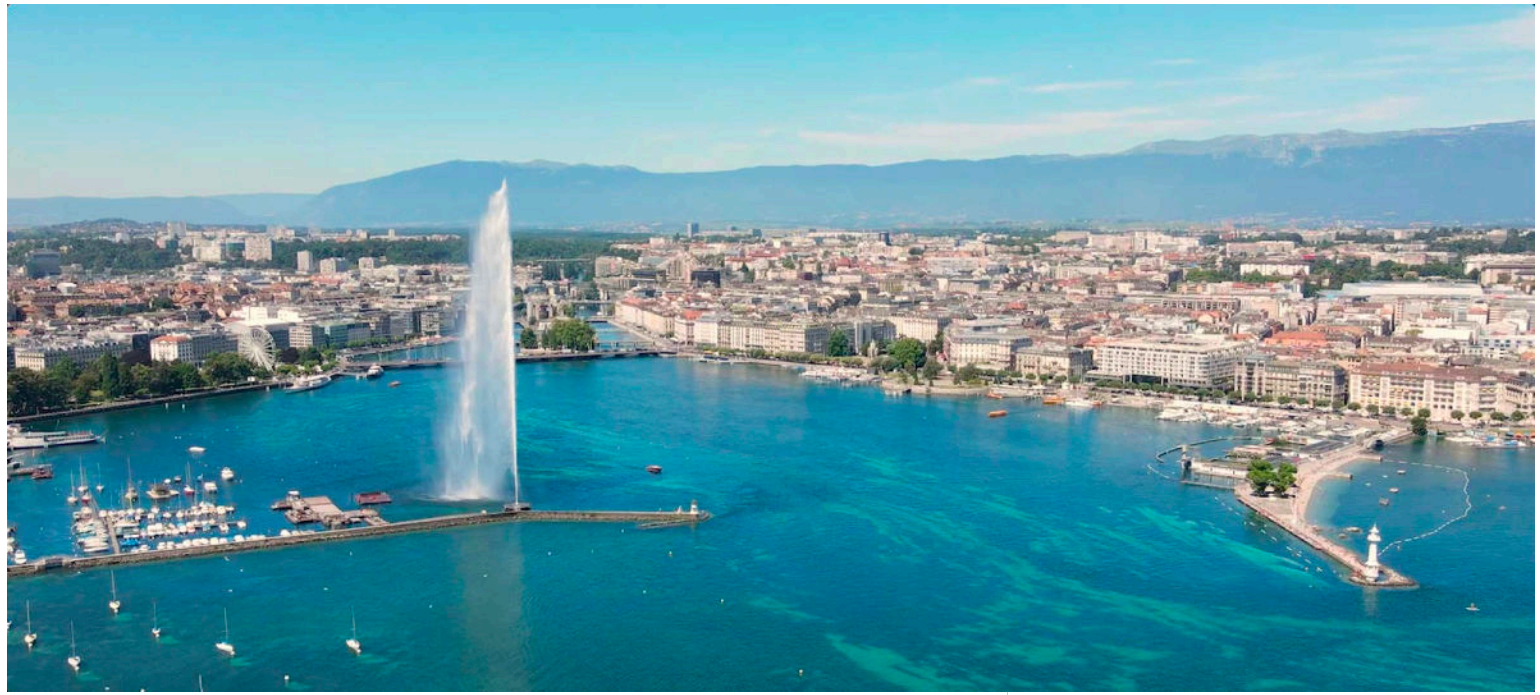

ATELIERS
PRATIQUES
VENTILATION
DOMICILE
27-28 septembre 2024

VNI et BPCO: qu'en est-il en 2024?



Service de Pneumologie

Hôpital de La Tour

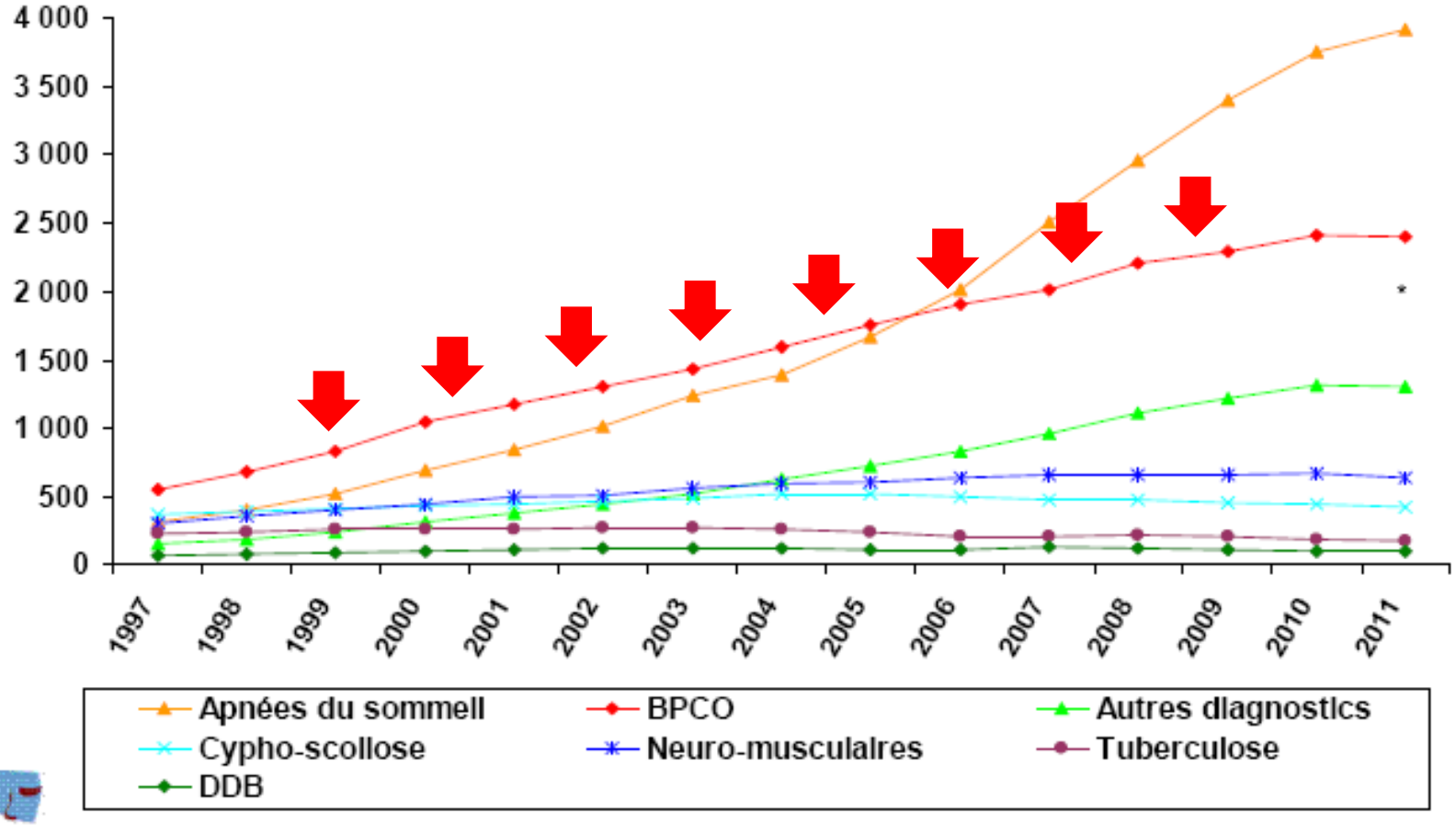
UNIVERSITÉ DE GENÈVE

HUG Hôpitaux Universitaires Genève

Prof. Jean-Paul Janssens

E-mail: jp.janssens56@gmail.com

Ventilation par masque ± oxygène : évolution des étiologies au 31 décembre



* 2011 : données non exhaustives

Observatoire des patients de l'ANTADIR - 2011

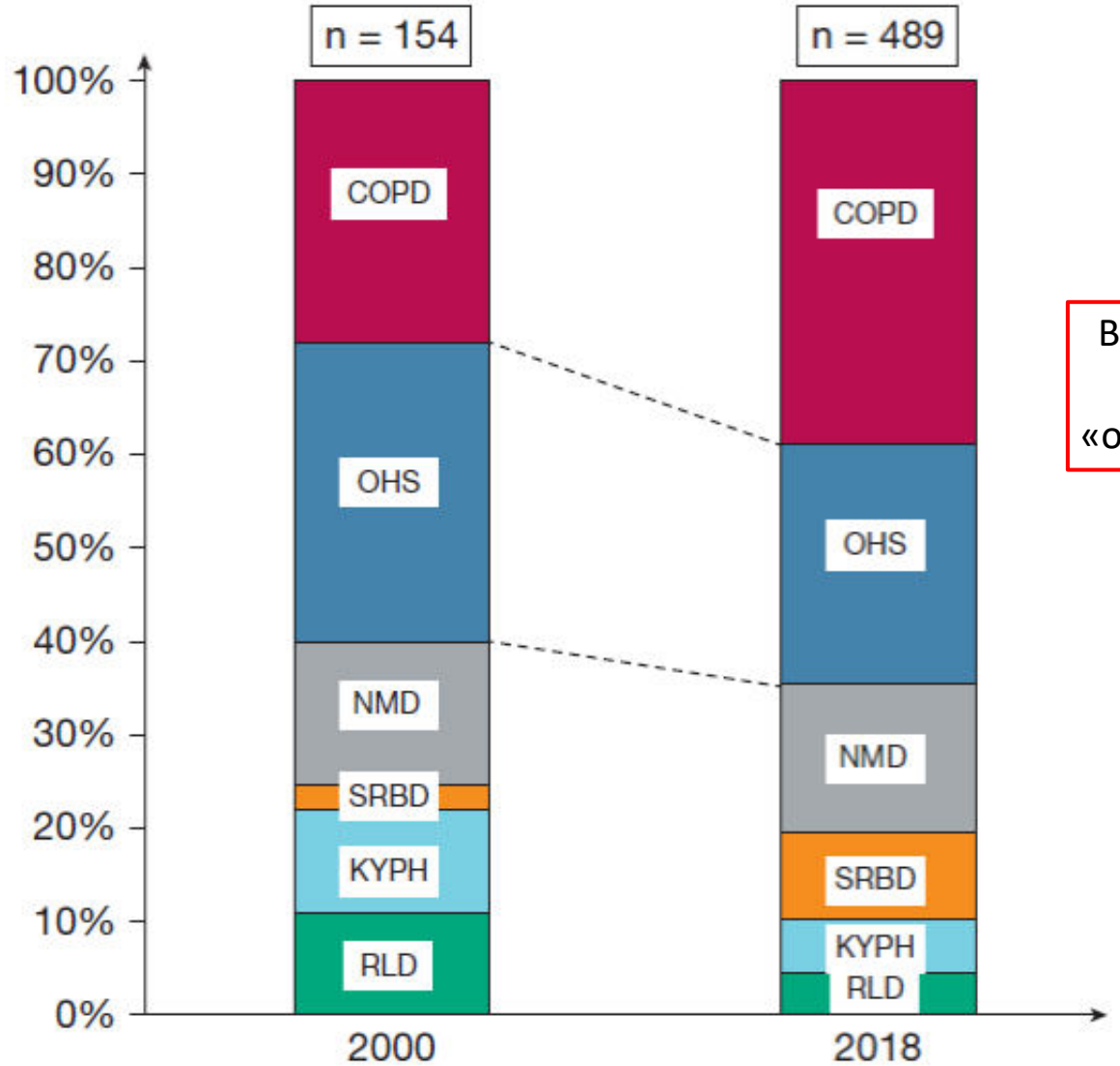


Figure 2 – *Evolution of indications for noninvasive ventilation in the Geneva Lake area between 2000 (n = 154) and 2018 (n = 489). COPD includes overlap syndrome. KYPH = kyphoscoliosis; NMD = neuromuscular disorders; OHS = obesity hypoventilation syndrome; RLD = restrictive lung disorder; SRBD = sleep-related breathing disorders.*

BPCO: 39% du total
Comprend les «overlap» syndromes

C Cantero et al, Chest 2020

Table 1 Baseline demographics of the study population

	Total population (N=1746)	London population (n=1118)	Rouen population (n=628)	P value
Age (years)	60.5 (±15.9)	58.8 (±15.7)	63.6 (±15.8)	<0.001
Gender (male), n (%)	949 (54)	613 (55)	336 (54)	0.617
$PaCO_2$ at admission for NIV set-up (kPa)*	7.1 (6.2–8.1)	7 (6.1–8.0)	7.5 (6.6–8.8)	<0.001
Spirometry at NIV set-up†				
FEV_1 (L)	1.1 (0.7–1.6)	1.1 (0.7–1.7)	1.0 (0.7–1.4)	0.078
FVC (L)	1.7 (1.2–2.4)	1.7 (1.1–2.4)	1.9 (1.4–2.4)	<0.001
Underlying respiratory disease				0.007
Neuromuscular diseases, n (%)	397 (22.7)	290 (25.9)	107 (17)	<0.001
Motor neuron disease	144 (36.3)	84 (29)	60 (56.1)	<0.001
Duchenne muscular dystrophy	49 (12.3)	37 (12.8)	12 (11.2)	
Postpolio syndrome	40 (10.1)	39 (13.4)	1 (0.9)	
Myotonic dystrophy	27 (6.8)	19 (6.6)	8 (7.5)	
Spinal cord injury	24 (6)	14 (4.8)	10 (9.3)	
Diaphragm palsy	21 (5.3)	13 (4.5)	8 (7.5)	
Other neuromuscular conditions‡	92 (23.2)	84 (29)	8 (7/5)	
Obstructive airway diseases, n (%)	334 (19.1)	199 (17.8)	135 (21.5)	0.001
COPD	305 (91.3)	182 (91.5)	123 (91.1)	0.733
Bronchiectasis	14 (4.2)	8 (4)	6 (4.4)	
Asthma	10 (3.0)	5 (2.5)	5 (3.7)	
Other obstructive conditions‡	5 (1.5)	4 (2)	1 (0.7)	
Chest wall diseases, n (%)	95 (5.4)	59 (5.3)	36 (5.7)	0.714
Kyphoscoliosis	58 (61.1)	32 (53.3)	26 (72.2)	0.003
Scoliosis	15 (15.8)	15 (25.0)	0 (0)	
Post-tuberculosis	10 (10.5)	3 (5.0)	7 (19.4)	
Pneumonectomy	5 (5.3)	3 (5.0)	2 (5.6)	
Other restrictive conditions‡	7 (8.3)	7 (11.6)	1 (2.8)	
Obesity hypoventilation syndrome with or without obstructive sleep apnoea, n (%)	515 (29.5)	319 (28.5)	196 (31.2)	0.251
Obstructive sleep apnoea, n (%)	184 (10.5)	122 (10.9)	62 (9.9)	0.517
Overlap between obstructive airway disease and sleep apnoea, n (%)	221 (12.7)	129 (11.5)	92 (14.6)	0.072
COPD	206 (93.2)	122 (94.6)	84 (91.3)	0.588
Asthma	10 (4.5)	6 (4.7)	4 (4.3)	
Bronchiectasis	5 (2.3)	1 (0.8)	4 (4.3)	

BPCO: 32%
Comprend les «overlap» syndromes

Contraintes physiologiques liées à la BPCO

- Augmentation de la R_{VA}
- Limitation du flux expiratoire, migration en périphérie du point d'égal pression, collapsibilité expiratoire des PVA et PEEPi
- Hyperinflation: position géométrique défavorable du diaphragme, compliance du système respiratoire diminuée
- Lors d'Overlap syndrome (OSAS et BPCO), obésité associée

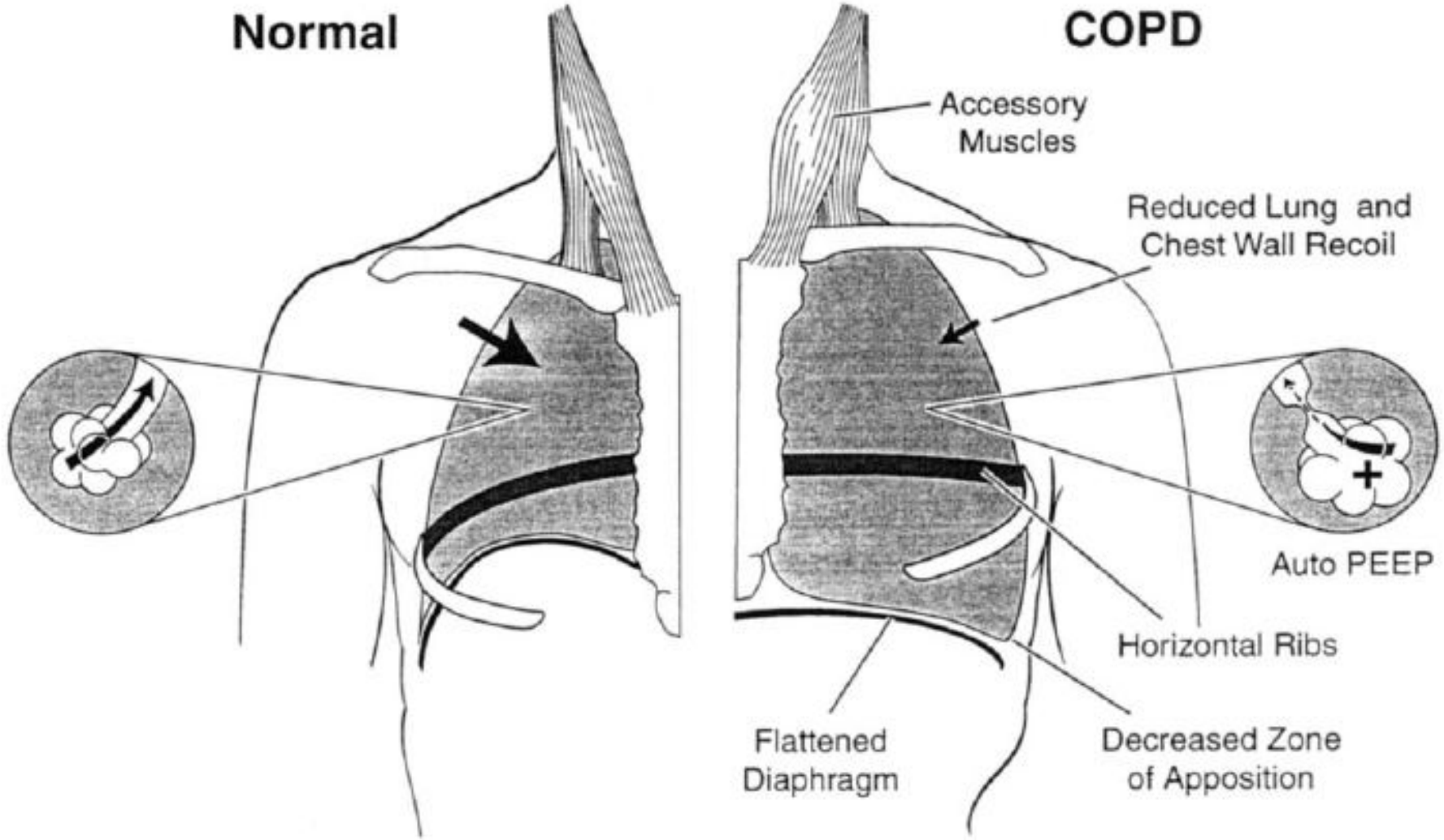


FIGURE 1. Schematic diagram showing normal hemithorax on left, compared with effects of hyperinflation on ventilatory mechanics in a patient with COPD. See text for details.

