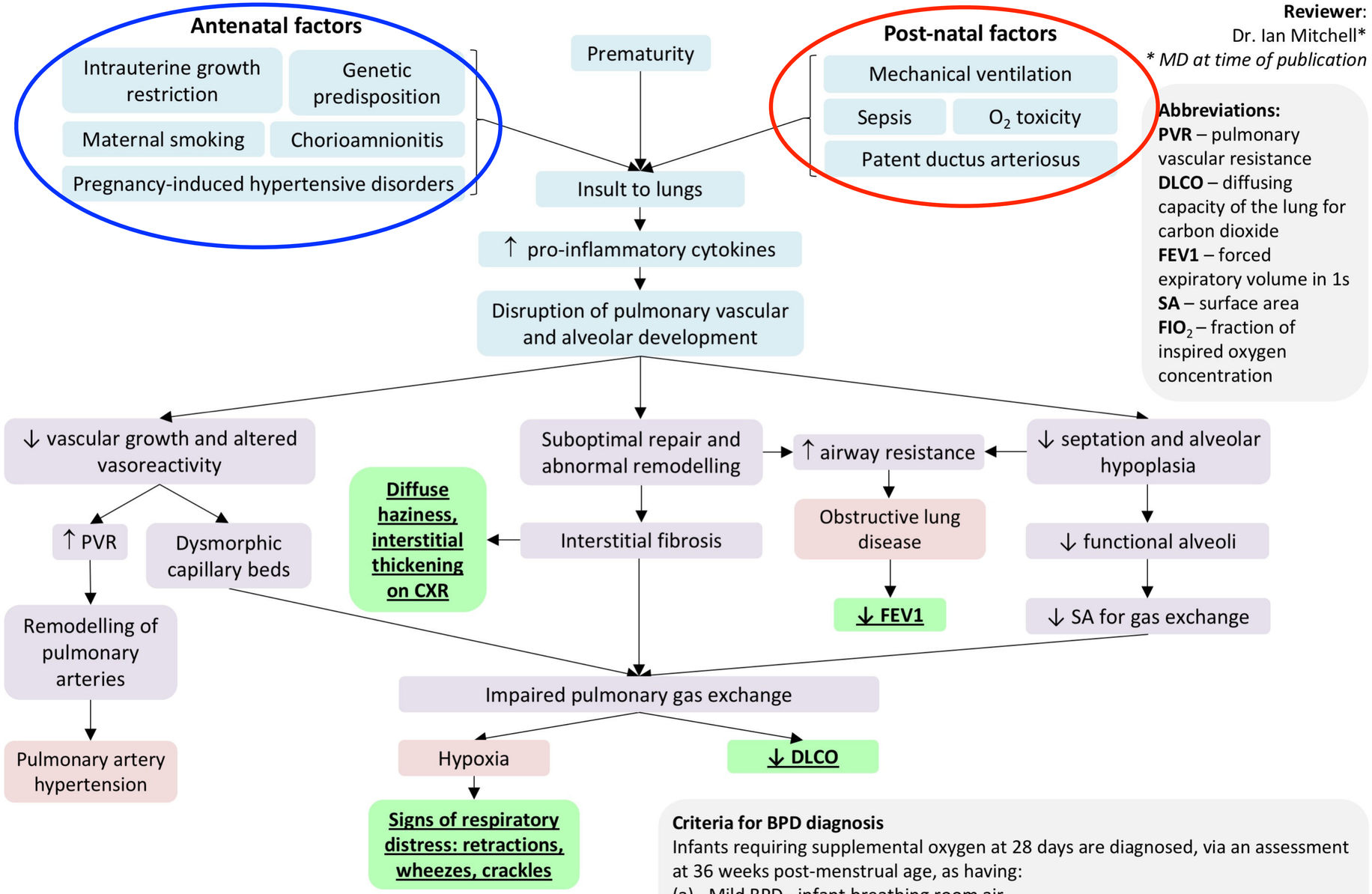
Global, regional, and national causes of under-5 mortality in 2000–19: an updated systematic analysis with implications for the Sustainable Development Goals

Jamie Perin, Amy Mulick, Diana Yeung, Francisco Villavicencio, Gerard Lopez, Kathleen L Strong, David Prieto-Merino, Simon Cousens, Robert E Black, Li Liu**

Lancet Child Adolesc Health, 2022; 6: 106 - 15

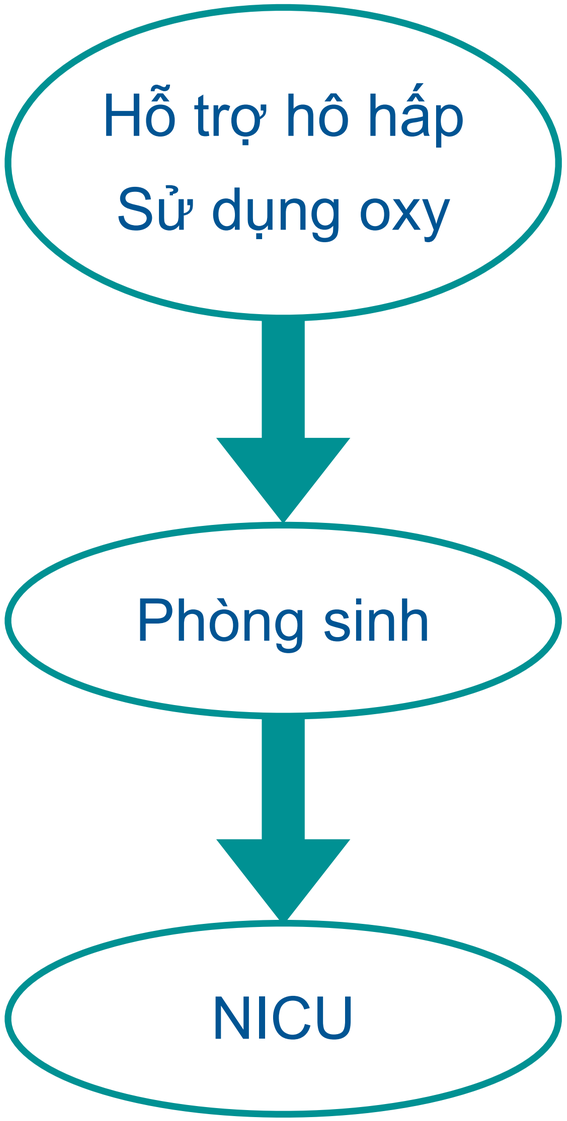
Bronchopulmonary Dysplasia (BPD): *Pathogenesis and clinical findings*

Author:
Nicola Adderley
Reviewer:
Dr. Ian Mitchell*
** MD at time of publication*



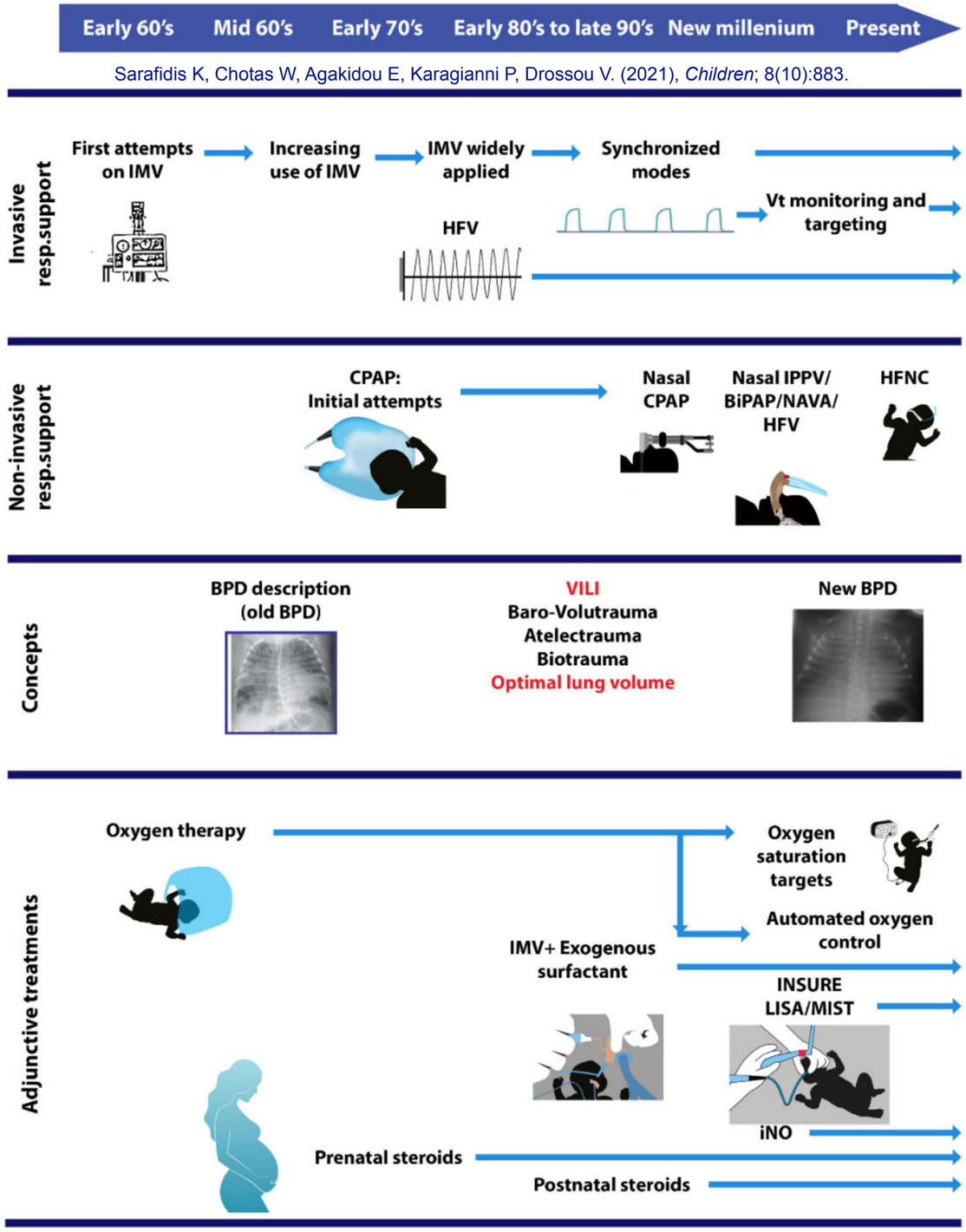
Abbreviations:
PVR – pulmonary vascular resistance
DLCO – diffusing capacity of the lung for carbon dioxide
FEV1 – forced expiratory volume in 1s
SA – surface area
FIO_2 – fraction of inspired oxygen concentration

