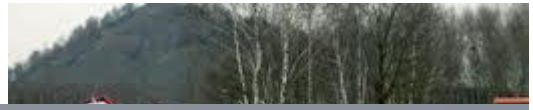
UMC Utrecht

Fit to fly workshop

29 mei 2024

Bart Luijk
Afdeling Longziekten
UMC Utrecht

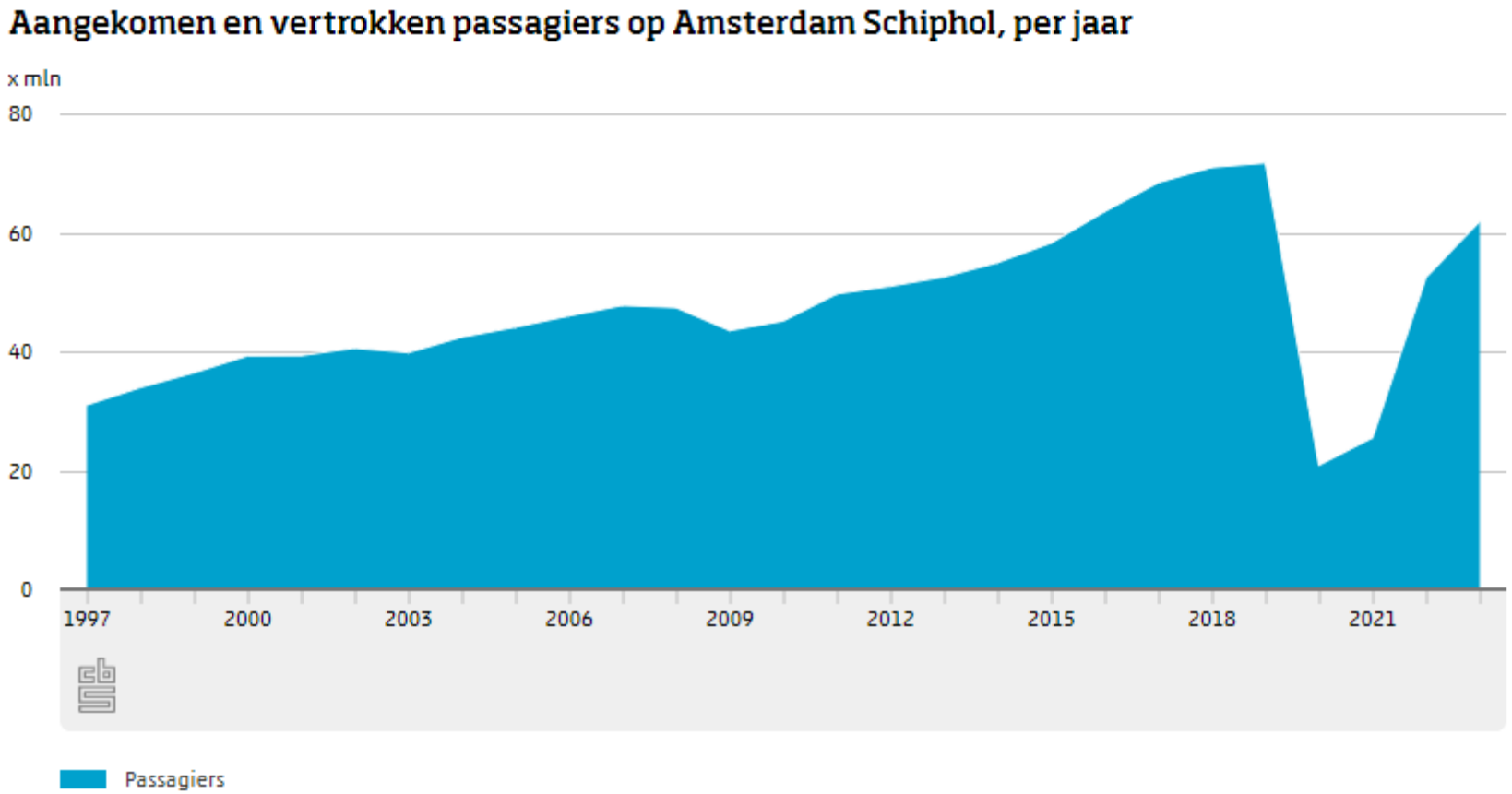
Indicatie Fit to Fly verklaring bij COPD
Wie ?



Workshop Fit to Fly

- Inleiding
- Casuistiek
- Wat gebeurt er tijdens de vlucht ?
- Welke testen heb je nodig ?
- Hoe kan je veilig vliegen met een longziekte?
- Hoe ga je het aanpakken op de polikliniek?
- Algoritme
- Conclusie

Aantal passagiers op luchthaven Schiphol

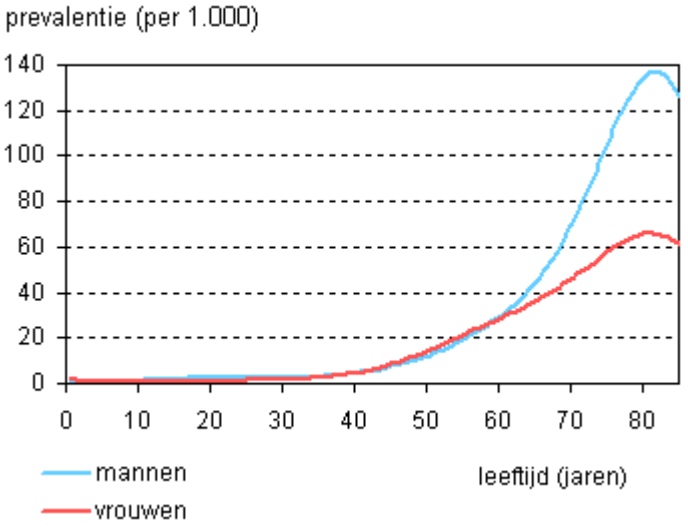


Website CBS

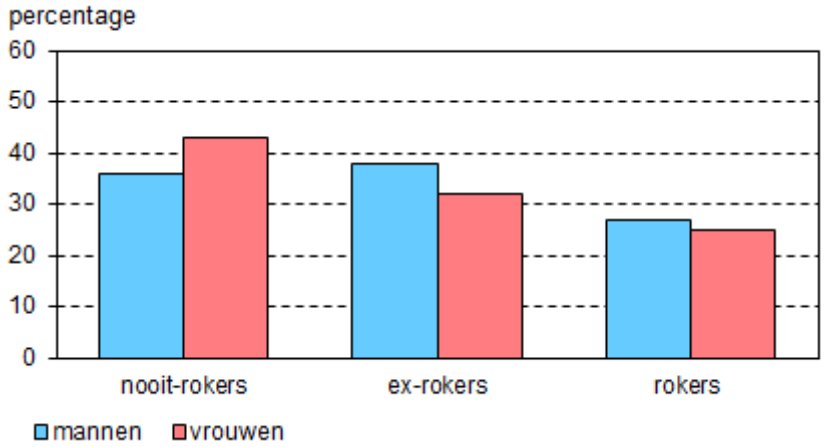
Prevalentie COPD

- Mannen: 2,5 per 1000 mensen
- Vrouwen: 2,0 per 1000 mensen

- Prevalentie:
- 20 per 1000



- Aantal rokers in NL ->26%



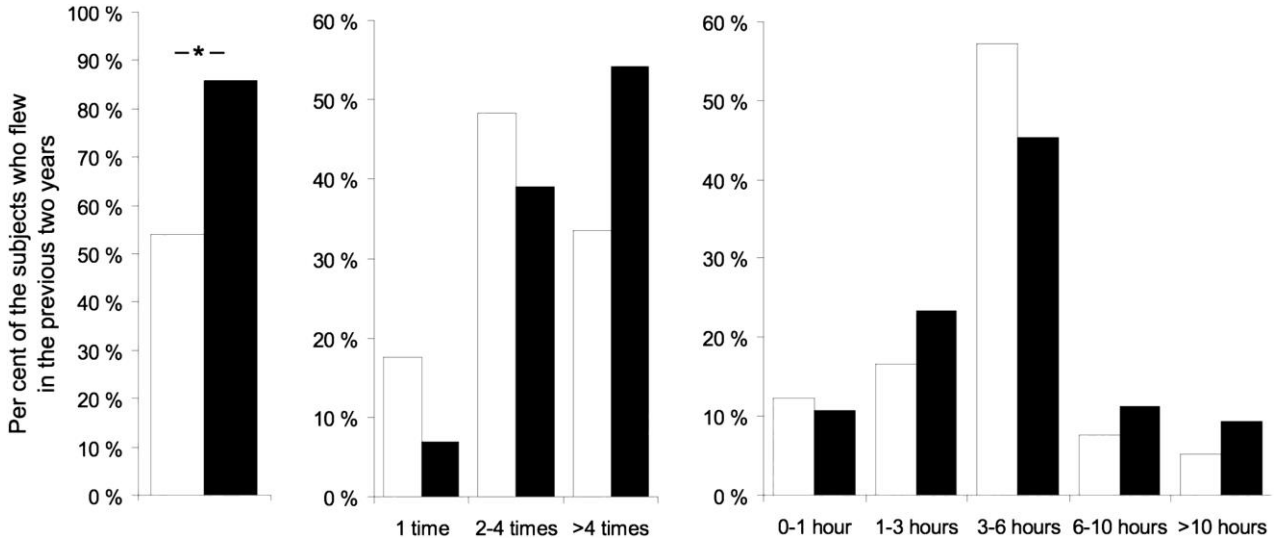
•Geschat aantal mensen met COPD die vliegen? 1.020.000 !

• % gold III-IV (15%-3%) theoretisch: 183.600!

• Aantal rokers op Schiphol: 13.260.000 !

Deels uit gegevens RIVM

COPD patienten en vlieguren



COPD patients

Non COPD patients

Evardsen Resp Med 2011

Indicatie Fit to Fly verklaring
Wie wel en wie niet?

- Fit to fly kunnen we als arts niet afgeven
- Je bent betrokken als hulpverlener bij jouw patient . Ben je wel onafhankelijk?
- Wat gaat de patient op vakantie doen? Is hij over 3 weken ook nog fit?

Fit to fly?

Fit to fly?

