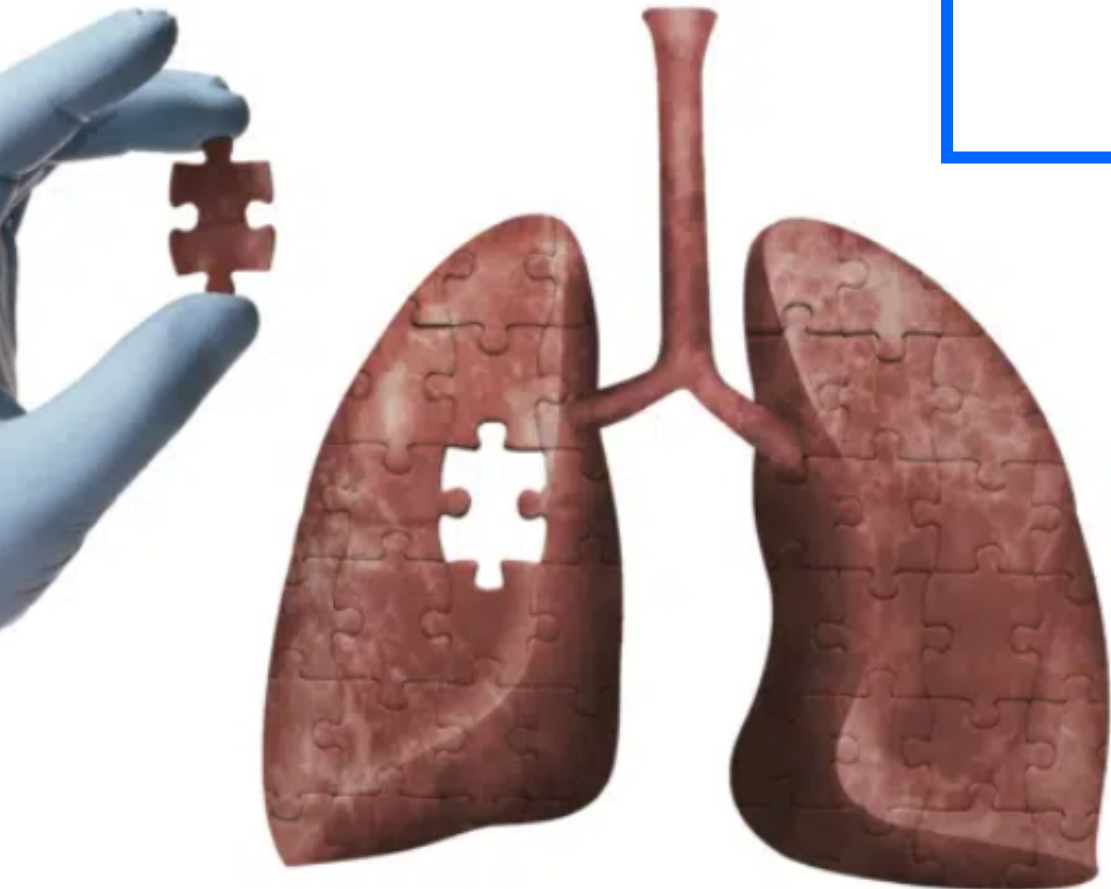


# SUPPORTS VENTILATOIRES NON-INVASIFS



quoi de neuf en 2025 ?

staff du 17/1/25

organisée conjointement par  
la SFAR, la SPLF et la SRLF

## Ventilation Non Invasive au cours de l'insuffisance respiratoire aiguë (nouveau-né exclu)

Avec la participation de la SFMU,  
du SAMU de France,  
du GFRUP  
et de l'ADARPEF

Le 12 octobre 2006  
Paris, Institut Montsouris

42, boulevard Jourdan  
75014 Paris



# RAPPELS

Tableau 1 – Contre-indications absolues de la VNI

- environnement inadapté, expertise insuffisante de l'équipe
- patient non coopérant, agité, opposant à la technique → DSI ?
- intubation imminente (sauf VNI en pré-oxygénation)
- coma (sauf coma hypercapnique de l'insuffisance respiratoire chronique [IRC])
- épuisement respiratoire
- état de choc, troubles du rythme ventriculaire graves
- sepsis sévère
- immédiatement après un arrêt cardio-respiratoire
- pneumothorax non drainé, plaie thoracique soufflante
- obstruction des voies aériennes supérieures (sauf apnées du sommeil, laryngo-trachéomalacie)
- vomissements incoercibles
- hémorragie digestive haute
- traumatisme crânio-facial grave
- tétraplégie traumatique aiguë à la phase initiale

- Défaillance d'organe autre que respiratoire
- Impossibilité de drainer les sécrétion respiratoires
- Risque élevé d'inhalation

Tableau 2 – Niveaux de recommandation pour les indications de la VNI

Intérêt certain Il faut faire (G1+)	Décompensation de BPCO OAP cardiogénique
Intérêt non établi de façon certaine <u>Il faut probablement faire (G2+)</u>	<u>IRA hypoxémique de l'immunodéprimé</u> Post-opératoire de chirurgie thoracique et abdominale Stratégie de sevrage de la ventilation invasive chez les BPCO Prévention d'une IRA post extubation <u>Traumatisme thoracique fermé isolé</u> (sans pneumoT !) <u>Décompensation de maladies neuromusculaires chroniques et autres IRC restrictives</u> <u>Mucoviscidose décompensée</u> <i>Forme apnéisante de la bronchiolite aiguë</i> <i>Laryngo-trachéomalacie</i>
Aucun avantage démontré Il ne faut probablement pas faire (G2-)	Pneumopathie hypoxémiante SDRA
	Traitement de l'IRA post-extubation <u>Maladies neuromusculaires aiguës réversibles</u>
Situations sans cotation possible	<u>Asthme Aigu Grave</u> Syndrome d'obésité-hypoventilation <i>Bronchiolite aiguë du nourrisson (hors forme apnéisante)</i>

### Les bonnes indications

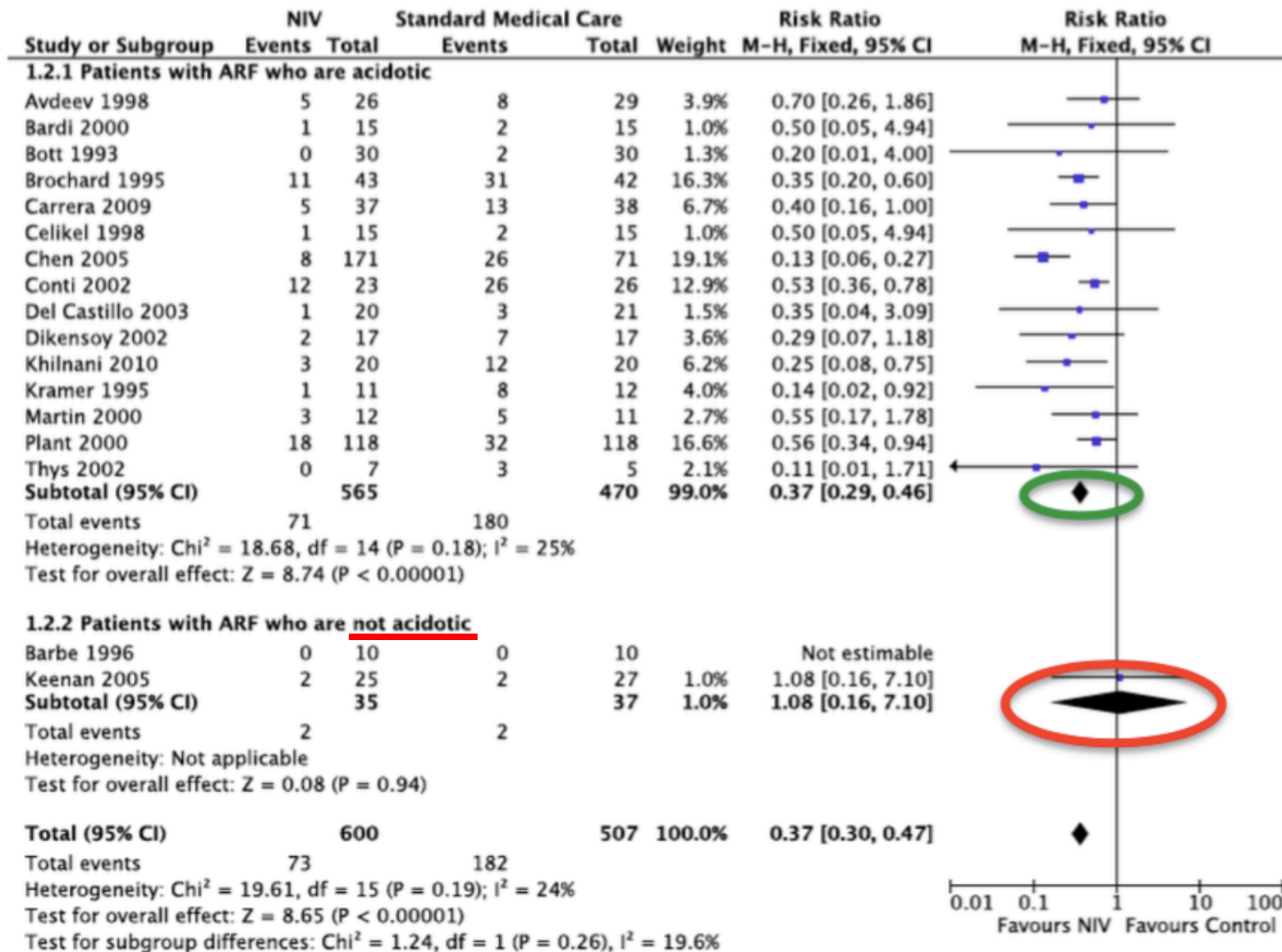
- Décompensation hypercapnique de BPCO
- **Œdème aigu pulmonaire** d'origine cardiogénique
- Décompensation de **syndrome obésité hypoventilation**

### Les non indications

- Détresse respiratoire de novo
- Patients en état de choc
- L'asthme aigue grave
- Les pathologies neuromusculaires aiguës avec troubles bulbaires