Criteria for BPD diagnosis
Infants requiring supplemental oxygen at 28 days are diagnosed, via an assessment at 36 weeks post-menstrual age, as having:
(a) Mild BPD– infant breathing room air
(b) Moderate BPD– infant requiring <30% FIO_2
(c) Severe BPD– infant requiring >30% FIO_2 or positive pressure ventilation



Legend: Pathophysiology | Mechanism | Sign/Symptom/Lab Finding | Complications

Published **February 7, 2019** on www.thecalgaryguide.com

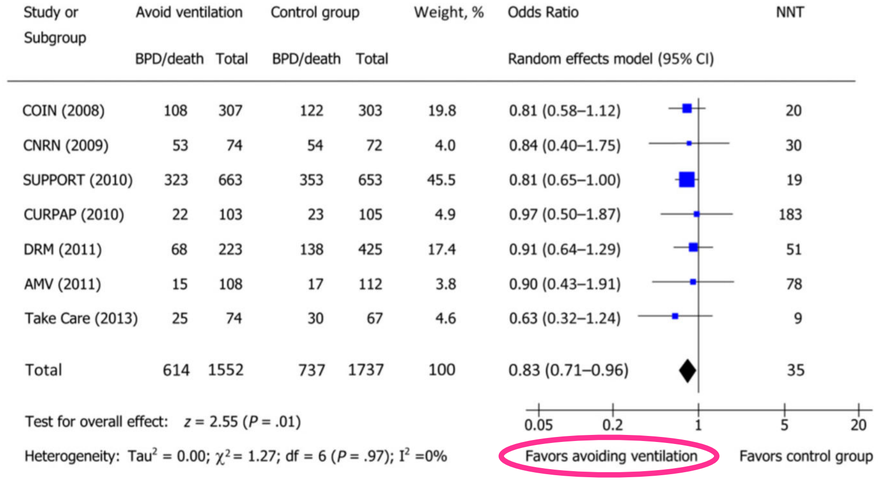


Sarafidis K, Chotas W, Agakidou E, Karagianni P, Drossou V. (2021), *Children*; 8(10):883.

PEDIATRICS Volume 132, Number 5, November 2013

FISCHER and BÜHRER

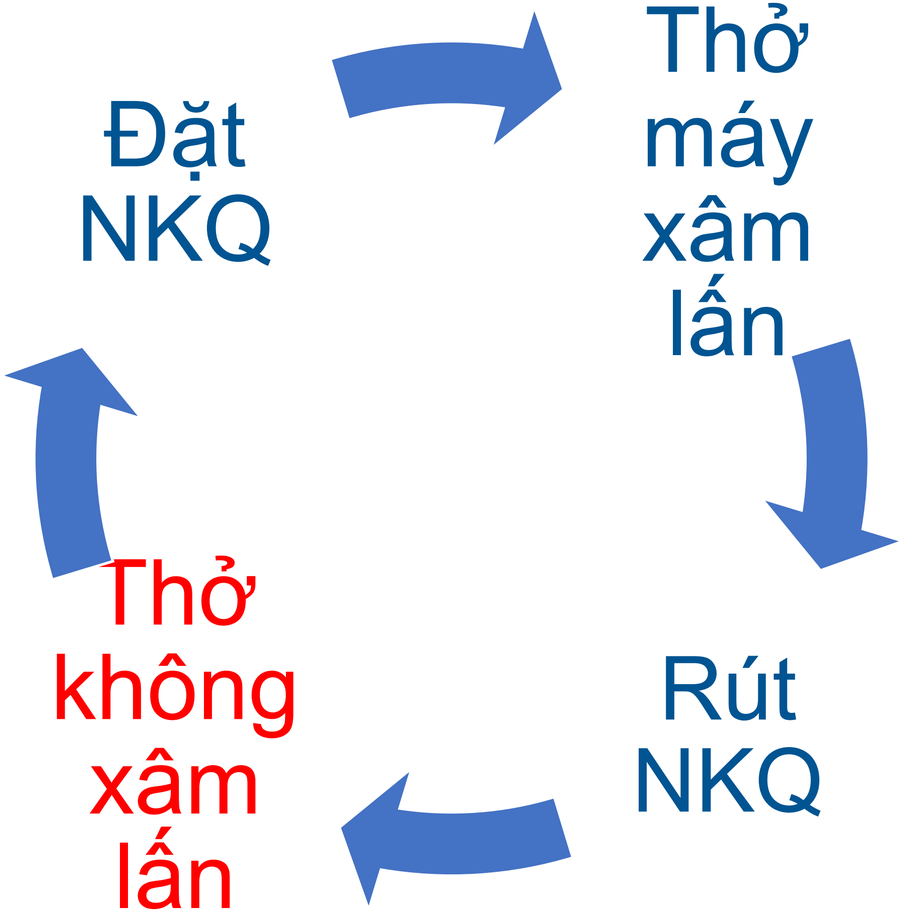
Avoiding Endotracheal Ventilation to Prevent Bronchopulmonary Dysplasia: A Meta-analysis



Hỗ trợ hô hấp không xâm lấn

- Ít bệnh phổi mạn
- Ít biến chứng trên đường thở
- Ít nhiễm trùng
- Giảm tình trạng viêm
- Ít stress cho trẻ
- Giảm chi phí

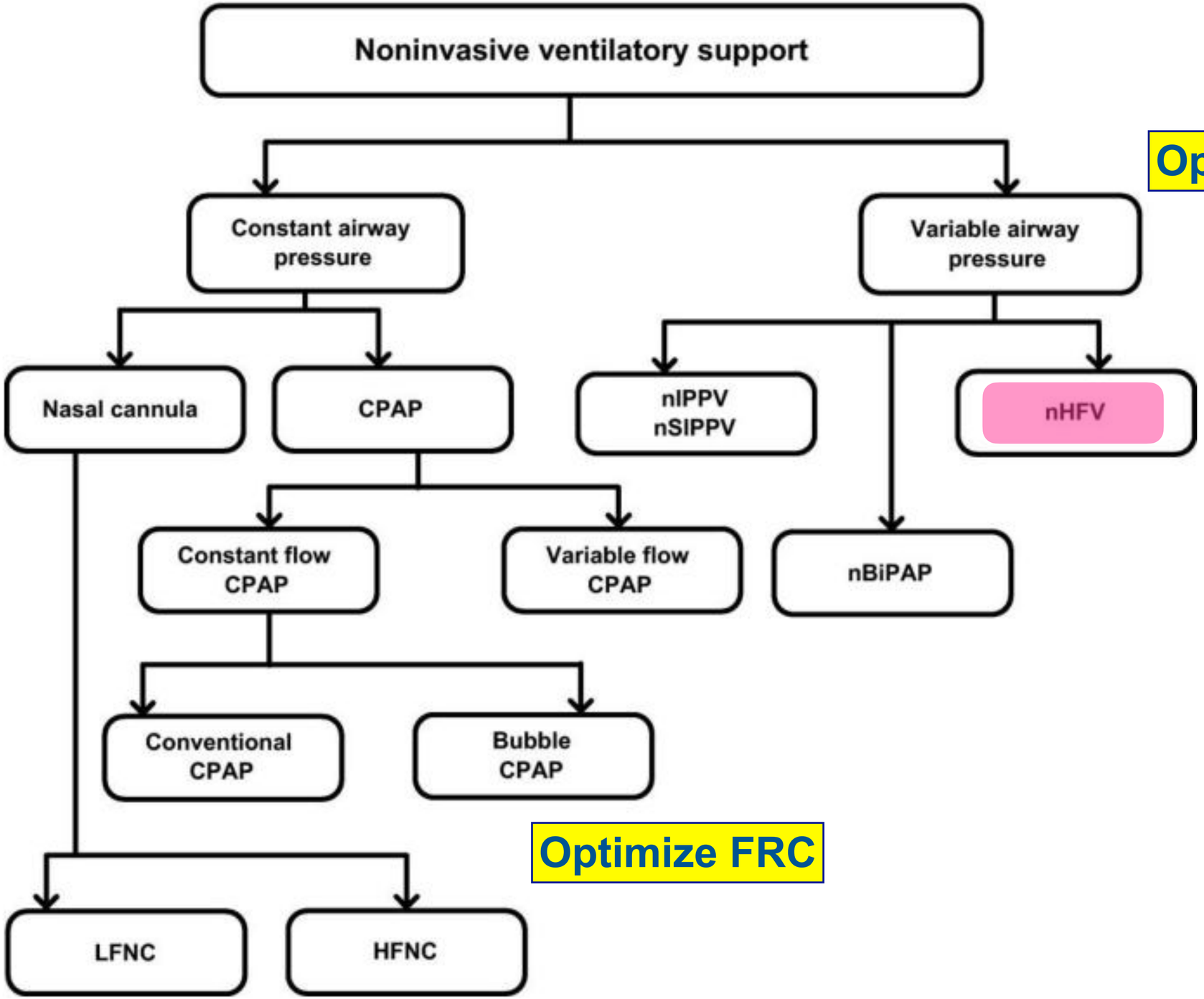
Giúp thở không xâm lấn sử dụng khi nào?