Mag ik naar Spanje dokter?
Alstublieft

Flying in a commercial aircraft and cabin pressure

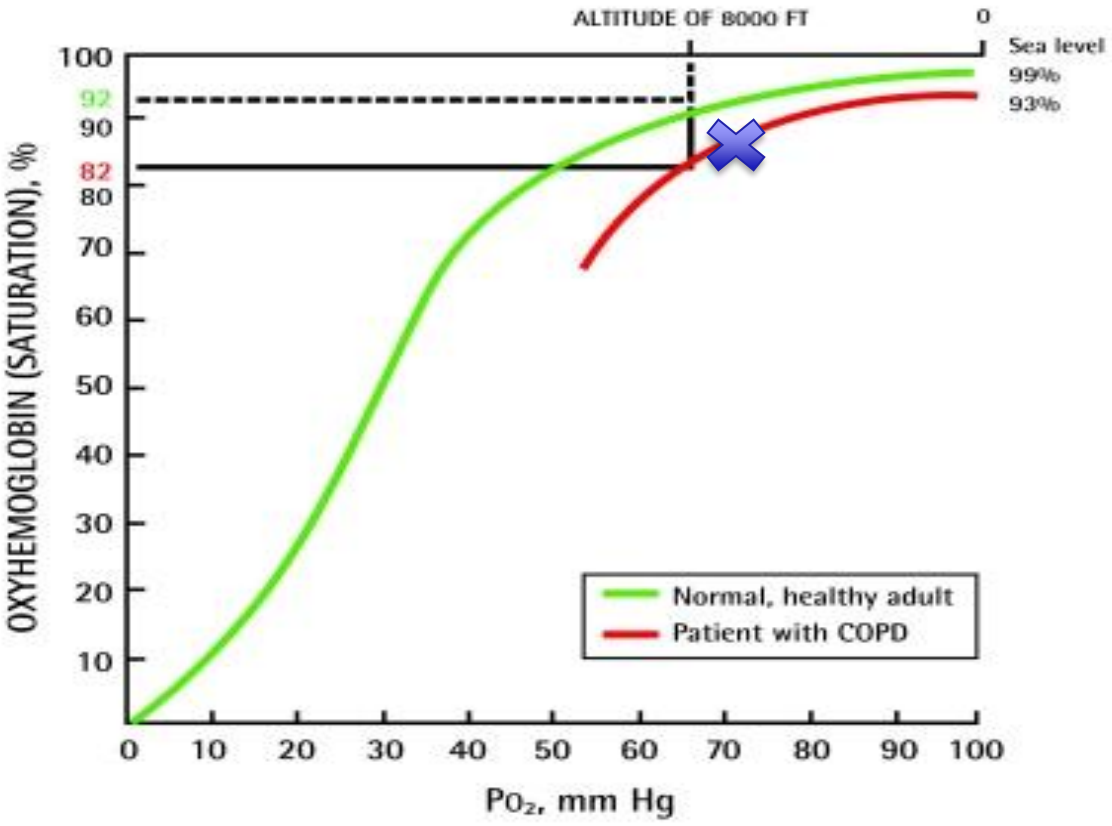
- Flying in a commercial aircraft the cabin pressure is equal to a pressure an altitude of not greater than 2438 m.
- This equal to FiO2 15.1% at sea level
- Decrease of pO2 between van 4-5 kPa (30-40 mmHg),
- Reaction to hypoxemia: hyperventilation (a slight tachycardia, decrease of pCO2)

- Indication for supplemental oxygen when drop in pO2 to:
  - pO2 <6,6kPa (<50mmHg)
  - Of pO2 <7,3kPa (<55mmHg)

(Relatieve) contra-indicaties vliegreizen (NHG-PraktijkWijzer Reizigersadvisering, 2008) , Evardsen et al Resp Med 2011
Ahmedzai et al. Thorax 2011

Oxygen saturation and altitude

Figure 1. Percentage of oxygen saturation at 8000 ft above sea level for a normal, healthy adult and a patient with COPD



COPD—chronic obstructive pulmonary disease.

Carvalho et al, Can Fam Physician 2009

Flying and COPD

pathophysiologic factors that are influenced by hypoxemia and increased cabin pressure

- Change of O2 dissociation curve
- Ventilatie-perfusion mismatch
- Diffusion disturbances
- Degree of ascent
- Durance of flight
- Airway resistance
- Exercise during the flight
- "Gas expansion on ascent and reduction during descent (according to Boyle's law) will cause problems in body cavities where there is air trapping (ie, barotitis, barosinusitis, tension pneumothorax"

Ahmedzai et al. Thorax 2011

Carvalho et al, Can Fam Physician 2009

COPD en coagulation during hypoxemia on high altitude

- increase in TAT ($P < .001$), F(1 + 2) ($P < .01$), and IL-6 ($P < .01$), whe
- Thus infla

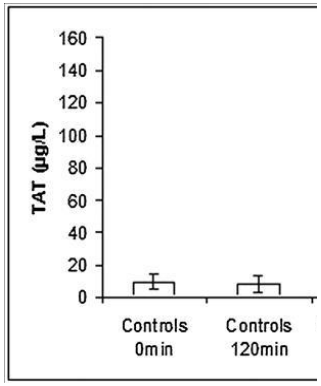
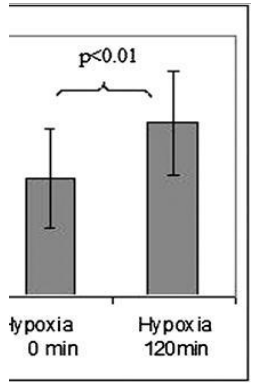


Table 1 Summary of risk factors for VTE during air travel

Risk status	Risk factors	Advice
All passengers	Low	Avoid excess alcohol and caffeine-containing drinks Remain mobile/exercise legs
Moderate risk	Examples include: Aged over 60 Extensive varicose veins Recent minor surgery Pregnancy	Above plus consider: Take short periods of sleep Support hosiery/graduated compression stockings
High risk	Examples include: Previous VTE (and not on current anticoagulation) Thrombophilia Within 6 weeks of major surgery Current malignancy	If travel is essential, consider: low-molecular-weight heparin or formal anticoagulation (including return journey) This requires careful clinical assessment

VTE, venous thromboembolism.



TAT :thombin-antithrombin complex
F(1+2) : pro-thrombine activation fragments

Sabit et al Chest 2010

COPD related problems and risk factors

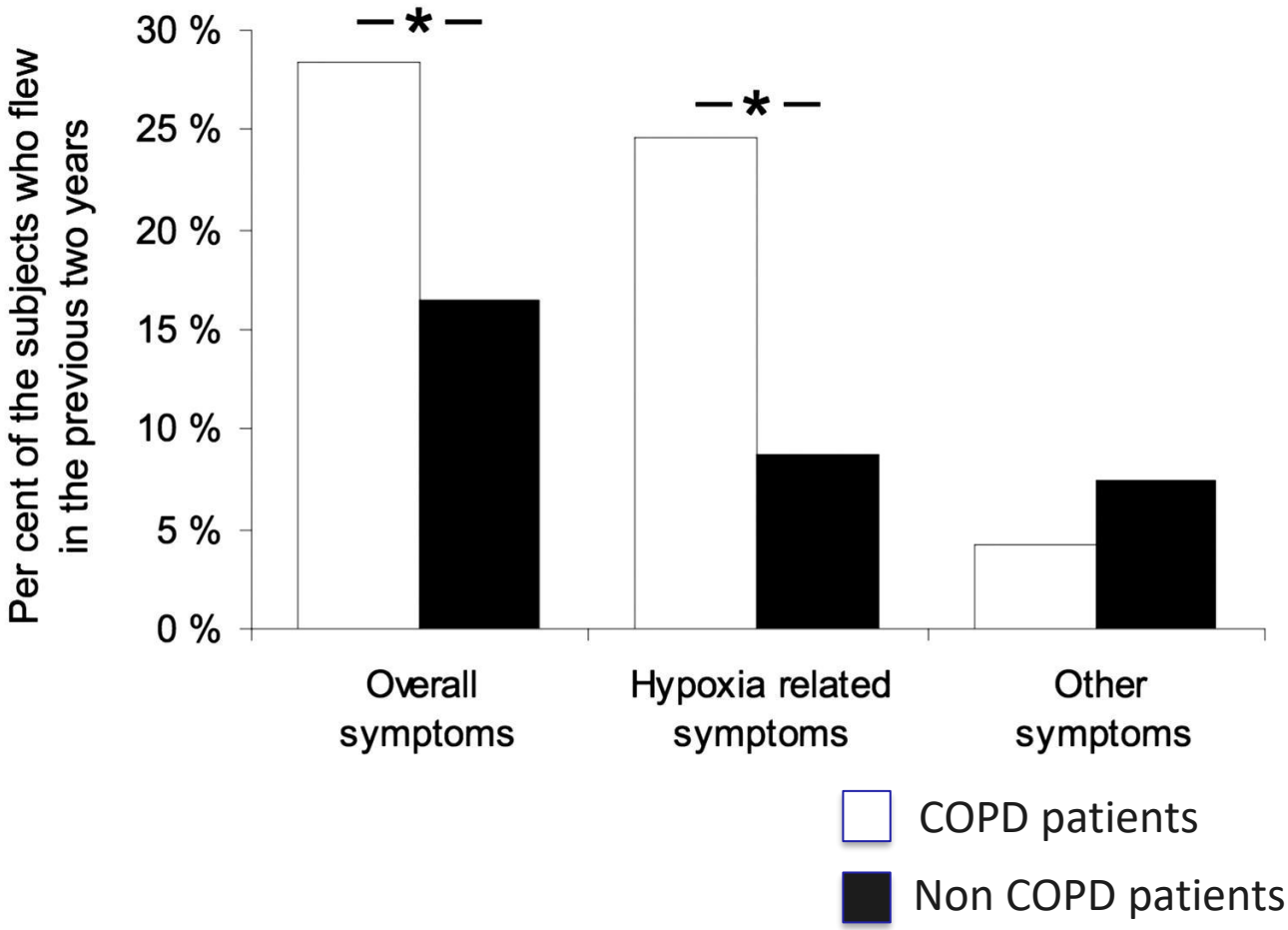
and effect on flying on high altitude

- Hypo-/hyperventilation
- Hypercapnia
- Dysregulated breathing
- Airway hyperresponsiveness
- Pulmonary hypertension
- combined COPD/OSAS syndrome

BTS guidelines Thorax 2002

Ahmedzai et al. Thorax 2011

Respiratory symptoms during flight



Evardsen Resp. Med 2011

Which symptoms?