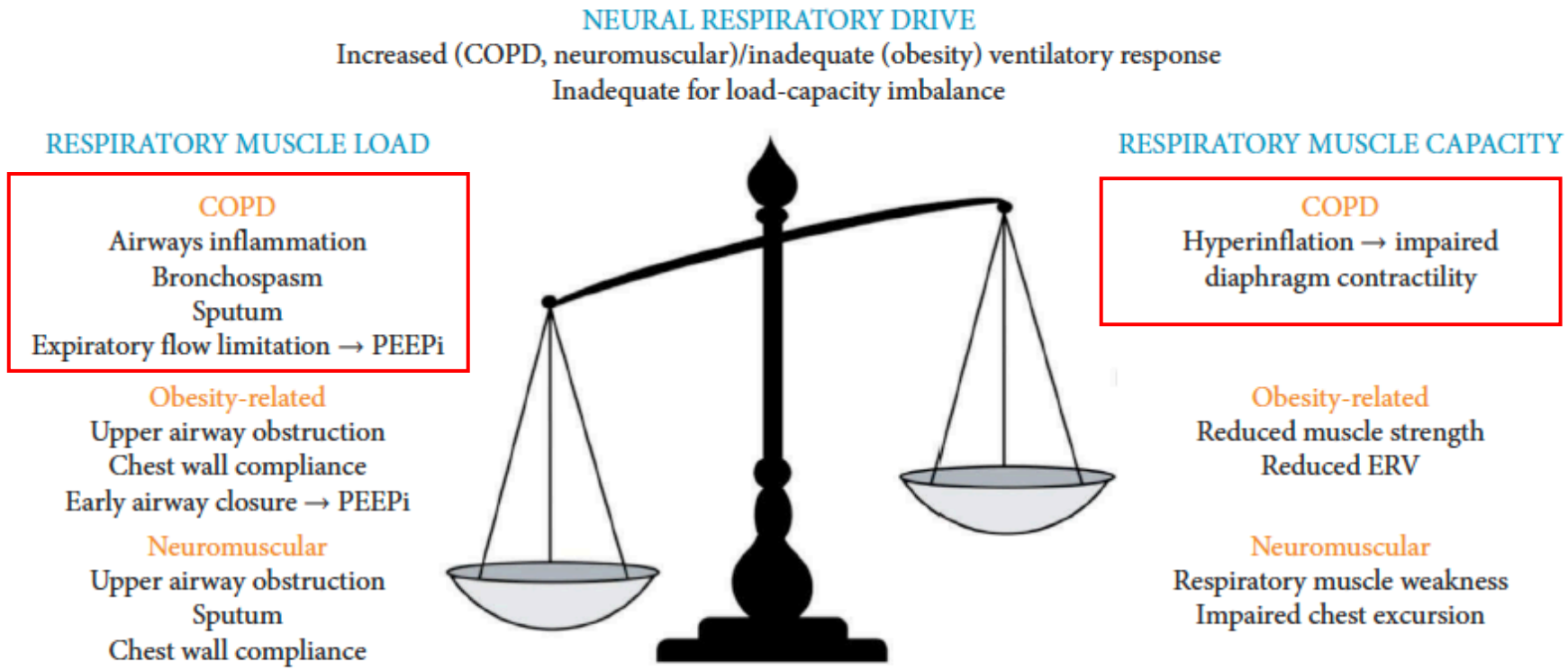


FIGURE 1: Schematic illustrating the pathophysiology of chronic respiratory failure caused by a load-capacity-drive imbalance of the respiratory muscle pump. COPD, chronic obstructive pulmonary disease; PEEPi, intrinsic positive end-expiratory pressure; ERV, expiratory reserve volume.

Que nous dit la littérature?

Revue des études les plus importantes

Pa_{O_2} (mm Hg, air)	52.5 (50.1 to 54.9) (n = 62)	54.8 (52.4 to 57.2) (n = 61)
Pa_{CO_2} (mm Hg, air)	54.4 (52.6 to 56.2) (n = 62)	52.6 (51.0 to 54.2) (n = 61)
SGRQ	64.1 (49.9–70.8)*	69 (57.2–77.2)*

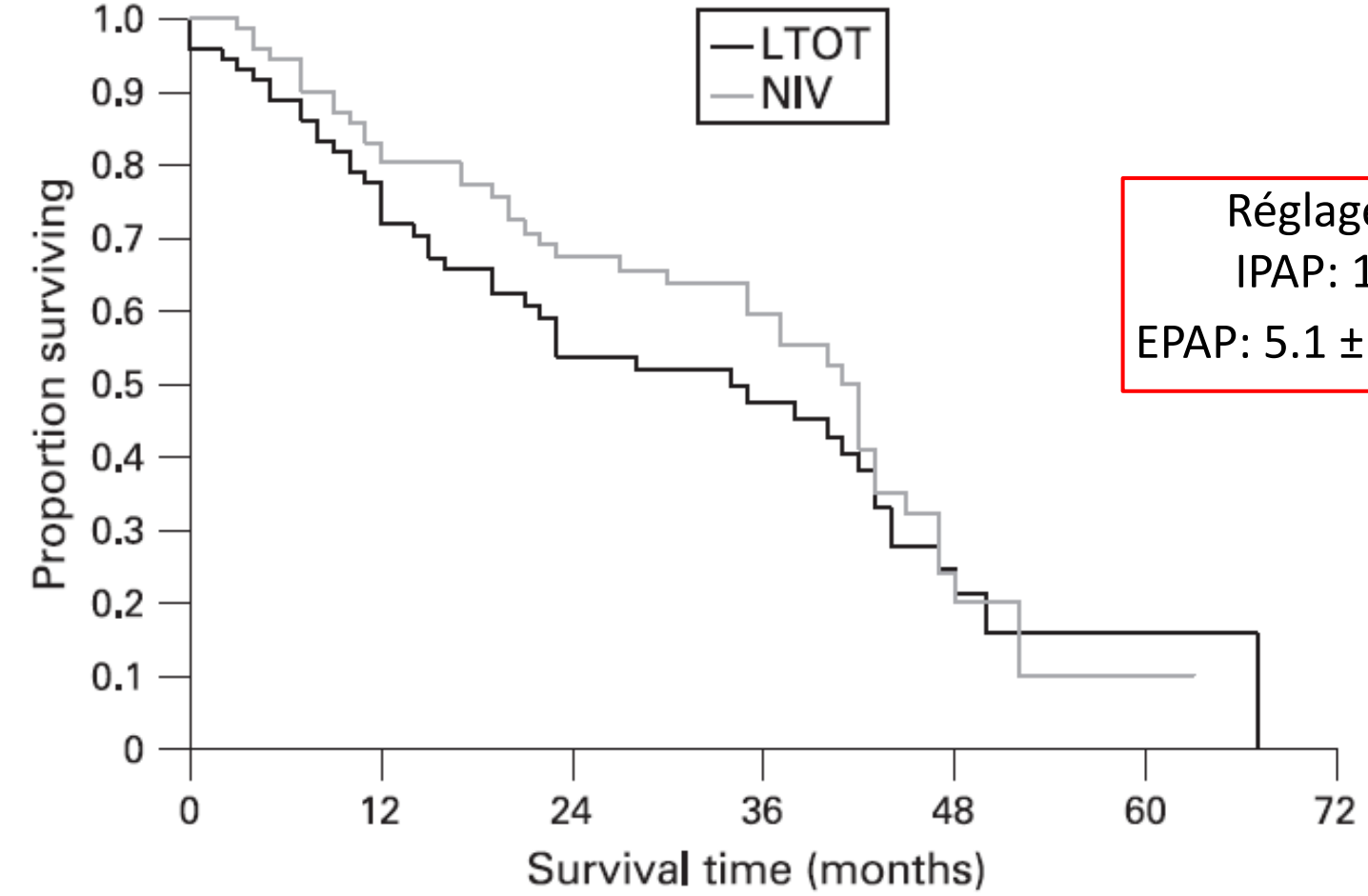
Table 3 Follow-up $Paco_2$ and $FEV_{1.0}$ results

		Baseline	6 months	12 months
$Paco_2$ (mm Hg)	LTOT	54.2 (52.0 to 56.4)	55.1 (52.1 to 58.1)	52.2 (49.5 to 54.9)
		n = 45	n = 43	n = 29
	NIV+LTOT	54.1 (51.7 to 56.5)	52.9 (50.5 to 55.3)	53.2 (50.6 to 55.8)
		n = 54	n = 44	n = 43
$FEV_{1.0}$ (% pred)	LTOT	23.9 (21.9 to 25.9)	23.4 (21.4 to 25.4)	26.3 (24.1 to 28.5)
		n = 51	n = 47	n = 38
	NIV+LTOT	25.3 (22.3 to 28.3)	24.9 (21.7 to 28.1)	24.1 (21.1 to 27.1)
		n = 58	n = 56	n = 47

Values are mean (95% CI). Sample sizes are unequal because patient data were censored if it was not possible to obtain measurements under the same conditions ($FEV_{1.0}$ prebronchodilator; arterial blood gases on room air or on oxygen at the same flow rate) on at least two of three occasions.

$FEV_{1.0}$, forced expiratory volume in 1 s; LTOT, long-term oxygen therapy; NIV + LTOT, nocturnal non-invasive ventilation plus long-term oxygen therapy; $Paco_2$, arterial carbon dioxide tension.

Réglages du ventilateur:
IPAP: 12.9 ± 1.8 cmH_2O;
EPAP: 5.1 ± 1.1 cmH_2O ; mode ST



Réglages du ventilateur:
IPAP: 12.9 ± 1.8 cmH_2O;
EPAP: 5.1 ± 1.1 cmH_2O ; mode ST

Figure 2 Survival curves of patients randomised to non-invasive ventilation plus long-term oxygen therapy (NIV + LTOT) and long-term oxygen therapy (LTOT) alone. Curves were constructed after adjustment

Table 4 SF36 measured quality of life at 12 months

	LTOT			NIV			
Variable	**No**	**Median**	**IQR**	**No**	**Median**	**IQR**	**Significance***
SF36 Physical functioning	40	10.0	28.8	50	5.0	17.5	0.307
SF36 Role physical	40	12.5	43.8	50	0.0	50.0	0.470
SF36 Bodily pain	40	73.0	47.5	50	61.0	61.3	0.253
SF36 General health	39	32.0	25.0	50	20.0	26.3	0.002
SF36 Vitality	40	45.0	25.0	50	35.0	25.0	0.107
SF36 Social functioning	40	56.3	50.0	50	50.0	65.6	0.340
SF36 Role emotional	40	100.0	66.7	50	66.7	100.0	0.286
SF36 Mental health	40	80.0	16.0	50	70.0	40.0	0.009

*Adjusted for ranked baseline values.
IQR, interquartile range; LTOT, long-term oxygen therapy; NIV, non-invasive ventilation.

Table 5 Profile of mood states (POMS) at 12 months

	LTOT			NIV			
Variable	**No**	**Median**	**IQR**	**No**	**Median**	**IQR**	**Significance***
POMS Depression-dejection	37	2.0	4.0	44	4.5	13.3	0.163
POMS Anger-hostility	37	2.0	3.0	47	2.0	5.0	0.819
POMS Confusion-bewilderment	38	3.0	4.0	46	5.0	6.3	0.020
POMS Fatigue	37	6.0	8.0	46	8.0	10.3	0.581
POMS Tension-anxiety	38	3.0	7.3	47	8.0	10.0	0.067
POMS Vigour	37	14.0	10.5	45	11.0	6.5	0.050
POMS Total mood	35	5.0	21.0	43	22.0	48.0	0.318

*Adjusted for ranked baseline values.
IQR, interquartile range; LTOT, long-term oxygen therapy; NIV, non-invasive ventilation.

High-intensity versus low-intensity non-invasive ventilation in patients with stable hypercapnic COPD: a randomised crossover trial

Michael Dreher,[1] Jan H Storre,[1] Claudia Schmoor,[2] Wolfram Windisch[1]

Thorax 2010;**65**:303–308.

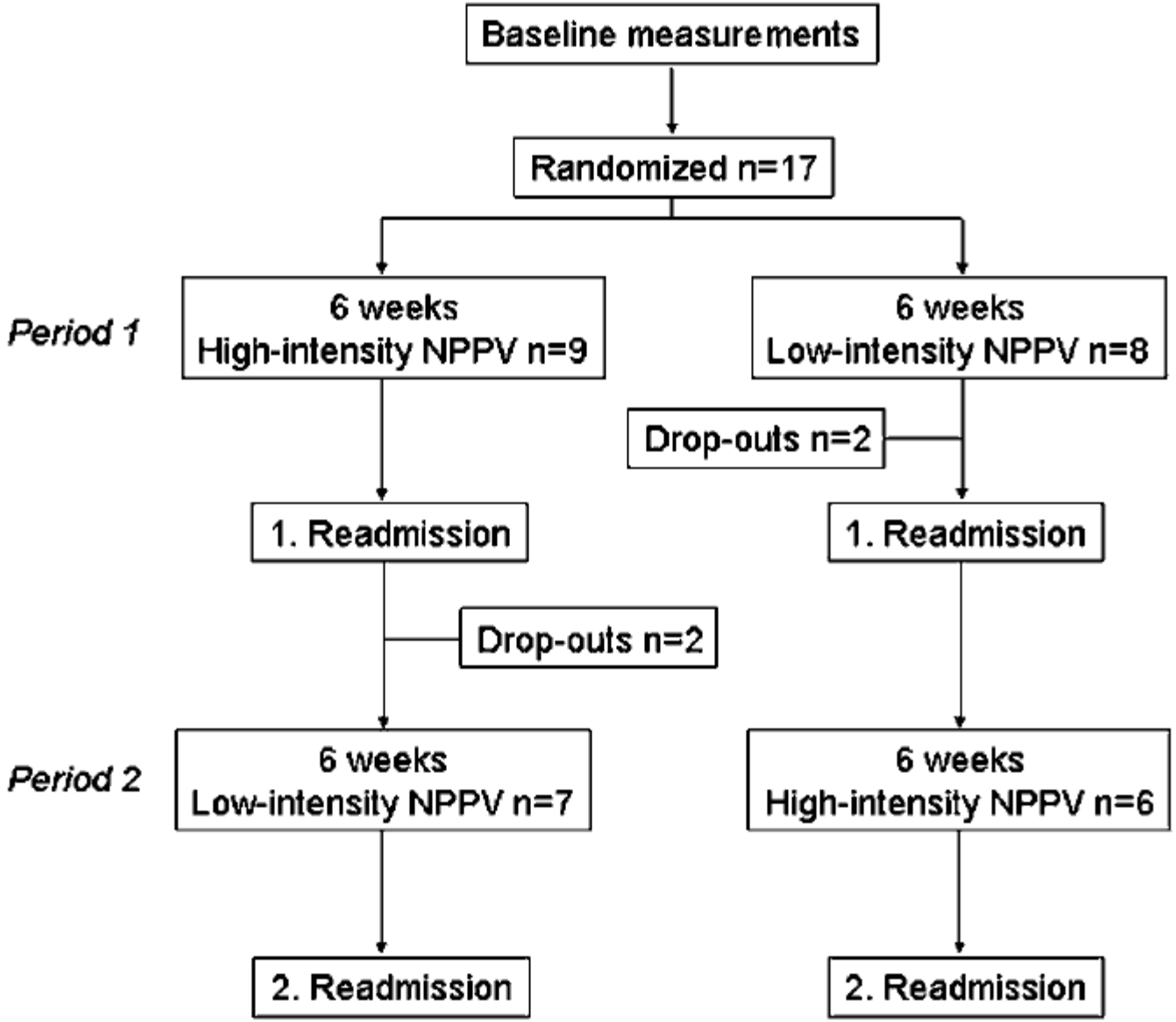


Figure 1 Trial profile. NPPV, non-invasive positive pressure ventilation.

Table 1 Ventilator settings, pneumotachographic measurements of ventilation parameters, treatment compliance and days in hospital needed for NPPV acclimatisation: high-intensity versus low-intensity NPPV

	Period	LI-NPPV	HI-NPPV	Difference between treatments (95% CI)	p Value
IPAP (mbar)		14.6±0.8	28.6±1.9		
EPAP (mbar)		4.0±0	4.5±0.7		
Bf (/min)		8.0±0	17.5±2.1		
Supplemental oxygen (l/min)		2.2±0.8	2.2±0.8		
Vinsp (ml)	Period 1	821±257	1183±486	325 (159 to 492)	0.002
	Period 2	846±356	1195±213		
Vexp (ml)	Period 1	351±161	414±218	96 (23 to 169)	0.015
	Period 2	289±130	415±169		
Vleak (ml)	Period 1	469±336	769±674	226 (928 to 425)	0.030
	Period 2	557±470	780±317		
RR (/min)	Period 1	15.4±3.5	17.8±3.7	−0.5 (−3.4 to 2.4)	0.71
	Period 2	18.9±5.1	15.3±1.3		
PIP (mbar)	Period 1	11.4±2.6	23.8±4.8	11.9 (9.5 to 14.3)	<0.001
	Period 2	11.5±1.8	23.1±2.0		
Mean daily use of ventilator (h/day)	Period 1	7.7±3.0	10.8±4.7	3.6 (0.6 to 6.7)	0.024
	Period 2	4.6±1.8	8.9±6.4		
Number of days for initiation of NPPV	Period 1	1.7±1.6	4.6±1.9	2.5 (1.3 to 3.7)	0.001
	Period 2	1.6±0.8	3.7±1.0		

Table 2 Physiological parameters, exercise capability and health-related quality of life: high-intensity versus low-intensity NPPV

	Period	LI-NPPV	HI-NPPV	Difference between treatments (95% CI)	p Value
$Paco_2$ (mm Hg) mean nighttime	Period 1	56.6±9.2	48.1±5.8	−9.2 (−13.7 to −4.6)	0.001
	Period 2	57.2±7.7	47.3±9.3		
HCO_3^- (mmol/l) mean nighttime	Period 1	31.3±2.2	28.9±1.9	−1.9 (−3.5 to −0.3)	0.022
	Period 2	31.1±2.1	29.6±2.6		
TLC (l)	Period 1	7.5±1.6	7.6±1.5	0.03 (−0.52 to 0.57)	0.91
	Period 2	7.4±0.8	7.3±1.5		
FEV_1 (l)	Period 1	0.64±0.11	0.97±0.46	0.05 (−0.01 to 0.11)	0.086
	Period 2	0.94±0.46	0.70±0.17		
VC (l)	Period 1	1.82±0.23	2.22±0.59	0.08 (−0.2 to 0.36)	0.55
	Period 2	2.29±0.87	2.00±0.18		
6MWD (m)	Period 1	271±56	302±163	14 (−42 to 70)	0.58
	Period 2	308±145	303±93		
BDS after 6MWT	Period 1	6.5±2.8	3.4±3.6	−2.4 (−4.3 to −0.4)	0.025
	Period 2	6.6±4.5	5.0±2.9		
$Paco_2$ (mm Hg) mean daytime	Period 1	51.8±8.6	50.1±3.0	−2.9 (−7.1 to 1.4)	0.17
	Period 2	53.5±8.6	49.6±6.7		
HCO_3^- (mmol/l) mean daytime	Period 1	30.1±2.7	29.4±1.3	−1.0 (−2.5 to 0.5)	0.18
	Period 2	30.5±2.3	29.3±2.3		
PImax (kPa)	Period 1	5.0±1.2	6.4±3.0	0.01 (−0.65 to 0.66)	0.99
	Period 2	5.3±1.9	4.6±1.7		
SRI-SS	Period 1	60.3±12.9	65.3±21.2	−0.14 (−4.9 to 4.6)	0.95
	Period 2	65.3±23.1	60.1±1\0.3		

Nocturnal noninvasive positive pressure ventilation in stable COPD: A systematic review and individual patient data meta-analysis

F.M. Struik [a,b,*], Y. Lacasse [c], R.S. Goldstein [d], H.A.M. Kerstjens [a,b], P.J. Wijkstra [a,b]

Respiratory Medicine (2014) 108, 329–337





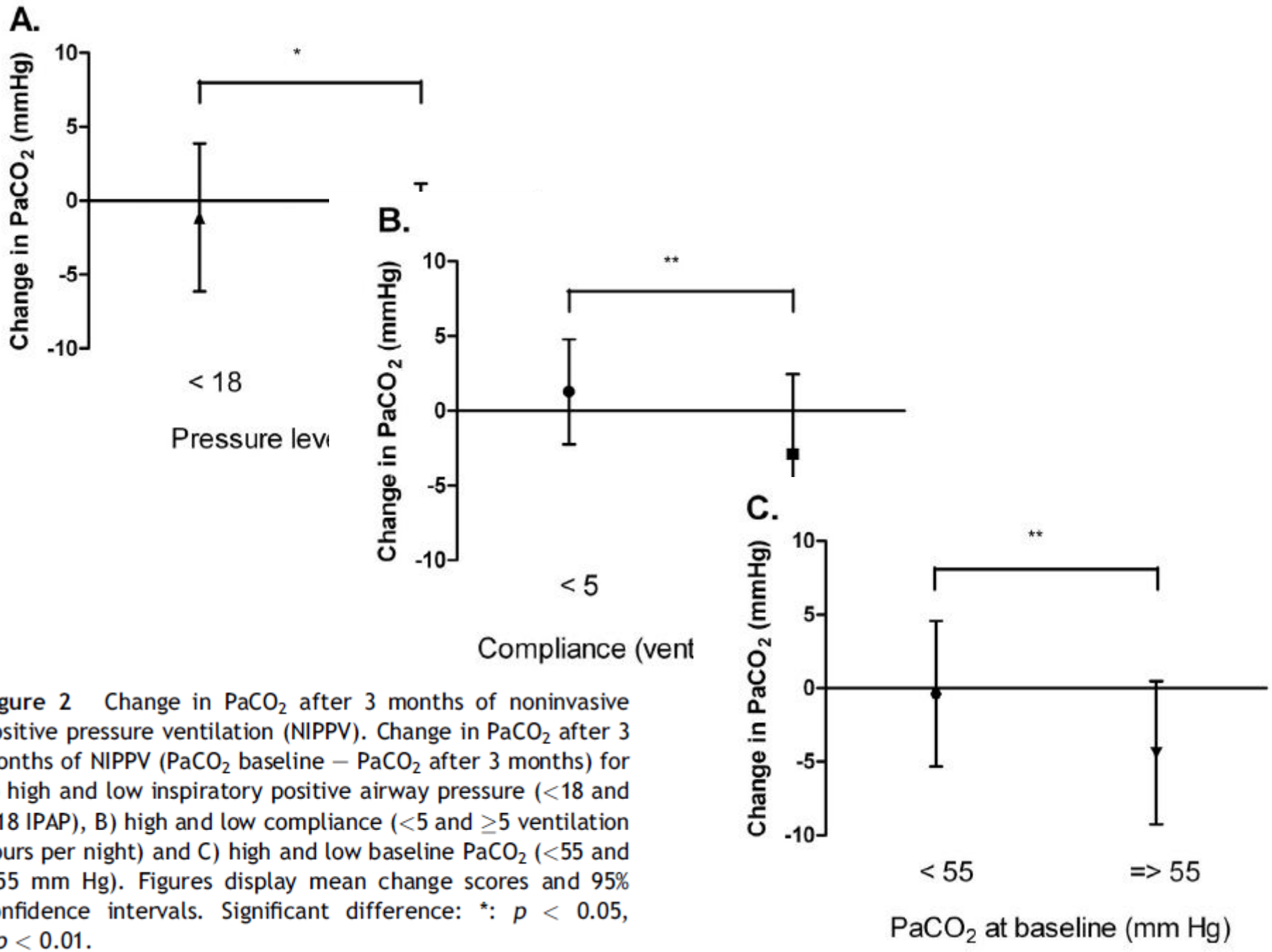


Figure 2 Change in $PaCO_2$ after 3 months of noninvasive positive pressure ventilation (NIPPV). Change in $PaCO_2$ after 3 months of NIPPV ($PaCO_2$ baseline − $PaCO_2$ after 3 months) for A) high and low inspiratory positive airway pressure (<18 and ≥18 IPAP), B) high and low compliance (<5 and ≥5 ventilation hours per night) and C) high and low baseline $PaCO_2$ (<55 and ≥55 mm Hg). Figures display mean change scores and 95% confidence intervals. Significant difference: *: $p < 0.05$, **$p < 0.01$.