Sử dụng ngay từ đầu
→ ↓ thở máy xâm lấn

Sử dụng sau rút NKQ
→ ↓ đặt lại NKQ

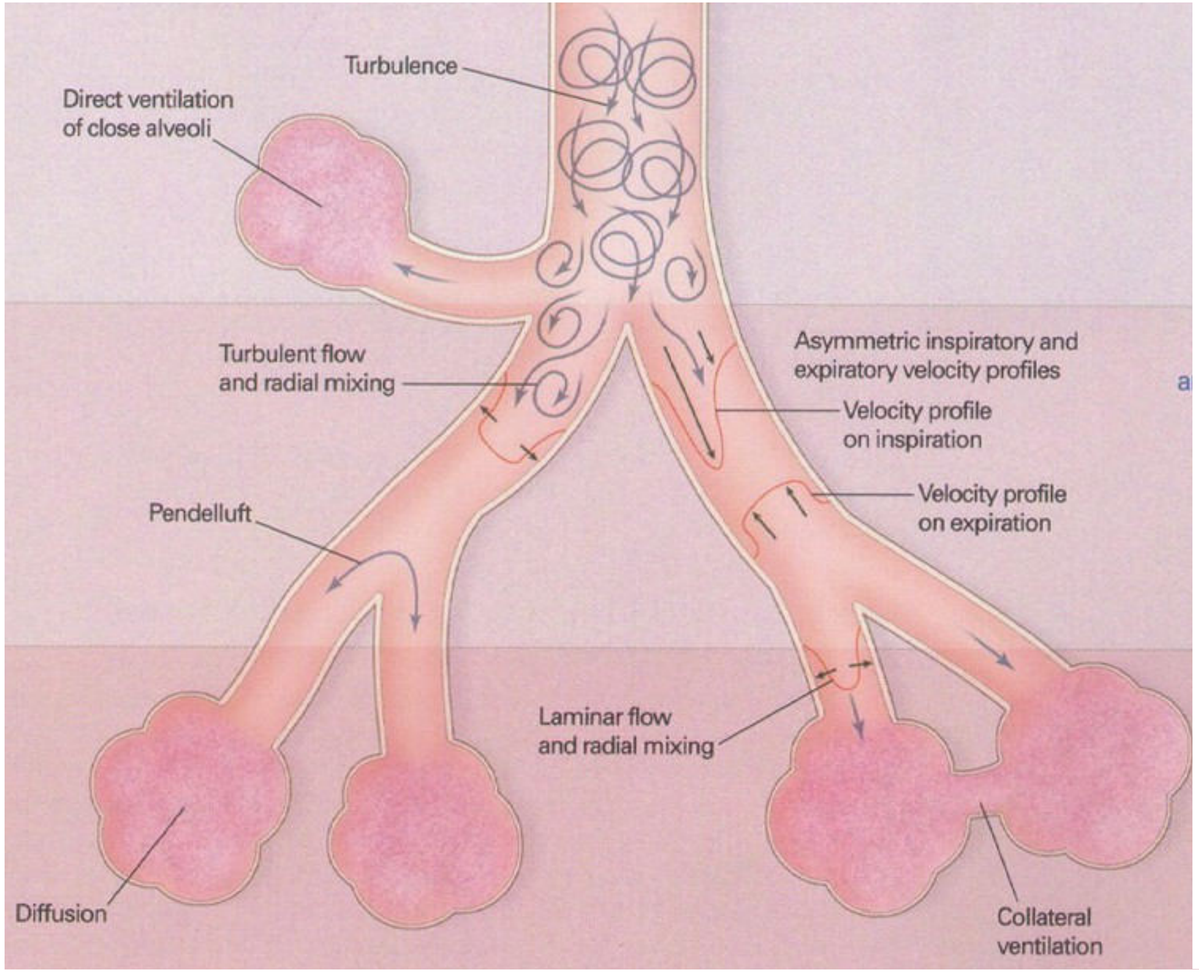
(*) Thở máy xâm lấn kéo dài làm tăng nguy cơ bệnh phổi mạn

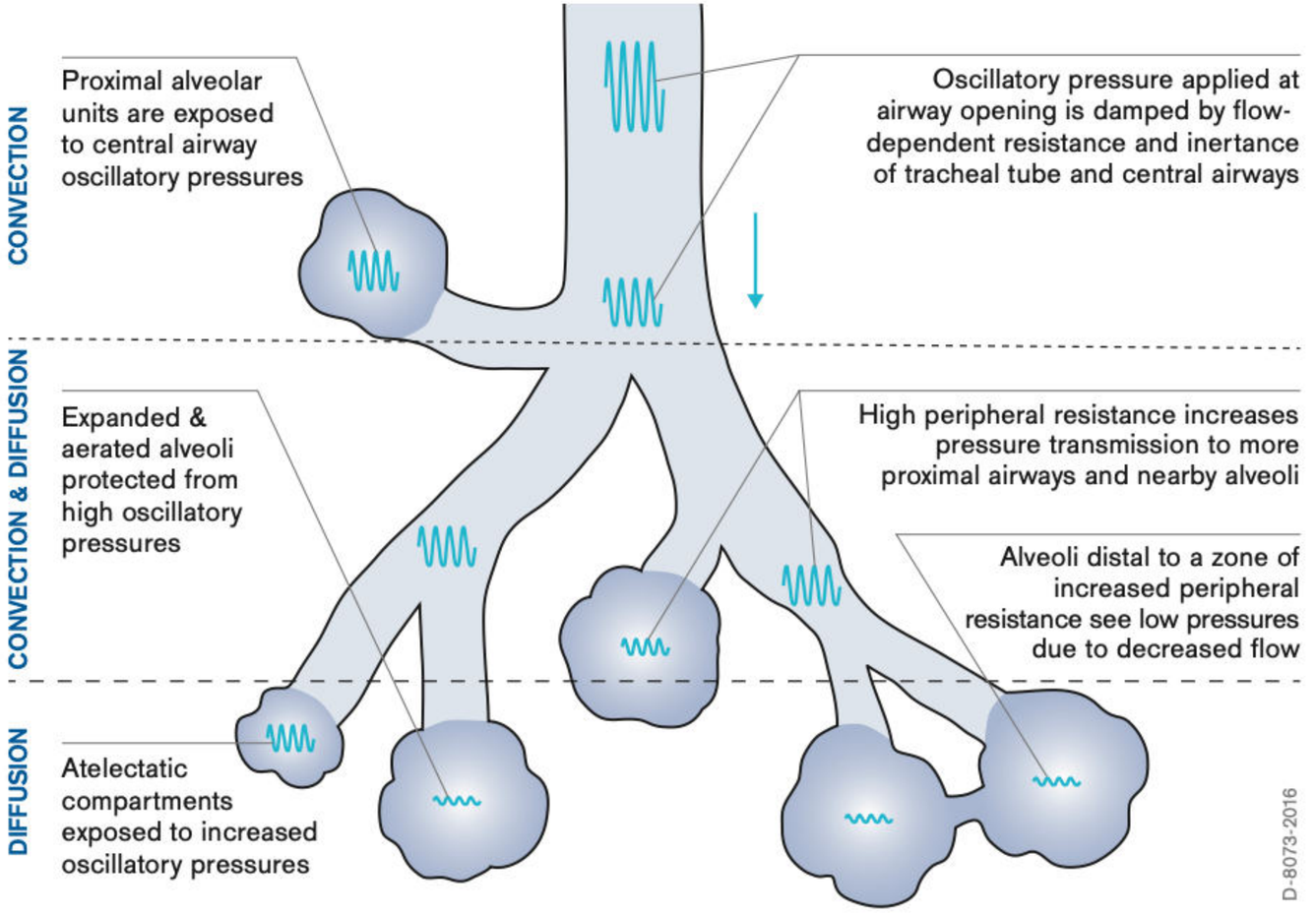


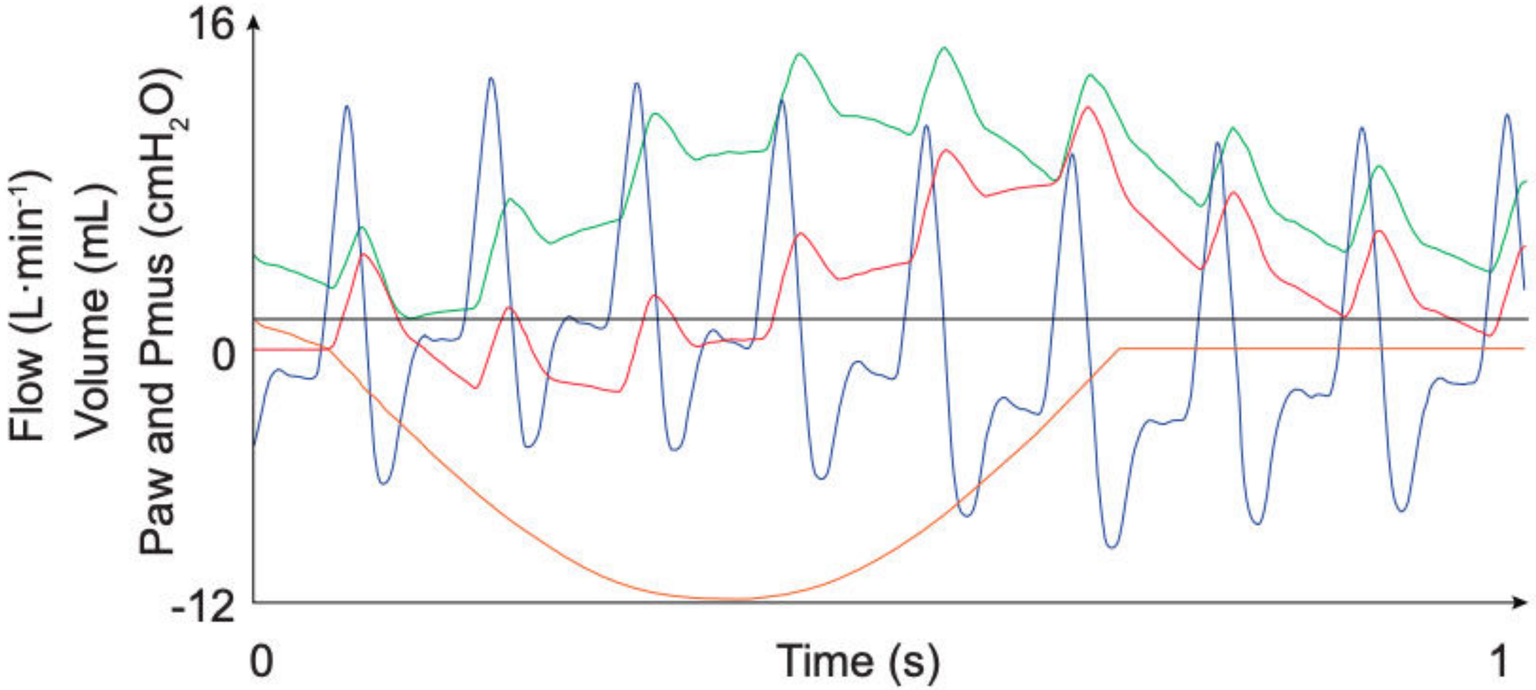
Optimize FRC & support Vt

Optimize FRC

NHFOV: Non-invasive (**n**asal) **H**igh **F**requency **O**scilatory **V**entilation







Flow

Volume

P đường thở (đo trong phổi)