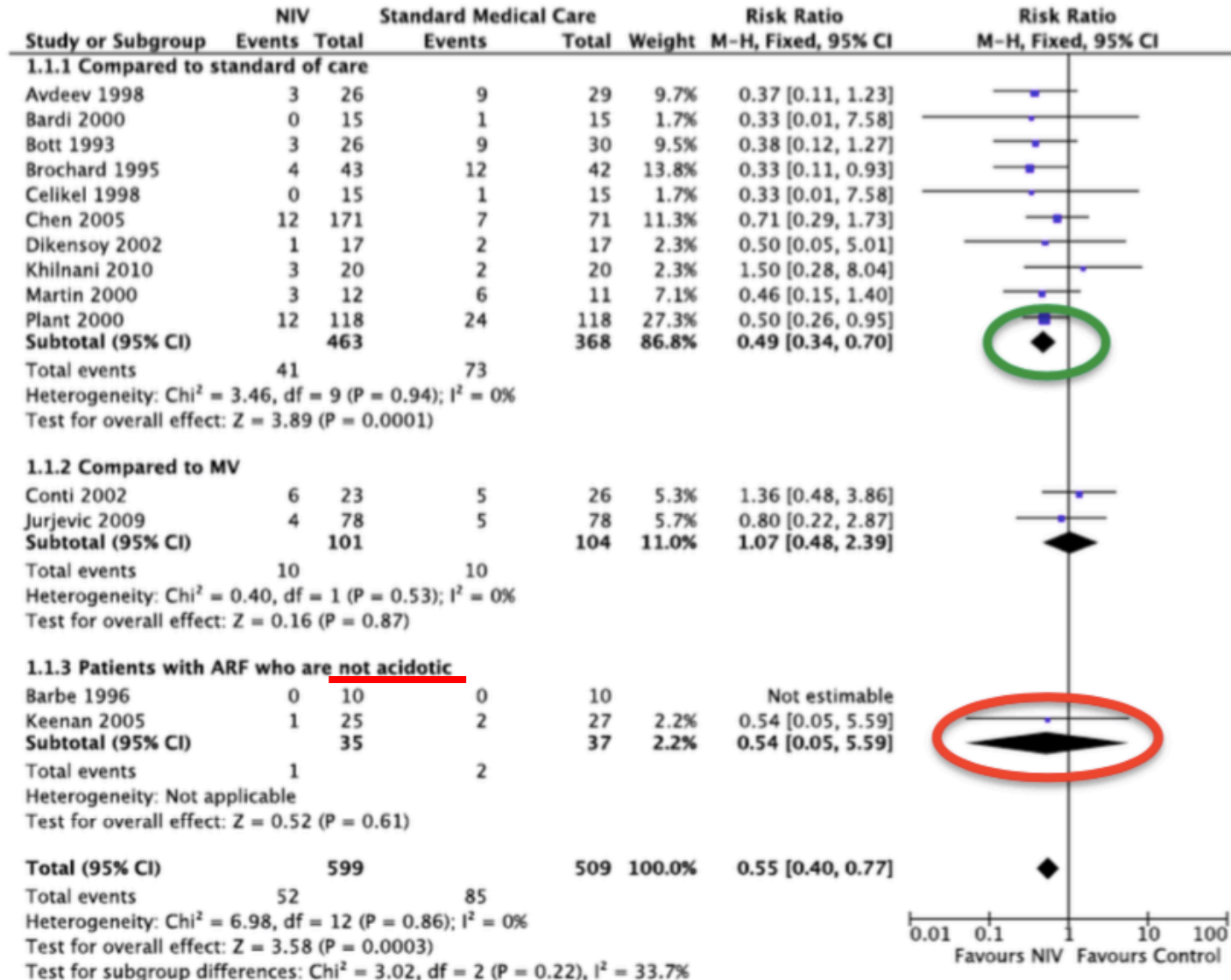
La **pneumopathie hypoxémiante** n'est pas une indication à la VNI

# Décompensation de BPCO : intérêt de la VNI sur l'IOT ?



VNI dans BPCO  
uniquement si  
pH < 7,35

# Décompensation de BPCO : intérêt de la VNI sur la survie ?



VNI dans BPCO  
uniquement si  
pH < 7,35

# Décompensation de BPCO : et en cas de coma hyperCO<sub>2</sub> ?

95 coma hypercapnique (score Glasgow <8)

80% réussite de VNI

**OUI, mais réévaluation à 1h !**  
(« épreuve de VNI »)

(réponse neurologique franche : ouverture des yeux, protection franche voies aériennes sup)

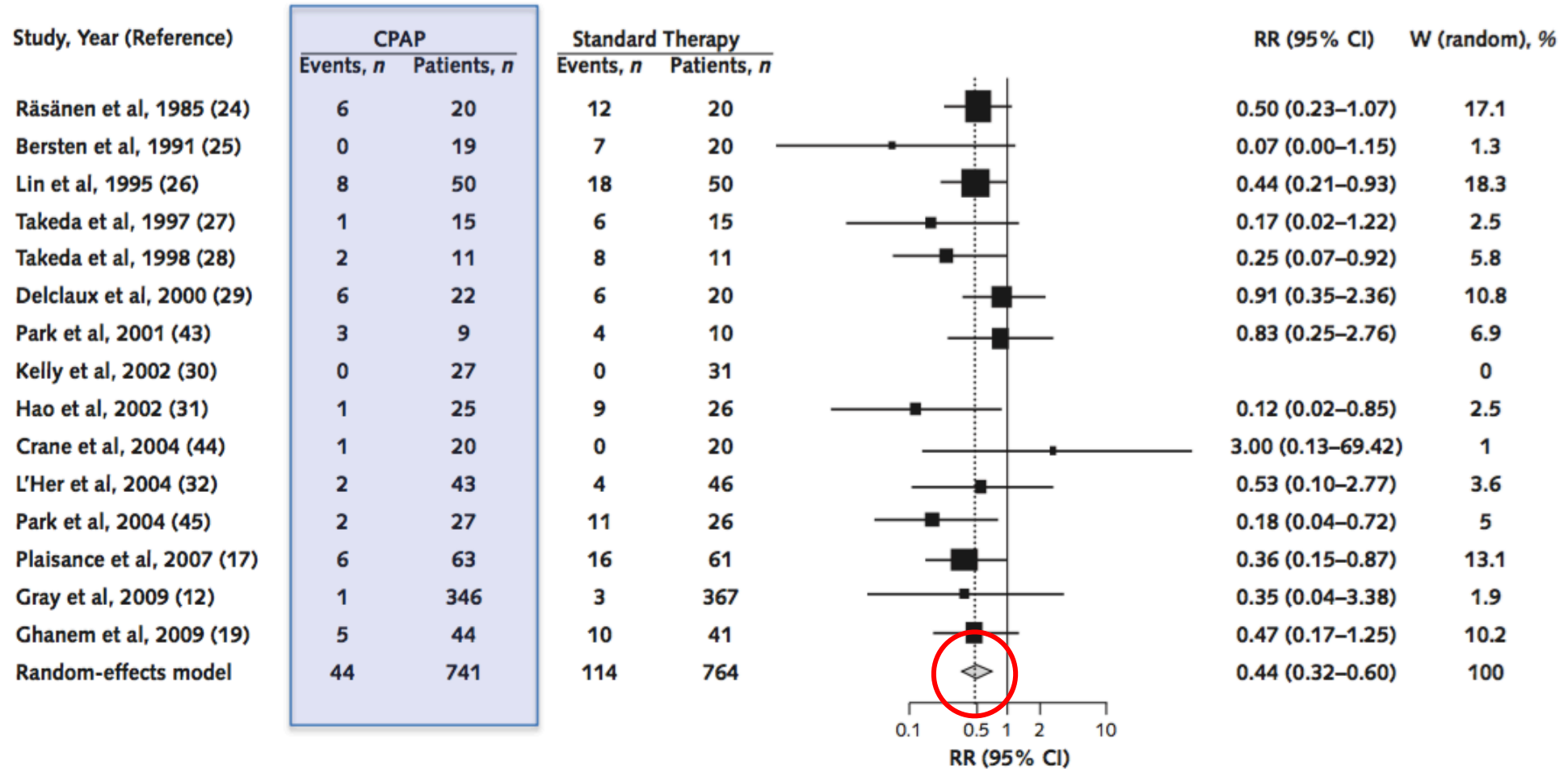
Variable	Success (n = 76)	Failure (n = 19)	p Value
GCS			
Admission	6.5 ± 1.8	6.1 ± 1.5	0.341
First hour	11.2 ± 2.0	7.9 ± 2.2	< 0.0001
RR			
Admission	27 ± 11	28 ± 9	0.686
First hour	27 ± 7	30 ± 5	0.144
pH			
Admission	7.13 ± 0.06	7.11 ± 0.08	0.631
First hour	7.23 ± 0.05	7.17 ± 0.05	< 0.0001
PaCO <sub>2</sub> , mm Hg			
Admission	98 ± 18	102 ± 25	0.513
First hour	78 ± 16	95 ± 25	< 0.0001
PaO <sub>2</sub> /FIO <sub>2</sub> ratio			
Admission	138 ± 40	140 ± 50	0.907
First hour	195 ± 40	166 ± 42	0.008

Quels sont les critères cliniques pour instaurer la VNI et avec quels modes ?