Le point en 2014…..

La VNI peut être bénéfique lors de BPCO:

- hez des sujets hypercapniques ($PaCO_2$ > 55 mmHg ou 7.3 kPa)
- se ventilant plus de 5:00 hrs/24
- et avec une pression inspiratoire (IPAP) > 18 cmH_2O lors de VDNP

ORIGINAL ARTICLE

Nocturnal non-invasive ventilation in COPD patients with prolonged hypercapnia after ventilatory support for acute respiratory failure: a randomised, controlled, parallel-group study

F M Struik,[1,2] R T M Sprooten,[3] H A M Kerstjens,[1,2] G Bladder,[1] M Zijnen,[4] J Asin,[5] N A M Cobben,[3] J M Vonk,[2,6] P J Wijkstra[1,2]

What is the key question?

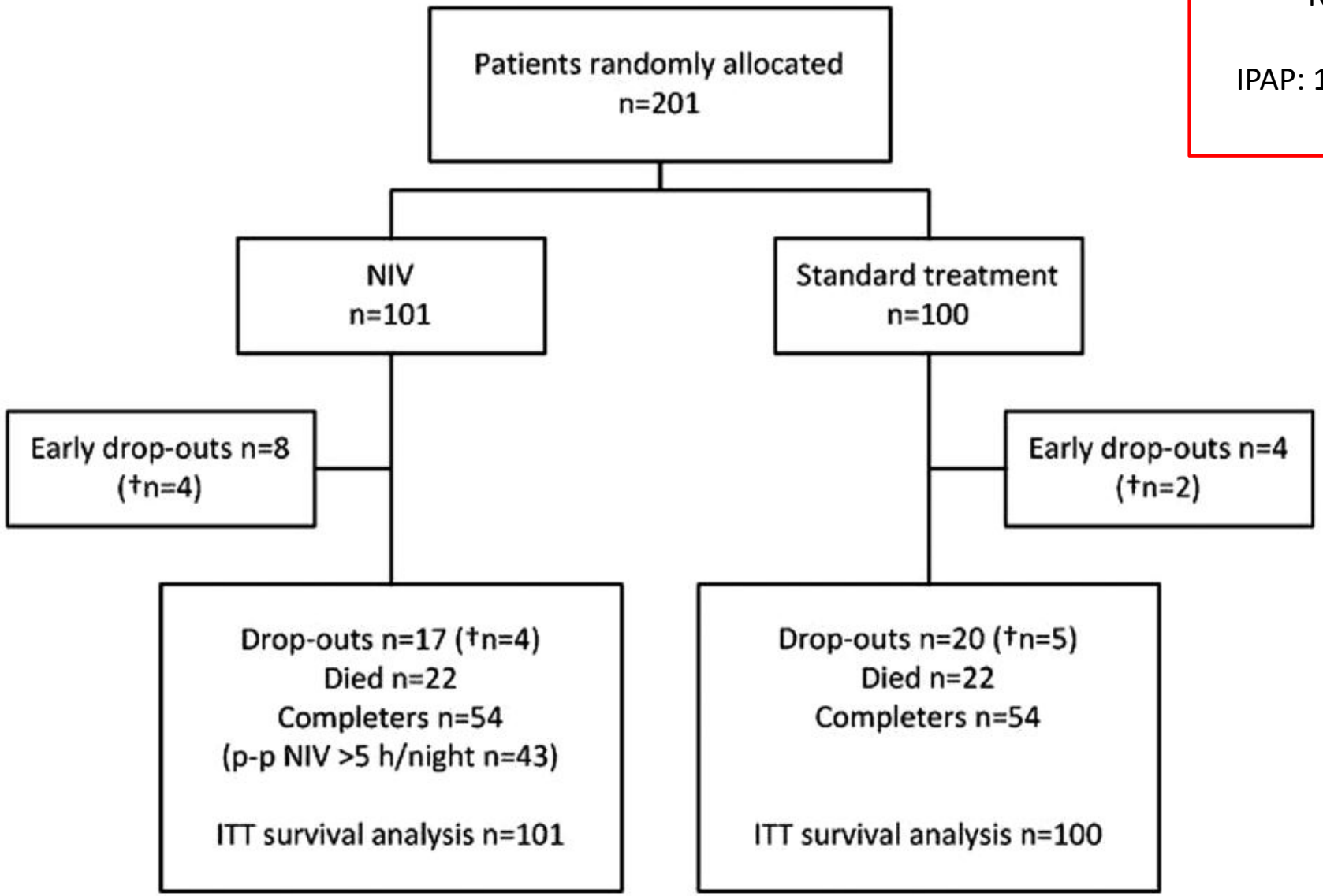
- What is the effect of nocturnal non-invasive positive pressure ventilation (NIV) alongside standard medical treatment in COPD patients with prolonged hypercapnia after ventilatory support for acute respiratory failure?

What is the bottom line?

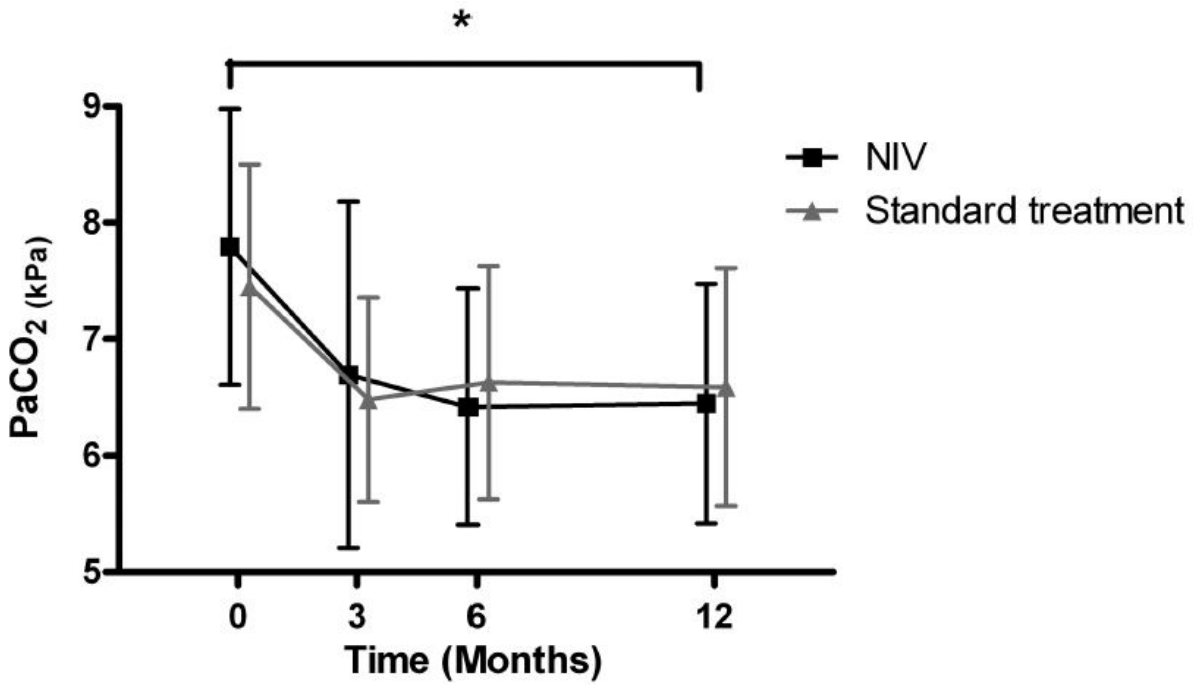
- We could not demonstrate an improvement in time to readmission or death by adding NIV for 1 year in COPD patients with prolonged hypercapnia after an episode of NIV for acute respiratory failure.

Struik FM, Thorax 2014

Nocturnal NIV with Synchrony
(Respironics Inc.)
IPAP: 19.2 ± 3.4 / EPAP: 4.8 ± 1.0 cmH_2O;
Mode ST



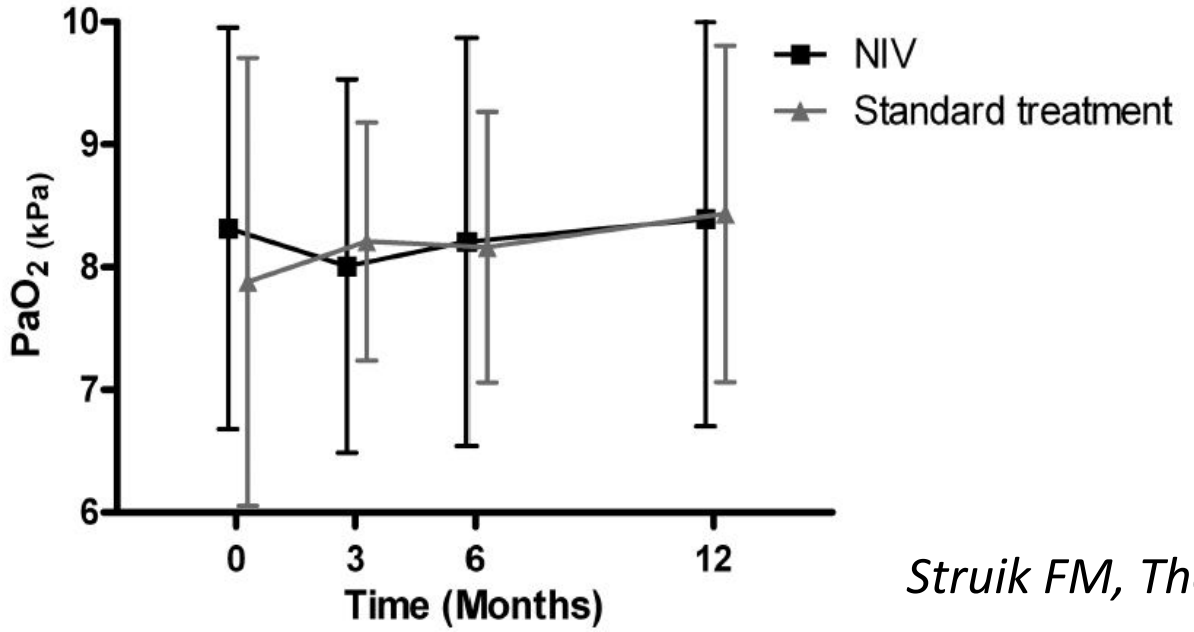
Struik FM, Thorax 2014



Nocturnal NIV with Synchrony
(Respironics Inc.)
IPAP: 19.2 ± 3.4 / EPAP: 4.8 ± 1.0 cmH_2O;
Mode ST

Struik FM, Thorax 2014

Figure 4 Daytime $PaCO_2$ and PaO_2 at baseline, 3, 6 and 12 months (means±SD). Measurements performed in complete case group (n=54 per group) regardless of oxygen use. NIV, non-invasive positive pressure ventilation; $PaCO_2$, arterial carbon dioxide pressure (kPa); PaO_2, arterial oxygen pressure (kPa). *Change in $PaCO_2$ was significantly better in the NIV group after 12 months ($p<0.05$).



Struik FM, Thorax 2014

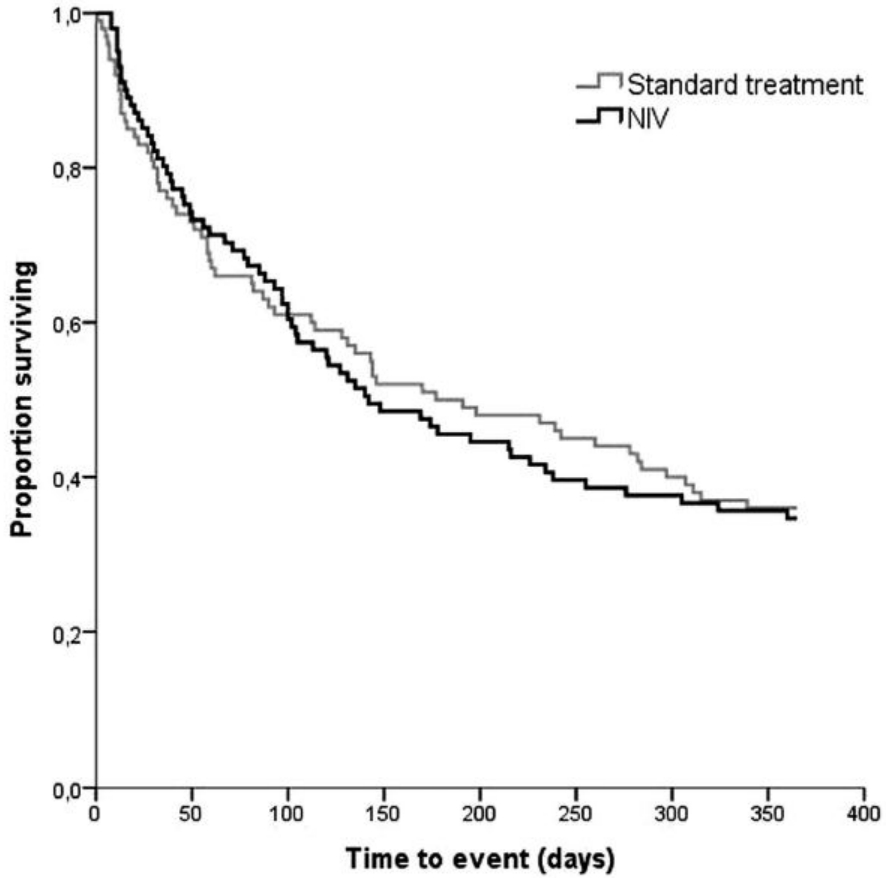


Figure 2 Kaplan–Meier plot of time to event (readmission for respiratory cause or death) in patients randomised to non-invasive positive pressure ventilation (NIV) and standard treatment.

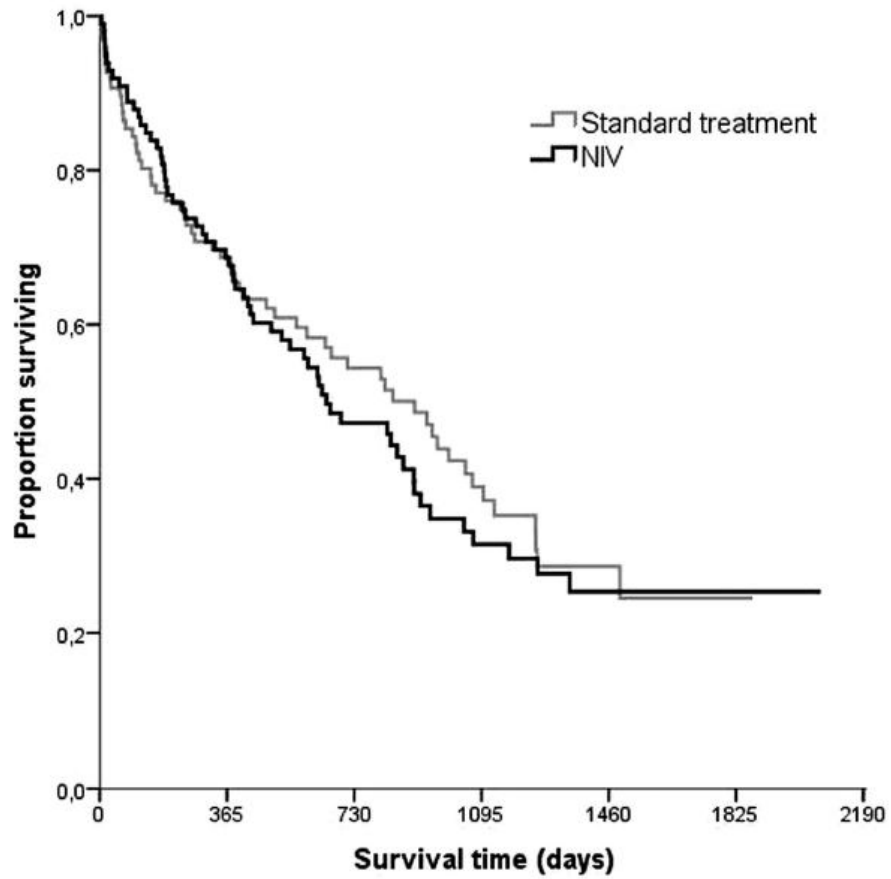
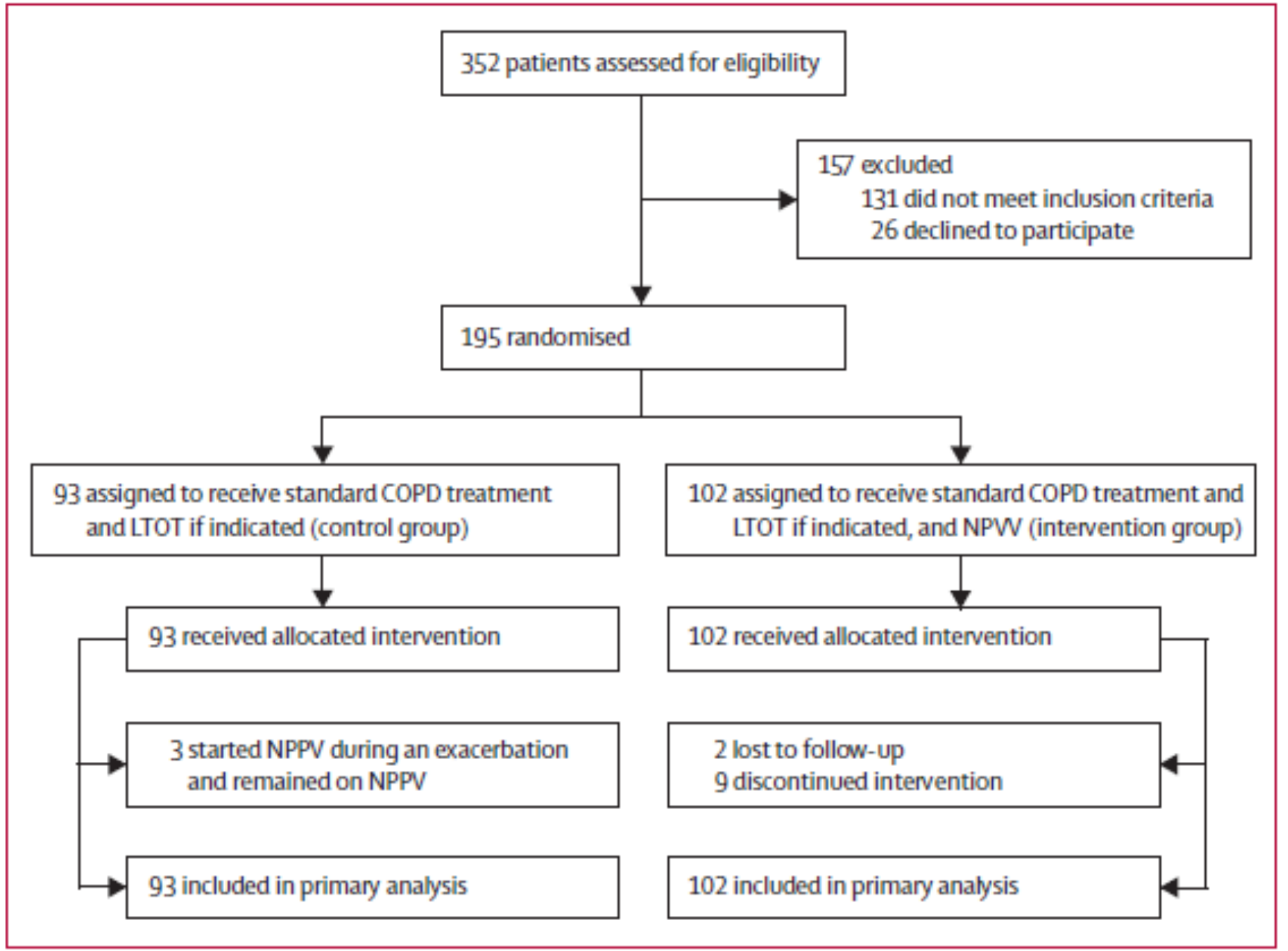


Figure 3 Kaplan–Meier plot of long-term survival curves of patients randomised to non-invasive positive pressure ventilation (NIV) and standard treatment. Because of small numbers of patients followed up after 3 years, the right-hand end of the survival plots remains uncertain.