	COPD patients *n* = 211	Subjects without COPD *n* = 159	*p*
Dyspnea	31 (14.7)	2 (1.3)	<0.001
Air hunger *	24 (11.4)	4 (2.5)	0.001
Cough	10 (4.7)	3 (1.9)	0.140
Headache	10 (4.7)	6 (3.8)	0.651
Dizziness	8 (3.8)	1 (0.6)	0.084
Palpitations	5 (2.4)	2 (1.3)	0.703
Chest pain	3 (1.4)	0 (0.0)	0.263
Fainting	1 (0.5)	1 (0.6)	~1

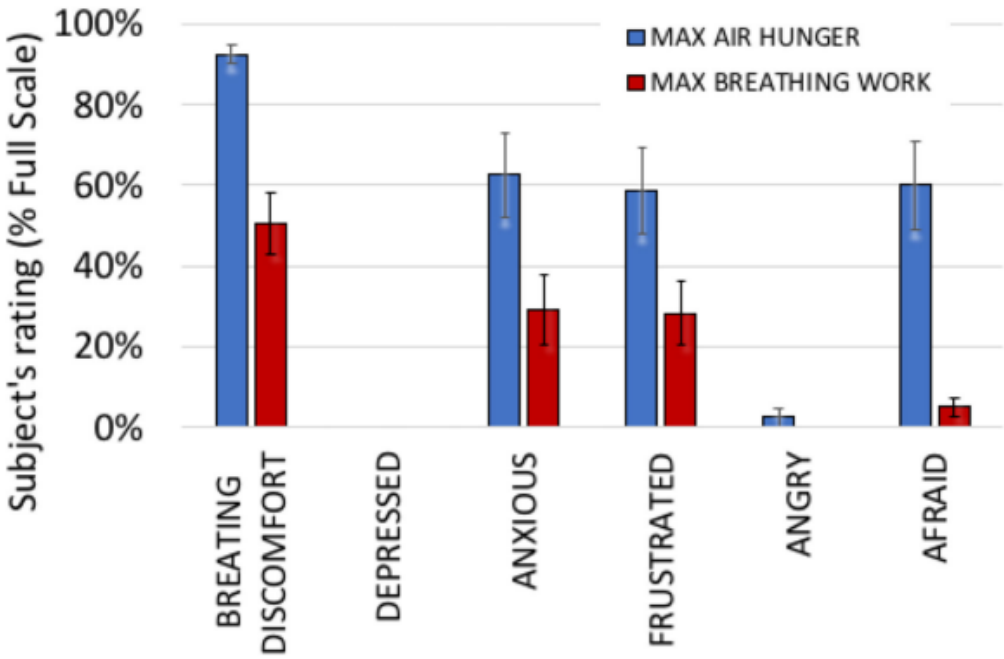
* Air hunger= the urge to breath, sensation of not being able to get enough air to breathe comfortably

Almost 50% of the patients in one recent study reported respiratory symptoms.
Previous studies reported 18–21% respiratory symptoms.

Evardsen Resp. Med 2011, ERJ2013

Air hunger

- a primal sensation, alerts us to a failure to meet an urgent homeostatic need maintaining gas exchange.
- Stimuli that increase air hunger include hypercapnia, hypoxia, exercise, and acidosis; tidal expansion of the lungs reduces air hunger



Banzett al Compr Physiol 2021

Relation symptoms with pulmonary function test or other parameters

	n	Had dyspnea and air hunger *n* = 44	n	Did not have dyspnea and air hunger *n* = 167	p
Sex, M/F	44	22/22	167	102/65	0.228
Age, yrs	44	61.2 (6.8)	167	62.1 (6.7)	0.885
FEV_1, % of predicted	44	46.2 (13.1)	167	48.9 (12.3)	0.197
*D*L,CO, % of predicted	38	56.8 (15.0)	151	62.5 (18.4)	0.077
RV/TLC, %	37	46.9 (7.5)	144	45.2 (7.9)	0.258
Blood gases and pulse oximetry					
Pa,O_2, kPa	42	9.4 (1.0)	162	9.5 (1.0)	0.746
Sp,O_2, %	42	95.4 (2.4)	157	95.5 (2.3)	0.688
6 min walk test	41		147		
Distance, m		435 (102)		466 (97)	0.077
End exercise Sp,O_2, %		90.7 (5.9)		92.4 (4.3)	0.039
MRC Dyspnea scale	43		151		0.001
Stage 0		3 (7)		32 (21)	
Stage 1		13 (30)		74 (49)	
Stage 2		18 (42)		34 (23)	
Stage 3		5 (12)		9 (6)	
Stage 4		4 (9)		2 (1)	

Evardsen Resp. Med 2011

Casus 1,2 en 3

Fit to fly?

- 71 jarige man COPD gold III/E en lobectomie 2012 LBK ivm NSCLC, wordt snel hypoxisch bij inspanning, soms wat drukkend gevoel ook op de borst bij inspanning als hij kortademig wordt.
- De cardioloog vond zijn pulmonaal druk wat aan de hoge kant.
- Geen 02 gebruik

Fit to fly?

- 79 jarige man, COPD gold III /E, 02 gebruik 1L/min , snel kortademig als hij opstaat al.
- 4 weken geleden opname longaanval
- inhalatie techniek lukt moeizaam

Mag ik naar Spanje dokter?
Alstublieft

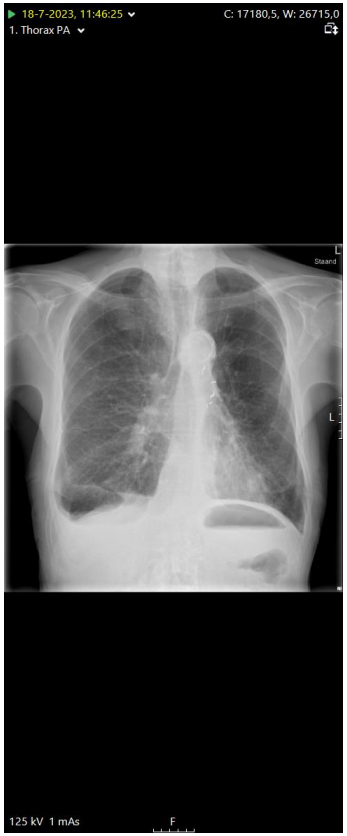
- 72 jarige vrouw, COPD gold III/E. 02 gebruik 1L/min thuis
- 6 weken geleden pneumonie gehad met opname.
- Herstelt langzaam, weinig kracht. Gaat al beter, maar nu wil ze naar haar dochter die gaat trouwen in Torremolinos over 3 weken

Casus 1

- 71 jarige man COPD gold III/E en lobectomie 2012 LBK ivm NSCLC wordt kortademig bij inspanning, soms wat drukkend gevoel ook op de borst bij inspanning als hij kortademig wordt.
- De cardioloog vond zijn pulmonaal druk wat aan de hoge kant.

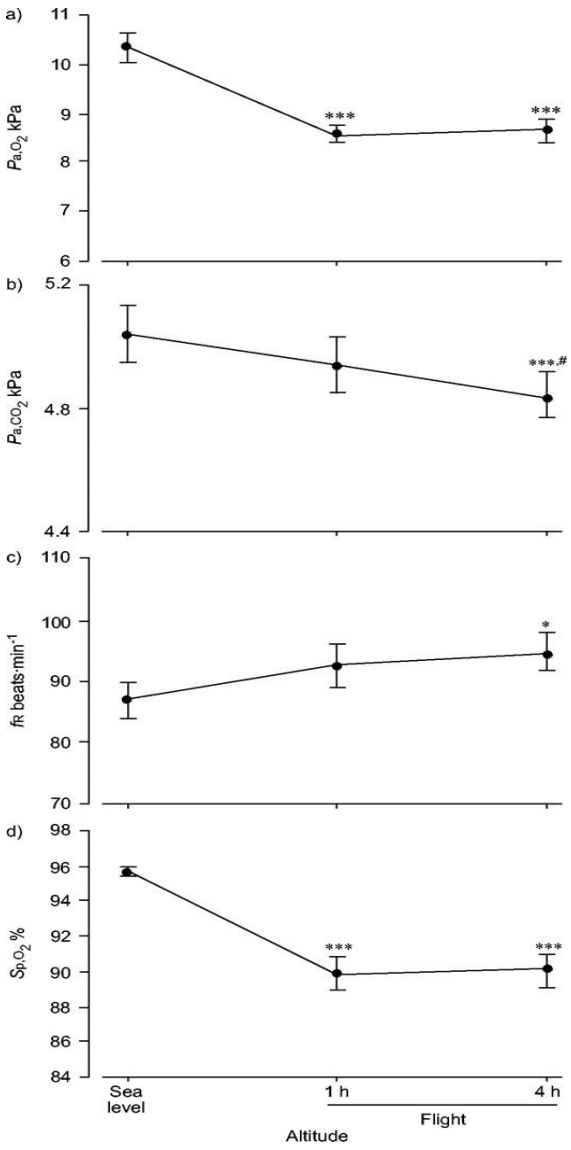
Uitslagen:

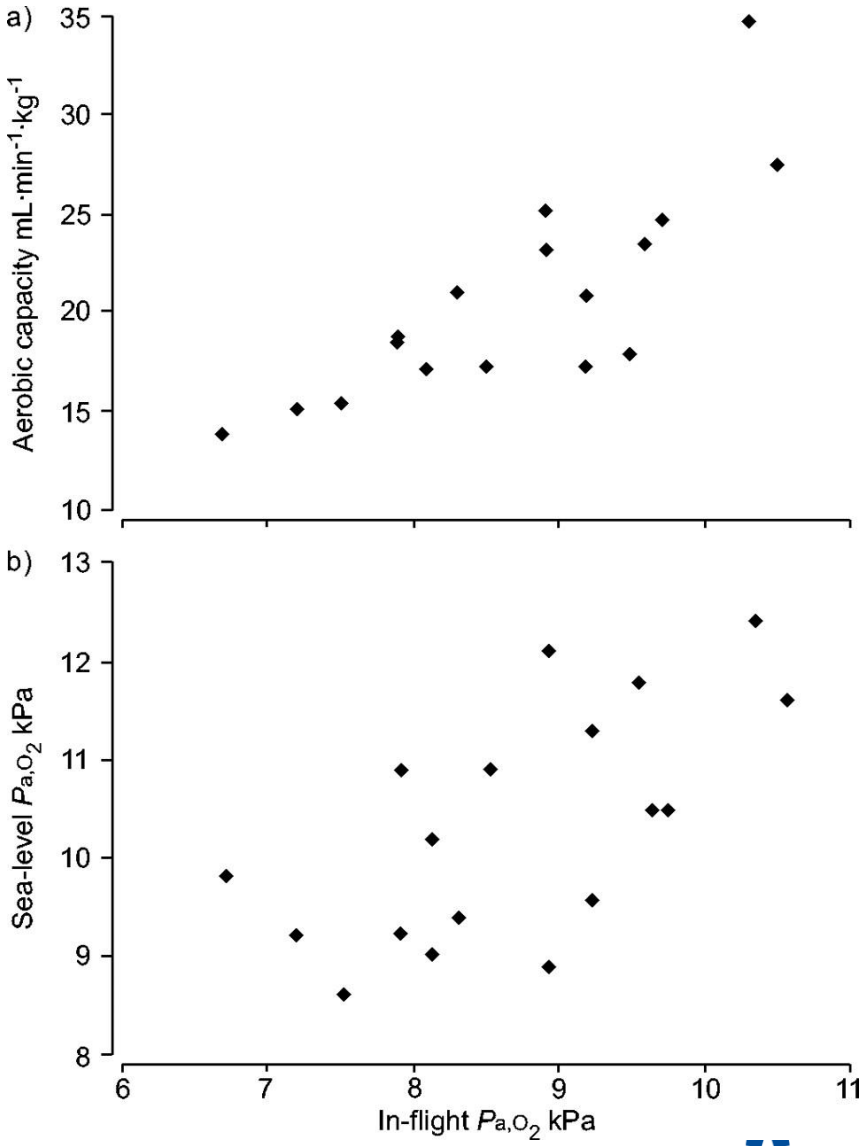
- Longfunctie: FEV1 1,39L 48% Tiff index 35% TLC 125%, RV/TLC 131%
- Saturatie 93% in rust
- Bij inspanning snel kortademig
- Echo cor: LVF goed, RVSP 35mmHg



Fit to fly?