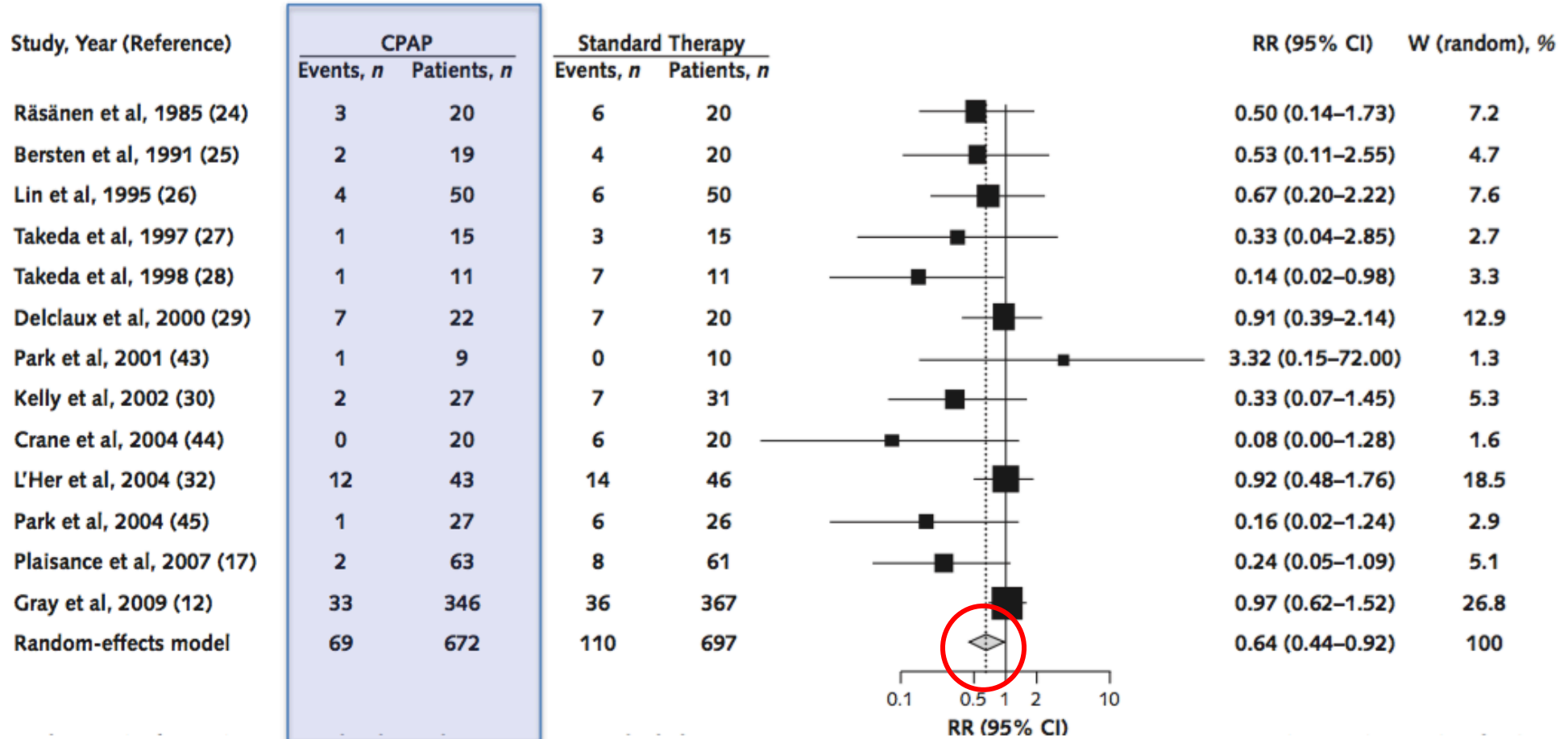
1 - BPCO

La VNI (mode VS-AI-PEP) est recommandée dans les décompensations de BPCO avec acidose respiratoire et pH < 7,35 (G1+). La VS-PEP ne doit pas être utilisée (G2-).

# OAPc : CPAP vs standard sur le taux d'IOT ?

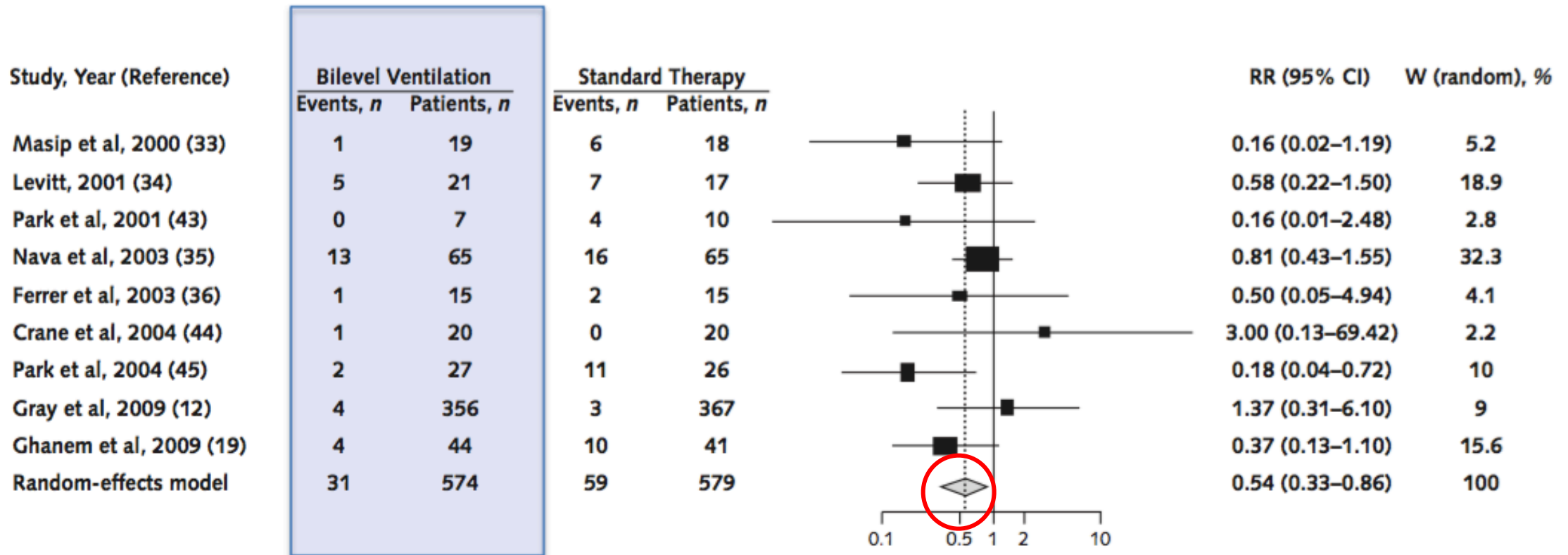


# OAPc : CPAP vs standard sur la mortalité ?

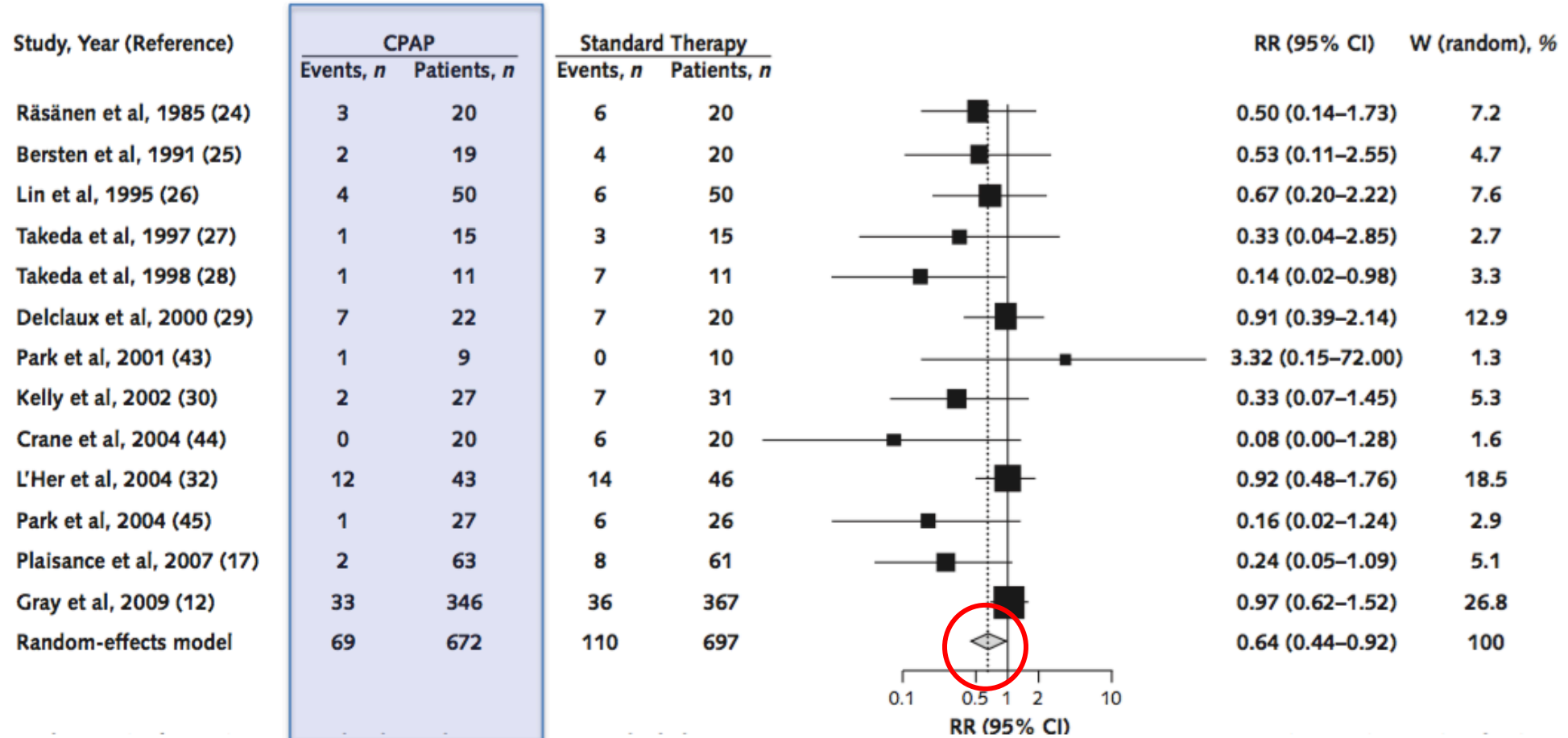




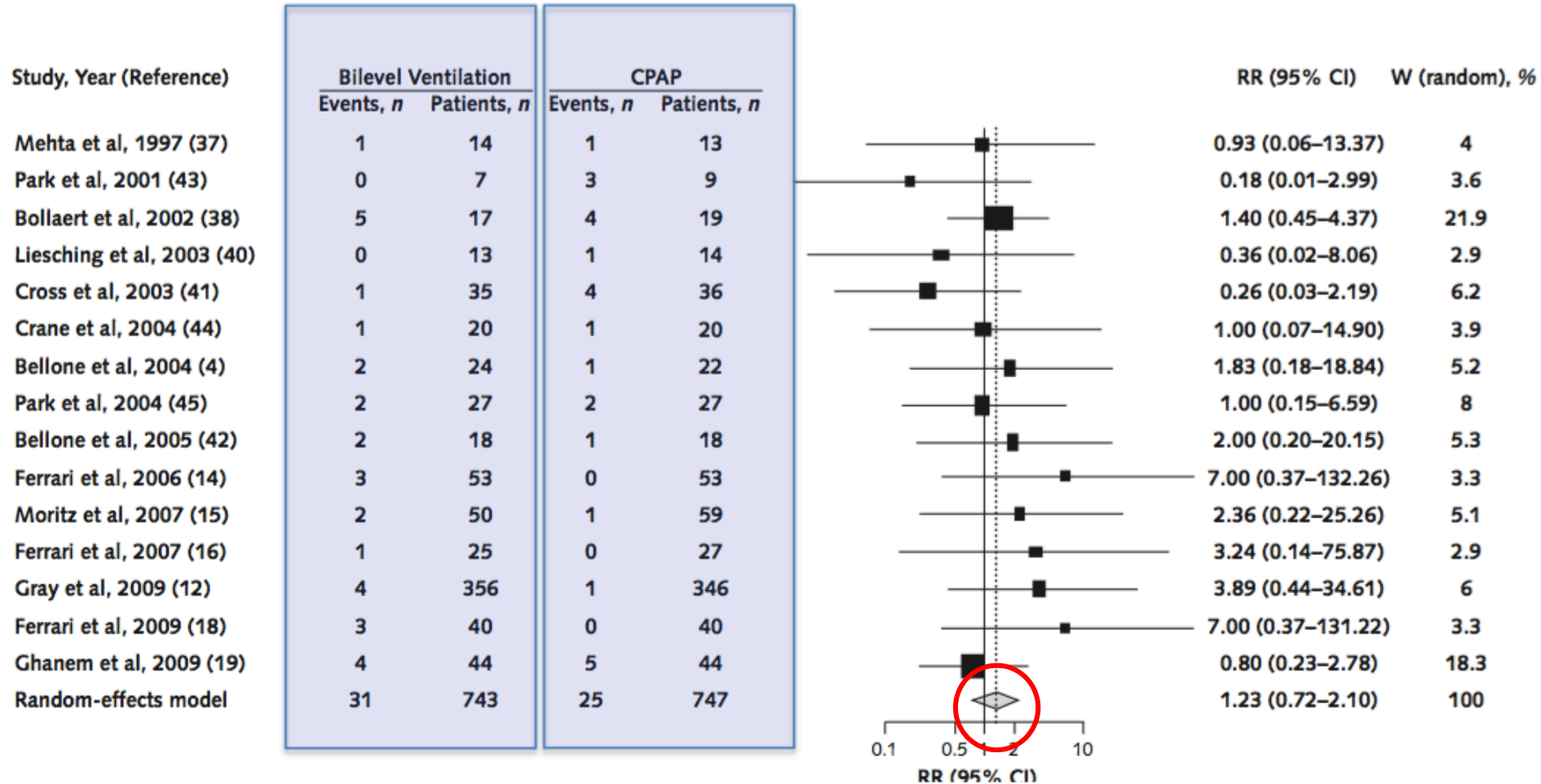
# OAPc : BiPAP vs standard sur le taux d'IOT ?