Struik FM, Thorax 2014


352 patients assessed for eligibility
157 excluded
131 did not meet inclusion criteria
26 declined to participate
195 randomised
93 assigned to receive standard COPD treatment and LTOT if indicated (control group)
102 assigned to receive standard COPD treatment and LTOT if indicated, and NPVV (intervention group)
93 received allocated intervention
102 received allocated intervention
3 started NPPV during an exacerbation and remained on NPPV
2 lost to follow-up
9 discontinued intervention
93 included in primary analysis
102 included in primary analysis

T Köhnlein, Lancet Respir Med 2014

pH	7·39 (0·05)	7·39 (0·04)
$PaCO_2$, kPa	7·7 (0·7)	7·8 (0·8)

McEvoy et al, Thorax 2009

Pao_2 (mm Hg, air)	52.5 (50.1 to 54.9) (n = 62)	54.8 (52.4 to 57.2) (n = 61)
$Paco_2$ (mm Hg, air)	54.4 (52.6 to 56.2) (n = 62)	52.6 (51.0 to 54.2) (n = 61)
	7.25 kPa	7.01 kPa

Réglages du ventilateur: IPAP: 21.6 ± 4.7 / EPAP: 4.8 ± 1.6 cmH2O; mode ST

Réglages du ventilateur: IPAP: 21.6 ± 4.7
EPAP: 4.8 ± 1.6 cmH2O; mode ST

	3 months	6 months	9 months	12 months
Overall	0·8 (3·5)	2·1 (5·7)	0·9 (4·0)	2·6 (8·6)
Non-invasive positive pressure ventilation group	0·2 (1·1)	1·4 (4·7)	1·3 (4·9)	2·2 (10·2)
Control group	1·5 (4·9)	3·0 (6·9)	0·4 (1·9)	3·1 (5·4)

Values are mean (SD).

Table 2: **Emergency hospital admissions per patient by follow-up period and treatment group**

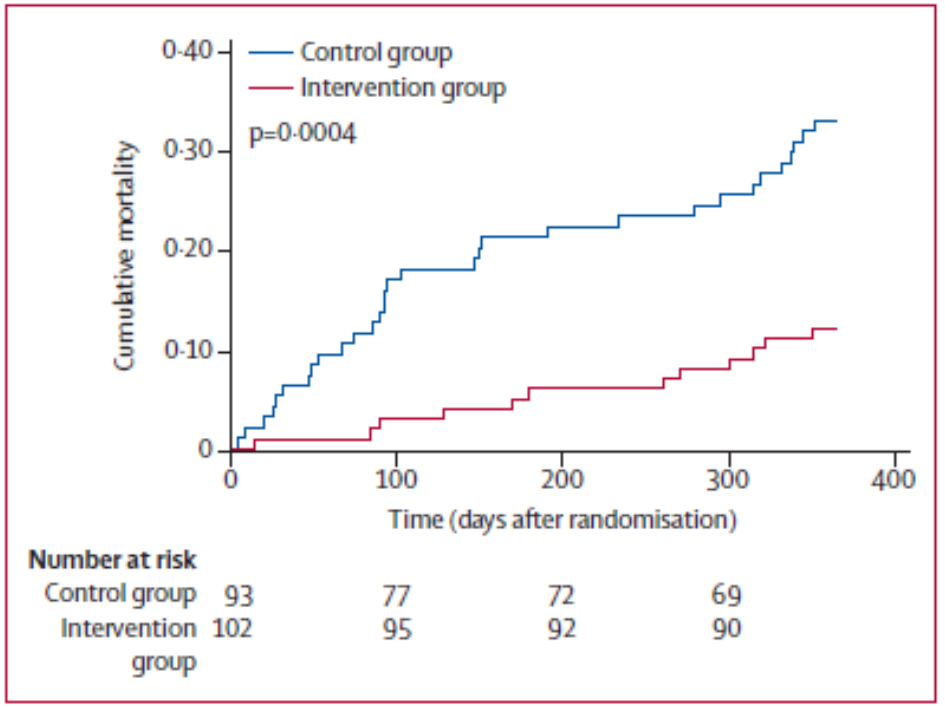


Figure 2: **Kaplan-Meier estimate of cumulative all-cause mortality during the first year after randomisation (primary outcome)**
The p value results from a log-rank test of the between-group difference.

	Baseline	14 days	3 months	6 months	9 months	12 months
All patients	7·9 (0·8)	7·0 (1·1)	7·0 (1·1)	6·7 (1·0)	6·8 (0·9)	6·9 (1·1)
Control group	7·9 (0·7)	7·5 (1·1)	7·4 (0·9)	7·1 (1·0)	7·3 (0·8)	7·4 (1·2)
Non-invasive positive pressure ventilation group	8·0 (0·8)	6·6 (0·9)	6·6 (1·1)	6·4 (0·9)	6·4 (0·9)	6·5 (0·9)

Values are mean (SD).

Table 4: **Arterial carbon dioxide pressure (kPa) during the 1-year study**



T Kohnlein et al; Lancet Respir Med 2014

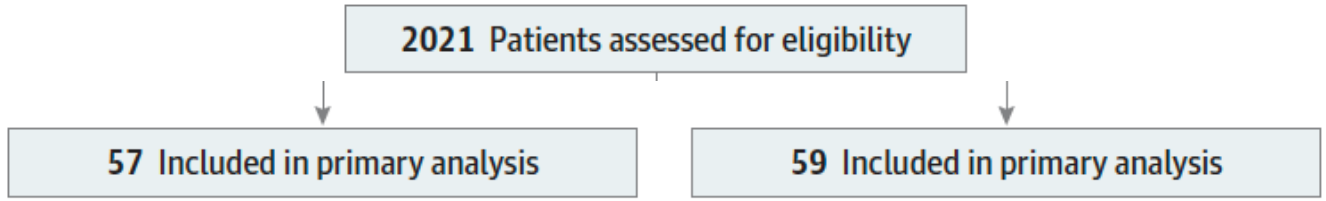
JAMA | Original Investigation

Effect of Home Noninvasive Ventilation With Oxygen Therapy vs Oxygen Therapy Alone on Hospital Readmission or Death After an Acute COPD Exacerbation

A Randomized Clinical Trial

Patrick B. Murphy, PhD; Sunita Rehal, MSc; Gill Arbane, BSc (Hons); Stephen Bourke, PhD; Peter M. A. Calverley, PhD; Angela M. Crook, PhD; Lee Dowson, MD; Nicholas Duffy, MD; G. John Gibson, MD; Philip D. Hughes, MD; John R. Hurst, PhD; Keir E. Lewis, MD; Rahul Mukherjee, MD; Annabel Nickol, PhD; Nicholas Oscroft, MD; Maxime Patout, MD; Justin Pepperell, MD; Ian Smith, MD; John R. Stradling, PhD; Jadwiga A. Wedzicha, PhD; Michael I. Polkey, PhD; Mark W. Elliott, MD; Nicholas Hart, PhD

Figure 1. Participant Flow Diagram

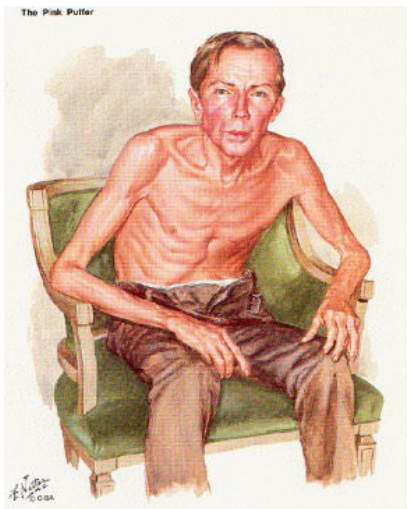


Recrutement pendant 5 ans dans 13 centres de GB

JAMA. 2017;317(21):2177-2186.

Table 1. Baseline Characteristics

	Home Oxygen Therapy Plus NIV (n = 57)	Home Oxygen Therapy Alone (n = 59)	Total (N = 116)
Age, mean (SD), y[a]	66.4 (10.2)	67.1 (9.0)	66.7 (9.6)
Body mass index, median (IQR)[a,b]	21.5 (18.8-24.5)	22.2 (17.9-26.9)	21.6 (18.2-26.1)
Prior use of long-term oxygen therapy, No. (%)[a]	40 (70)	40 (68)	80 (69)
≥3 COPD-related readmissions within past year, No. (%)[a]	30 (53)	31 (53)	61 (53)
Apnea Hypopnea Index, median (IQR), /h[c]	2.4 (0.9-6.2)	2.0 (0.8-3.9)	2.2 (0.8-5.1)
FEV_1 % predicted, mean (SD)	24.0 (8.6)	22.9 (8.6)	23.4 (8.6)
$PaCO_2$ while breathing room air, mean (SD), mm Hg	59 (7)	59 (7)	59 (7)
St George's Respiratory Questionnaire summary score, median (IQR)[d]	74.7 (63.7-81.7)	71.0 (62.6-78.6)	73.8 (63.3-80.3)
Severe Respiratory Insufficiency Questionnaire summary score, mean (SD)[e]	45.8 (15.0)	46.9 (15.6)	46.4 (15.2)
Medical Research Council dyspnea score, median (IQR)[f]	5.0 (4.0-5.0)	5.0 (4.0-5.0)	5.0 (4.0-5.0)



JAMA. 2017;317(21):2177-2186.

Patients inclus: $PaCO_2$ >7kPa 2-4 semaines après une insuffisance respiratoire aiguë de type II

Patients exclus: BMI >35 kg/m² ou SAOS

Endpoint primaire: Temps passé sans rehospitalisation sur 1 an

Resultats: 116 patients (67.0 ± 9.6 yrs, 53% F, BMI 21.6 (18.2-26.1)kg/m², VEMS 0.6 ± 0.2L et $PaCO_2$: 7.9±0.9kPa).

59 patients dans le groupe HOT; 57 dans le groupe HOT-HMV (O_2 1.0 (0.5-1.5)Lpm); IPAP 24 (22-26) cmH_2O, EPAP 4 (4-5) cmH_2O; FS: 14 (14-16).

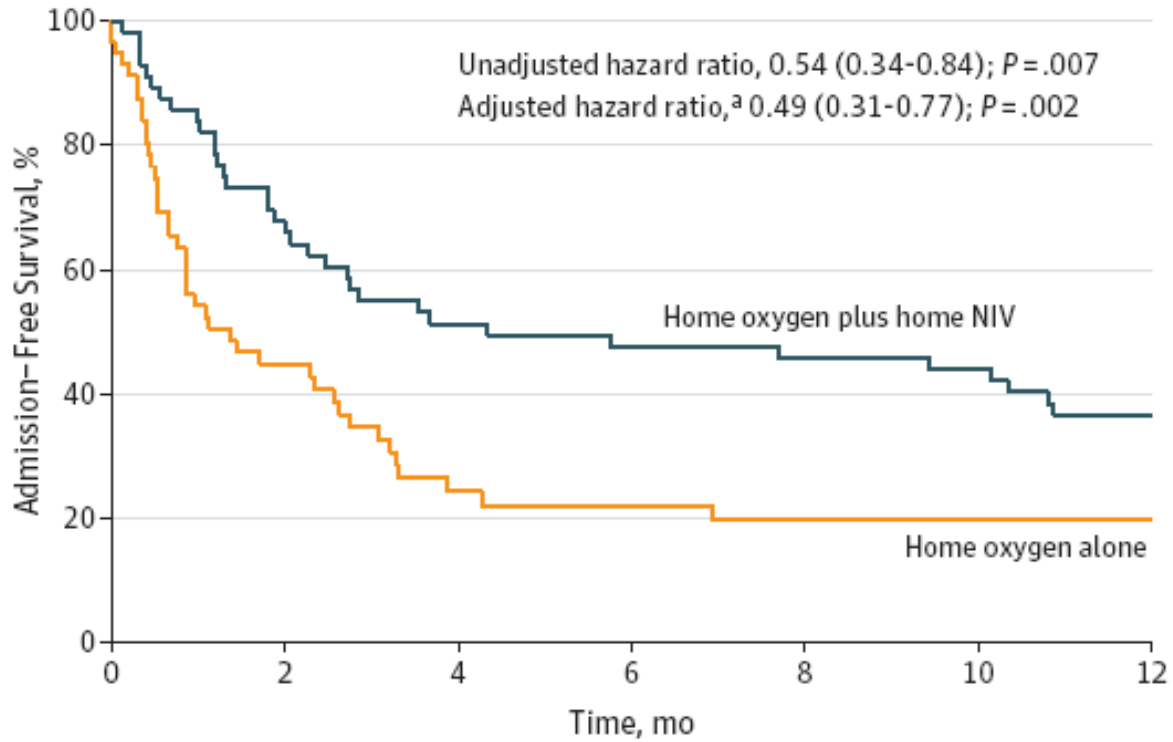
***Temps median passé sans rehospitalisation*:** 4.3 mois pour le groupe HOT-HMV vs. 1.4 months pour le groupe HOT; OR (multivarié): 0.49 (0.31-0.77); p=0.002.

***Conclusion*:** *En dépit d'un pronostic sombre pour ces patients, la mise sous VNI retarde les réadmissions en milieu hospitalier*

Harmony 2 (Respironics Inc.) or VPAP IIISTa (ResMed); Réglages: mediane [IQR]: IPAP: 24 [22-26] / EPAP: 4 [4-5] cmH2O; ST

JAMA. 2017;317(21):2177-2186.

Figure 2. Kaplan-Meier Survival Plot of Time to Readmission or Death From Randomization to the End of Trial Follow-up at 1 Year



No. at risk

Home oxygen plus home NIV	57	37	28	26	25	24	16
Home oxygen alone	59	23	11	10	8	8	6

The median follow-up times were 8.1 months (interquartile range, 2.3-12.6 months) for the home oxygen therapy alone group and 12.2 months (interquartile range, 8.9-12.9 months) for the home oxygen therapy plus home noninvasive ventilation (NIV) group.

[a] Adjusted for number of chronic obstructive pulmonary disease readmissions within past year, prior use of long-term oxygen therapy, age, and body mass index.

Harmony 2 (Respironics Inc.) or VPAP IIISTa (ResMed); Réglages: mediane [IQR]: IPAP: 24 [22-26] / EPAP: 4 [4-5] cmH2O; ST

JAMA. 2017;317(21):2177-2186.

Lors de BPCO hypercapnique, la littérature récente:

- Ne recommande pas la mise en route d'une VNI au long cours au décours immédiat d'une décompensation hypercapnique aiguë *(Struik, 2014)*
- Valide la mise en route d'une VNI au long cours 2 à 4 semaines après une décompensation hypercapnique aiguë chez des sujets restant hypercapniques *(P Murphy, JAMA 2017)*
- Valide la mise en route d'une VNI au long cours chez des sujets stables, hypercapniques à distance d'une exacerbation aiguë (>7 kPa, 53 mmHg) pour autant qu'on abaisse la $PaCO_2$ en dessous de 6.5 kPa (49 mmHg) ou d'au moins 20% par rapport aux valeurs initiales *(T Kohnlein, 2014)*
- Montre un bénéfice marginal lors du recours à la ventilation avec VT cible ou auto-titrante *(P Murphy, ERJ 2015)*

VNI et BPCO: contraintes physiologiques

- R_{VA} augmentée
- Expirium prolongé
- PEEP* intrinsèque
- Piégeage statique et dynamique (air-trapping)
- Amyotrophie
- Altérations géométriques du diaphragme



**: PEEP: Positive End Expiratory Pressure*

Résumé du paramétrage lors de BPCO

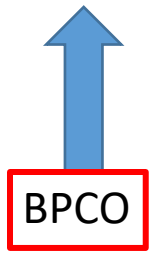
- Mode S/T; FR proche de la FR spontanée (ou 1-2 cycles au-dessus: Windisch et al.)
- ***Valeurs élevées d'AI ont un meilleur impact physiologique***
- Temps de montée en pression court (100-150 msec)
- EPAP (PEP): 4-5 cmH_2O à moins d'avoir un «Overlap syndrome»
- TI_{MIN} bas; TI_{MAX} calculé pour obtenir un rapport I:E ≈ 1:3
- Trigger inspiratoire: valeurs par défaut (si efforts non récompensés, envisager fuites et/ou PEEPi)
- Cyclage: pourcentage élevé du débit inspiratoire de pointe