What's happening during the flight?

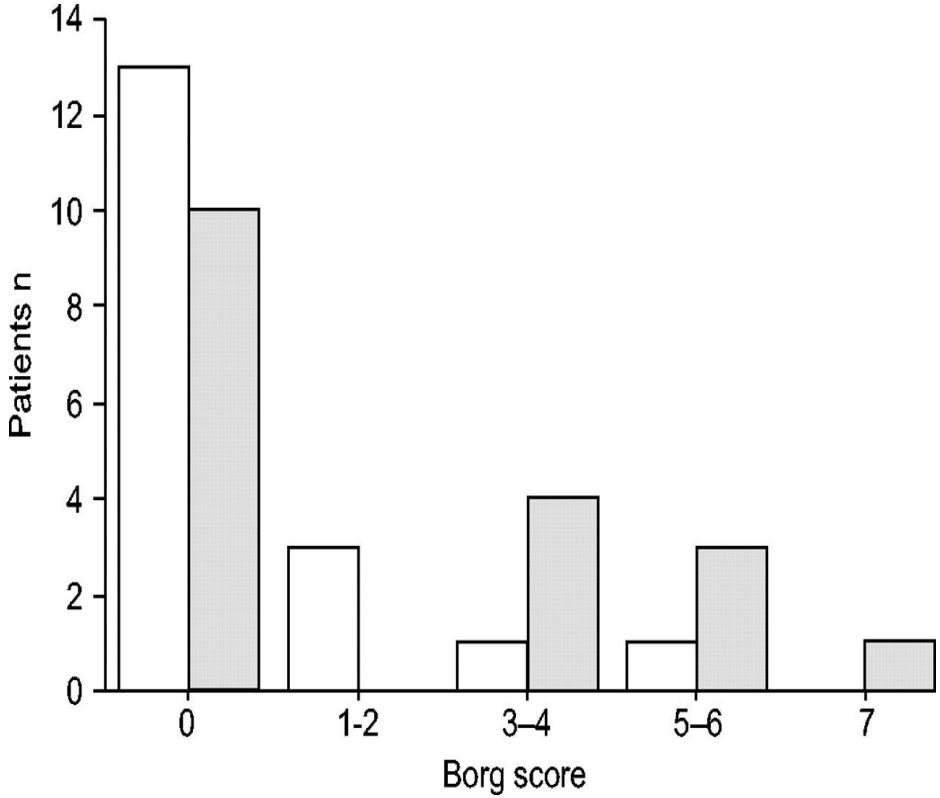


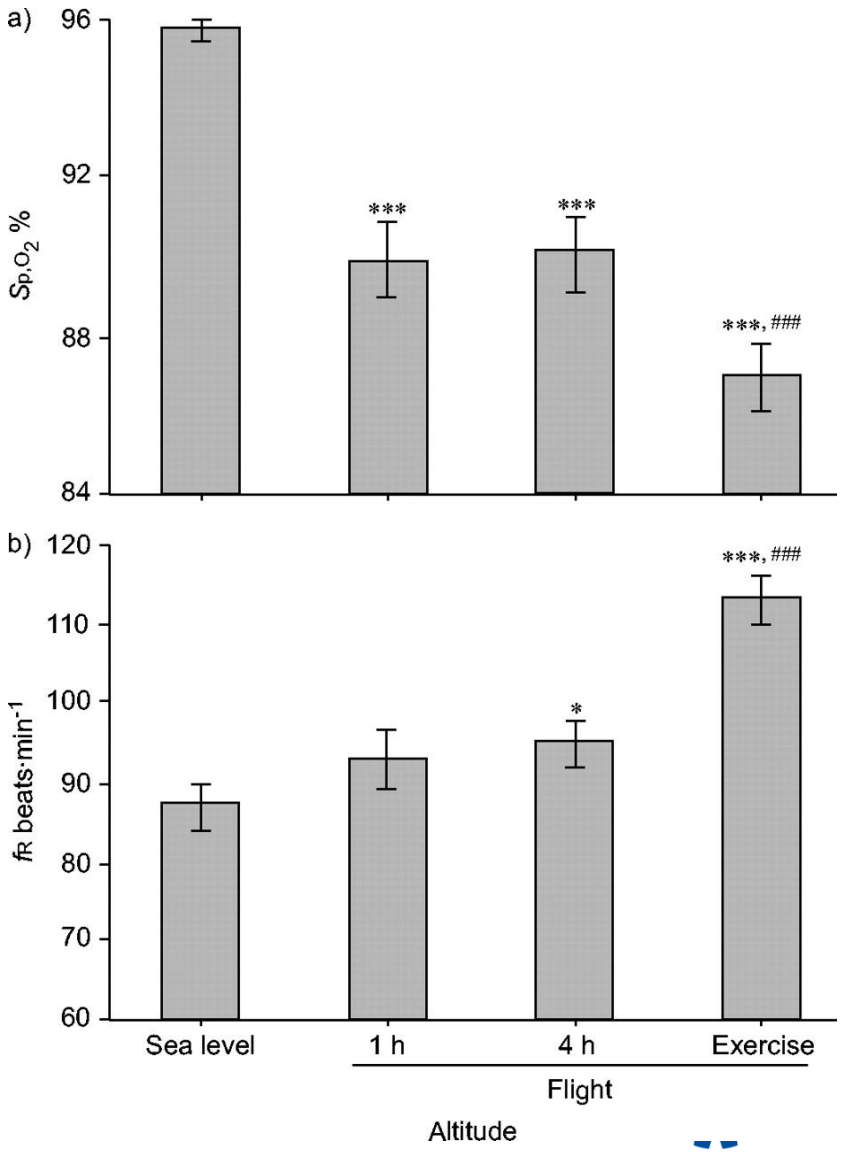


Akero et al ERJ2005

What's happening during the flight?

At rest and during excercise





Akero et al ERJ2005

Pre flight assessment in COPD
contra-indications for flying?

- COPD stage (i.e. GOLD 3) or respiratory insufficiency (diffusion capacity < 50%)?
- Recent pneumonia, RTI?
- Recent exacerbation with orwithout hospitalization?
- Recent thoracal operation?
- Recent pneumothorax?
- Other upper resp. tract infections? For example OME
- (severe) hemoptysis?
- Oxygen use >4L /min. ?
- Invasive/ NIV ventilation ?
- Former O2 use ?

(Relatieve) contra-indicaties vliegreizen (NHG-PraktijkWijzer Reizigersadvisering, 2008)

Ahmedzai et al. Thorax 2011, Carvalho et al, Can Fam Physician 2009

Pre flight assessment COPD
COPD and comorbidity

- Anemia (Hb <5,6mmol/L)
- Cardiac disease
- Diabetes Mellitus
- COPD and increased risk for VTE
  (in general: 2-3 fold increase, effect of polycythemia ?)
- Prednisone use -> increased risk for infection during flight
- Effect obesity (BMI>30kg/m2->increased risk for VTE)

(Relatieve) contra-indicaties vliegreizen (NHG-PraktijkWijzer Reizigersadvisering, 2008)

Carvalho et al, Can Fam Physician 2009

Bertoletti ERJ 2012 VTE and COPD, Sabit et al Chest 2010

What is needed to travel safe when hypoxemia is suggested

only pulse oximetry ?

- No this is not sufficient
- below 6.6 kPa during HAST were: Spo2sl > 95%: 30%;
- Spo2sl 92-95% without additional risk factors: 67%;
- Spo2sl 92-95% with additional risk factors: 70%; Spo2sl < 92%: 83%; and patients using domiciliary oxygen: 81%.
- When below P(a)o(2) 6.6 kPa, -> supplemental oxygen of median 1 L /min was needed to exceed this limit.

Akero et al. Aviat. Space Environ Med 2008

Casus 1

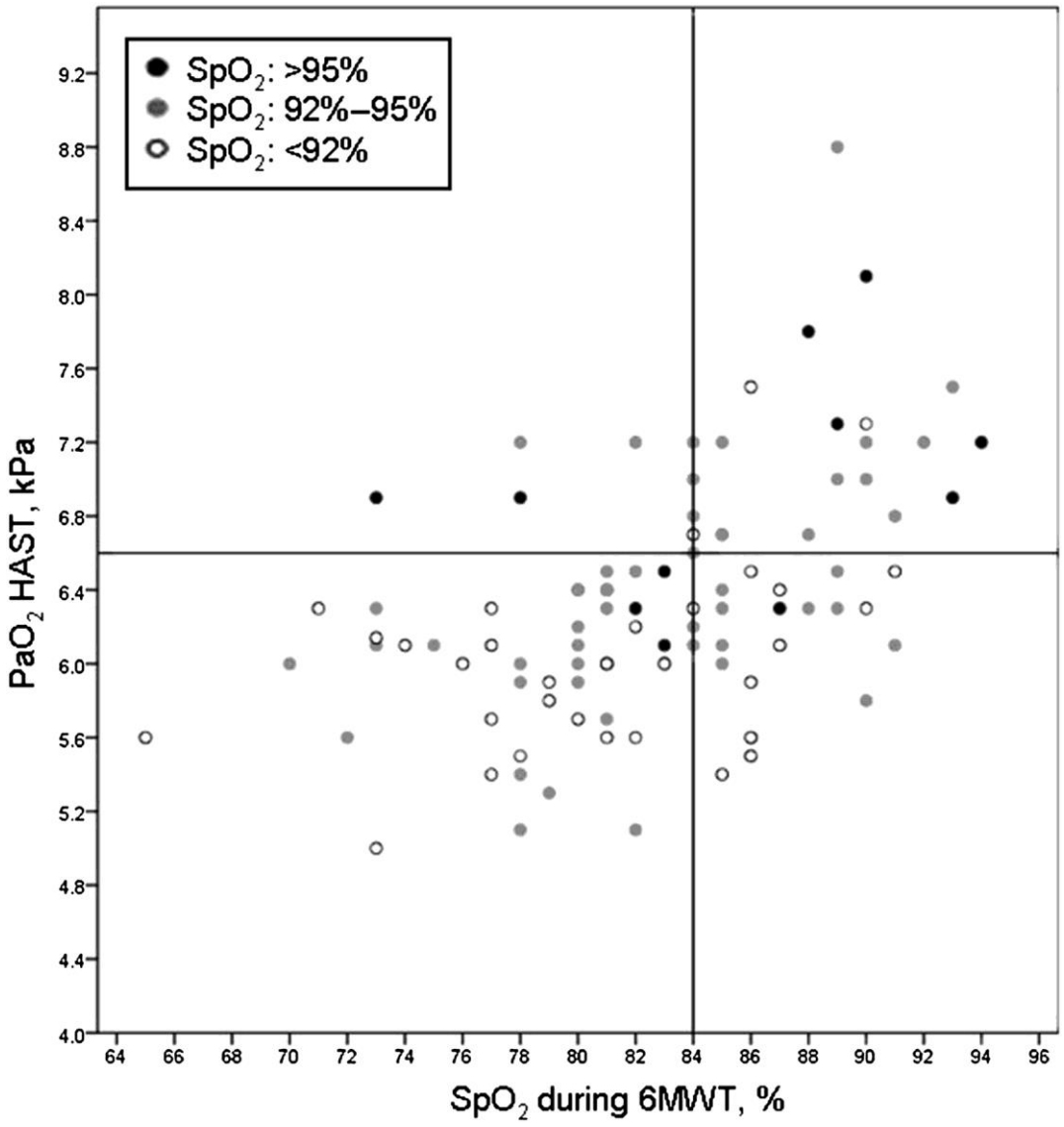
Fit to fly?