# OAPc : BiPAP vs standard sur la mortalité ?

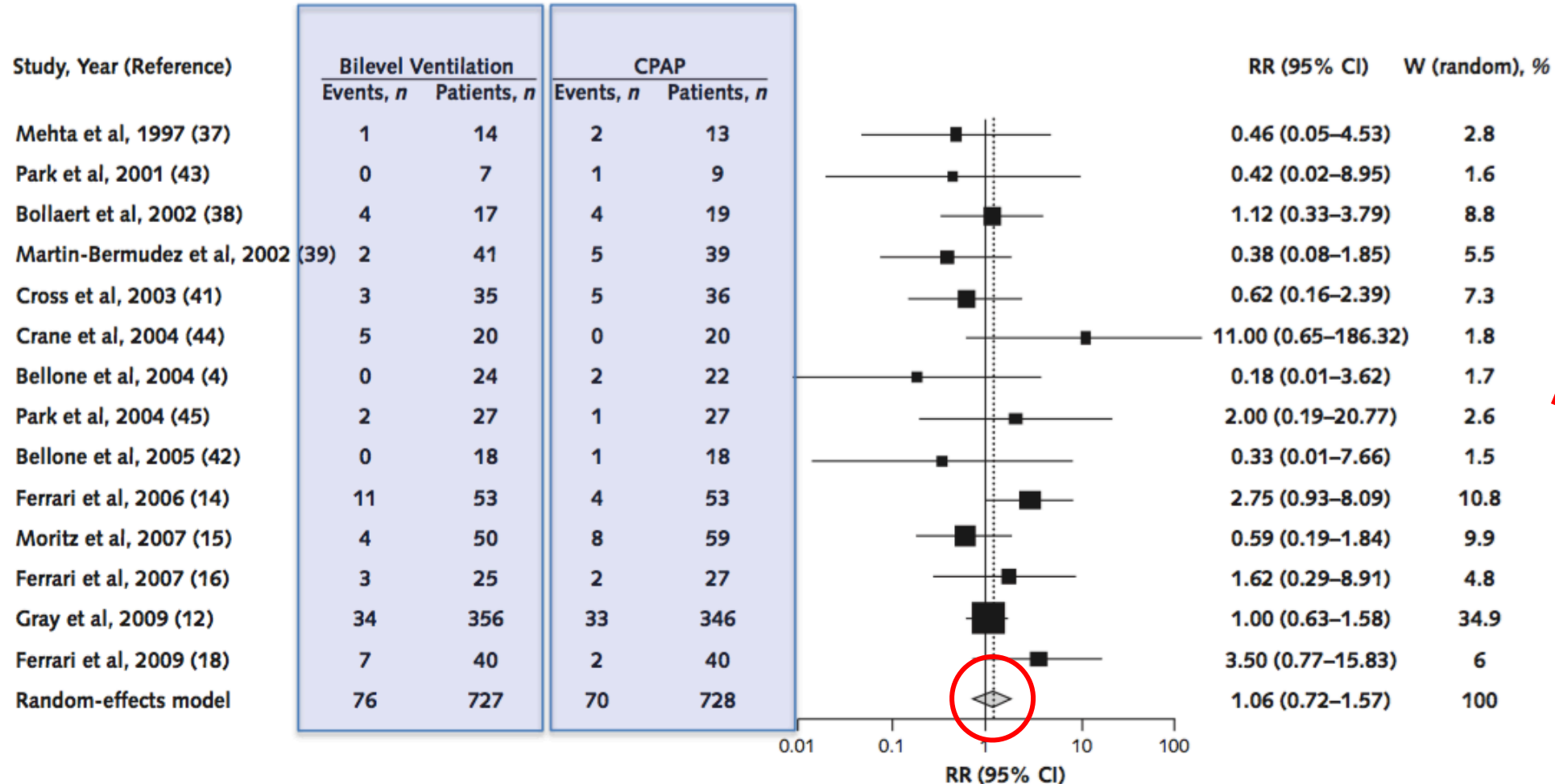


# OAPc : BiPAP vs CPAP sur le taux d'IOT ?



Pas de différence entre VNI et CPAP

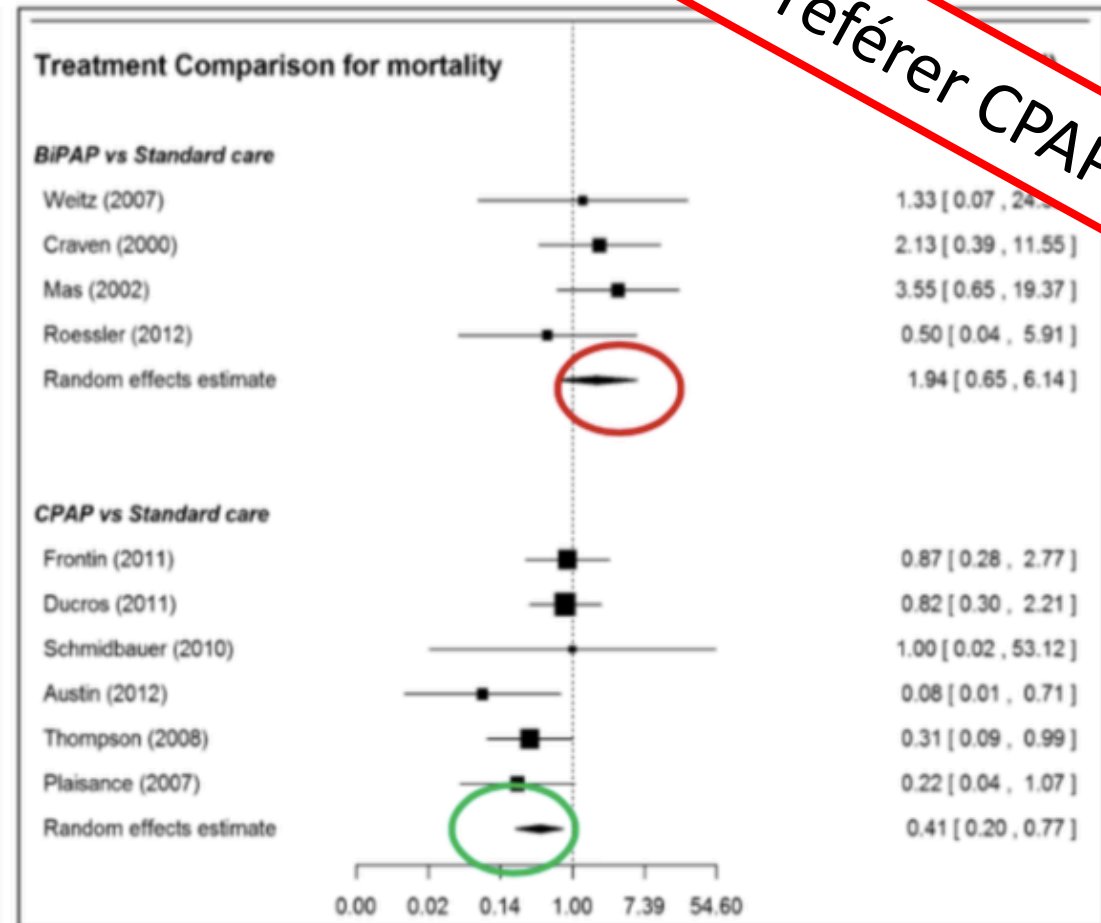
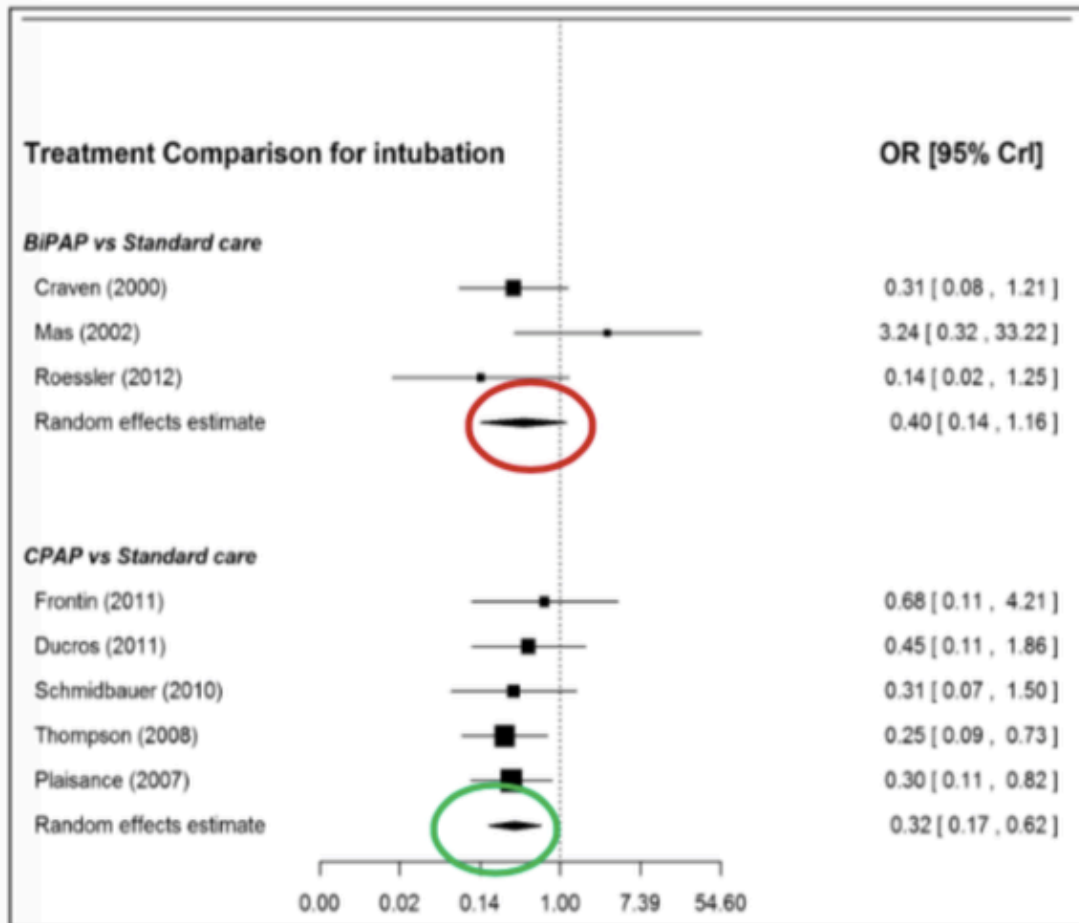
# OAPc : BiPAP vs CPAP sur la mortalité ?