P âm trong thì hít vào tự nhiên

Mô hình trẻ sinh non RDS

- CNLS 1.5kg, R 100 $cmH_2O/L/s$, C 0.5 $mL/cmH_2O/kg$
- RR 40 lần/phút
- Paw 8 cmH_2O, amplitude 30 cmH_2O, F 9Hz, I/T = 1/2

Variable	Effect on gas exchange
Oscillation amplitude	↑
Inspiratory time	↑
Frequency	↓
Leaks	↓*
Interface	variable
Mean airway pressure	variable
Gravity (patient positioning)	variable

De Luca D, Centorrino R (2021), Clinics in Perinatology, 48 (4), pp.761-782

Nasal high frequency ventilation in neonates with moderate respiratory insufficiency

Mark van der Hoeven, Erik Brouwer, Carlos E Blanco

Table 1 Summary of clinical data of 21 infants studied

	Median (20th–80th percentile)
Birthweight (g)	1010 (750–2170)
Gestation (weeks)	29 (27–32)
Age at study (h)	24 (4–480)
Duration nHFV (h)	36 (12–108)
IRDS	10
TTN	3
Air leak	2
Apnoea	6
Required mechanical ventilation	5

IRDS: idiopathic respiratory distress syndrome; TTN: transient tachypnoea of the newborn

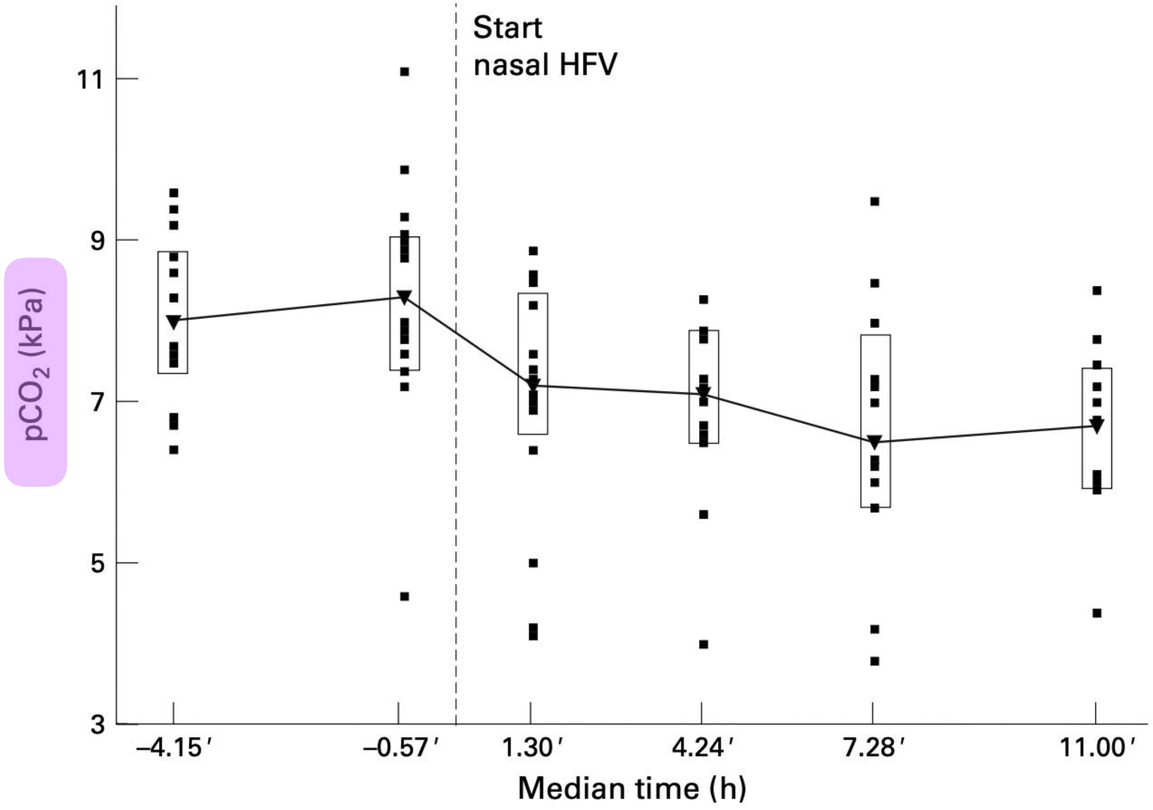


Figure 2 Course of pCO ₂ in two blood gases measured before (4.15 and 0.57 hours) and four blood gases measured after (1.3, 4.24, 7.38 and 11 hours) the start of nHFV. Median and 20th and 80th percentiles are shown together.

Noninvasive high-frequency oscillatory ventilation versus nasal continuous positive airway pressure in preterm infants with moderate-severe respiratory distress syndrome: A preliminary report

Zhu X-W, Zhao J-N, Tang S-F, Yan J, Shi Y.
Pediatr Pulmonol. 2017; 52: 1038–1042

Objective: The aim of this study was to compare the effect of noninvasive high-frequency oscillatory ventilation (nHFOV) with nasal continuous positive airway pressure (nCPAP) in preterm infants with moderate-severe respiratory distress syndrome (RDS) after surfactant administration via INSURE (intubation, surfactant, extubation) method on the need for invasive mechanical ventilation (IMV).

TABLE 1 Patients' characteristics in NHFOV and NCPAP groups

Variable	NHFOV (*n* = 37)	NCPAP (*n* = 39)	*P*-value
Gender (male/female,)	22/15	21/18	0.397
Gestational age (weeks)	31.7 ± 1.7	32.0 ± 1.9	0.624
Birth weight (g)	1670 ± 353	1735 ± 327	0.623
Cesarean section (%)	11 (29.7)	17 (43.6)	0.072
Prenatal corticosteroid (%)	13 (35.1)	15 (38.5)	0.475
Premature rupture of the membrane(%)	16 (43.2)	21 (53.8)	0.244
Apgar score @5 min	6.9 ± 2.4	6.7 ± 2.2	0.824

TABLE 2 Primary and secondary outcomes in NHFOV and NCPAP groups

Variable	NHFOV (*n* = 37)	NCPAP (*n* = 39)	*P*-value
Need for IMV (%)	9 (24.3)	22 (56.4)	0.004
Mortality (%)	2 (5.4)	3 (7.7)	0.525
BPD (%)	3 (8.1)	5 (12.8)	0.386
IVH (%)	4 (10.8)	3 (7.7)	0.470
Air leak (%)	0	0	/

NHFV: Non-invasive (nasal) **H**igh **F**requency **V**entilation

Cochrane Library

Cochrane Database of Systematic Reviews

Non-invasive high-frequency ventilation in newborn infants with respiratory distress (Review)

Abdel-Latif ME, Tan O, Fiander M, Osborn DA

Cochrane Database of Systematic Reviews 2024, Issue 5. Art. No.: CD012712.

2134 studies (1696 databases; 413 trial registries; 25 conference abstracts)

921 duplicates removed

1213 records screened

1088 records excluded (irrelevant)

125 full-text articles assessed for eligibility

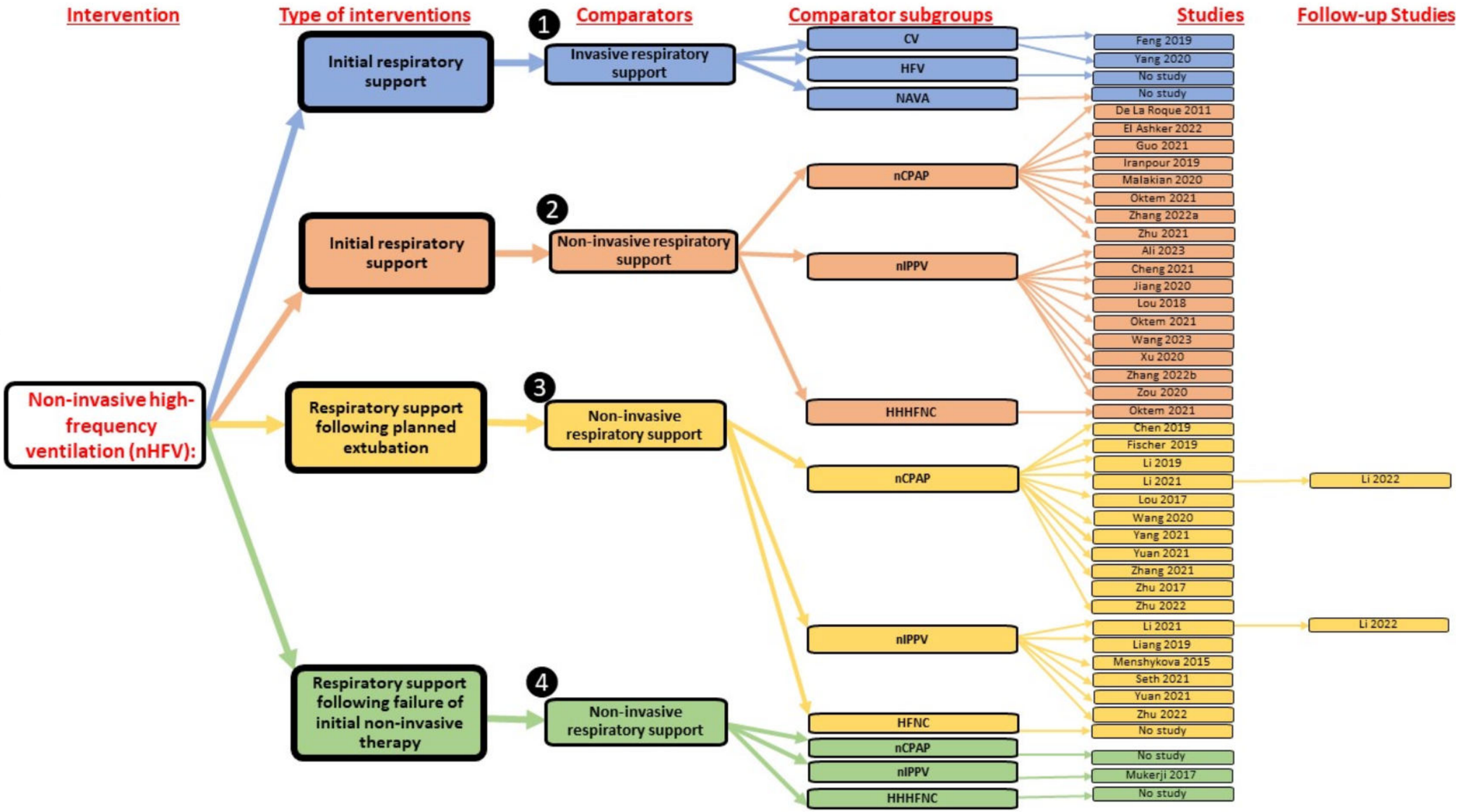
34 studies (40 references) excluded, with reasons

33 studies (59 references) included in qualitative synthesis

25 ongoing trials (26 references)

0 awaiting classification

33 studies included in quantitative synthesis (meta-analysis)



33 studies (low- to middle-income settings)

5068 preterm and 46 term infants

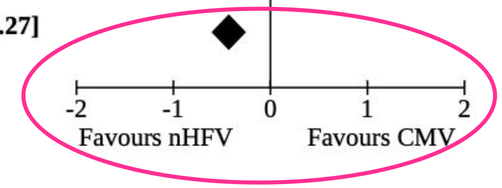
nHFV compared to invasive respiratory therapy for initial RS

We are very uncertain whether nHFV reduces mortality before hospital discharge (RR 0.67, 95% CI 0.20 to 2.18; 1 study, 80 infants) or the incidence of CLD (RR 0.38, 95% CI 0.09 to 1.59; 2 studies, 180 infants), both very low-certainty. ET intubation, death or CLD, severe intraventricular haemorrhage (IVH) and neurodevelopmental disability (ND) were not reported.