- Saturatie 95% in rust
- Aankleden kost moeite
- Recent een 6MWT gedaan en hij loopt 322meter met desaturatie tot 83% (trots dat hij geen 02 nodig had)

- 71 jarige man COPD gold III/E en lobectomie 2012 LBK ivm NSCLC, wordt snel hypoxisch bij inspanning, soms wat drukkend gevoel ook op de borst bij inspanning als hij kortademig wordt.
- De cardioloog vond zijn pulmonaal druk wat aan de hoge kant.

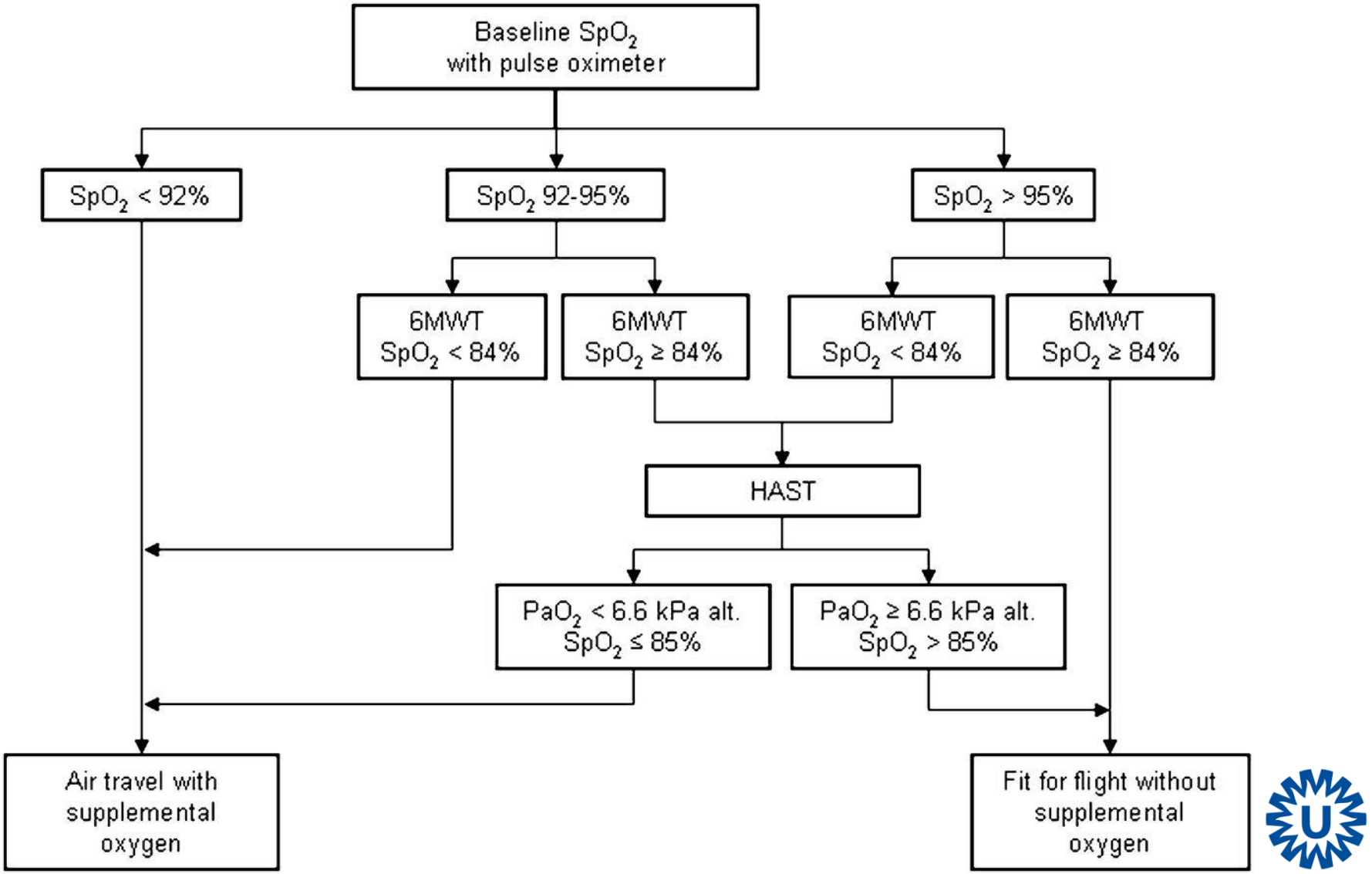
Kan patient vliegen?
Krijgt hij 02 advies tijdens de vlucht?

SpO2 during 6MWT versus PaO2 HCST. Patients are grouped after sea-level SpO2 >95%, 92–95% and <92%.



Edvardsen A et al. Thorax 2012;67:964-969

Pre-flight flow chart-algorithm using 6MWT



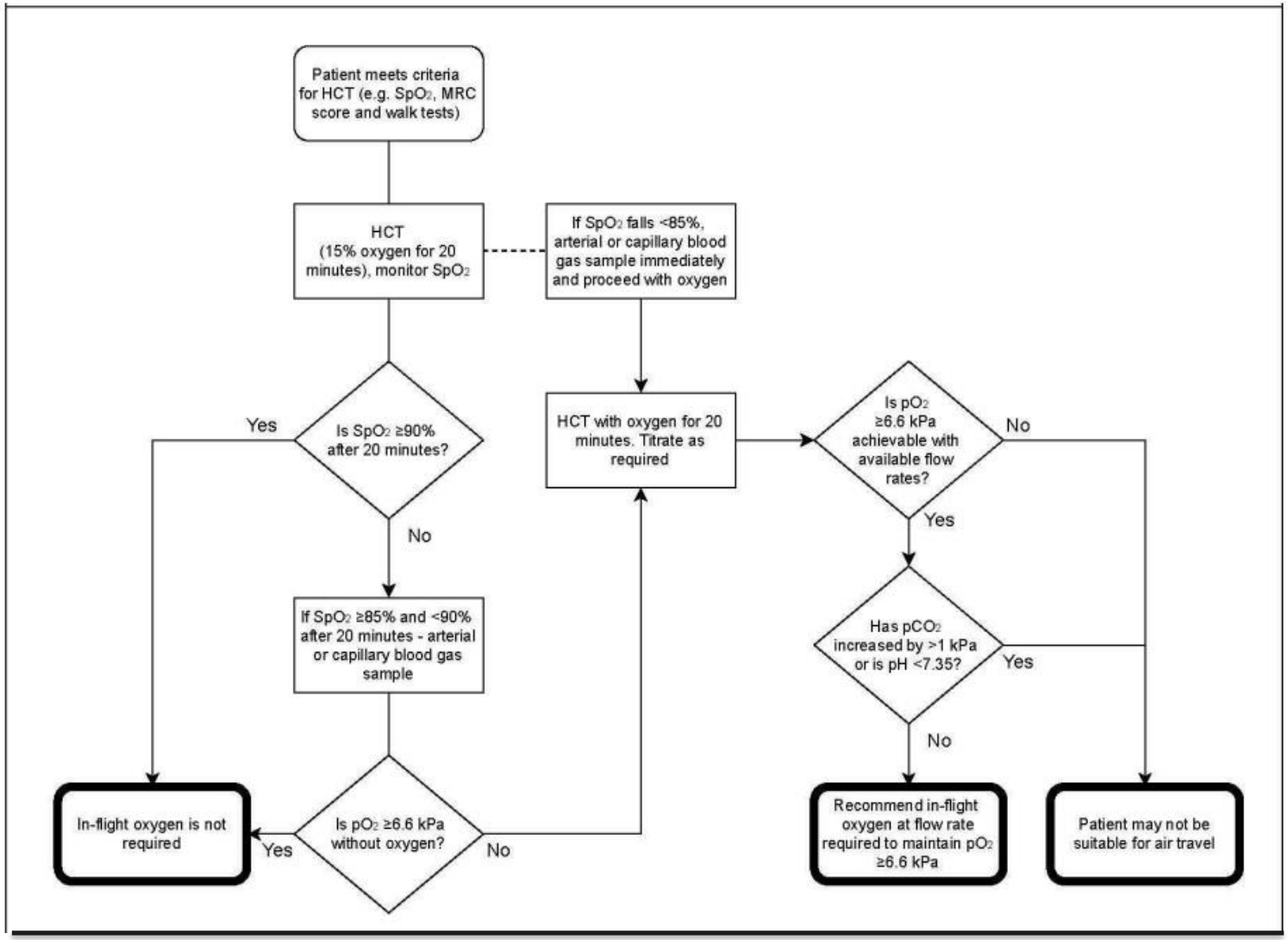
Edvardsen A et al. Thorax 2012;67:964-969

Hypoxix challenge test (HCT)

- A 15% oxygen gas mixture is required for HCT. This can be supplied to the patient in a number of ways;
  - from pre-mixed cylinders, or pure nitrogen is used to dilute room air to reduce FiO_2. This mixture can be delivered either from a Douglas bag and a one-way mask circuit, or to fill a body box/tent (normally for paediatric patients),
  - a 40% Venturi mask using nitrogen as the driving gas, giving a resultant mixture containing 15% oxygen,
  - a hypoxic gas generator.
- It is advised to monitor FiO_2 using a rapid-response oxygen analyser to avoid excessive hypoxia, and to monitor SpO_2 in all those exposed to a hypoxic atmosphere (such as adults accompanying children in a body plethysmograph or tent).
- Arterial or capillary blood gas measurement is gold standard, although SpO_2 ≥85% as a surrogate value for pO_2 ≥6.6 kPa is an acceptable alternative if blood gas analysis is not available. In those with a history of hypercapnia, supplementary oxygen should not raise SpO_2 above the resting normoxic value if pCO_2 and pH are unavailable.
- Most in-flight oxygen is currently delivered by portable oxygen concentrators (POC) and nasal cannula. Although some models are capable of delivering continuous flow (currently up to 3 L/min), pulsed delivery is the most common POC mode and should be the method by which patients are initially assessed.
- If the highest pulsed delivery flow rates do not maintain adequate oxygenation, continuous flow up to 3 L/min may be considered (this is the maximum continuous flow rate currently available from some POC models).
- Those with a significant increase in pCO_2 or fall in pH with supplementary oxygen are not necessarily precluded from air travel. Factors such as length of flight and magnitude of blood gas changes should be considered by a respiratory specialist.
- The HCT is not a 'fitness to fly assessment', and should not be referred to as such. A 'pre-flight oxygen test' is a more accurate description.