Pas de différence entre VNI et CPAP

# OAPc : BiPAP vs CPAP en préhospitalier ?

Préférer CPAP



# OAPc : BiPAP vs CPAP en préhospitalier ?

Importance CPAP précoce

	CPAP précoce	CPAP tardive	p et OR quand ce
Intubation	6	16	0,01 (OR = 0,30)
Dobutamine	0	5	0,02
Décès	2	8	0,05 (OR = 0,22)
PaO2 T15	89	68	0,0003
PaCO2 T15	42	45	0,06
PaO2 T45	97	85	0,018

Monocentrique,  
SAMU Lariboisière,

Patient OAP

Exclusion : choc,  
coma, BPCO

CPAP à 0' vs CPAP 15'

# OAPc : alors BiPAP ou CPAP ?

## 2 - OAP cardiogénique

La VNI ne se conçoit qu'en association au traitement médical optimal (G1+) et ne doit pas retarder la prise en charge spécifique d'un syndrome coronarien aigu (G2+).

Elle doit être instaurée sur le mode VS-PEP ou VS-AI-PEP (G1+) :

- en cas de signes cliniques de détresse respiratoire, sans attendre le résultat des gaz du sang (G2+).
- en cas d'hypercapnie avec  $\text{PaCO}_2 > 45 \text{ mmHg}$  (G1+)
- en cas de non-réponse au traitement médical.

**En préhospitalier :**

**CPAP : PEP (8-10 cmH<sub>2</sub>O)**


**A l'hôpital :  
(SAUV ou soins intensifs)**

**Si pas d'hypercapnie : CPAP (PEP 8-10 cmH<sub>2</sub>O)**

**Si Acidose hypercapnique : VSAI- PEP**

**Ne pas retarder geste de revascularisation  
Intubation si pas d'amélioration ou choc**


# OAPc : alors BiPAP ou CPAP ?



Annals of Emergency Medicine

Available online 20 November 2024



In Press, Corrected Proof [? What's this?](#)



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Critical care/expert clinical management

## Managing Acute Respiratory Failure With Facemask Noninvasive Ventilation

Alexander Bracey MD <sup>a</sup>  , Brian J. Wright MD <sup>b</sup>

**Clément va nous en parler**



The NEW ENGLAND JOURNAL of MEDICINE

SPECIALTIES ▾ TOPICS ▾ MULTIMEDIA ▾ CURRENT ISSUE ▾ LEARNING/CME ▾ AUTHOR CENTER PUBLICATIONS ▾

ORIGINAL ARTICLE f X in ✉

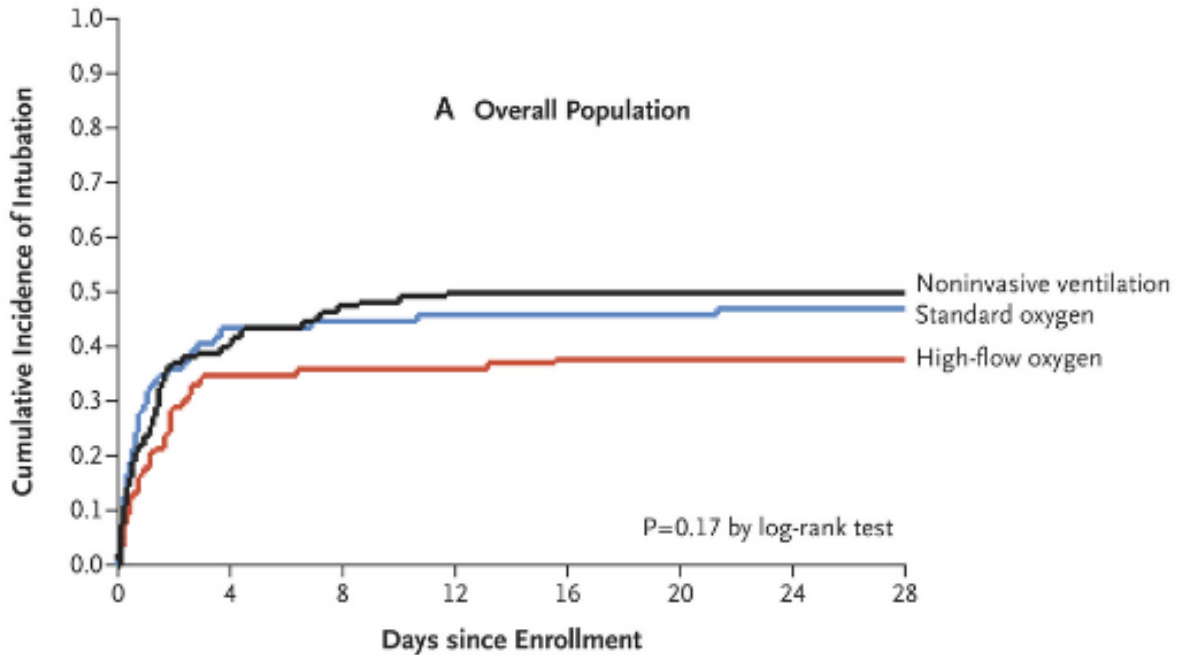
## High-Flow Oxygen through Nasal Cannula in Acute Hypoxemic Respiratory Failure

Authors: Jean-Pierre Frat, M.D., Arnaud W. Thille, M.D., Ph.D., Alain Mercat, M.D., Ph.D., Christophe Girault, M.D., Ph.D., Stéphanie Ragot, Pharm.D., Ph.D., Sébastien Perbet, M.D., Gwénaél Prat, M.D., <sup>†</sup>23, for the FLORALI Study Group and the REVA Network\* [Author Info & Affiliations](#)

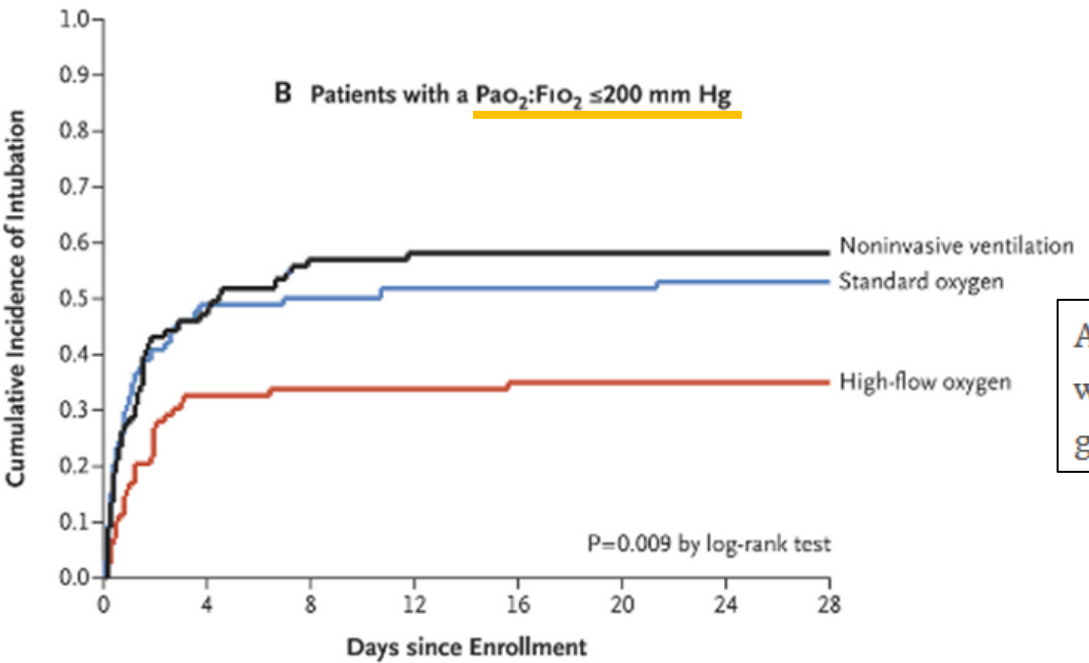
Published June 4, 2015 | N Engl J Med 2015;372:2185-2196 | DOI: 10.1056/NEJMoa1503326 | VOL. 372 NO. 23

RCT multicentrique sur 310 patients avec  $PaO_2/FiO_2 < 300$  :OHDB vs VNI

# VNI dans l'IRA hypoxémique ?



A total of 310 patients were included in the analyses. The intubation rate (primary outcome) was 38% (40 of 106 patients) in the high-flow-oxygen group, 47% (44 of 94) in the standard group, and 50% (55 of 110) in the noninvasive-ventilation group (P=0.18 for all comparisons).



probable manque de puissance pour l'analyse du sous-groupe de patients avec  $PaFi < 200$