Analysis 1.2. Comparison 1: Initial respiratory support: nHFV vs invasive respiratory therapy, Outcome 2: Duration of respiratory support, days

Study or Subgroup	nHFV Mean	nHFV SD	nHFV Total	CMV Mean	CMV SD	CMV Total	Weight	Mean Difference IV, Fixed, 95% CI	Risk of Bias A B C D E F G H
Feng 2019	3.5	0.35	40	3.93	0.4	40	100.0%	-0.43 [-0.59 , -0.27]	+ ? − ? ? + ? ?
Total (95% CI)			**40**			**40**	**100.0%**	**-0.43 [-0.59 , -0.27]**	

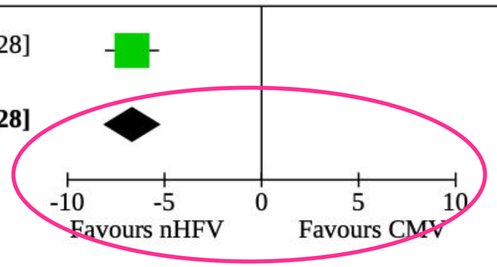
Heterogeneity: Not applicable
Test for overall effect: Z = 5.12 (P < 0.00001)
Test for subgroup differences: Not applicable



Analysis 1.5. Comparison 1: Initial respiratory support: nHFV vs invasive respiratory therapy, Outcome 5: Length of hospital stay, days

Study or Subgroup	nHFV Mean	nHFV SD	nHFV Total	CMV Mean	CMV SD	CMV Total	Weight	Mean Difference IV, Fixed, 95% CI	Risk of Bias A B C D E F G H
Feng 2019	27.48	2.81	40	34.16	3.52	40	100.0%	-6.68 [-8.08 , -5.28]	+ ? − ? ? + ? ?
Total (95% CI)			**40**			**40**	**100.0%**	**-6.68 [-8.08 , -5.28]**	

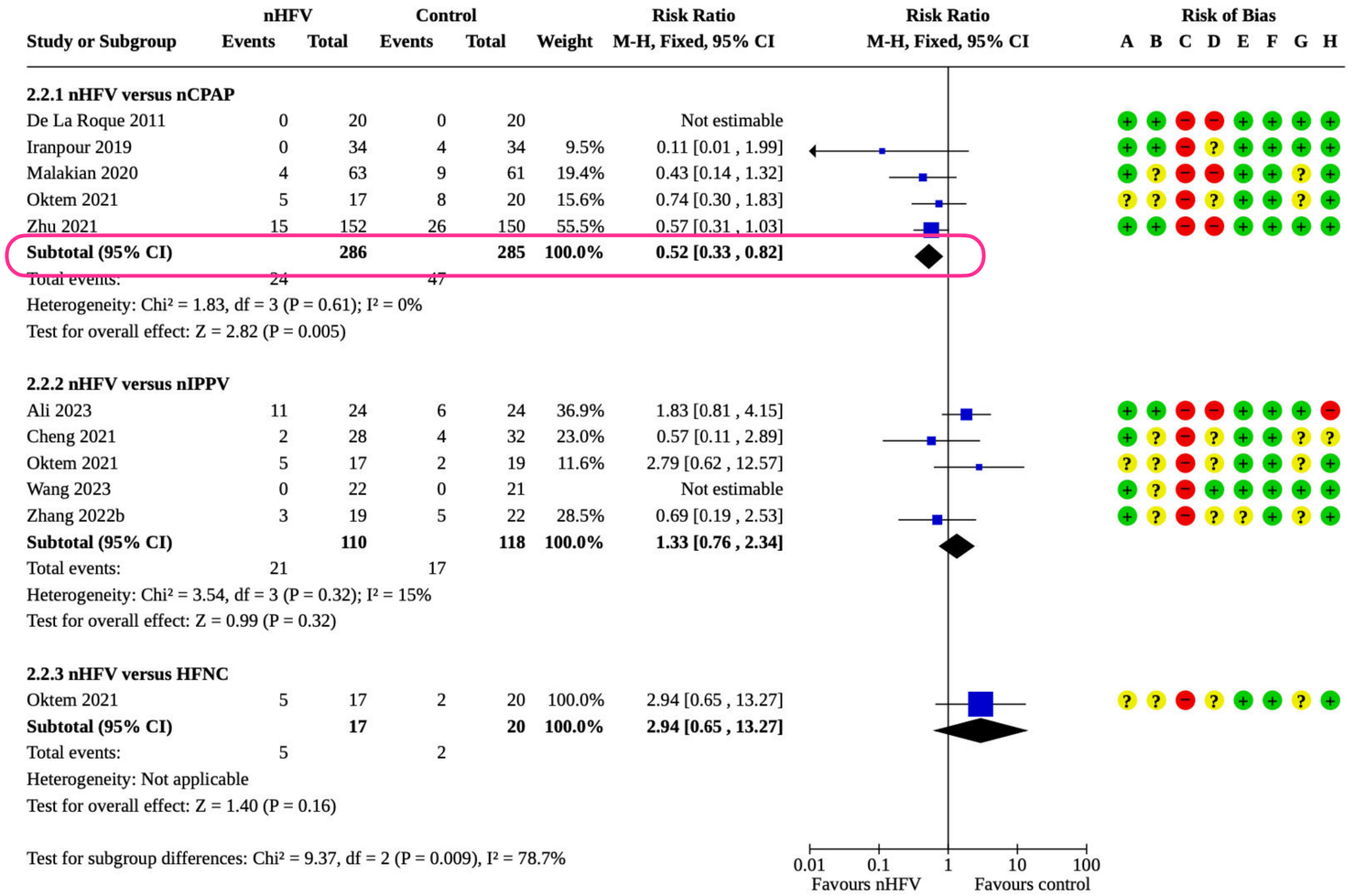
Heterogeneity: Not applicable
Test for overall effect: Z = 9.38 (P < 0.00001)
Test for subgroup differences: Not applicable



nHFV vs nasal continuous positive airway pressure (nCPAP) used for initial RS

We are very uncertain whether nHFV reduces mortality before hospital discharge (RR 1.00, 95% CI 0.41 to 2.41; 4 studies, 531 infants; very low-certainty). nHFV may reduce ET intubation (RR 0.52, 95% CI 0.33 to 0.82; 5 studies, 571 infants), but there may be little or no difference in CLD (RR 1.35, 95% CI 0.80 to 2.27; 4 studies, 481 infants); death or CLD (RR 2.50, 95% CI 0.52 to 12.01; 1 study, 68 participants); or severe IVH (RR 1.17, 95% CI 0.36 to 3.78; 4 studies, 531 infants), all low-certainty evidence. ND was not reported.

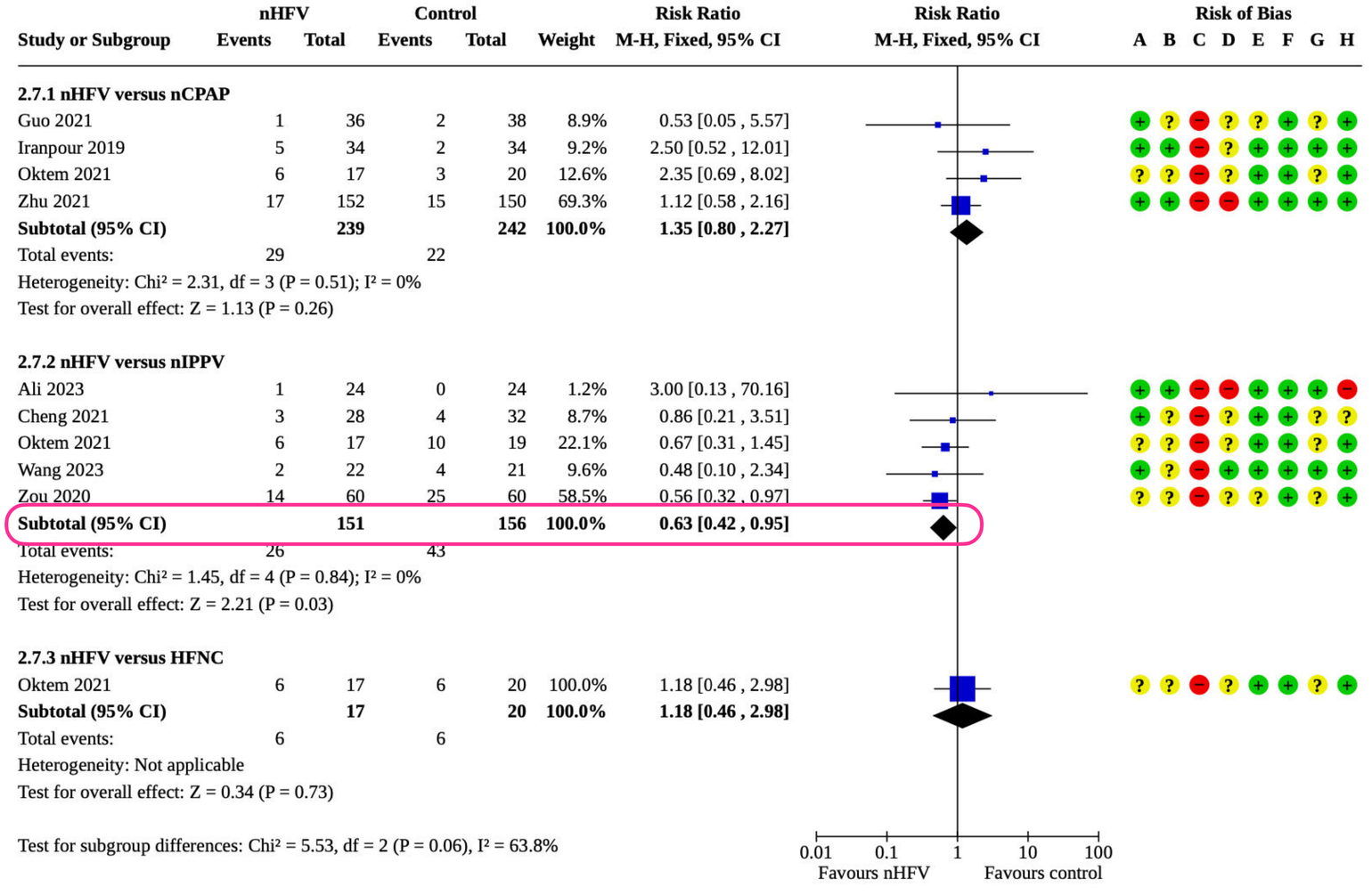
Analysis 2.2. Comparison 2: Initial respiratory support: nHFV vs other non-invasive respiratory therapy modalities, Outcome 2: Endotracheal intubation