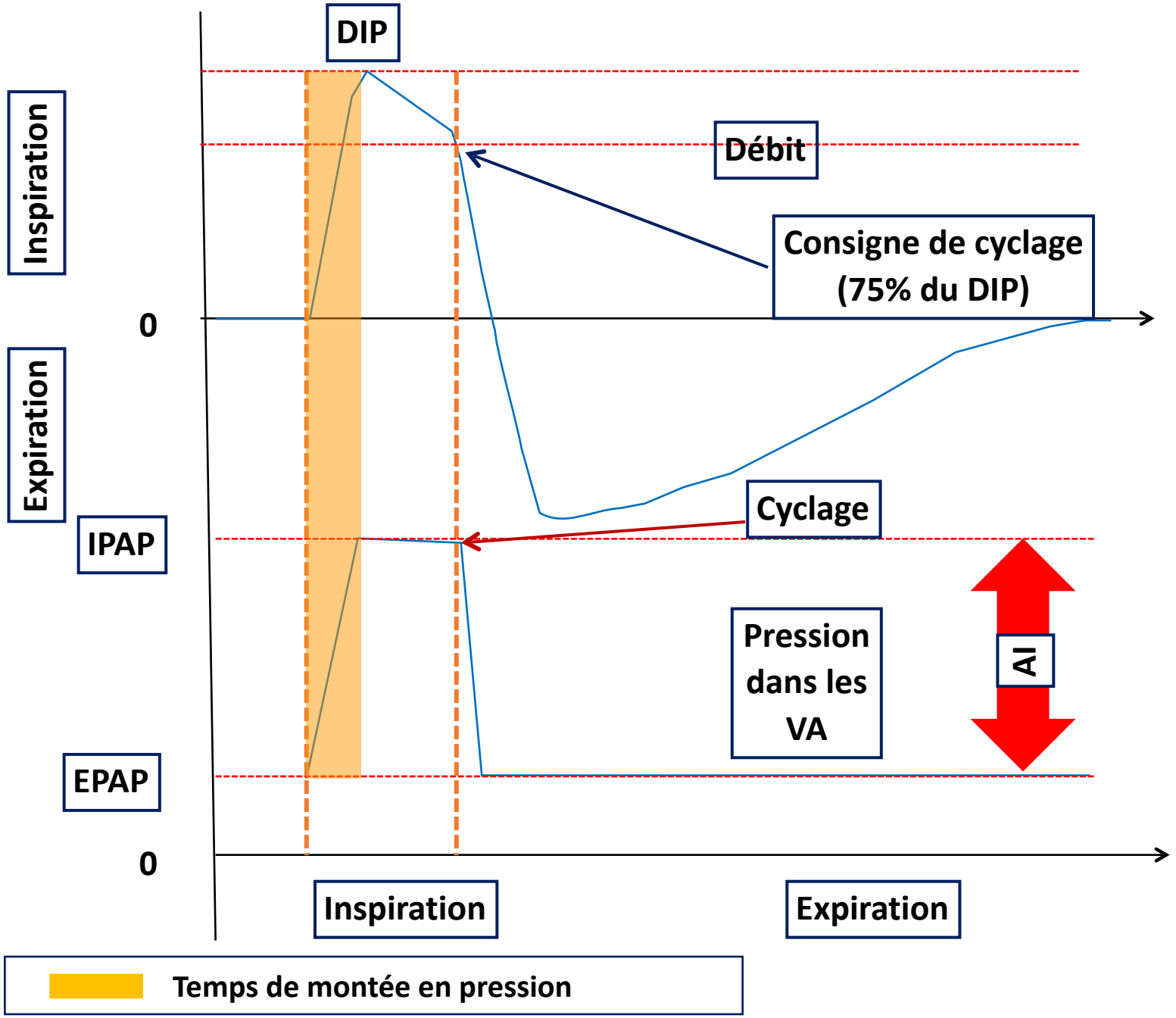
*: rares cas avec PEEPi ad 8-10 cmH_2O

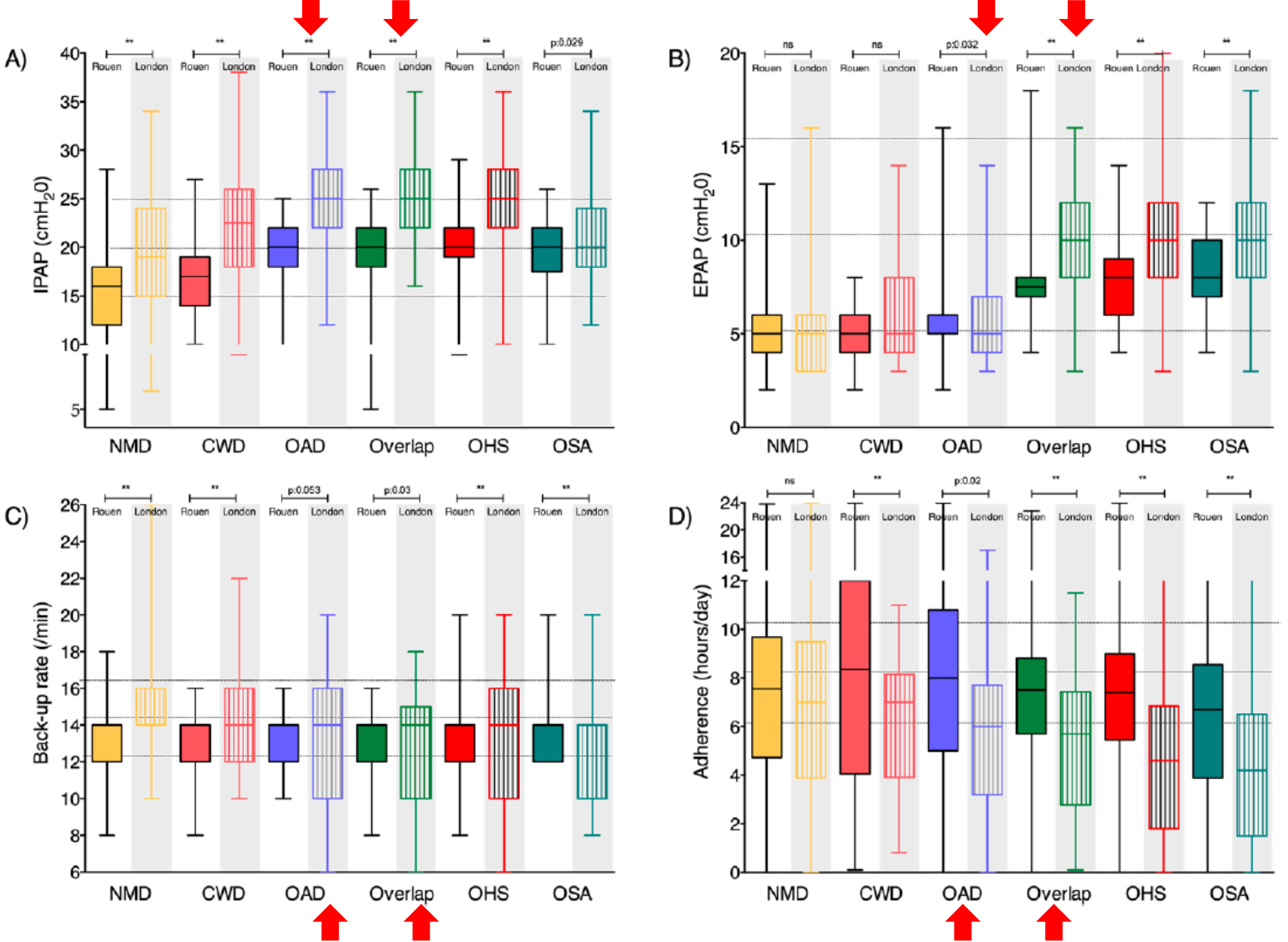


TI_{MAX} détermine le rapport I:E

Patient breaths per min	T_{tot} = 60 ÷ breaths per min (sec)	I:E = 1:2 (eg, normal lungs)	I:E = 1:1 (eg, restrictive lungs)		I:E = 1:3 (eg, obstructive lungs)
			Ti Min	Ti Max	Ti Max
10	6	2	1.0	2.5	1.5
15	4	1.3	1.0	1.7	1.3
20	3	1.0	0.8	1.5	1.0
25	2.4	0.8	0.7	1.2	0.8
30	2	0.7	0.6	1.0	0.7
35	1.7	0.6	0.5	0.8	0.7
40	1.5	0.5	0.5	0.7	0.7




DIP
Inspiration
Débit
Consigne de cyclage
(75% du DIP)
0
Expiration
Cyclage
IPAP
Pression
dans les
VA
AI
EPAP
0
Inspiration
Expiration
Temps de montée en pression



Patout M
Thorax 2020

Impact of High-Intensity-NIV on the heart in stable COPD: a randomised cross-over pilot study



Marieke Leontine Duiverman[1,2,3*†], Petra Maagh[4†], Friederike Sophie Magnet[3], Claudia Schmoor[5], Maria Paola Arellano-Maric[3,6], Axel Meissner[4], Jan Hendrik Storre[7,8], Peter Jan Wijkstra[1,2], Wolfram Windisch[3] and Jens Callegari[3]



Duiverman *et al. Respiratory Research* (2017) 18:76

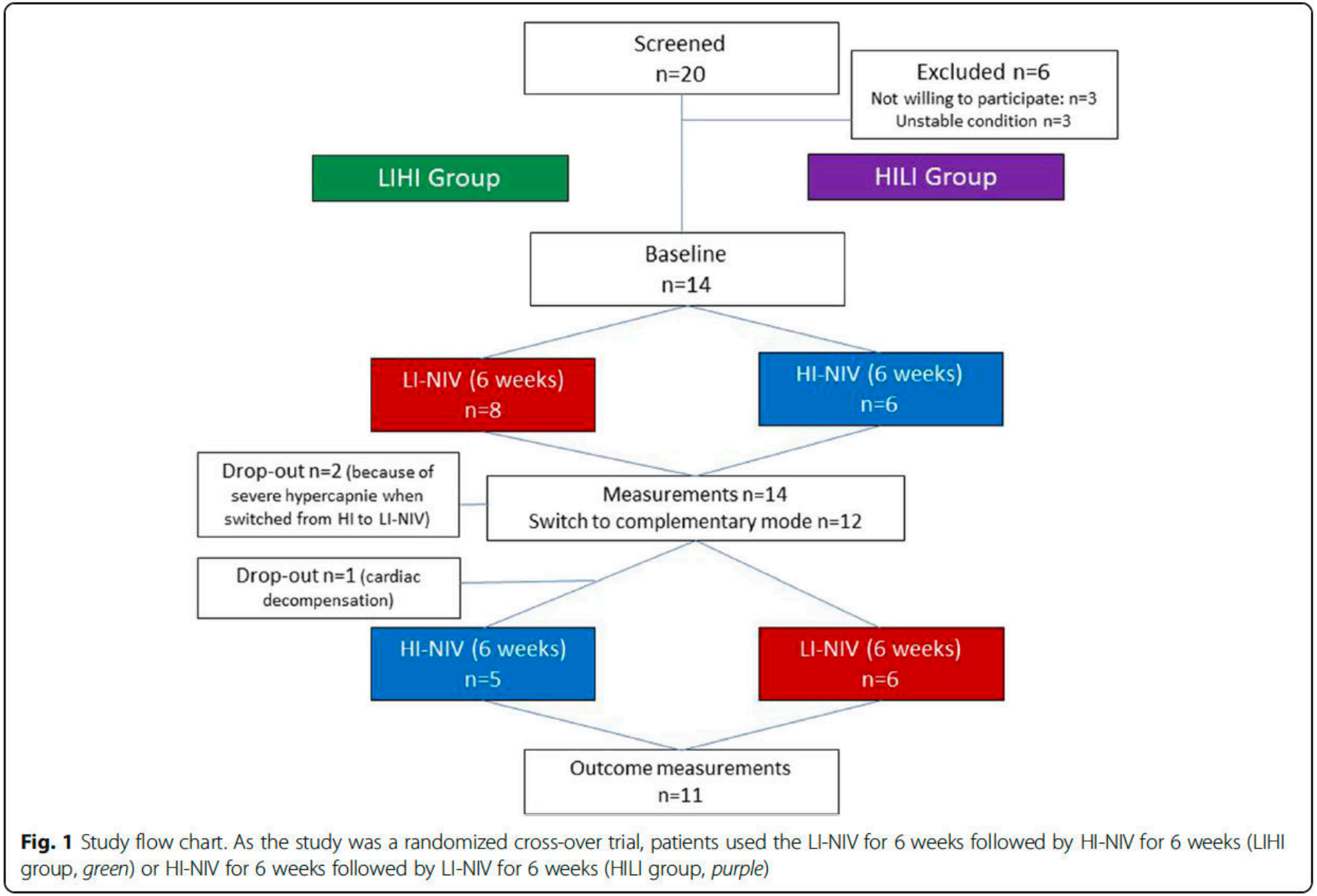


Fig. 1 Study flow chart. As the study was a randomized cross-over trial, patients used the LI-NIV for 6 weeks followed by HI-NIV for 6 weeks (LIHI group, *green*) or HI-NIV for 6 weeks followed by LI-NIV for 6 weeks (HILI group, *purple*)

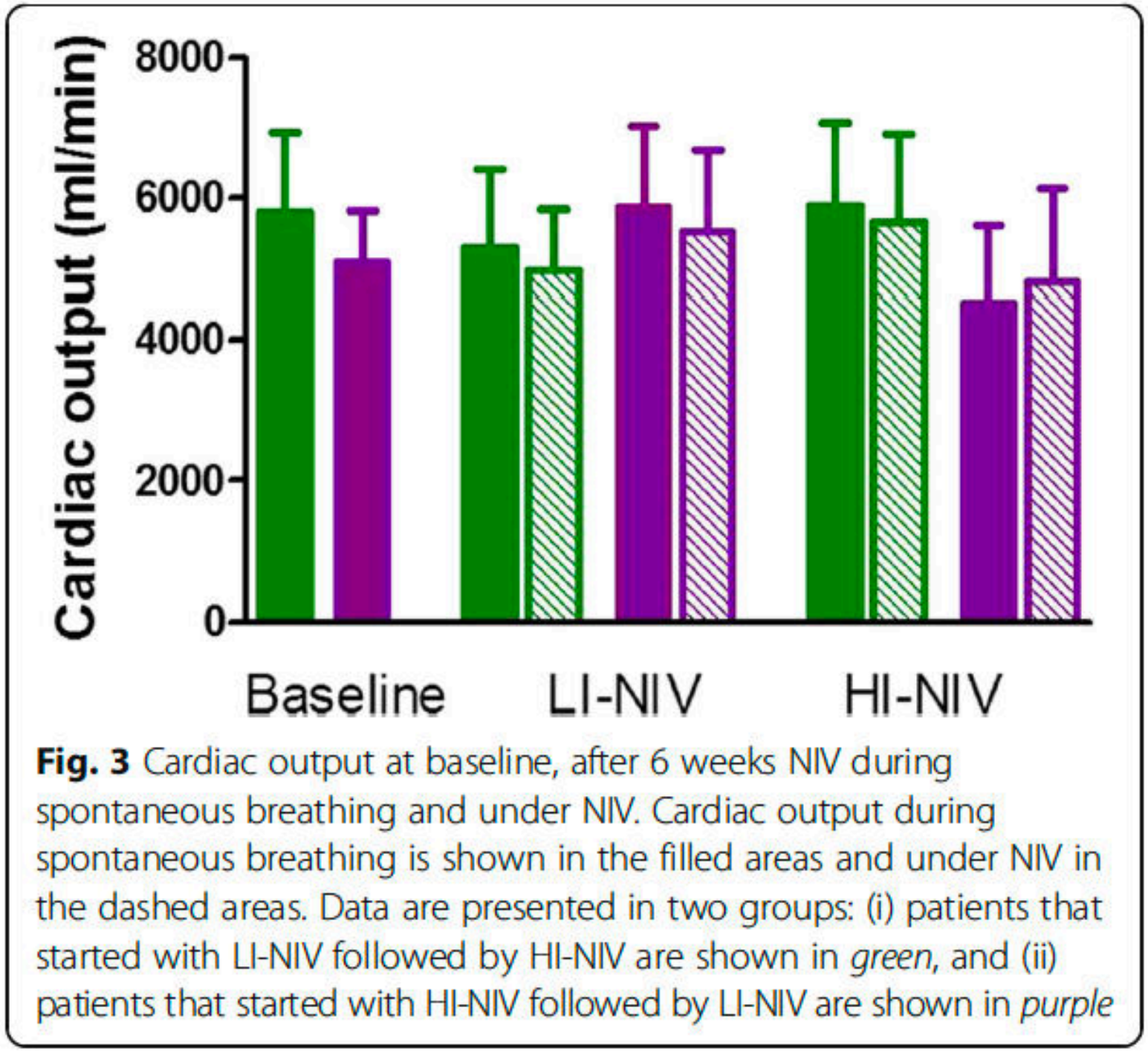


Fig. 3 Cardiac output at baseline, after 6 weeks NIV during spontaneous breathing and under NIV. Cardiac output during spontaneous breathing is shown in the filled areas and under NIV in the dashed areas. Data are presented in two groups: (i) patients that started with LI-NIV followed by HI-NIV are shown in *green*, and (ii) patients that started with HI-NIV followed by LI-NIV are shown in *purple*

La dyspnée de déventilation lors de BPCO sévère

b



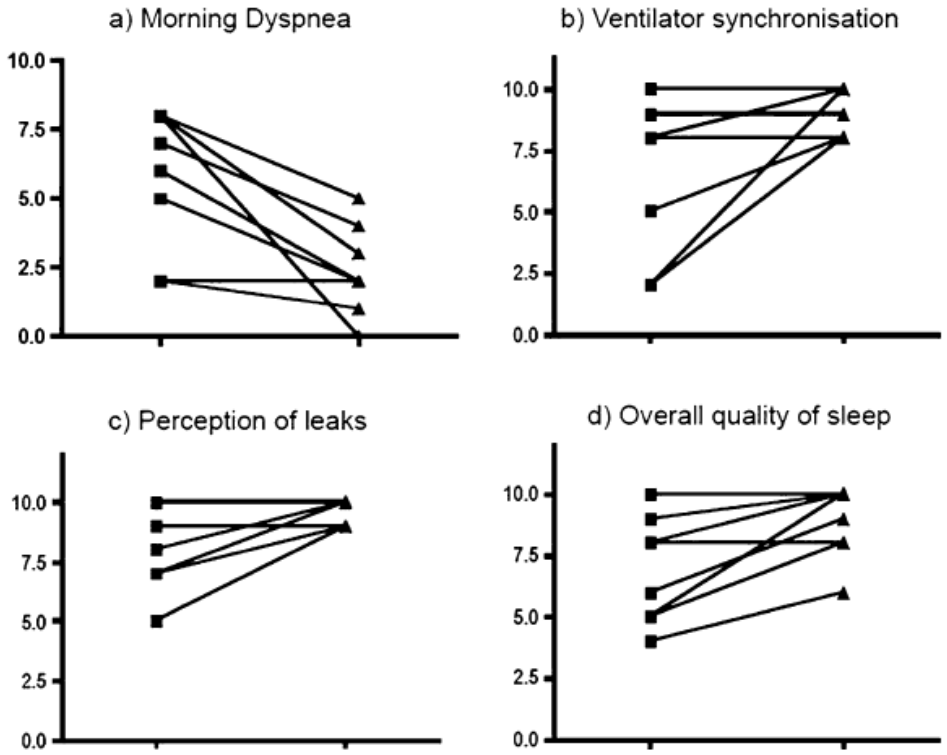
D Adler et al, Sleep Breath 2012

Table 2 Ventilator settings before and after adjustment under PSG

Patients	IPAP (cmH_2O)	EPAP (cmH_2O)	Pressure support (cmH_2O)	Back-up rate (/min)	Time to peak (ms)	TI_{MAX} (s)
Initial ventilator settings						
1	22	5	17	13	100	1.2
2	18	6	12	14	100	1.2
3	18	6	12	14	100	1.2
4	19	5	14	14	100	1.2
5	16	4	12	12	100	1.5
6	19	4	15	14	100	1.4
7	18	5	13	14	100	1.1
8	22	8	14	14	100	1.3
Mean	19	5.4	13.6	13.6	100	1.26
SD	2.1	1.3	1.8	0.7	0	0.13
Adjusted ventilator settings						
1	17	5	12	13	200	1.2
2	17	6	12	14	200	1.1
3	14	5.4	8.6	14	150	1.3
4	15	6	9	19	150	1.1
5	14	6	8	16	150	1.1
6	16	4	12	14	150	1.4
7	18.6	9	9.6	19	200	1.1
8	20	9	11	17	200	1.2
Mean	16.5*	6.3***	10.3**	15.8***	175**	1.19***
SD	2.1	1.8	1.7	2.4	26.7	0.11

FEV$_1$ Forced expiratory volume in 1 s, *TLC* total lung capacity, *RV* residual volume, *IPAP* inspiratory positive airway pressure, *EPAP* expiratory positive airway pressure, *RR* respiratory rate, TI_{MAX} maximal inspiratory time

*p=0.04; **p<0.0005; ***p = NS, *P* values for paired *t* tests comparing baseline vs. adjusted ventilator settings



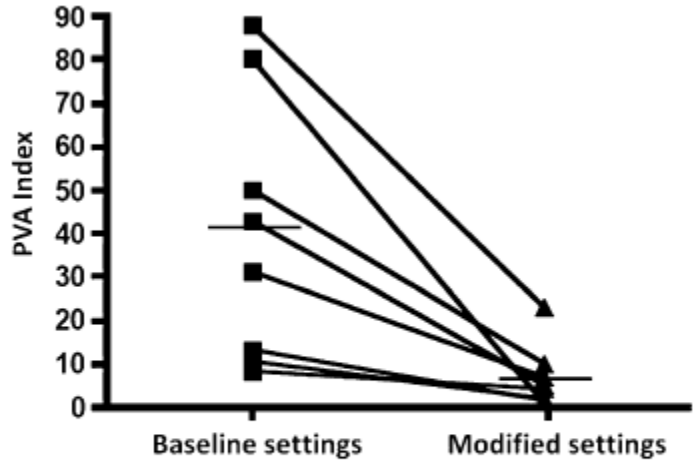
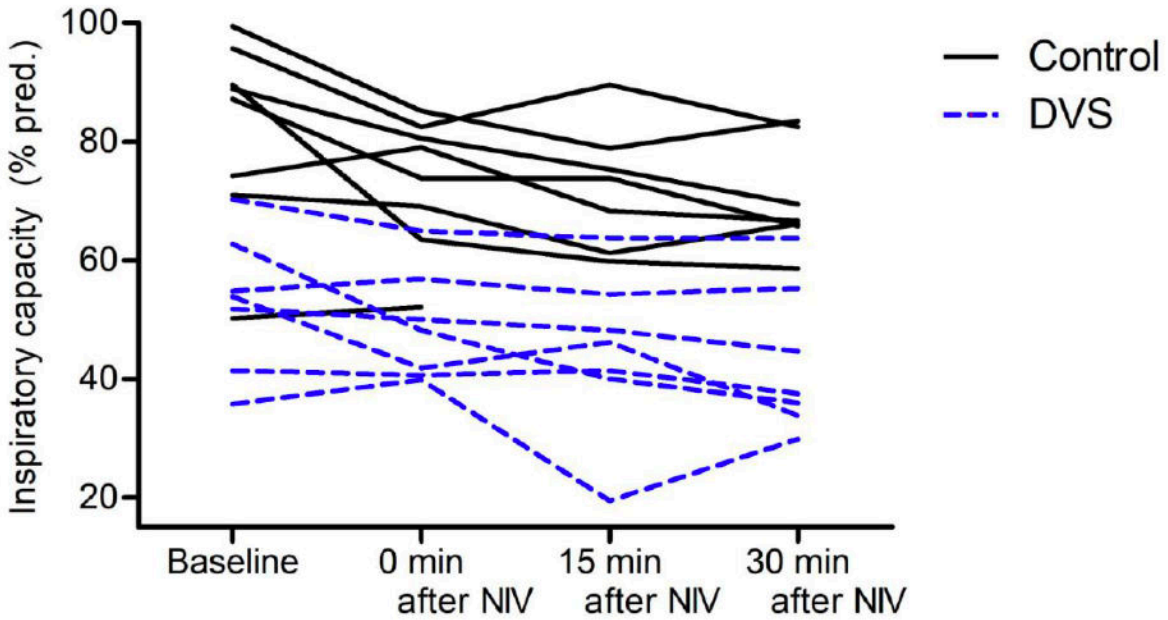


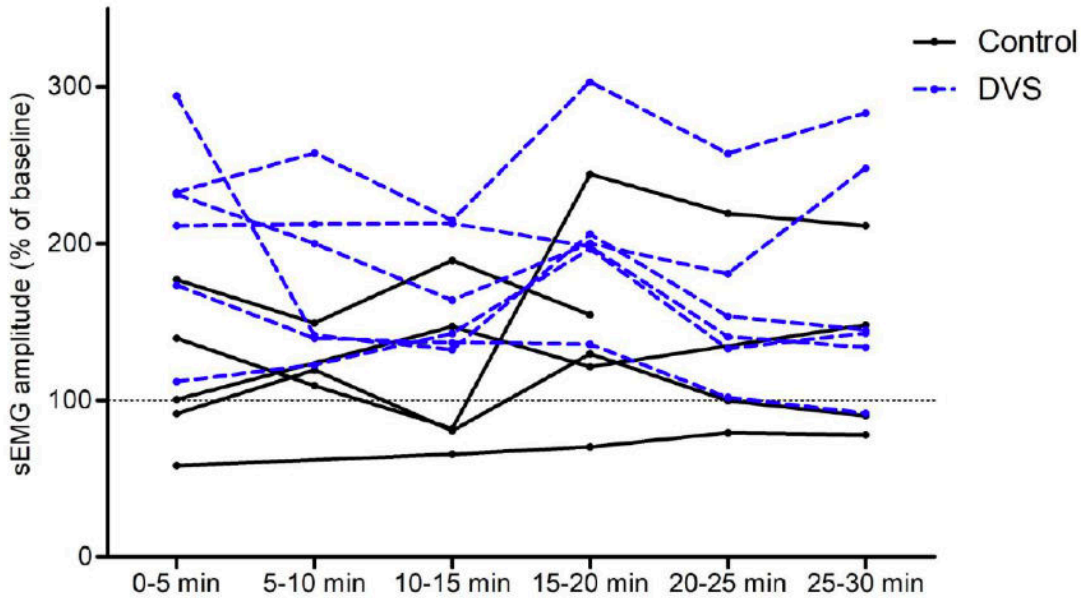
Fig. 2 Patient–ventilator asynchrony index (PVA index: total time spent with unrewarded efforts/total sleep time) for each patient before and after NIV adjustment with polysomnography

D Adler et al, Sleep Breath 2012

Deventilation syndrome in patients with chronic obstructive pulmonary disease using nocturnal non-invasive ventilation: what are the underlying mechanisms?