The NEW ENGLAND JOURNAL of MEDICINE

SPECIALTIES ▼ TOPICS ▼ MULTIMEDIA ▼ CURRENT ISSUE ▼ LEARNING/CME ▼ AUTHOR CENTER PUBLICATIONS ▼

ORIGINAL ARTICLE f X in ✉

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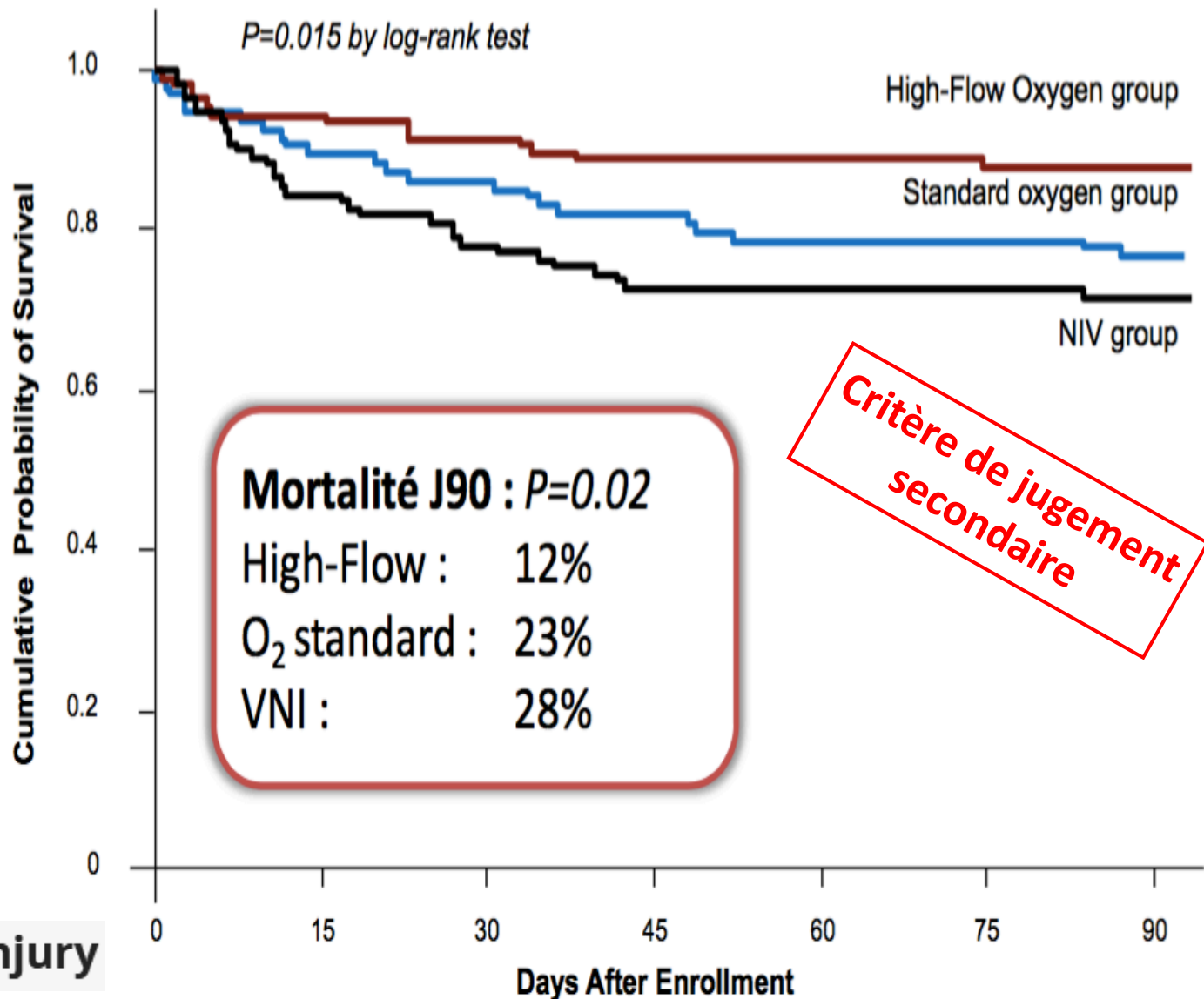
**Etude négative sur le CJP mais qd mm...**

La pneumopathie hypoxémiante n'est pas une indication à la VNI

**Retard à l'intubation + VILI**

**Ventilator-induced lung injury**

# VNI dans l'IRA hypoxémique ?



# et donc on en arrive à cette étude



**Original Investigation** | Caring for the Critically Ill Patient  
 December 10, 2024  
**JAMA**  
**High-Flow Nasal Oxygen vs Noninvasive Ventilation in Patients With Acute Respiratory Failure**  
 The RENOVATE Randomized Clinical Trial

RENOVATE was a noninferiority trial conducted among **1800 patients** at 33 hospitals in Brazil between 2019 and 2023 (including during the Covid pandemic). Patients with acute hypoxemic respiratory failure were analyzed in 5 subgroups:

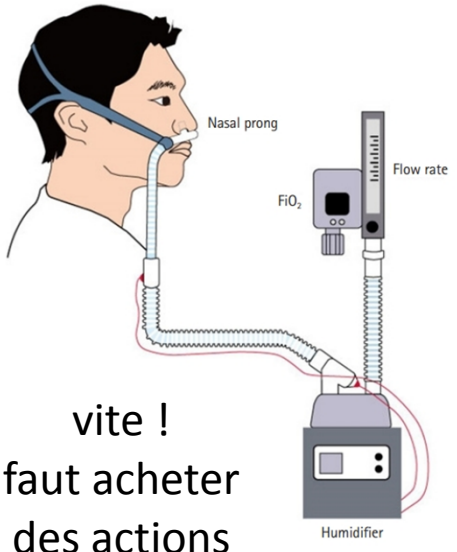
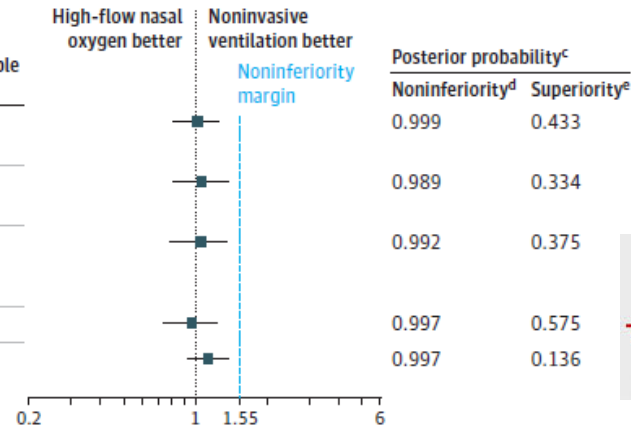


Figure 2. Primary Outcome of Endotracheal Intubation or Death Within 7 Days

A Analysis of the primary outcome<sup>a</sup>

Patients with acute respiratory failure	No./total (%)		Model-fitted median odds ratio (95% credible interval) <sup>b</sup>
	High-flow nasal oxygen	Noninvasive ventilation	
Nonimmunocompromised with hypoxemia	81/249 (32.5)	78/236 (33.1)	1.02 (0.81-1.26)
Immunocompromised with hypoxemia	16/28 (57.1)	8/22 (36.4)	1.07 (0.81-1.39)
Chronic obstructive pulmonary disease exacerbation with respiratory acidosis	10/35 (28.6)	11/42 (26.2)	1.05 (0.79-1.36)
Acute cardiogenic pulmonary edema	14/136 (10.3)	29/136 (21.3)	0.97 (0.73-1.23)
Hypoxemic COVID-19	223/435 (51.3)	210/447 (47.0)	1.13 (0.94-1.38)



**THE DEVIL IS IN THE DETAILS**

**Findings** In this randomized clinical trial (n = 1766 patients), a bayesian hierarchical model with dynamic borrowing across 5 patient groups found high-flow nasal oxygen was noninferior (defined by a posterior probability  $\geq 0.992$  for an odds ratio  $< 1.55$ ) to noninvasive ventilation for rates of endotracheal intubation or death at 7 days in 4 of the patient groups



vite !  
 faut acheter  
 des actions  
 Fisher & Paykel

# et donc on en arrive à cette étude



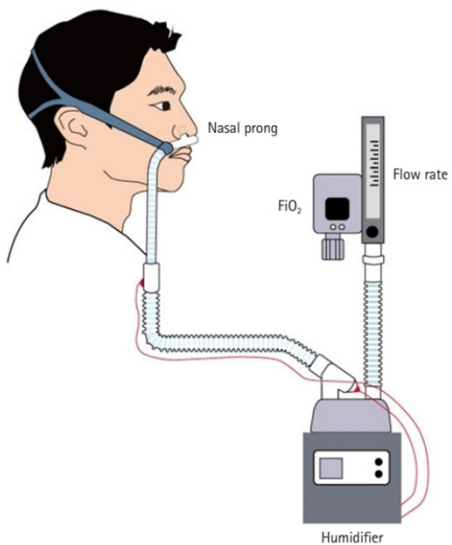
Original Investigation | Caring for the Critically Ill Patient

December 10, 2024

JAMA

## High-Flow Nasal Oxygen vs Noninvasive Ventilation in Patients With Acute Respiratory Failure The RENOVATE Randomized Clinical Trial

RENOVATE was a noninferiority trial conducted among 1800 patients at 33 hospitals in Brazil between 2019 and 2023 (including during the Covid pandemic). Patients with acute hypoxemic respiratory failure were analyzed in 5 subgroups:



- COVID-19 (in ~890, about half the patients)
- Nonimmunocompromised (n~485),
- Immunocompromised (only 50 patients),
- Chronic obstructive pulmonary disease exacerbation with respiratory acidosis (77 patients),
- Acute cardiogenic pulmonary edema (272 patients).



THE  
**DEVIL IS IN**  
THE  
**DETAILS**

dans chaque groupe,  
plus de crossover dans le bras OHDBN  
que dans le bras VNI  
(jusqu'à 23% des BPCO ont fait OHDBN -> VNI)

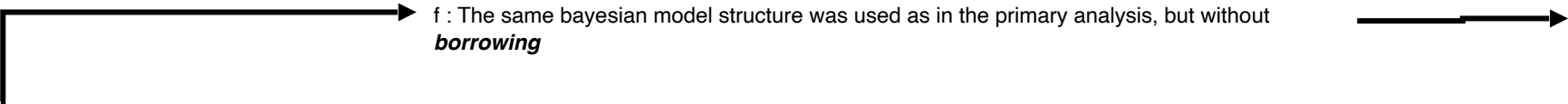
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# et donc on en arrive à cette étude



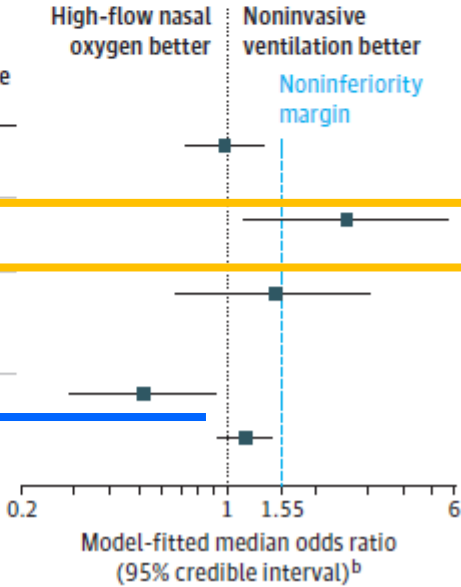
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 The RENOVATE Randomized Clinical Trial

- Enrolment stopped in April 2021 for **futility** in the immunocompromised group
- Enrolment stopped in March 2023 for **non-inferiority** in **COVID-19** and in Oct 2023 for the **nonimmunocompromised group** and **ACPO group**
- Enrolment continued as planned until the final analysis for COPD patients