nHFV vs nasal intermittent positive-pressure ventilation (nIPPV) used for initial RS

nHFV may result in little to no difference in mortality before hospital discharge (RR 1.86, 95% CI 0.90 to 3.83; 2 studies, 84 infants; low-certainty). nHFV may have little or no effect in reducing ET intubation (RR 1.33, 95% CI 0.76 to 2.34; 5 studies, 228 infants; low-certainty). There may be a reduction in CLD (RR 0.63, 95% CI 0.42 to 0.95; 5 studies, 307 infants; low-certainty). A single study (36 infants) reported no events for severe IVH. Death or CLD and ND were not reported.

Analysis 2.7. Comparison 2: Initial respiratory support: nHFV vs other non-invasive respiratory therapy modalities, Outcome 7: Chronic lung disease at 36 weeks

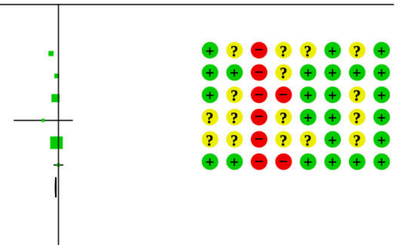


Analysis 2.5. Comparison 2: Initial respiratory support: nHFV vs other non-invasive respiratory therapy modalities, Outcome 5: Duration of respiratory support, days

Study or Subgroup	nHFV Mean	nHFV SD	nHFV Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
2.5.1 nHFV vs nCPAP								
Guo 2021	3.81	0.49	36	5.08	0.5	38	10.7%	-1.27 [-1.50 , -1.04]
Iranpour 2019	0.8	0.3	34	1.1	0.7	34	8.3%	-0.30 [-0.56 , -0.04]
Malakian 2020	1.6	0.4	63	2.1	0.4	61	27.3%	-0.50 [-0.64 , -0.36]
Oktem 2021	4.7	4.8	17	7.3	10.3	20	0.0%	-2.60 [-7.66 , 2.46]
Zhang 2022a	2.49	0.24	51	2.83	0.28	51	52.9%	-0.34 [-0.44 , -0.24]
Zhu 2021	4	3.6	152	4	3.9	150	0.8%	0.00 [-0.85 , 0.85]
Subtotal (95% CI)			**353**			**354**	**100.0%**	**-0.48 [-0.55 , -0.40]**

Heterogeneity: Chi² = 58.34, df = 5 (P < 0.00001); I² = 91%

Test for overall effect: Z = 12.71 (P < 0.00001)



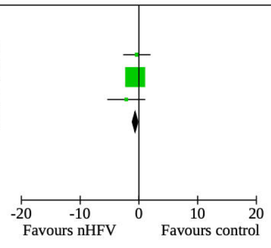
Analysis 2.6. Comparison 2: Initial respiratory support: nHFV vs other non-invasive respiratory therapy modalities, Outcome 6: Duration of oxygen therapy, days

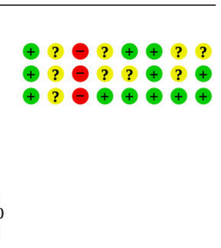
Study or Subgroup	nHFV Mean	nHFV SD	nHFV Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
2.6.2 nHFV versus nIPPV								
Cheng 2021	10.93	4.82	28	11.28	4.29	32	4.2%	-0.35 [-2.67 , 1.97]
Jiang 2020	3.96	1.05	41	4.59	1.23	41	93.6%	-0.63 [-1.13 , -0.13]
Wang 2023	5.15	2.46	22	7.3	7.17	21	2.2%	-2.15 [-5.38 , 1.08]
Subtotal (95% CI)			**91**			**94**	**100.0%**	**-0.65 [-1.13 , -0.17]**

Heterogeneity: Chi² = 0.90, df = 2 (P = 0.64); I² = 0%

Test for overall effect: Z = 2.67 (P = 0.008)

Test for subgroup differences: Chi² = 7.59, df = 1 (P = 0.006), I² = 86.8%





Analysis 2.20. Comparison 2: Initial respiratory support: nHFV vs other non-invasive respiratory therapy modalities, Outcome 20: Length of hospital stay, days

Study or Subgroup	nHFV Mean	nHFV SD	nHFV Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
2.20.1 nHFV versus nCPAP								
Guo 2021	11.23	0.8	36	15.5	1.06	38	84.4%	-4.27 [-4.70 , -3.84]
Malakian 2020	22.6	5.6	63	20.4	6.4	61	3.4%	2.20 [0.08 , 4.32]
Zhang 2022a	13.65	3.28	51	18.54	2.76	51	11.1%	-4.89 [-6.07 , -3.71]
Zhu 2021	30.2	16.8	152	29.7	16.5	150	1.1%	0.50 [-3.26 , 4.26]
Subtotal (95% CI)			**302**			**300**	**100.0%**	**-4.07 [-4.46 , -3.67]**

Heterogeneity: Chi² = 42.02, df = 3 (P < 0.00001); I² = 93%

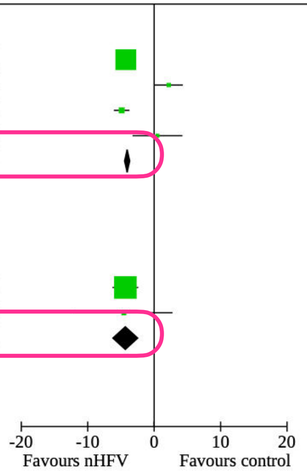
Test for overall effect: Z = 20.34 (P < 0.00001)

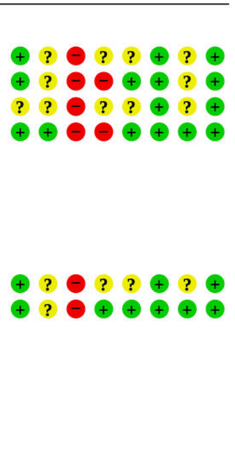
2.20.2 nHFV versus nIPPV								
Jiang 2020	11.34	3.52	41	15.67	5.28	41	93.4%	-4.33 [-6.27 , -2.39]
Wang 2023	18.64	10.23	22	23.19	13.87	21	6.6%	-4.55 [-11.86 , 2.76]
Subtotal (95% CI)			**63**			**62**	**100.0%**	**-4.34 [-6.22 , -2.47]**

Heterogeneity: Chi² = 0.00, df = 1 (P = 0.95); I² = 0%

Test for overall effect: Z = 4.54 (P < 0.00001)

Test for subgroup differences: Chi² = 0.08, df = 1 (P = 0.78), I² = 0%





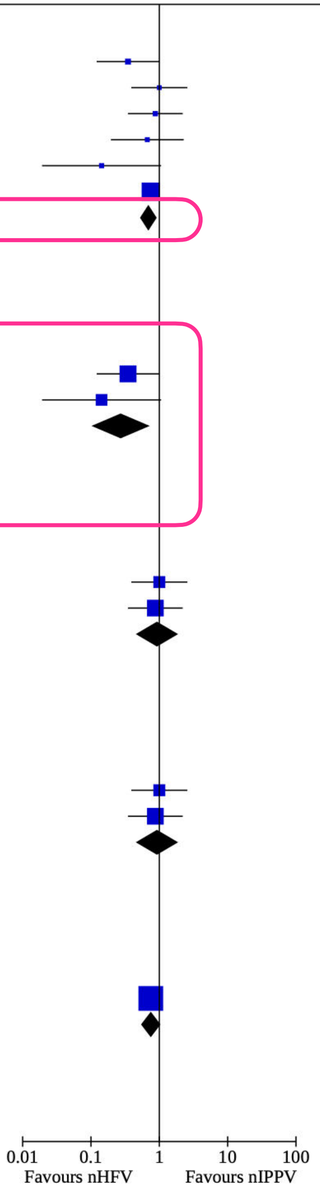
nHFV versus nIPPV used for RS following planned extubation

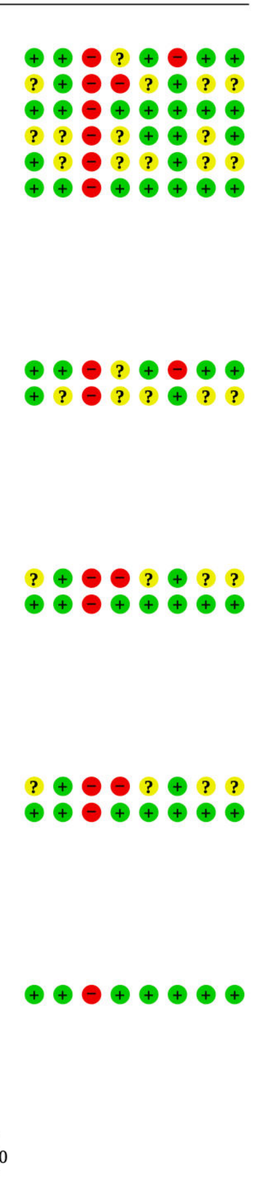
nHFV may have little or no effect on mortality before hospital discharge (RR 1.83, 95% CI 0.70 to 4.79; 2 studies, 984 infants; low-certainty). There is probably a reduction in ET reintubation (RR 0.69, 95% CI 0.54 to 0.89; 6 studies, 1364 infants), but little or no effect on CLD (RR 0.88, 95% CI 0.75 to 1.04; 4 studies, 1236 infants); death or CLD (RR 0.92, 95% CI 0.79 to 1.08; 3 studies, 1070 infants); or severe IVH (RR 0.78, 95% CI 0.55 to 1.10; 4 studies, 1162 infants), all moderate-certainty. One study reported there might be no difference in ND (RR 0.88, 95% CI 0.35 to 2.16; 1 study, 72 infants; low-certainty).