Elshof J, Oppersma E, Wisse JJ, Bladder G, Meijer PM, Torres A, Wijkstra PJ, Duiverman ML





Conclusion

This study suggests that it is unlikely that DVS originates from the inability to create diaphragmatic muscle activity after NIV. Instead, NIV-induced hyperinflation in individuals with static hyperinflation may play a significant role. Addressing hyperinflation holds promise in preventing DVS symptoms in COPD patients.

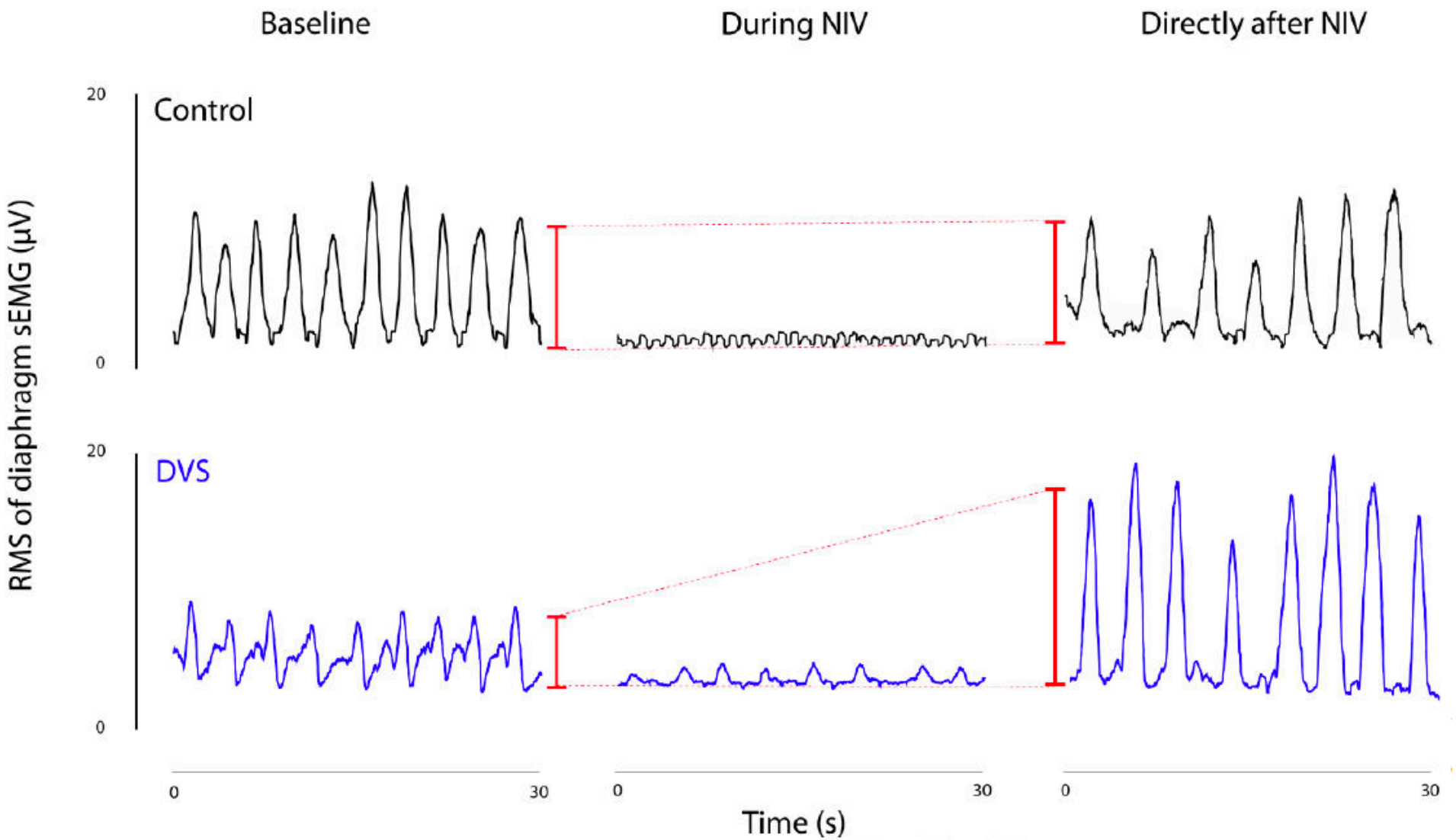

Baseline
During NIV
Directly after NIV
Control
DVS
20
0
20
0
RMS of diaphragm sEMG (µV)
0
30
0
30
0
30
Time (s)

Table 1 Characteristics of study participants

	Controls (n=9)	DVS patients (n=7)	p value
Baseline			
Sex (n, % female)	5 (55.6%)	5 (71.4%)	0.633
Age (years)	65 [64 – 71]	62 [59 – 66]	0.174
BMI (kg/m²)	26.8 [21.7 – 35.0]	26.8 [22.5 – 32.1]	1.000
Smoking status			
Active smoker (n, %)	2 (22.2%)	1 (14.3%)	1.000
Packyears	38.5 [27.8 – 56.8]	32.0 [15.0 – 55.0]	0.397
Lung function			
FEV1 (%pred.)	21 [16 – 35]	30 [18 – 35]	0.536
FEV1/FVC (%)	28 [25 – 31]	33 [26 – 39]	0.174
TLC (%pred.)	132 [123 – 140]	132 [102 – 134]	0.536
RV (%pred.)	184 [166 – 212]	237 [153 – 263]	0.351
RV/TLC (%)	58 [54 – 66]	65 [55 – 69]	0.397
ABG before start NIV			
$PaCO_2$ (kPa)	7.2 [6.8 – 8.4]	7.0 [6.9 – 7.6]	0.918
bicarbonate (mmol/L)	32.0 [30.5 – 37.0]	35.0 [31.0 – 38.0]	0.681
ABG after start NIV			
$PaCO_2$ (kPa)	6.2 [5.9 – 6.9]	6.7 [5.8 – 7.1]	0.867
bicarbonate (mmol/L)	30.0 [27.8 – 32.5]	32.0 [28.0 – 33.0]	0.613
Specifics of non-invasive ventilation			
Duration of NIV (months)	12.0 [4.8 – 27.3]	24.5 [12.0 – 51.0]	0.351
Settings			
IPAP (cmH_2O)	25.0 [22.0 – 26.0]	23.0 [21.0 – 27.0]	0.837
EPAP (cmH_2O)	6.0 [4.5 – 8.0]	6.0 [5.0 – 9.0]	0.758
BURR (min^{-1})	12.0 [10.5 – 14.0]	14.0 [10.0 – 14.0]	0.681
Oxygen treatment			
During daytime (L/min)	1.0 [0.5 – 1.5]	1.0 [0.0 – 2.0]	0.837
During NIV (L/min)	1.0 [1.0 – 2.5]	1.5 [1.0 – 2.0]	0.758

Accepted Manuscri

Table 4 Inspiratory capacity measurements (both in Liters and percentage of predicted) during the study

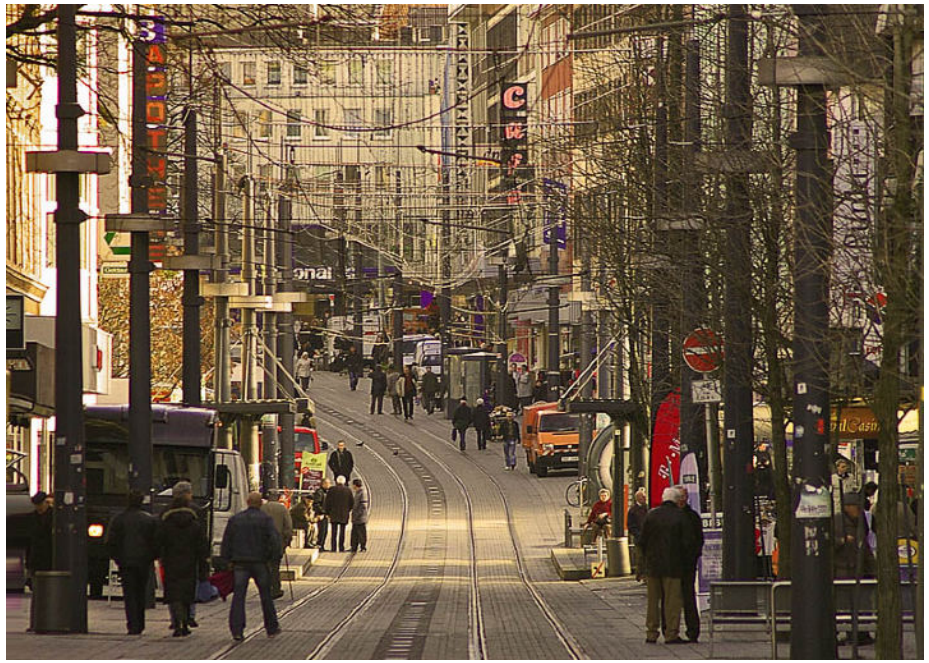
		Controls (n=8)	DVS patients (n=7)	p value
Baseline	*L*	1.7 [1.4 – 2.1]	1.1 [0.9 – 1.6]	0.054
	% pred.	88 [72 – 94]	54 [41 – 63]	0.006
After afternoon sleep with NIV				
At 0 minutes	*L*	1.5 [1.4 – 2.0]	1.1 [1.0 – 1.5] *(n=6)*	0.059
	% pred.	76 [65 – 82]	45 [40 – 59] *(n=6)*	0.005
At 15 minutes	*L*	1.4 [1.3 – 1.9] *(n=7)*	1.1 [0.8 – 1.4]	0.026
	% pred.	74 [61 – 79] *(n=7)*	46 [40 – 54]	0.002
At 30 minutes	*L*	1.5 [1.2 – 1.9] *(n=7)*	1.0 [0.8 – 1.1]	0.007
	% pred.	67 [66 – 82] *(n=7)*	38 [34 – 55]	0.001

Notes: Results are presented as median [Q1 – Q3]. One control patient was unable to conduct inspiratory capacity measurements due to severe dyspnea resulting from the use of the nose clip.

Abbreviations: DVS, deventilation syndrome; NIV, non-invasive ventilation.

Interfaces and ventilator settings for long-term noninvasive ventilation in COPD patients

Jens Callegari[1]
Friederike Sophie Magnet[1]
Steven Taubner[1]
Melanie Berger[2]
Sarah Bettina Schwarz[1]
Wolfram Windisch[1]
Jan Hendrik Storre[3,4]



International Journal of COPD 2017:12 1883–1889

Table 2 Ventilation settings and interfaces

Variable	N=123
IPAP (mbar)	23.2±4.6
EPAP (mbar)	5.8±1.3
BR/minute	16.7±2.4
PSV (%)	52.8 (65)
aPCV (%)	47.2 (58)
Full-face mask	77.2 (95)
Nasal mask	22.8 (28)
Active exhalation valve	32.5 (40)
Active humidification	87.0 (107)
NIV compliance (hours/day)	6.5 (121)

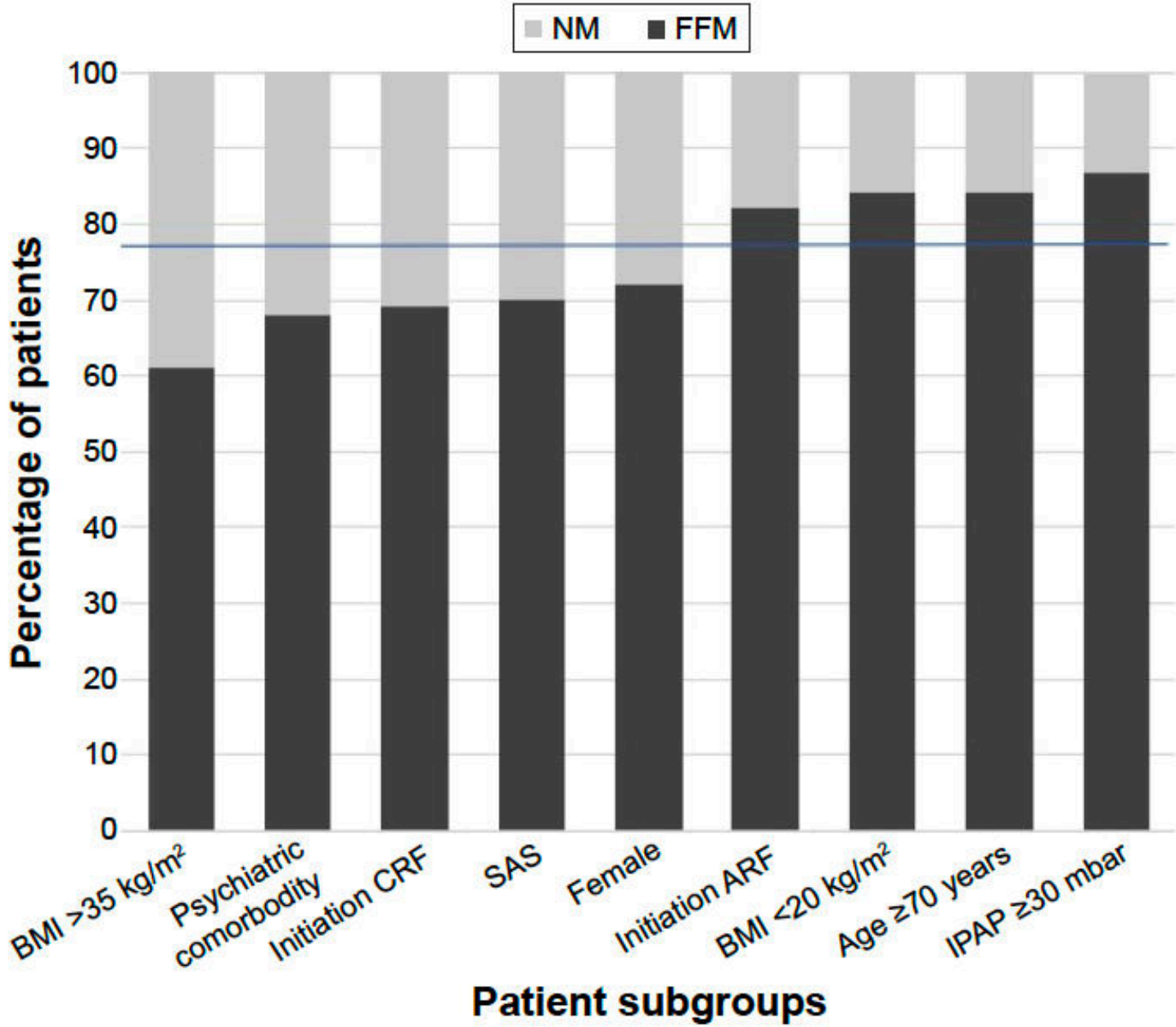
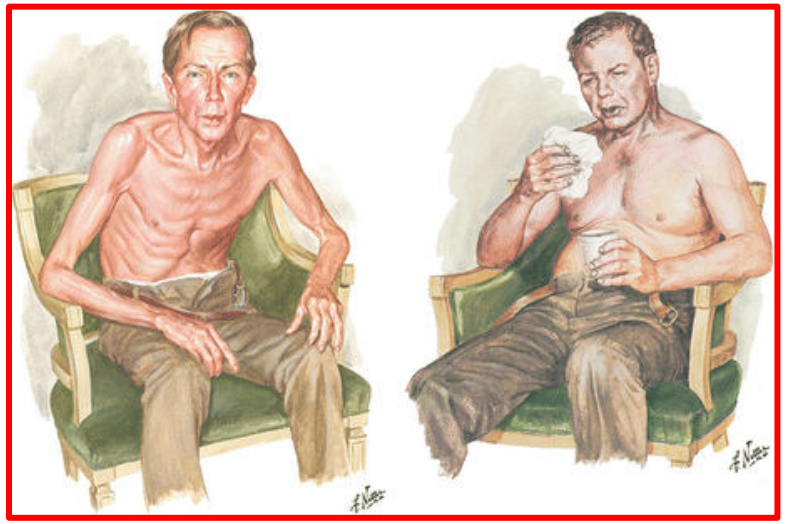


Figure 2 Distribution of oro-nasal masks (FFMs, dark gray) and NMs (light gray) in different subgroups of patients.

BPCO et ventilation noninvasive au long cours:

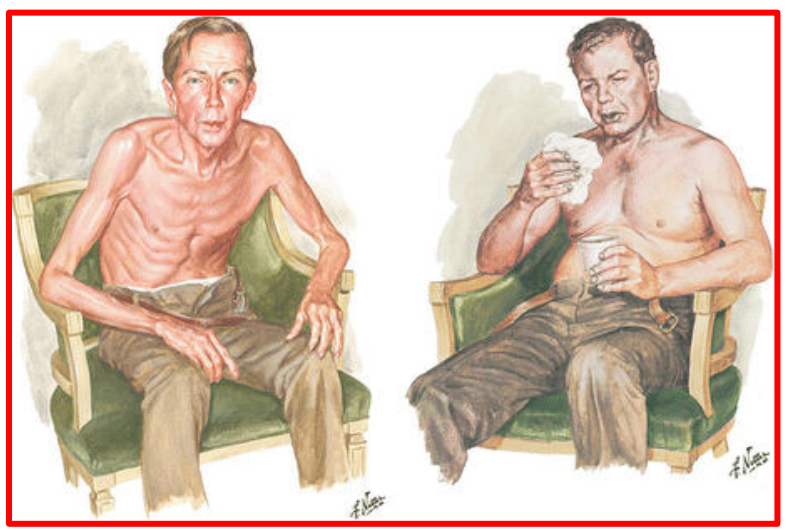
les phenotypes ont-ils un impact sur la survie?