**B** Post hoc analysis of the primary outcome<sup>f</sup>

Patients with acute respiratory failure	No./total (%)		Model-fitted median odds ratio (95% credible interval) <sup>b</sup>	Posterior probability <sup>c</sup>	
	High-flow nasal oxygen	Noninvasive ventilation		Noninferiority <sup>d</sup>	Superiority <sup>e</sup>
<u>Nonimmunocompromised with hypoxemia</u>	81/249 (32.5)	78/236 (33.1)	0.98 (0.73-1.33)	0.996	0.542
<b>Immunocompromised with hypoxemia</b>	16/28 (57.1)	8/22 (36.4)	2.56 (1.14-5.68)	0.144	0.023
Chronic obstructive pulmonary disease exacerbation with respiratory acidosis	10/35 (28.6)	11/42 (26.2)	1.48 (0.67-3.09)	0.549	0.192
Acute cardiogenic pulmonary edema	14/136 (10.3)	29/136 (21.3)	0.52 (0.29-0.91)	0.999	0.970
<u>Hypoxemic COVID-19</u>	223/435 (51.3)	210/447 (47.0)	1.16 (0.94-1.43)	0.992	0.111



Although **borrowing** can improve precision under the assumption of similar treatment effects, it could also **produce biased estimates when there is heterogeneity across groups**



mais les OAPc graves (sous VNI d'emblée) étaient exclus

# et donc on en arrive à cette étude

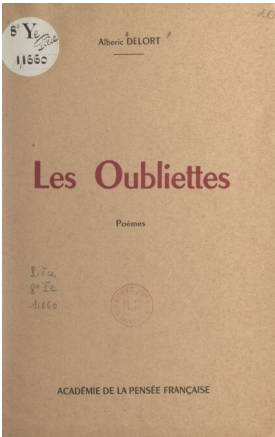


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The RENOVATE Randomized Clinical Trial



December 10, 2024  
**Is High-Flow Oxygen the Standard for All Patients With Acute Respiratory Failure?**  
Jean-Pierre Frat, MD, PhD<sup>1,2,3</sup>; Sylvain Le Pape, MD, PhD<sup>1,2,3</sup>; Arnaud W. Thille, MD, PhD<sup>1,2,3</sup>

December 10, 2024  
**Reevaluating Respiratory Support in Acute Respiratory Failure—Insights From the RENOVATE Trial and Implications for Practice**  
Yonathan Freund, MD, PhD<sup>1,2</sup>; Amelie Vromant, MD<sup>2</sup>





# 2ème grosse étude de fin 2024

JAMA | Original Investigation

Effect of High-Intensity vs Low-Intensity Noninvasive Positive Pressure Ventilation on the Need for Endotracheal Intubation in Patients With an Acute Exacerbation of Chronic Obstructive Pulmonary Disease  
The HAPPEN Randomized Clinical Trial

Enrollment required an acute exacerbation of COPD, an arterial pH level of less than 7.35, and a PaCO<sub>2</sub> level greater than 45 mm Hg after 6 hours on low-intensity NPPV.

(1) pH < 7,25  
et ↗ PaCO<sub>2</sub> > 10% de la baseline  
ou PaO<sub>2</sub> / FIO<sub>2</sub> < 100

+

(2) au moins 1 critère clinique parmi :  
coma, confusion, tirage muscles  
respiratoires accessoires, respiration  
paradoxe, hypersécrétion bronchique,  
inhalation, vomissements, hématomèse,  
choc, TV, FA, ACR

## POPULATION

203 Men  
97 Women



Adults with an acute exacerbation of COPD and persistent hypercapnia

Mean age: 73 years

## LOCATION

30 Respiratory non-intensive care units in China



## INTERVENTION



High-intensity NPPV



Low-intensity NPPV

300 Patients randomized

147

153

intubation was considered if the prespecified criteria were met :

## PRIMARY OUTCOME

The need for endotracheal intubation during hospitalization, which was defined by prespecified criteria

(2 experts indépendants et aveugles de la randomisation confirmaient le besoin d'IOT)



# ...la même équipe, 2 ans avant...

> Ann Intensive Care. 2022 May 19;12(1):41. doi: 10.1186/s13613-022-01018-4.

## Physiological effects of high-intensity versus low-intensity noninvasive positive pressure ventilation in patients with acute exacerbation of chronic obstructive pulmonary disease: a randomised controlled trial

Zujin Luo<sup>1 2</sup>, Zhixin Cao<sup>2</sup>, Yichong Li<sup>3</sup>, Jiawei Jin<sup>2</sup>, Wei Sun<sup>2</sup>, Jian Zhu<sup>2</sup>, Na Zhao<sup>2</sup>, Jichen Liu<sup>2</sup>, Bing Wei<sup>4</sup>, Yue Hu<sup>4</sup>, Ying Zhang<sup>4</sup>, Yingmin Ma<sup>5</sup>, Chen Wang<sup>6 7 8 9</sup>

EPAP=5-8cmH<sub>2</sub>O et backup RR=12/min

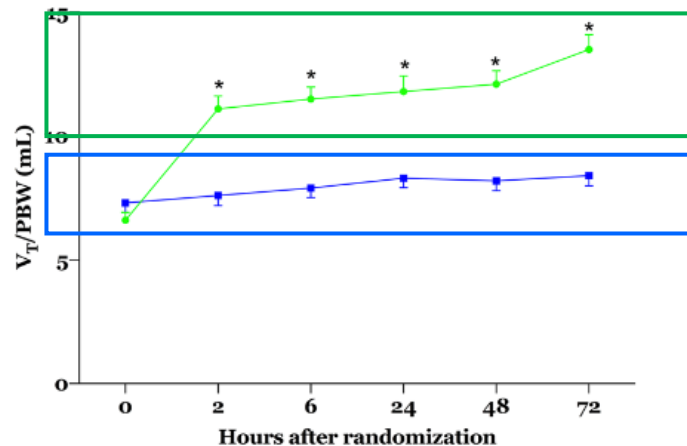
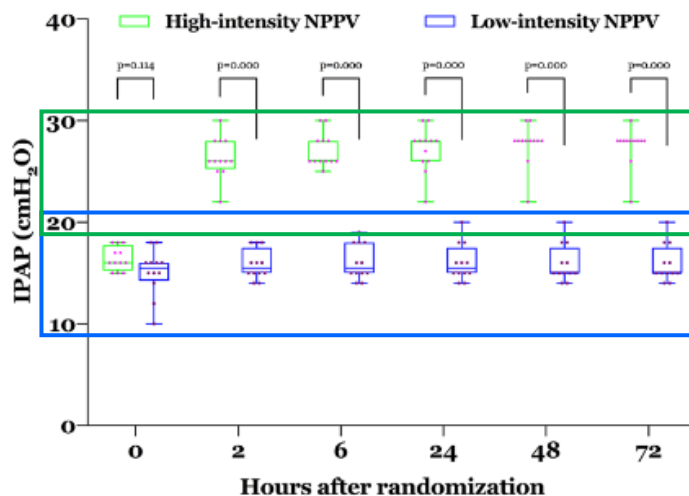
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low-intensity NPPV group

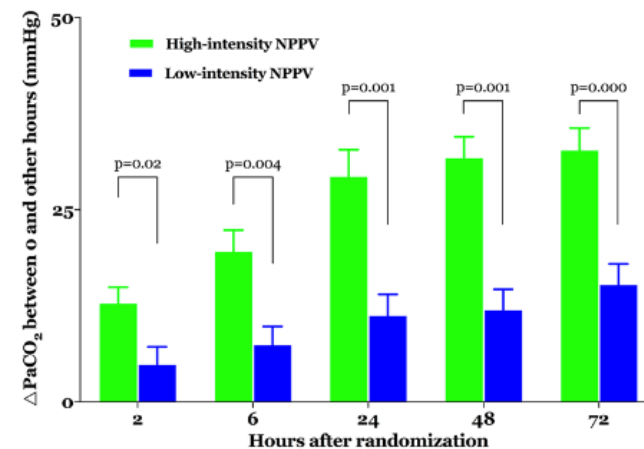
high-intensity NPPV group

IPAP : paliers de 1-2 cm H<sub>2</sub>O (max : 20 cm H<sub>2</sub>O)  
pour obtenir a Vt=6-10 mL/kg of PBW

IPAP : paliers de 1-2 cm jusqu'à 20-30 cm H<sub>2</sub>O  
pour obtenir a Vt=10-15 mL/kg of PBW



primary outcome :  
PaCO<sub>2</sub> à H24  
de la randomisation



« ouais mais nous on soigne des malades, pas des gazo... »





# 2<sup>ème</sup> grosse étude de fin 2024

JAMA | Original Investigation

Effect of High-Intensity vs Low-Intensity Noninvasive Positive Pressure Ventilation on the Need for Endotracheal Intubation in Patients With an Acute Exacerbation of Chronic Obstructive Pulmonary Disease  
The HAPPEN Randomized Clinical Trial

Enrollment required an acute exacerbation of COPD, an arterial pH level of less than 7.35, and a PaCO<sub>2</sub> level greater than 45 mm Hg after 6 hours on low-intensity NPPV.

Ah ouais quand même

## POPULATION

203 Men  
97 Women



Adults with an acute exacerbation of COPD and persistent hypercapnia

Mean age: 73 years

## LOCATION

30 Respiratory non-intensive care units in China



## INTERVENTION



300 Patients randomized

147

### High-intensity NPPV

Inspiratory positive airway pressure (IPAP) adjusted to obtain tidal volume of 10-15 mL/kg

153

### Low-intensity NPPV

IPAP adjusted to obtain tidal volume of 6-10 mL/kg of predicted body weight

## PRIMARY OUTCOME

The need for endotracheal intubation during hospitalization, which was defined by prespecified criteria

## FINDINGS

Patients needing endotracheal intubation

### High-intensity NPPV

4.8% (7 of 147 patients)

### Low-intensity NPPV

13.7% (21 of 153 patients)

The results were significant:

Absolute difference, -9.0%

(95% CI, -15.4% to -2.5%), 1-sided P = .004

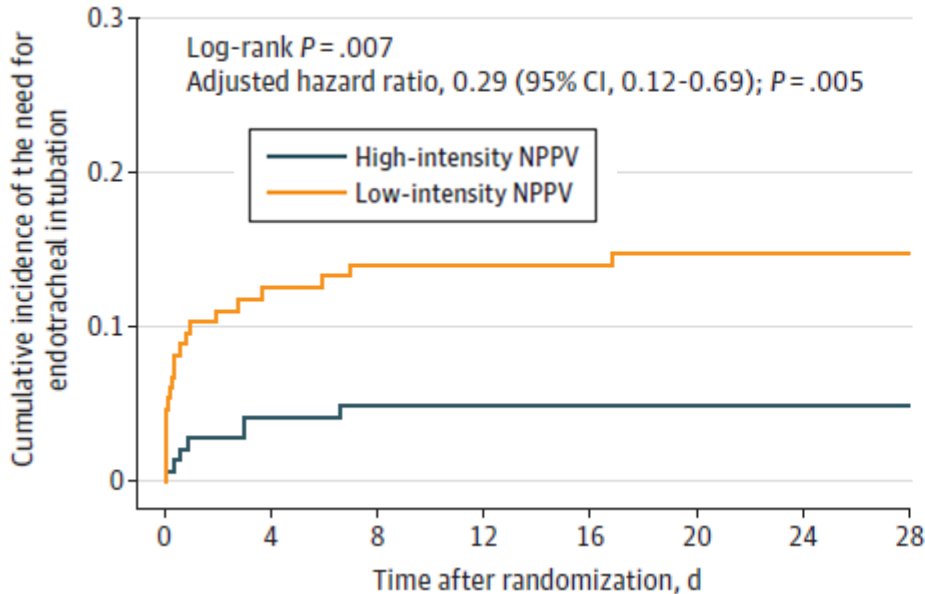


# 2ème grosse étude de fin 2024

JAMA | Original Investigation

Effect of High-Intensity vs Low-Intensity Noninvasive Positive Pressure Ventilation on the Need for Endotracheal Intubation in Patients With an Acute Exacerbation of Chronic Obstructive Pulmonary Disease  
The HAPPEN Randomized Clinical Trial

**A** Need for endotracheal intubation (IOT théoriquement indiquée)



« patients in the low-intensity group who met the prespecified criteria for endotracheal intubation were allowed to crossover to high-intensity NPPV »

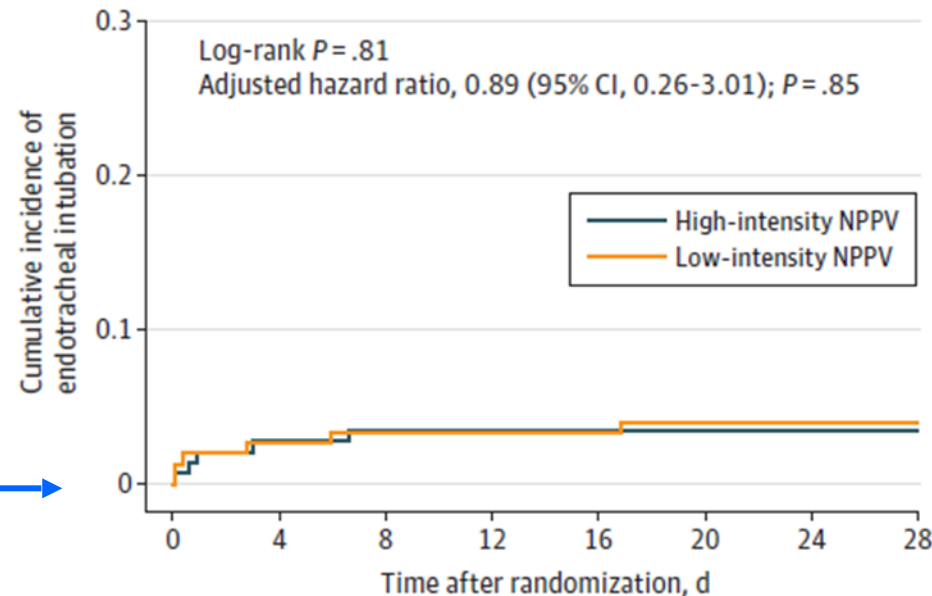
(ce qui a concerné 62% des patients du groupe low-intensity)

80% de ces crossover n'ont pas été intubés grâce au high-intensity

Ah ouais quand même

Ah ouais quand même

**B** Endotracheal intubation (IOT « effective »)



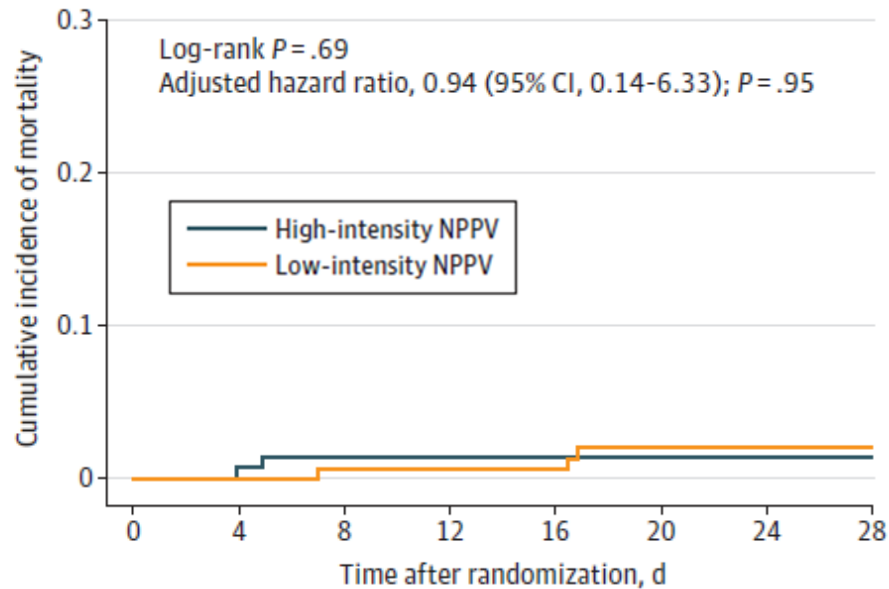


# 2<sup>ème</sup> grosse étude de fin 2024

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D Mortality



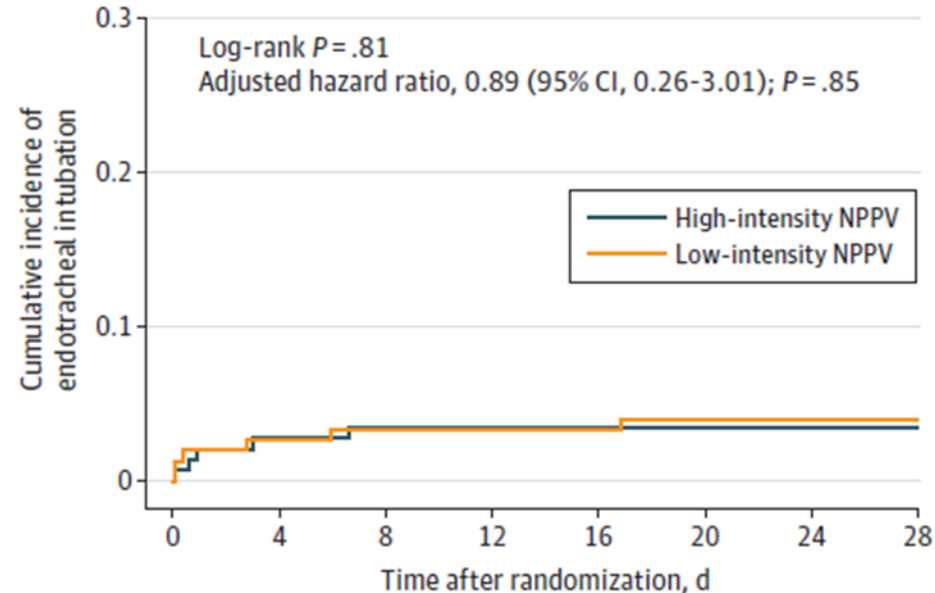
## High-intensity NPPV resulted in :

- more abdominal distention (37.4% vs 25.5%)
- but not more severe intolerance or removal from NPPV
- “mildly higher” severe alkalosis (pH >7.55) (4.1% vs 0%)
- but other severe adverse events were rare and similar between groups

Ah ouais quand même

Ah ouais quand même

B Endotracheal intubation





## 2<sup>ème</sup> grosse étude de fin 2024

JAMA | **Original Investigation**

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"findings may not be generalizable to patients with evident emphysematous bullae and presence of restrictive ventilatory dysfunction (e.g., pulmonary consolidation) because these patients were excluded from this trial."



Further, the editorialists noted that "the majority of patients had already been acclimatized to mask ventilation as used for noninvasive ventilation prior to randomization, and it remains unclear if high-intensity NPPV would have been as successful and comparably well tolerated if patients had never received NPPV, which is typical for many clinical trials."

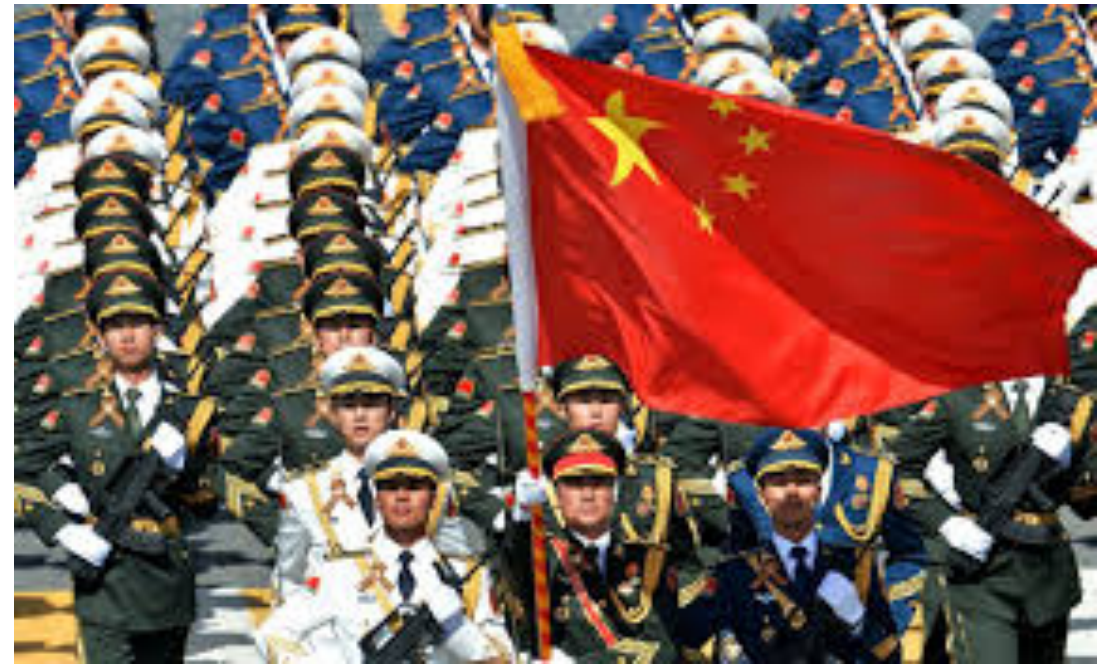


high-intensity for everyone ?

...en conclusion...



VS



qu'en pensent nos experts MIR ?

A vibrant watercolor splash in the center of the page, featuring a mix of colors including yellow, orange, red, pink, purple, and teal. The splash has a soft, painterly texture with various sized droplets and splatters.

*merci*