So với NIPPV, nHFOV giúp giảm tái đặt NKQ, ở nhóm trẻ thở với MAP ≥ 10 cm H_2O

Analysis 8.2. Comparison 8: Respiratory support following planned extubation: nHFV vs nIPPV - subgroup analyses, Outcome 2: Endotracheal reintubation

Study or Subgroup	nHFV Events	nHFV Total	nIPPV Events	nIPPV Total	Weight	Risk Ratio M-H, Fixed, 95% CI
8.2.2 nHFV versus nIPPV - preterm infants						
Li 2021	4	45	12	47	9.6%	0.35 [0.12 , 1.00]
Menshykova 2015	5	12	5	12	4.1%	1.00 [0.39 , 2.58]
Seth 2021	7	43	8	43	6.6%	0.88 [0.35 , 2.20]
Yuan 2021	4	80	6	80	4.9%	0.67 [0.20 , 2.27]
Zhenyu 2019	1	21	7	21	5.8%	0.14 [0.02 , 1.06]
Zhu 2022	63	480	84	480	69.0%	0.75 [0.55 , 1.01]
Subtotal (95% CI)		**681**		**683**	**100.0%**	**0.69 [0.54 , 0.89]**
Total events:	84		122			
Heterogeneity: Chi² = 5.12, df = 5 (P = 0.40); I² = 2%						
Test for overall effect: Z = 2.84 (P = 0.005)						
8.2.3 nHFV versus nIPPV - nHFV MAP ≥ 10 cm H2O						
Li 2021	4	45	12	47	62.6%	0.35 [0.12 , 1.00]
Zhenyu 2019	1	21	7	21	37.4%	0.14 [0.02 , 1.06]
Subtotal (95% CI)		**66**		**68**	**100.0%**	**0.27 [0.11 , 0.68]**
Total events:	5		19			
Heterogeneity: Chi² = 0.61, df = 1 (P = 0.44); I² = 0%						
Test for overall effect: Z = 2.76 (P = 0.006)						
8.2.4 nHFV versus nIPPV - nHFV MAP < 10 cm H2O						
Menshykova 2015	5	12	5	12	38.5%	1.00 [0.39 , 2.58]
Seth 2021	7	43	8	43	61.5%	0.88 [0.35 , 2.20]
Subtotal (95% CI)		**55**		**55**	**100.0%**	**0.92 [0.47 , 1.80]**
Total events:	12		13			
Heterogeneity: Chi² = 0.04, df = 1 (P = 0.84); I² = 0%						
Test for overall effect: Z = 0.23 (P = 0.81)						
8.2.5 nHFV versus nIPPV - nHFV Hz ≥ 10						
Menshykova 2015	5	12	5	12	38.5%	1.00 [0.39 , 2.58]
Seth 2021	7	43	8	43	61.5%	0.88 [0.35 , 2.20]
Subtotal (95% CI)		**55**		**55**	**100.0%**	**0.92 [0.47 , 1.80]**
Total events:	12		13			
Heterogeneity: Chi² = 0.04, df = 1 (P = 0.84); I² = 0%						
Test for overall effect: Z = 0.23 (P = 0.81)						
8.2.6 nHFV versus nIPPV- nHFV Hz < 10						
Zhu 2022	63	480	84	480	100.0%	0.75 [0.55 , 1.01]
Subtotal (95% CI)		**480**		**480**	**100.0%**	**0.75 [0.55 , 1.01]**
Total events:	63		84			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.87 (P = 0.06)						
Test for subgroup differences: Chi² = 5.49, df = 4 (P = 0.24), I² = 27.2%						





Risk of bias legend

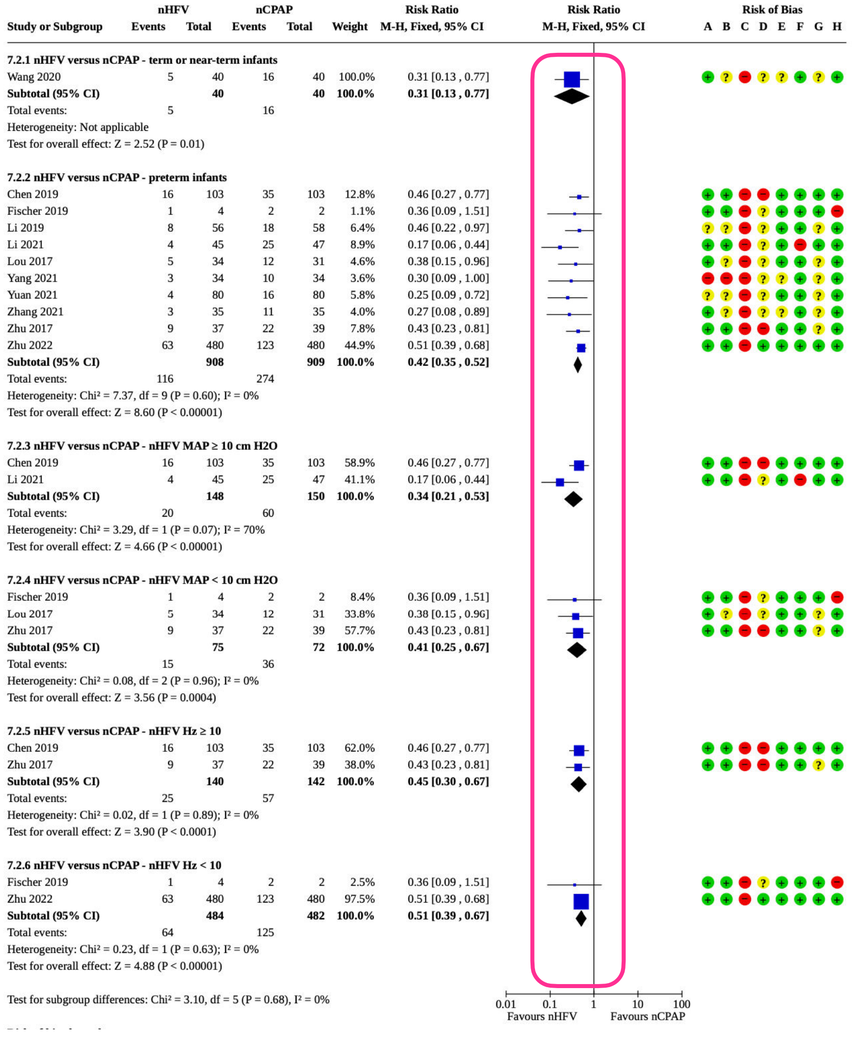
(A) Random sequence generation (selection bias)

nHFV vs nCPAP used for RS following planned extubation

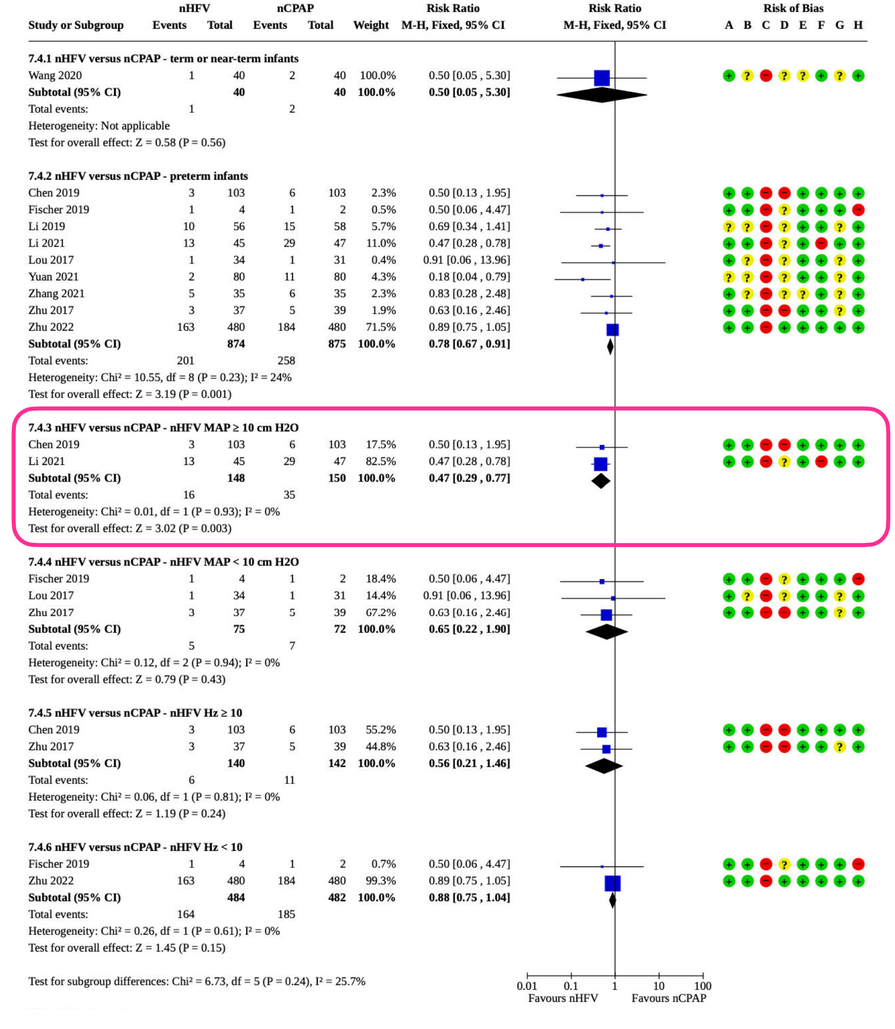
nHFV probably results in little or no difference in mortality before hospital discharge (RR 0.92, 95% CI 0.52 to 1.64; 6 studies, 1472 infants; moderate-certainty). nHFV may result in a reduction in ET reintubation (RR 0.42, 95% CI 0.35 to 0.51; 11 studies, 1897 infants) and CLD (RR 0.78, 95% CI 0.67 to 0.91; 10 studies, 1829 infants), both low-certainty. nHFV probably has little or no effect on death or CLD (RR 0.90, 95% CI 0.77 to 1.06; 2 studies, 966 infants) and severe IVH (RR 0.80, 95% CI 0.57 to 1.13; 3 studies, 1117 infants), both moderate-certainty. We are very uncertain whether nHFV reduces ND (RR 0.92, 95% CI 0.37 to 2.29; 1 study, 74 infants; very low-certainty).