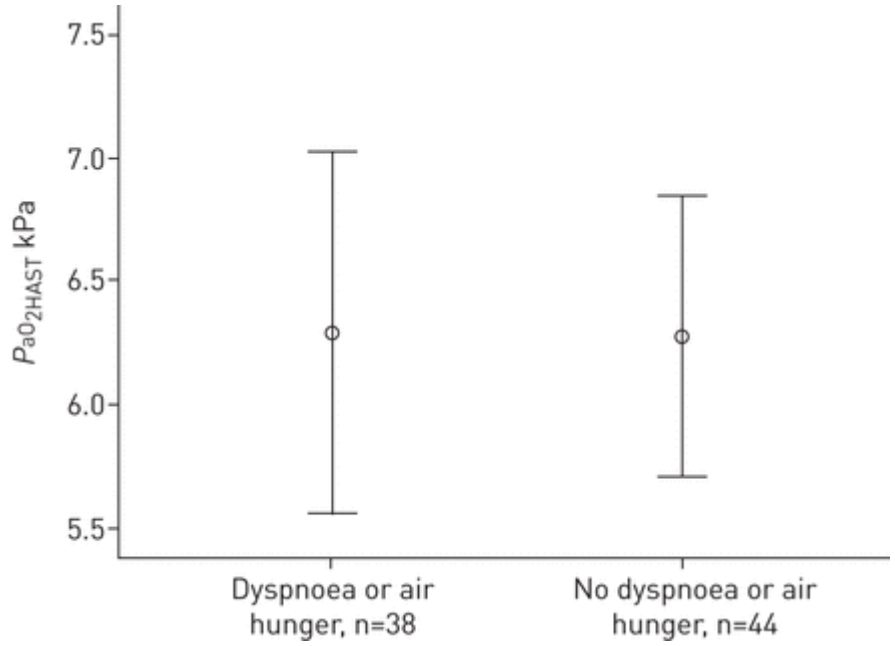
BTS guideline 2022

HCT test



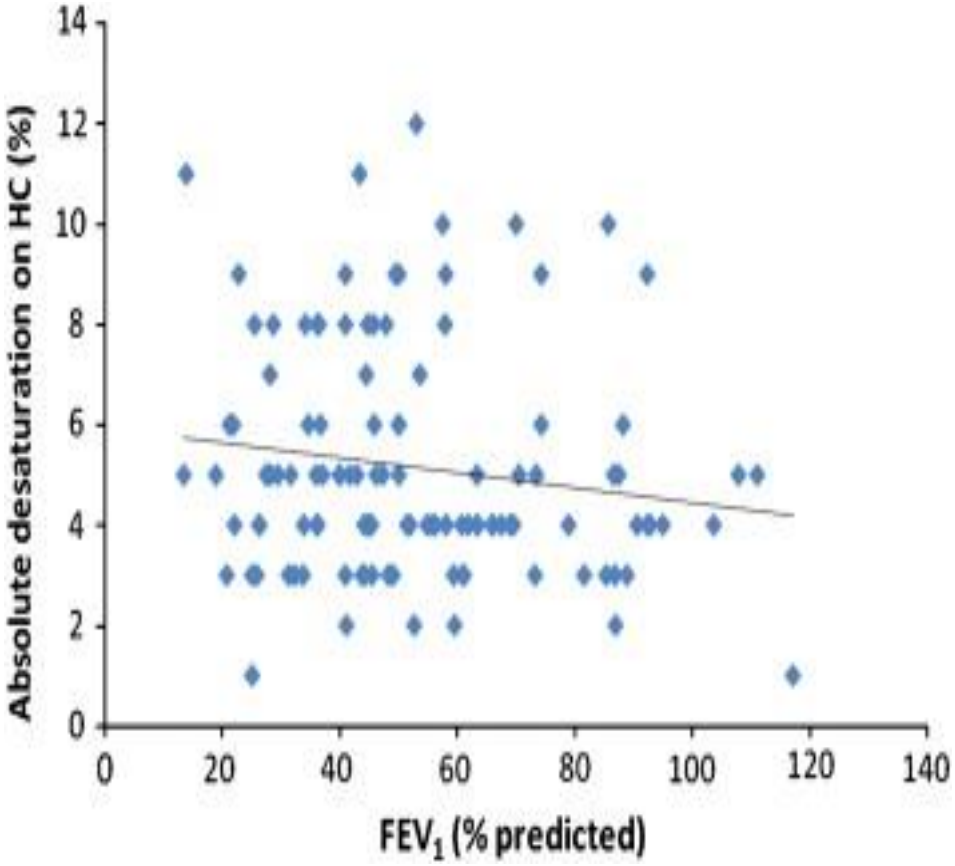
BTS guideline 2022

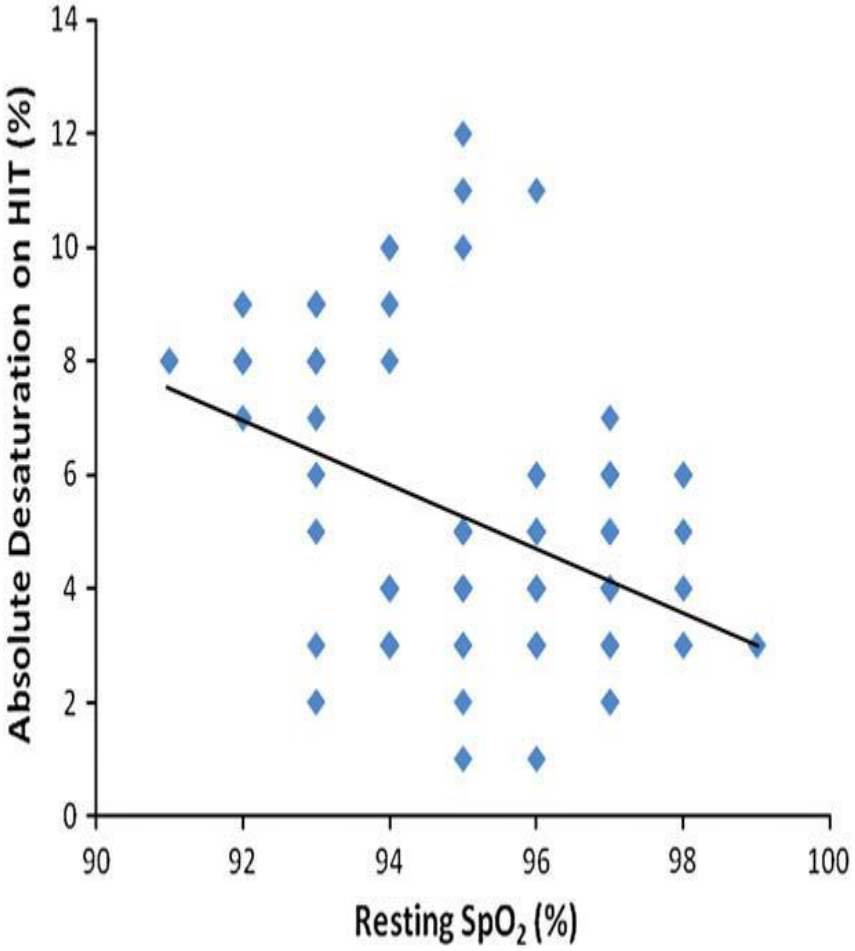
No association between dyspnoea and PaO2 during HCT



Evardsen ERJ 2013

Effect hypoxic challenge on FEV1 and resting SpO2





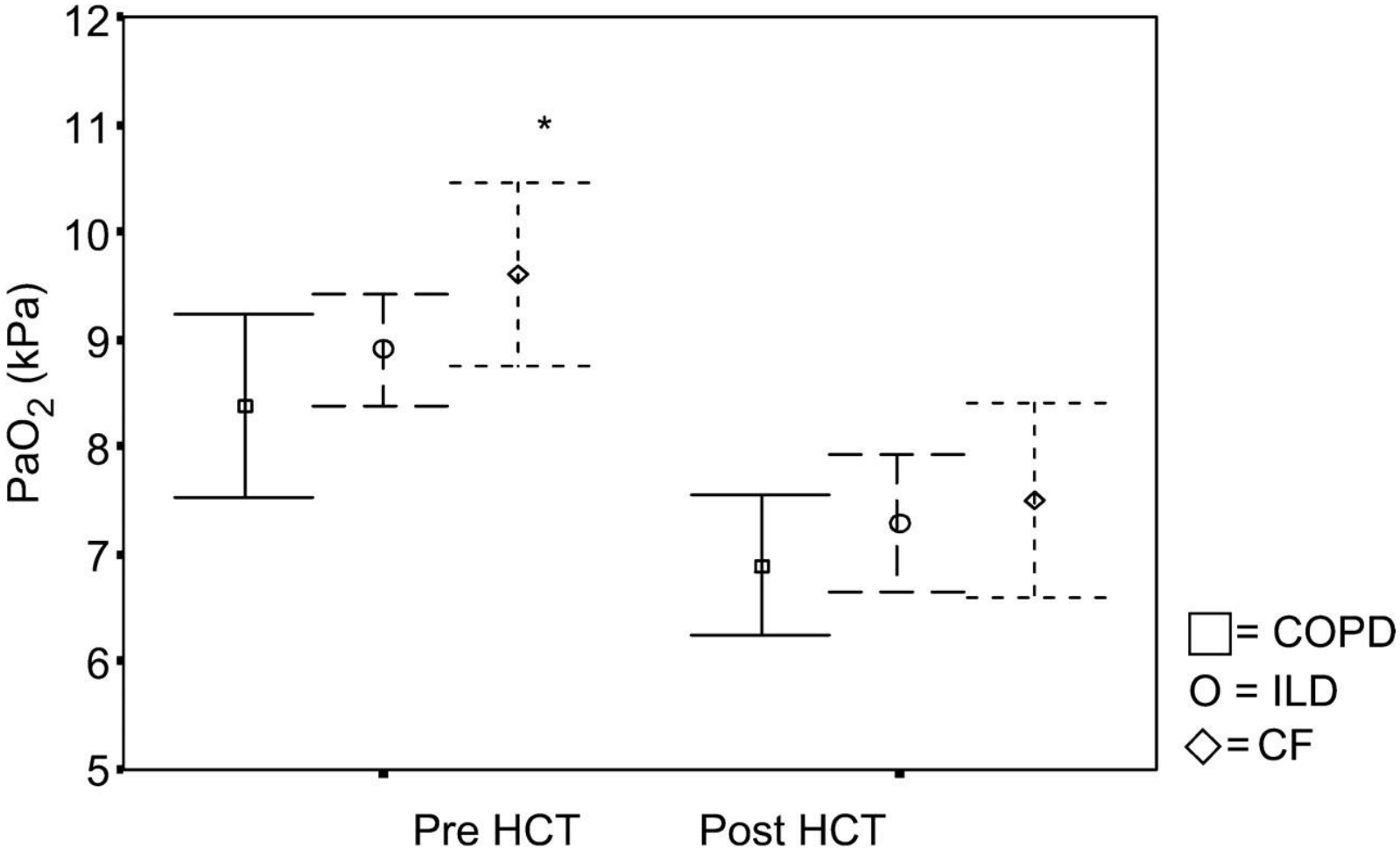
Robson et al. Respiratory Medicine Volume 102, Issue 11 2008 1592 - 1597

pO2 during hypoxia-altitude simulation test (HAST or HCT) and 6MWT

- Strong correlation HAST paO2 and SpO2 (r=0,81, P<0,001
- Cut off value SpO2 HAST ≤85% (sens 89%, spec 81%)
- Stongest correlation between Sp02 6MWT and SpO2 at sea level
- Cut off value SpO2 6MWT <84% -> sens 80% and spec 71%

Edvardsen A et al. Thorax 2012;67:964-969

HCT in COPD and other diseases



*The CF group have significantly higher PaO_2 ground Pre HCT ($p<0.05$) than the ILD or COPD groups.