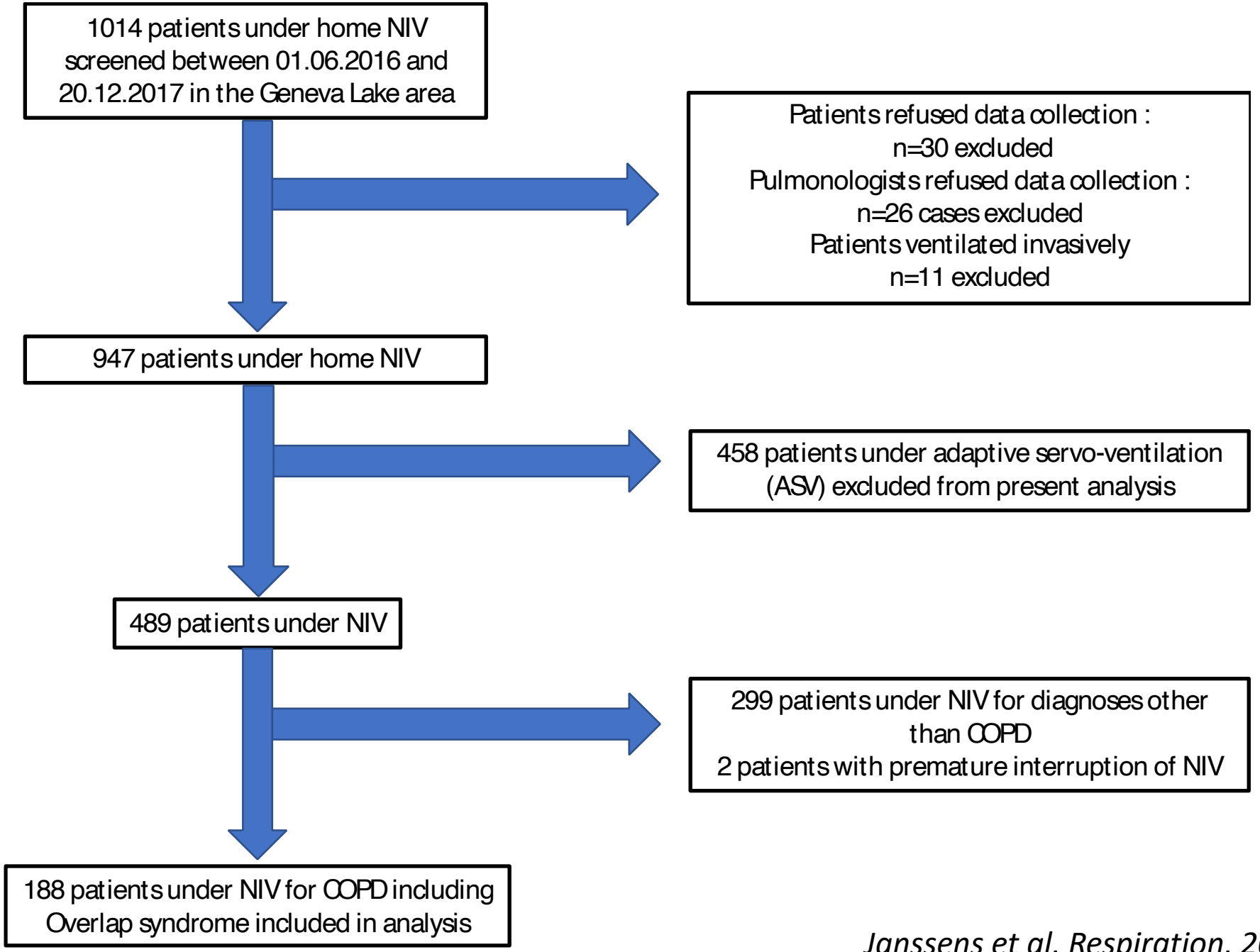


Long-Term Noninvasive Ventilation in Chronic Obstructive Pulmonary Disease: Association between Clinical Phenotypes and Survival

Jean-Paul Janssens[a, b] Chloé Cantero[a] Patrick Pasquina[a] Cyril Jaksic[c]
Dan Adler[a, b] Christophe Uldry[d] Bernard Egger[d] Maura Prella[e]
Alain Bigin Younossian[f] Claudio Rabec[g] Paola M. Soccal Gasche[a, b]
Jean-Louis Pépin[h, i] on behalf of all the investigators of the Geneva Lake Study

Respiration, 2022





Janssens et al, Respiration, 2022

Méthodes

- Analyse en classes latentes («Latent class analysis»);
- Régression logistique permettant de classer les patients selon les phénotypes établis
- Comparaison entre groupes des variables sélectionnées
- Analyse comparative de la survie des n groupes (extension de l'observation des patients de la «Geneva Lake Study» sur un minimum de 2 ans ; courbes de Kaplan Meier et «log-rank test»)
- Analyse de risques compétitifs («Competitive risk analysis») pour comparer la part respective des décès et des autres causes d'arrêt de la VNI

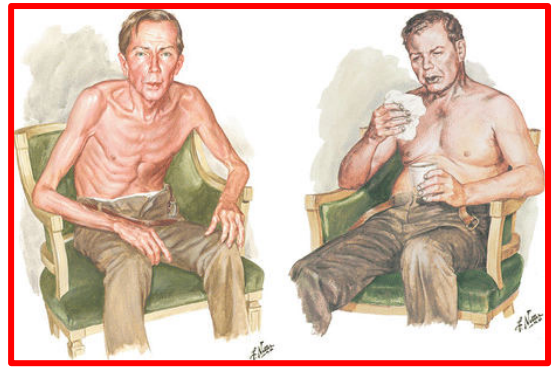
Table 1. Characteristics of study population (all COPD, "systemic COPD" and "respiratory COPD" phenotypes)

	All COPD	"Systemic COPD"	"Respiratory COPD"	*p* value*
Patients, *n* (%)	*n* = 188 (100)	*n* = 104 (55)	*n* = 84 (45)	
Age, median (IQR), years	72 (66–79)	72 (64–79)	72 (68–77)	0.427
Gender (female), *n* (%)	85 (45)	51 (49)	34 (41)	0.305
BMI, median (IQR), kg/m^2	29.1 (22.7–35.9)	34.7 (29.5–39.7)	23.3 (20.1–27.7)	<0.001
Diagnosis, *n* (%)				
Overlap syndrome	54 (29)	42 (40)	12 (15)	<0.001
COPD without documented overlap syndrome	134 (71)	62 (60)	72 (85)	
Pulmonary function tests, median (IQR)				
FEV_1 (% predicted)	35 (24–51)	49 (40–60)	23 (19–29)	<0.001
FVC (% predicted)	66 (52–74)	73 (64–83)	51 (43–65)	<0.001
FEV_1/FVC (% predicted)	60 (45–78)	75 (55–84)	49 (38–64)	<0.001
Duration of LTNIV at inclusion, median (IQR), months	27 (12–57)	33 (16–64)	19 (8–41)	<0.001
Comorbidities, *n* (%)				
Obesity	88 (47)	76 (73)	12 (14)	<0.001
Systemic hypertension	135 (72)	91 (87)	44 (52)	<0.001
Dyslipidemia	82 (44)	56 (54)	26 (31)	0.003
Diabetes	41 (22)	35 (34)	6 (7)	<0.001
Chronic heart failure	44 (23)	28 (27)	16 (19)	0.274
Cerebrovascular disease	14 (7)	7(7)	7 (8)	0.891
Anxiety and/or depression disorder	97 (52)	41 (40)	56 (67)	<0.001
Pulmonary hypertension	51 (27)	21 (20)	30 (36)	0.027

Table 3. Outcome of COPD patients under NIV according to attribution of phenotype ("systemic COPD" vs. "respiratory COPD") 5 years after implementation of NIV

Phenotype	Systemic COPD	Respiratory COPD	*p* value
Patients, *n* (%)	*n* = 104 (55)	*n* = 84 (45)	
Five years after implementation of NIV, % (95% CI)			
Probability of pursuing NIV	72.7 (64.4–82.1)	47.9 (38.0–60.3)	<0.001*
Probability of death	22.3 (15.4–32.2)	47.2 (37.4–59.6)	0.001**
Probability of interrupting NIV for other causes	5.0 (2.1–11.8)	4.9 (1.9–12.7)	0.631*

COPD, chronic obstructive pulmonary disease; NIV, noninvasive ventilation; 95% CI, 95% confidence interval.
* *p* value for the log-rank test and ** for competitive risk analysis.



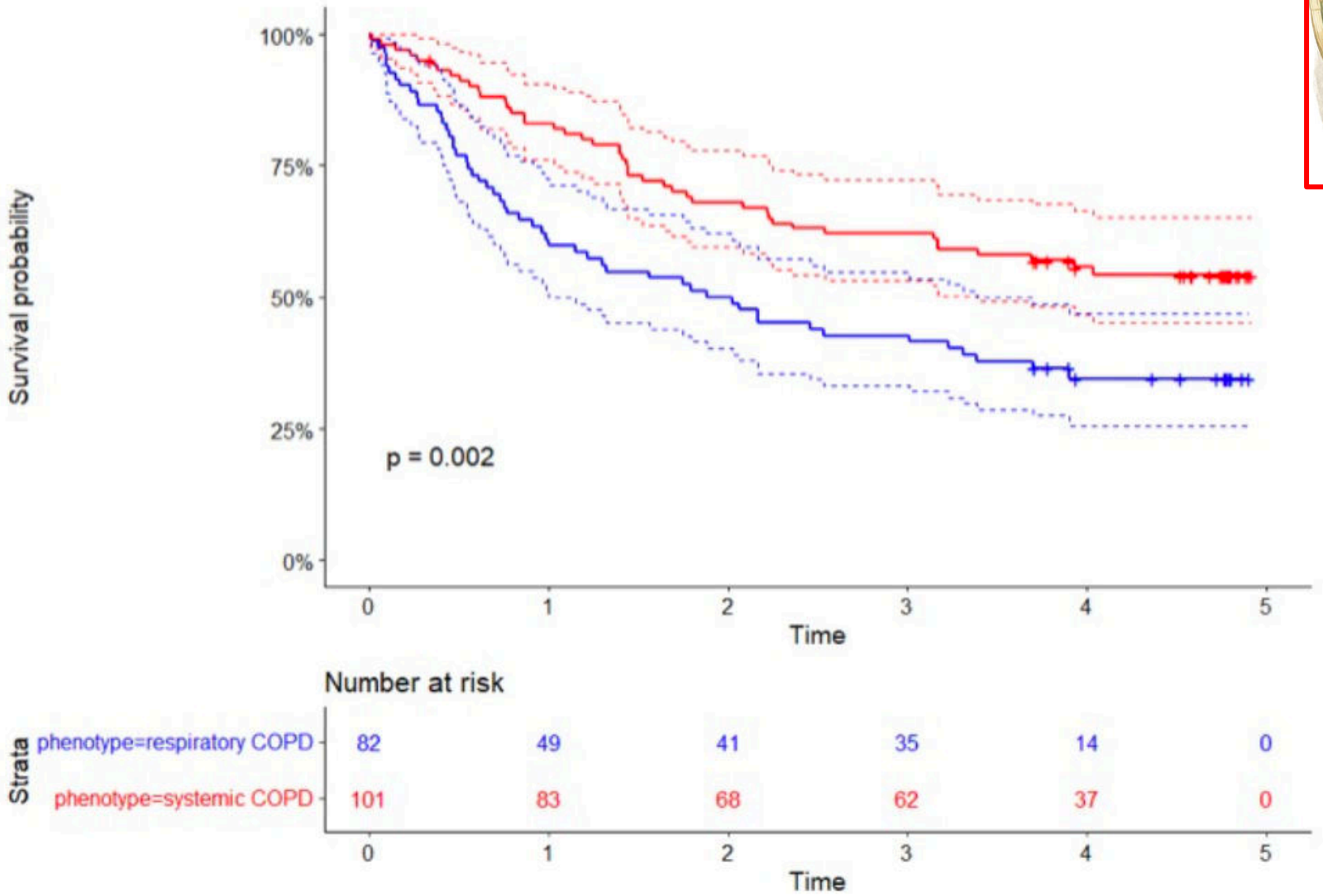


Figure 2S: Probability of pursuing LTNIV as of date of inclusion in study, according to attribution to phenotype ("Systemic COPD", in red; "Respiratory COPD", in blue) and 95% confidence intervals. For causes of cessation of LTNIV, see table 1. P value refers to Log Rank test.

Conclusions de l'analyse des phenotypes de BPCO sous VNI

- Sur la base d'un large collectif de sujets BPCO en état clinique stable sous VNI au long cours, 2 phénotypes ont pu être identifiés (BPCO «respiratoire» vs «systémique») par analyse en classes latentes
- Une régression logistique permet de classifier les patients dans l'une de ces 2 catégories avec un niveau de performance élevé (97%) . L'équation a été validée dans un collectif de 348 patients au Portugal*
- L'appartenance à l'un ou l'autre de ces phénotypes est associé à une différence significative en termes de suivie.
- Cette analyse doit être validée dans d'autres collectifs afin d'en confirmer la pertinence clinique

* C Ribeiro et al, 2024, version révisée soumise

Health trajectories before initiation of non-invasive ventilation for chronic obstructive pulmonary disease: a French nationwide database analysis

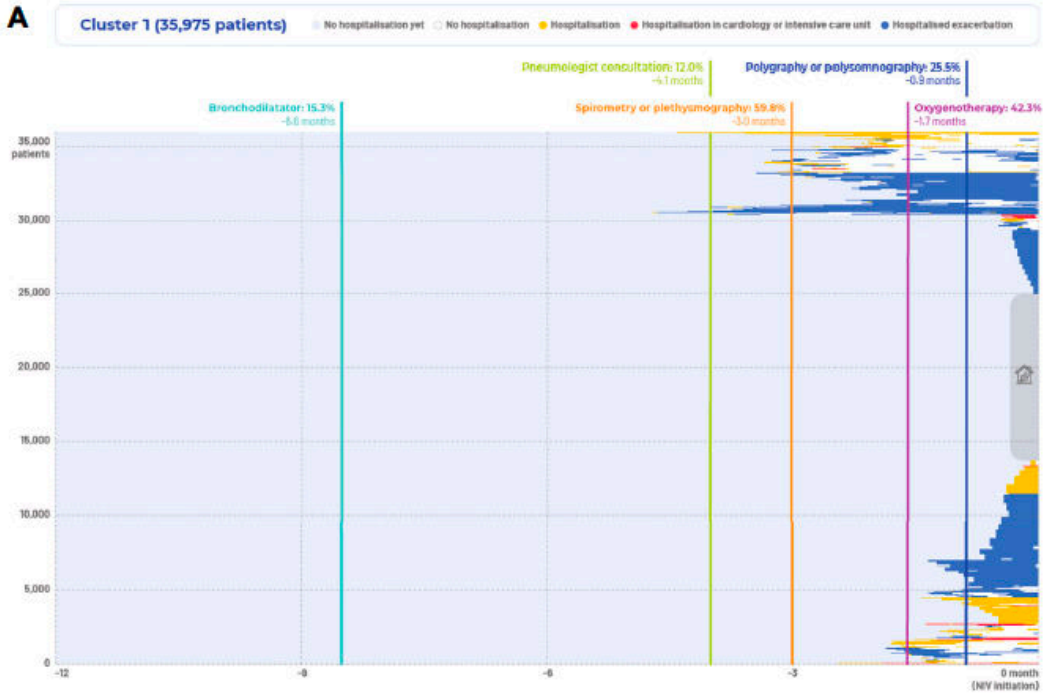
Jean-Louis Pepin,[a,*] Pauline Lemeille,[b] Hélène Denis,[b] Anne Josseran,[c] Florent Lavergne,[c] Arnaud Panes,[b] Sébastien Bailly,[a] Alain Palot,[d] and Arnaud Prigent,[e] on behalf of the medXcloud group

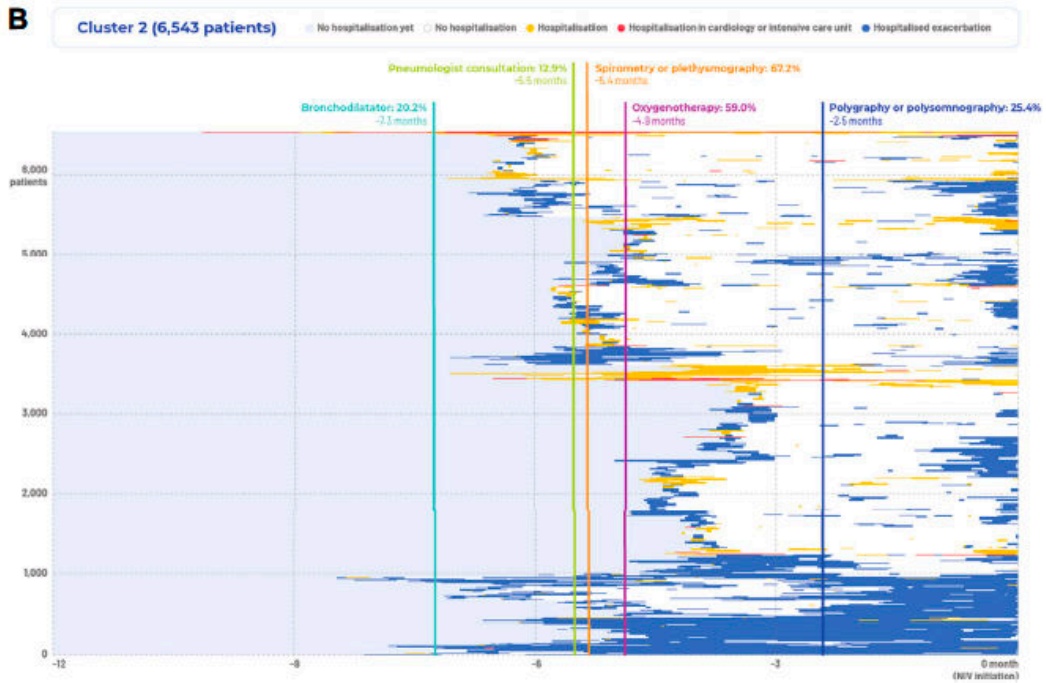
	Participants (n = 54,545)
Age, years	70 (62, 79)
Male sex, n (%)	27,920 (51)
Number of exacerbations requiring hospitalisation in the year before NIV initiation	1 (0, 2)
Duration of hospitalisation during AECOPD, days	11 (6, 20)
Medical history within the previous 5 years, n (%)	
Undernutrition	15,140 (28)
Morbid obesity	25,158 (46)
Sleep apnoea	18,309 (34)
Hypertension or cardiovascular disease	41,262 (76)
Diabetes	16,137 (30)
Psychiatric diseases, anxiety or depression	20,338 (37)
Charlson comorbidity index n (%)	
0	3889 (7)
1–2	42,572 (78)
3–4	7591 (14)
≥5	493 (1)

Values are median (interquartile range) or number of patients (%). AECOPD, acute exacerbation of chronic obstructive pulmonary disease; NIV, non-invasive ventilation.

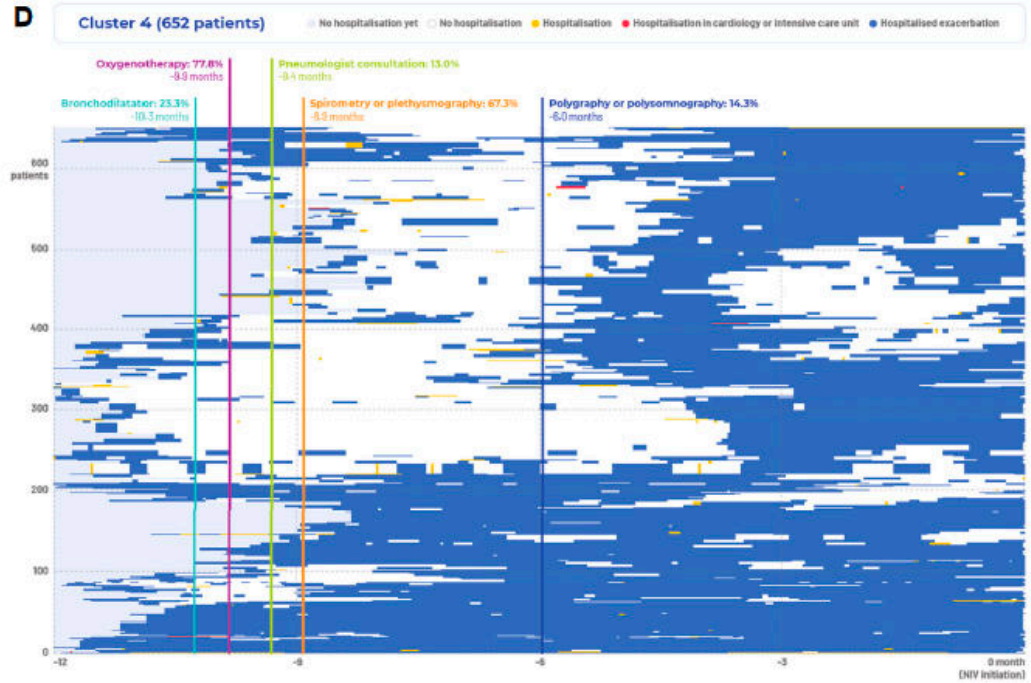
Table 1: **Baseline demographics and characteristics of the study population.**

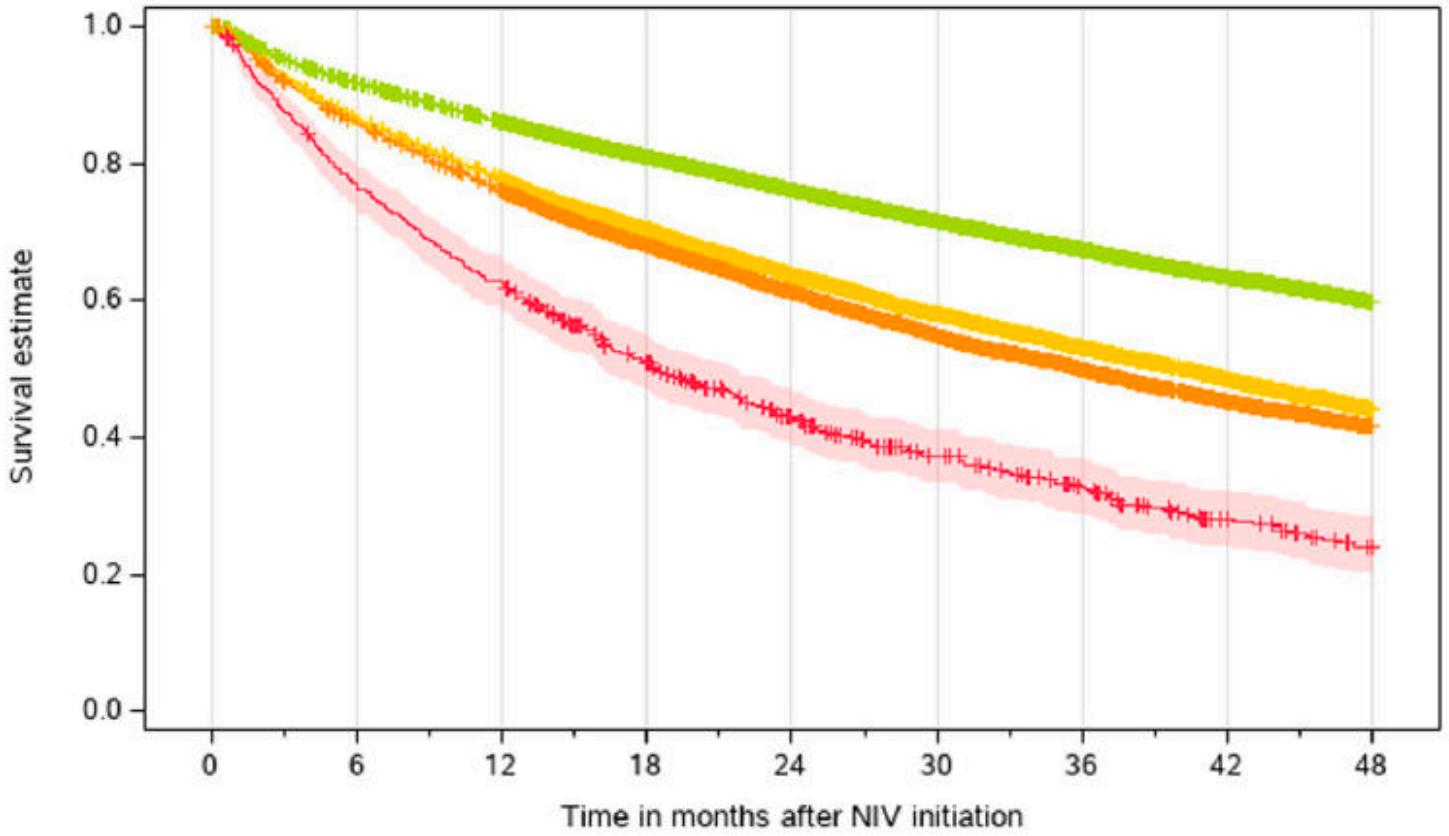
The largest group of individuals in this study were grouped into Cluster 1 (two-thirds of the total sample), and were started on NIV in ambulatory settings or after the first hospitalisation for a severe acute event/exacerbation. These individuals were younger, had fewer comorbidities, were less likely to be undernourished, and were more likely to have undergone evaluations to detect sleep-disordered breathing. It could be hypothesised that the latter indicates an endotype with obesity (or sarcopenia obesity). The large number of patients in Cluster 1 who were started on NIV within a few weeks after first visiting a respiratory physician provides an indication of the high rates of underdiagnosis of COPD, whereby a significant proportion of individuals living with COPD have not been identified as having the disease.[2] Furthermore, the low rates of bronchodilator use in this cluster likely reflect the fact that a high proportion were diagnosed with COPD just before initiation of NIV and would have had the addition of these medications at a later point in their care pathway.