So với nCPAP, nHFOV giúp giảm tái đặt NKQ, và giảm CLD ở nhóm MAP ≥ 10 cm H_2O

Analysis 7.2. Comparison 7: Respiratory support following planned extubation: nHFV vs nCPAP - subgroup analyses, Outcome 2: Endotracheal reintubation



Analysis 7.4. Comparison 7: Respiratory support following planned extubation: nHFV vs nCPAP - subgroup analyses, Outcome 4: Chronic lung disease at 36 weeks



Analysis 6.19. Comparison 6: Respiratory support following planned extubation: nHFV vs other non-invasive respiratory therapy modalities, Outcome 19: Length of hospital stay, days

Study or Subgroup	nHFV Mean	nHFV SD	nHFV Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
6.19.1 nHFV versus nCPAP								
Chen 2019	22	14.3	103	27.6	17.1	103	4.1%	-5.60 [-9.90 , -1.30]
Li 2019	32.2	5	56	31.3	4	58	27.4%	0.90 [-0.77 , 2.57]
Li 2021	37.33333333	12.25277	45	43.33333333	9.941568	47	3.6%	-6.00 [-10.57 , -1.43]
Yang 2021	31.54	2.5	34	32.6	2.43	34	55.4%	-1.06 [-2.23 , 0.11]
Yuan 2021	23.95	8.7042	80	27.7	9.6636	80	9.4%	-3.75 [-6.60 , -0.90]
Subtotal (95% CI)			**318**			**322**	**100.0%**	**-1.14 [-2.01 , -0.27]**

Heterogeneity: Chi² = 17.47, df = 4 (P = 0.002); I² = 77%

Test for overall effect: Z = 2.56 (P = 0.01)

Mean Difference IV, Fixed, 95% CI

Risk of Bias: A B C D E F G H

Analysis 6.6. Comparison 6: Respiratory support following planned extubation: nHFV vs other non-invasive respiratory therapy modalities, Outcome 6: Duration of oxygen therapy, days

Study or Subgroup	nHFV Mean	nHFV SD	nHFV Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
6.6.1 nHFV versus nCPAP								
Fischer 2019	79.66666667	73.16776	4	81	3.543383	2	0.0%	-1.33 [-73.20 , 70.54]
Li 2021	24.33333333	12.25277	45	26.66666667	9.176832	47	6.2%	-2.33 [-6.77 , 2.11]
Yuan 2021	9.45	3.5518	80	11.75	4.731	80	72.6%	-2.30 [-3.60 , -1.00]
Zhu 2022	23.33333333	19.33248	480	26	18.58893	480	21.2%	-2.67 [-5.07 , -0.27]
Subtotal (95% CI)			**609**			**609**	**100.0%**	**-2.38 [-3.48 , -1.28]**

Heterogeneity: Chi² = 0.07, df = 3 (P = 1.00); I² = 0%

Test for overall effect: Z = 4.22 (P < 0.0001)

Mean Difference IV, Fixed, 95% CI

Risk of Bias: A B C D E F G H

Analysis 6.5. Comparison 6: Respiratory support following planned extubation: nHFV vs other non-invasive respiratory therapy modalities, Outcome 5: Duration of respiratory support, days

Study or Subgroup	nHFV Mean	nHFV SD	nHFV Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
6.5.1 nHFV versus nCPAP								
Fischer 2019	30.5	42.59019	4	47	24.80368	2	0.0%	-16.50 [-70.57 , 37.57]
Li 2019	3.09	0.63	56	3.25	0.67	54	11.9%	-0.16 [-0.40 , 0.08]
Li 2021	10.33333333	5.360589	45	15.66666667	9.176832	47	0.1%	-5.33 [-8.39 , -2.28]
Lou 2017	4.4	3.1	34	5.5	3.9	31	0.2%	-1.10 [-2.82 , 0.62]
Yang 2021	3.13	0.22	34	3.23	0.22	34	64.6%	-0.10 [-0.20 , 0.00]
Zhang 2021	3.2	0.34	35	3.26	0.41	35	22.7%	-0.06 [-0.24 , 0.12]
Zhu 2022	11	9.66624	480	12.66666667	10.4098	480	0.4%	-1.67 [-2.94 , -0.40]
Subtotal (95% CI)			**688**			**683**	**100.0%**	**-0.11 [-0.20 , -0.03]**

Heterogeneity: Chi² = 19.12, df = 6 (P = 0.004); I² = 69%

Test for overall effect: Z = 2.60 (P = 0.009)

6.5.2 nHFV versus nIPPV								
Li 2021	10.33333333	5.360589	45	11.33333333	8.412096	47	18.6%	-1.00 [-3.87 , 1.87]
Zhu 2022	11	9.66624	480	13.33333333	11.89691	480	81.4%	-2.33 [-3.70 , -0.96]
Subtotal (95% CI)			**525**			**527**	**100.0%**	**-2.09 [-3.32 , -0.85]**

Heterogeneity: Chi² = 0.68, df = 1 (P = 0.41); I² = 0%

Test for overall effect: Z = 3.30 (P = 0.0010)

Test for subgroup differences: Chi² = 9.73, df = 1 (P = 0.002), I² = 89.7%

Mean Difference IV, Fixed, 95% CI

-20 -10 0 10 20

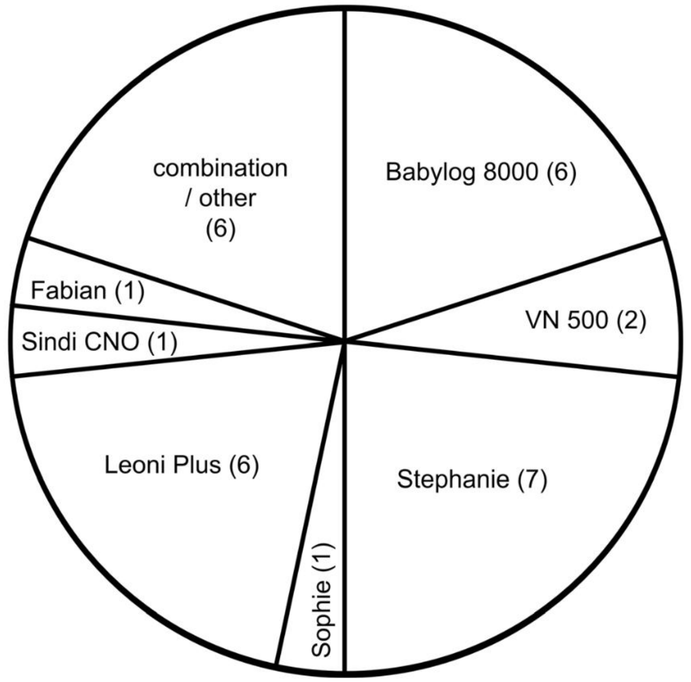
Favours nHFV Favours control

Risk of Bias: A B C D E F G H

Nasal high-frequency oscillation ventilation in neonates: a survey in five European countries

Fischer, H.S., Bohlin, K., Bührer, C. *et al*. *Eur J Pediatr* **174**, 465–471 (2015).

	Number (%)
Which interface(s) for nHFOV do you use?	
Binasal prongs	22 (73)
Single nasopharyngeal tube	19 (63)
Nose mask	5 (17)
Oronasal mask	3 (10)
Which indication(s) for nHFOV do you accept?	
Nasal CPAP failure	27 (90)
Immediately after extubation	15 (50)
Hypercapnia	5 (17)
Primary treatment of RDS	3 (10)
In your department, you extubate	
From endotracheal HFOV to nHFOV	14 (47)
From conventional ventilation to nHFOV	12 (40)
Which infants do you treat with nHFOV?	
Premature infants <1500 g	27 (90)
Premature infants >1500 g	13 (43)
Term babies	8 (27)



Which specific side effects did you observe more frequently during nHFOV than during nasal CPAP?	
Abdominal distension	11 (37)
Upper airway obstruction due to secretions	8 (27)
Thick, almost solid secretions	7 (23)
Leakage around the prongs	1 (3)
Strong agitation	1 (3)
Pneumothorax	1 (3)
Ventilator dysfunction	1 (3)

TABLE 7 | Suggested settings for Nasal High Frequency Ventilation.

Frequency, Hz	Start at 6–8 Hz; May decrease to 4 Hz in patients with hypercapnia; If using HFJV, start at 300 bpm (5 Hz) and may decrease to 240 bpm (4 Hz)
Amplitude, cmH_2O	MAPx2; Start at 20–30 cmH_2O; May increase to as high 70 cmH_2O. If using during weaning, set Amplitude equaling PIP prior to extubation
I: E ratio	Start at 1:1; May change to 1:2 in cases of gas trapping; If using HFJV, jet valve on time: 20 ms and may increase to 30–34 ms to improve oxygenation and increase tidal volume delivery
Mean Airway Pressure (MAP), cmH_2O	MAP: Start with the same MAP as on SIMV or 2–3 cmH_2O higher than CPAP; Start at 8–10 cmH_2O; May increase as needed based on FiO_2 and or lung expansion
NIPPV Back up rate	If available, use rates between 30 and 40 bpm; If using HFJV, keep the NIPPV settings same as before adding NHFJV

Shi Y et al, (2020), Front. Pediatr. 8:270

Take home message

- Thở máy không xâm lấn làm giảm các biến chứng lâu dài ở trẻ sơ sinh non tháng
- NHFOV đã được chứng minh hiệu quả và an toàn
- Có thể dùng khởi đầu ở trẻ suy hô hấp hoặc sau rút NKQ

LESS IS MORE!

THANK YOU!