Martin S et al. QJM 2007;100:361-367

Casus 2

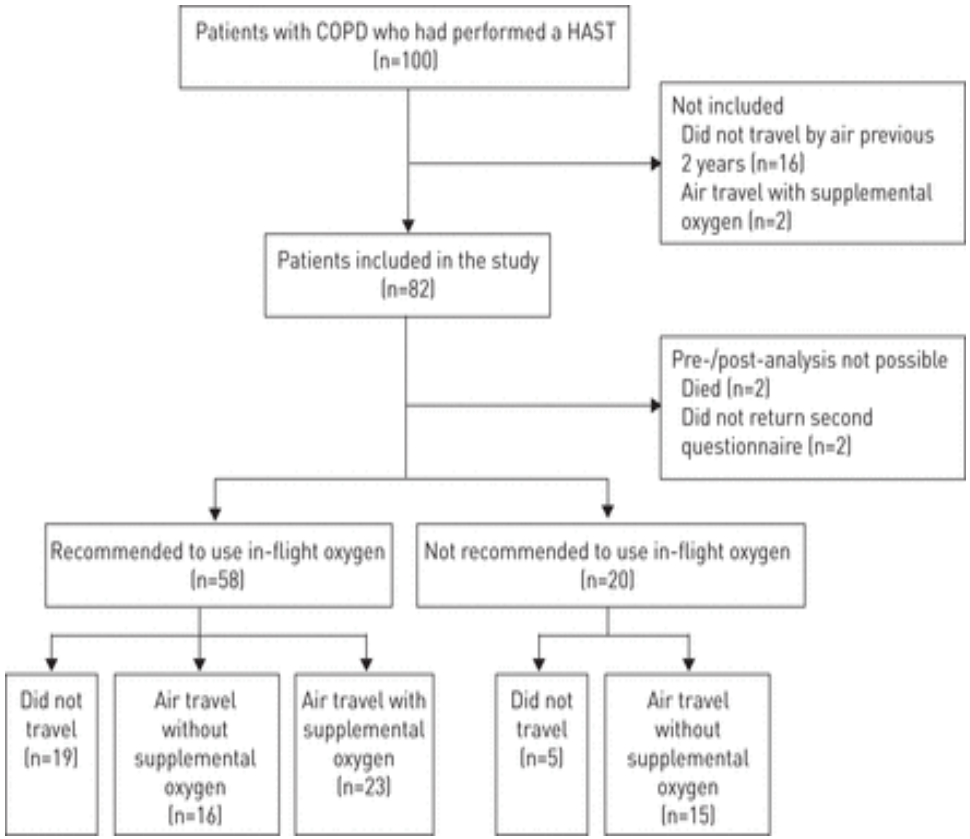
Fit to fly?

- 79 jarige man, COPD gold III /E, snel kortademig als hij opstaat al.
- 4 weken geleden opname longaanval
- 02 gebruik na opname 1L/min
- inhalatie techniek lukt moeizaam.

- Actieradius is beperkt, hij kan van bank naar toilet lopen
- Aankleden en douchen heeft hij nu hulp bij nodig
- Tijdens opname ook hypercapnie
- Saturatie is 93% met 1L02

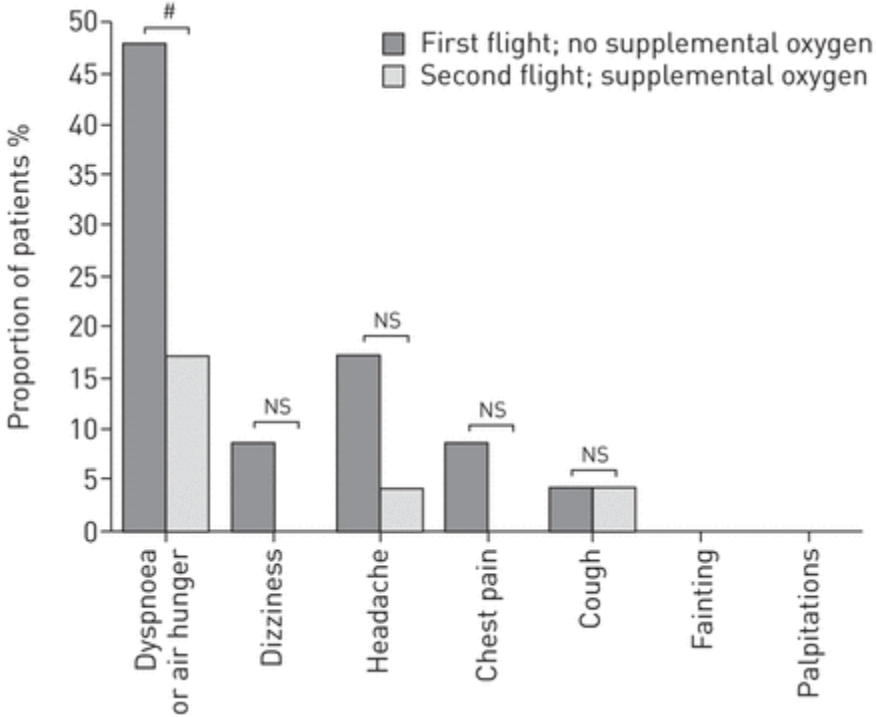
Kan hij vliegen?
Zuurstof ophogen?

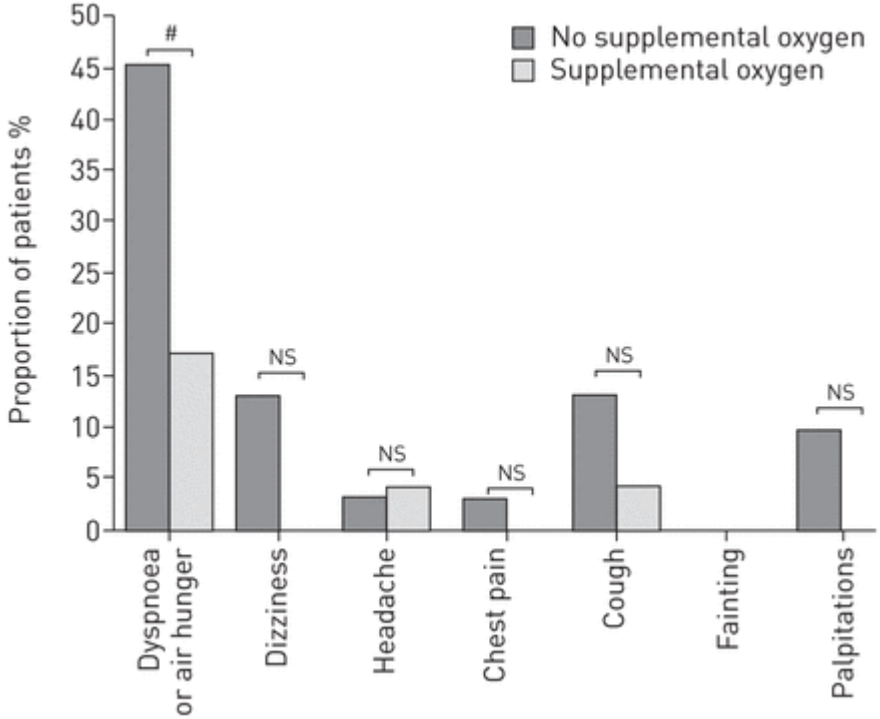
Effect of HCT evaluation and supplemental oxygen