A
Cluster 1 (35,975 patients)
No hospitalisation yet
No hospitalisation
Hospitalisation
Hospitalisation in cardiology or intensive care unit
Hospitalised exacerbation
Pneumologist consultation: 12.0%
-4.1 months
Polygraphy or polysomnography: 25.5%
-0.9 months
Bronchodilatator: 15.3%
-8.6 months
Spirometry or plethysmography: 59.8%
-3.0 months
Oxygenotherapy: 42.3%
-1.7 months
35,000 patients
30,000
25,000
20,000
15,000
10,000
5,000
0
-12
-9
-6
-3
0 month
(NIV initiation)


B
Cluster 2 (6,543 patients)
No hospitalisation yet
No hospitalisation
Hospitalisation
Hospitalisation in cardiology or intensive care unit
Hospitalised exacerbation
Pneumologist consultation: 12.9%
-5.5 months
Spirometry or plethysmography: 67.2%
-1.4 months
Bronchodilatator: 20.2%
-2.1 months
Oxygenotherapy: 59.0%
-4.9 months
Polygraphy or polysomnography: 25.4%
-2.5 months
6,000 patients
5,000
4,000
3,000
2,000
1,000
0
-12
-9
-6
-3
0 month
(NIV initiation)


C
Cluster 3 (11,375 patients)
No hospitalisation yet
No hospitalisation
Hospitalisation
Hospitalisation in cardiology or intensive care unit
Hospitalised exacerbation
Spirometry or plethysmography: 69.1%
-5.1 months
Bronchodilatator: 22.4%
-9.3 months
Oxygenotherapy: 63.6%
-9.2 months
Pneumologist consultation: 15.7%
-7.2 months
Polygraphy or polysomnography: 25.1%
-3.5 months
10,000 patients
8,000
6,000
4,000
2,000
0
-12
-9
-6
-3
0 month
(NIV initiation)


D
Cluster 4 (652 patients)
No hospitalisation yet
No hospitalisation
Hospitalisation
Hospitalisation in cardiology or intensive care unit
Hospitalised exacerbation
Oxygenotherapy: 77.8%
-9.9 months
Pneumologist consultation: 13.0%
-9.4 months
Bronchodilatator: 23.3%
-10.3 months
Spirometry or plethysmography: 67.3%
-6.9 months
Polygraphy or polysomnography: 14.3%
-6.0 months
600 patients
500
400
300
200
100
0
-12
-9
-6
-3
0 month
(NIV initiation)



At risk									
Cluster 1	35,975	32,929	30,810	26,167	21,295	17,549	13,734	11,010	8,115
Cluster 2	6,543	5,650	5,065	4,038	3,270	2,614	1,999	1,555	1,104
Cluster 3	11,375	9,746	8,612	6,938	5,425	4,200	3,251	2,414	1,720
Cluster 4	652	497	405	303	224	166	120	78	54

***Fig. 3:* Kaplan Meier survival curves by patient cluster.** NIV, non-invasive ventilation.

The Role of High Flow Nasal Therapy in Chronic Respiratory Failure

Emma Gray, FRACP, MPH[a,b,*], Collette Menadue, BAppSc(Phty), PhD[a]

SI



Airvo2 (Fisher & Paykel)



MyAirvo3 (Fisher & Paykel)

Fig. 1. High flow nasal therapy devices. (*A*) Airvo2 (Fisher & Paykel). (*B*) MyAirvo3 (Fisher & Paykel).

- Long term HFNT can reduce COPD exacerbation rates compared to LTOT alone in those with severe COPD and CHRF. This is most likely related to humidification and improved mucociliary clearance.
- HFNT may be an alternative to select patients with CHRF from other causes who are intolerant to NIV and would benefit from improved dead space washout and humidification.

En résumé

- BPCO: groupe étiologique d'importance majeure dans la VNBI au long cours
- Validation récente du bénéfice (EFR, QVLS, hospitalisations, survie..)
- L'aide inspiratoire doit être suffisante pour corriger la capnie ou au moins la diminuer de 20% par rapport à la valeur initiale
- La plupart du temps: VDNP, Mode ST, TI court, montée en pression rapide, cyclage rapide


Merci pour votre attention..!

Table 1. Spirometry and ventilator settings

	COPD	Overlap syndrome	Obesity hypoventilation	Neuromuscular disorders	Restrictive disorders[1]	CSAS
Patients, n	32	29	38	19	21	11
Pulmonary lung functions						
FEV_1 % predicted, %	30 (25–44)	58 (46–66)	75 (62–94)	57 (41–62)	43 (36–67)	87 (80–131)
FVC % predicted, %	59 (51–75)	75 (57–86)	79 (64–94)	53 (37–61)	50 (39–64)	92 (83–125)
FEV_1/FVC	56 (44–62)	81 (76–83)	99 (95–103)	102 (93–116)	94 (86–103)	96 (91–101)
Ventilator settings						
IPAP, cm H_2O	19 (16–22)	20 (18–22)	20 (18–22.5)	14 (13–18)	16 (14–18)	15 (11–16)
EPAP, cm H_2O	5 (5–6)	8 (6–10)	8 (7–10)	4 (4–6)	4 (4–6)	6 (5–8)
Back-up RR, n	14 (13.5–16)	14 (12–15)	14 (12–14)	14 (12–16)	14 (14–16)	14 (12–14)
Time to peak, ms	150 (100–200)	150 (100–200)	150 (100–200)	150 (150–250)	125 (100–250)	150 (150–250)
TI_{min}, s	0.6 (0.5–0.7)	0.8 (0.6–0.8)	0.7 (0.7–0.8)	0.8 (0.7–0.8)	0.7 (0.5–0.8)	0.6 (0.5–0.8)
TI_{max}, s	1.2 (1.1–1.3)	1.4 (1.3–1.6)	1.4 (1.2–1.5)	1.3 (1.1–1.6)	1.5 (1.35–1.6)	1.3 (1.2–1.4)

All values are expressed as medians and interquartile ranges. FEV_1 = Forced expiratory volume in 1 s; FVC = forced vital capacity; TI_{min} and TI_{max} only apply to subjects using ResMed ventilators since Philips Respironics ventilators rely on the automated AutoTrak system (not adjustable). Inspiratory and expiratory triggers (ResMed ventilators) were set at default values (Medium) in 82 and 88%, respectively.

[1] Includes 1 case with diffuse bronchiectasis.

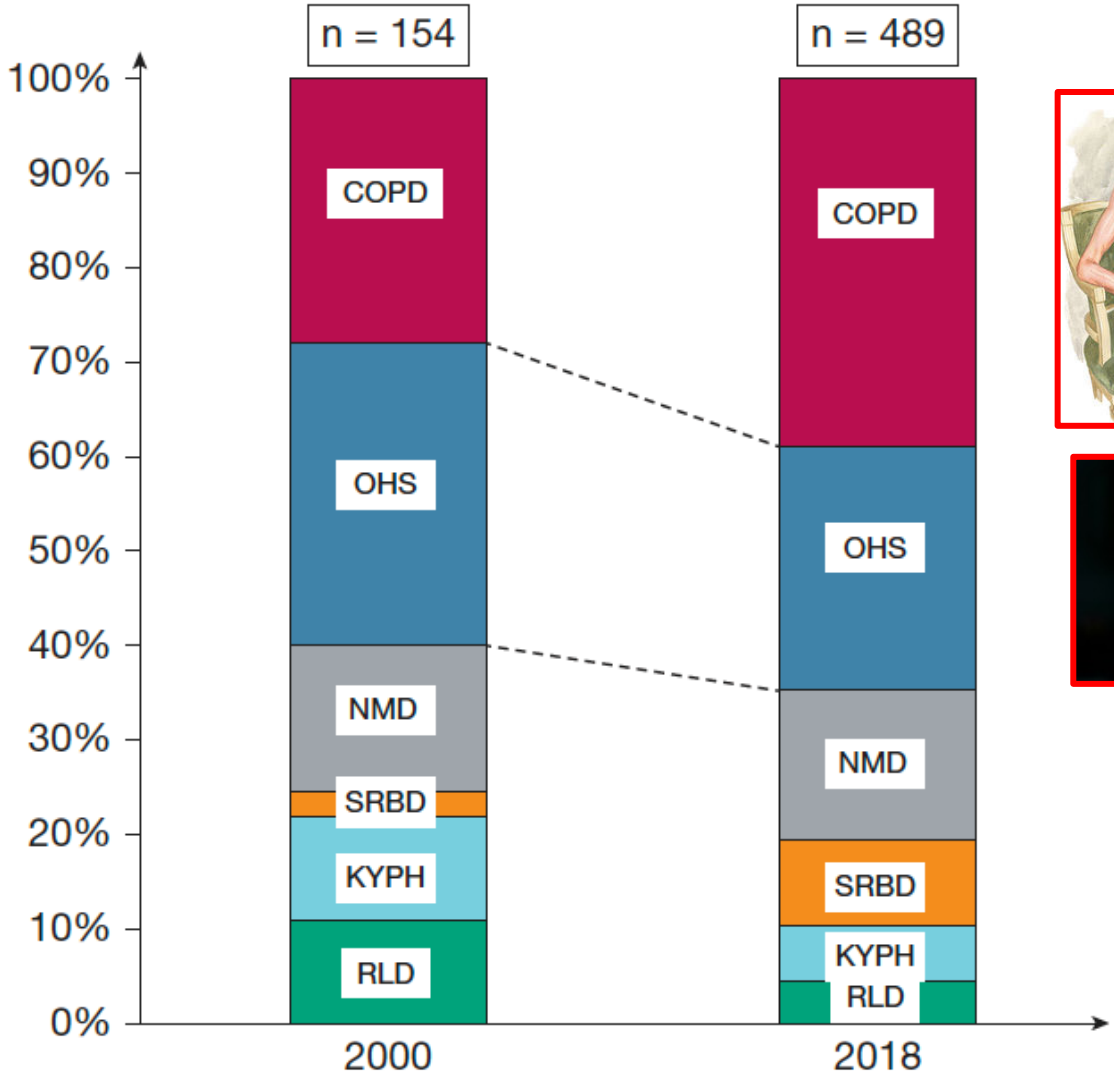
P Pasquina et al; Respirology 2011

TABLE 4] Ventilator Modes, Interfaces, and Other Adjuncts to NIV

Modes, Interfaces and Adjuncts	All Patients	COPD	Overlap Syndrome	Neuromuscular Disorders
No. (%)	489 (100)	135 (28)	55 (11)	79 (16)
Bilevel ventilator modes	479 (98)[a]	135 (100)	55 (100)	71 (90)
Spontaneous/timed mode	407 (83)	115 (86)	46 (84)	63 (80)
iVAPS mode	29 (6)	12 (9)	4 (7)	4 (6)
AVAPS-AE mode	20 (4)	5 (4)	3 (5)	2 (2)
Other modes	19 (4)	2 (1)	2 (4)	1 (1)
Multimodal ventilator modes	11 (2)[b]	...	...	8 (10)[b]
VAC mode	5 (1)	...	...	2 (3)
PC mode	4 (0.8)	...	...	4 (6)
PS mode	1 (0.2)	...	...	1 (1)
Interfaces				
Facial mask	359 (73)	115 (85)	45 (82)	44 (56)
Nasal mask	91 (19)	12 (9)	7 (13)	22 (28)
Nasal pillows	40 (8)	8 (6)	3 (5)	15 (19)
Other adjuncts to NIV				
Oxygen	196 (40)	103 (76)	22 (40)	7 (9)
Humidifier	350 (72)	107 (79)	43 (78)	58 (73)[c]

TABLE 5] Ventilator Settings According to Modes

Settings, AHI, and Compliance	All Patients	COPD	Overlap Syndrome
No. (%)	489 (100)	135 (28)	55 (11)
Bilevel ventilators, ST mode (n = 407)			
IPAP, cm H_2O[a]	18 (16-21)	18 (16-20)	20 (18-22)
EPAP, cm H_2O[a]	7 (5-10)	6 (5-7)	8 (7-10)
BURR, cycles/min[b]	14 (12-17)	14 (12-16)	16 (14-18)
Bilevel ventilators, volume-targeted modes (n = 49)			
ResMed devices	29 (6)	12 (9)	4 (7)[c]
Targeted VA, L/min[d]	5.2 (5.2-5.2)	5.2 (5.2-5.2)	...
Targeted RR, cycles/min[a]	15 (13-15)	15 (13.5-15)	...
Philips Respironics devices	20 (4)	5 (4)	3 (5)[c]
Targeted V_T, mL	500 (500-555)	570 (550-600)	...
Targeted V_T/body weight, mL/kg	5 (4.5-5.9)	5.1 (5-6)	...
Bilevel positive pressure ventilators, ResMed (n = 381; 78% of total) and Lowenstein			
AHI, No./h	1.5 (0.4-4.1)	1 (0.3-3)	2.1 (1.2-5)
Mean daily use, min/d	428 (310-532)	448 (333-549)	428 (376-531)
Bilevel positive pressure ventilators, Philips Respironics devices (n = 87; 18% of tota			
AHI, No./h	3.4 (1.8-9.1)	3.3 (1.5-3.9)	2.6 (1.7-3.3)
Mean daily use, min/d	425 (336-542)	464 (370-567)	503 (377-584)



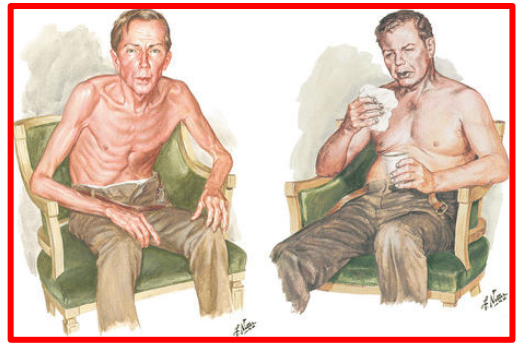




Figure 2 – *Evolution of indications for noninvasive ventilation in the Geneva Lake area between 2000 (n = 154) and 2018 (n = 489). COPD includes overlap syndrome. KYPH = kyphoscoliosis; NMD = neuromuscular disorders; OHS = obesity hypoventilation syndrome; RLD = restrictive lung disorder; SRBD = sleep-related breathing disorders.*

C Cantero, Chest 2020

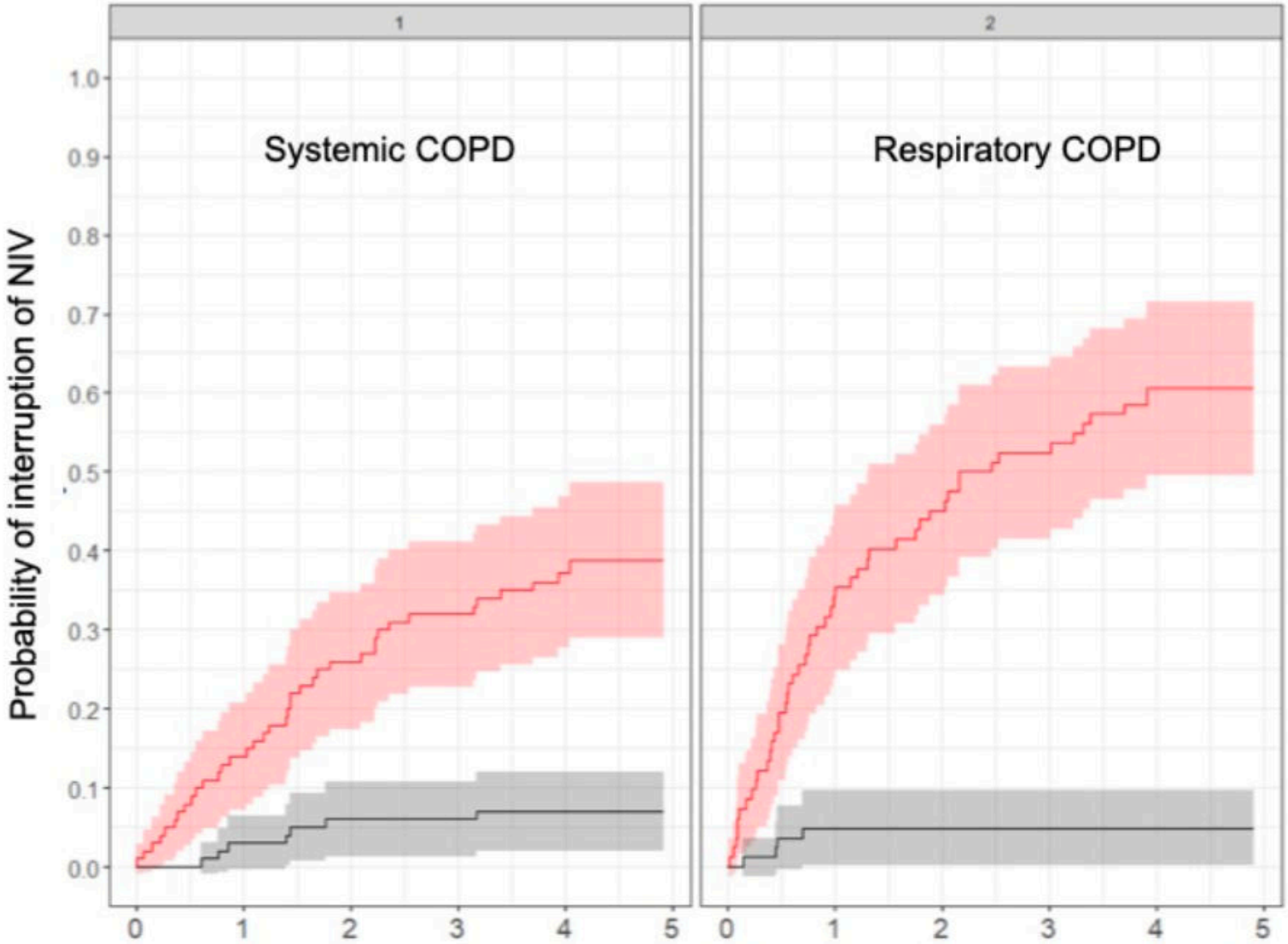


Figure 3S: Competitive risk analysis as of date of inclusion in study, allowing to discriminate between death (red curves) and other outcomes (black curve) for Phenotype 1 (left, "Systemic COPD"), or Phenotype 2 (right, "Respiratory COPD"). Y axis shows probability of either death (red curve) or another event (black curve). Differences for probability of death between both phenotypes is significant (p=0.001), but not for other outcomes (p=0.582).