Evardsen ERJ2013

Effect of HCT evaluation and supplemental oxygen





Evardsen ERJ2013

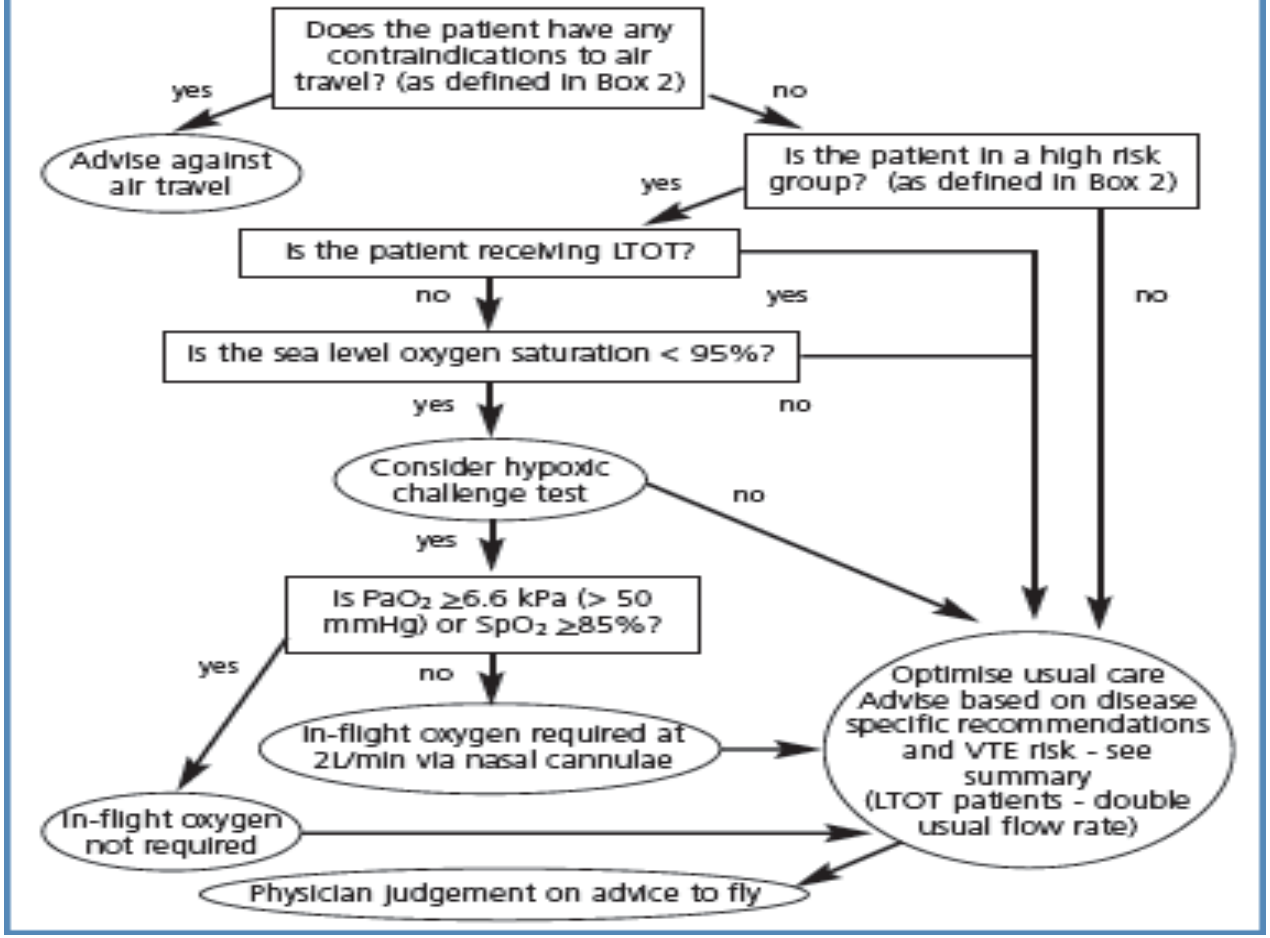
Diagnostic route in every COPD patient

- Pre-flight assessment of COPD severity, risk factors, comorbidity
- Pulse oximetry
- When needed in algorithm perform a 6MWT
- And additional HCT when needed.
- Overestimation of necessity of oxygen suppletion is present when using 6MWT
  - pre-flight evaluation algorithm : sens 99%, spec 82%
  - 33% of patients needed a HCT test
  - 6 patients were misclassified in this algorithm
  - 5 patients were recommended oxygen without having pO2 HCT of 6,6kPa.

Edvardsen A et al. Thorax 2012;67:964-969

BTS algorithm old 2012

Figure 1. Algorithm for managing adult passengers with stable respiratory disease planning air travel.[9] LTOT=long-term oxygen therapy, VTE=venous thromboembolism, PaO_2=arterial oxygen tension, SpO_2=oxygen saturation



Casus 3

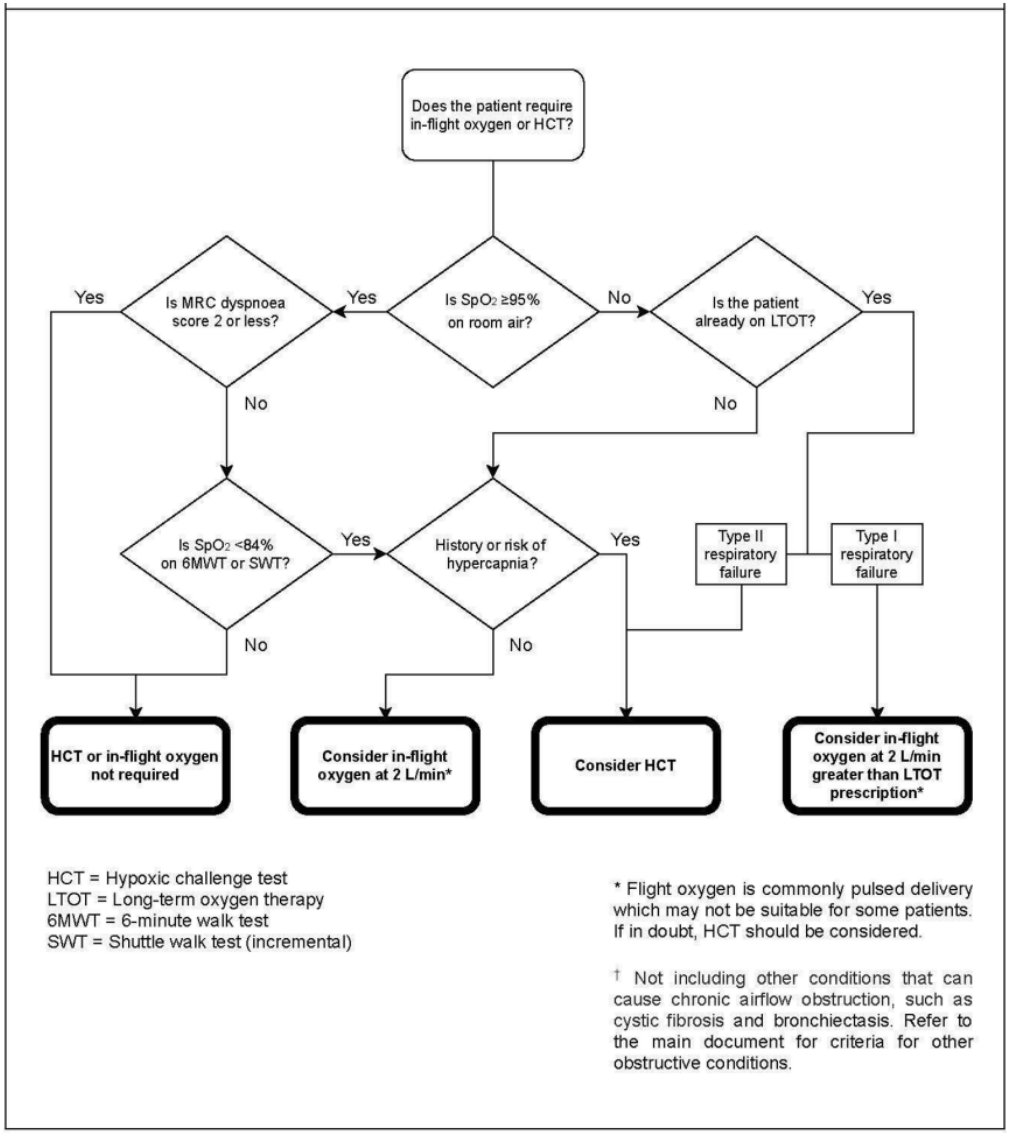
- Aankleden kost moeite, loopt kleine stukjes
- Gelukkig een traplift in huis
- Saturatie is 94% met 02 1L/min nu gemeten door huisarts

Mag ik naar Spanje dokter? Alstublieft

- 72 jarige vrouw, COPD gold III/E. 02 gebruikt 1L/min sinds opname
- 6 weken geleden pneumonie gehad met opname.
- Herstelt langzaam, weinig kracht. Gaat al beter, maar nu wil ze naar haar dochter die gaat trouwen in Torremolinos over 3 weken

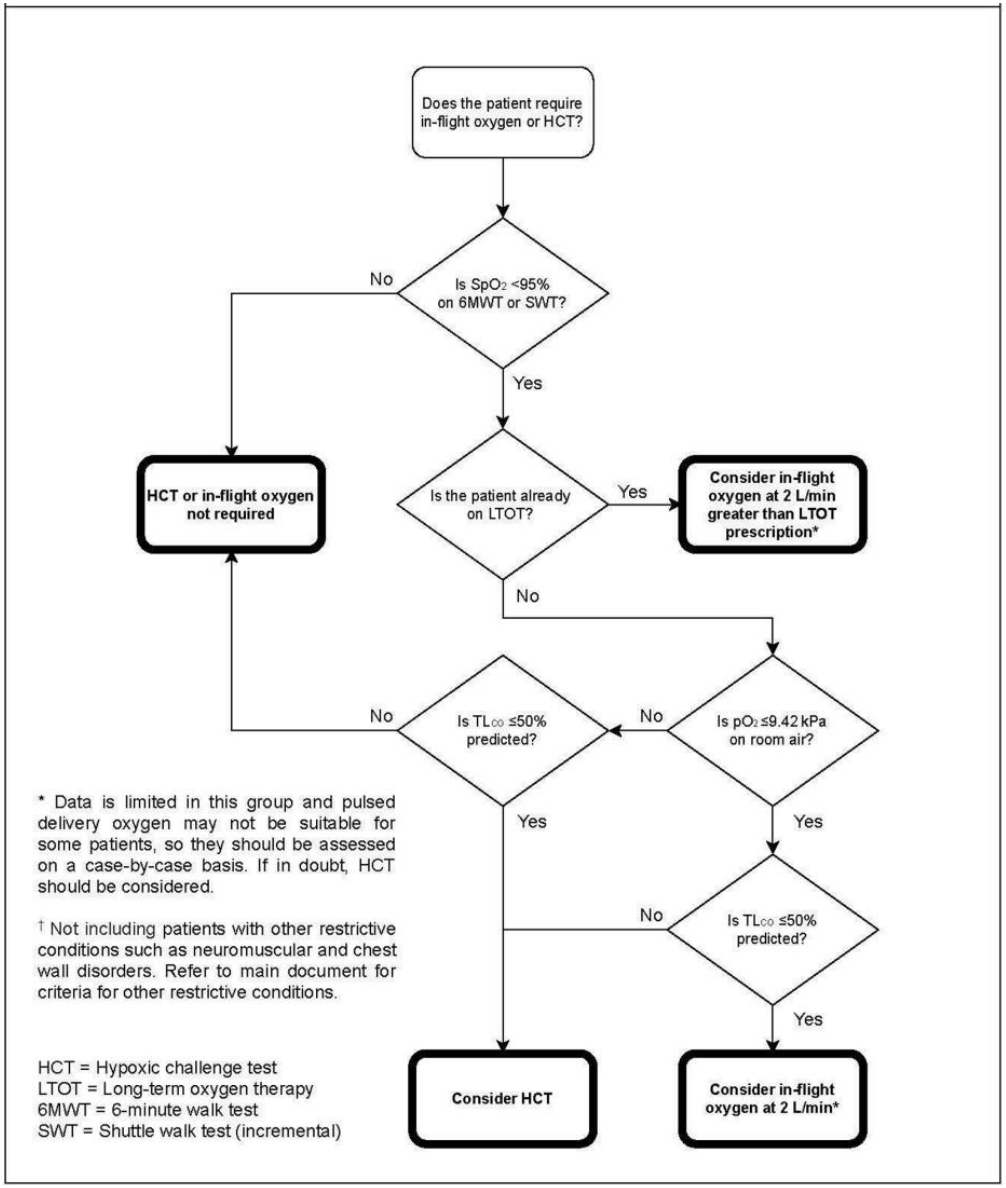
Mag ze vliegen?
Zuurstof ophogen?

BTS algorithm obstructive disease



BTS guideline 2022

BTS guideline restrictive disease



BTS guideline 2022

Contraindications /High risk patients

Box 2. Recommendations for adults

Contraindications to travel:

- Infectious tuberculosis
- Ongoing pneumothorax with persistent air leak
- Major haemoptysis
- Patients on LTOT whose usual oxygen requirements exceed 4L/min at sea level (because commercial airlines are unable to deliver double this rate, which would be the usual recommendation at altitude).

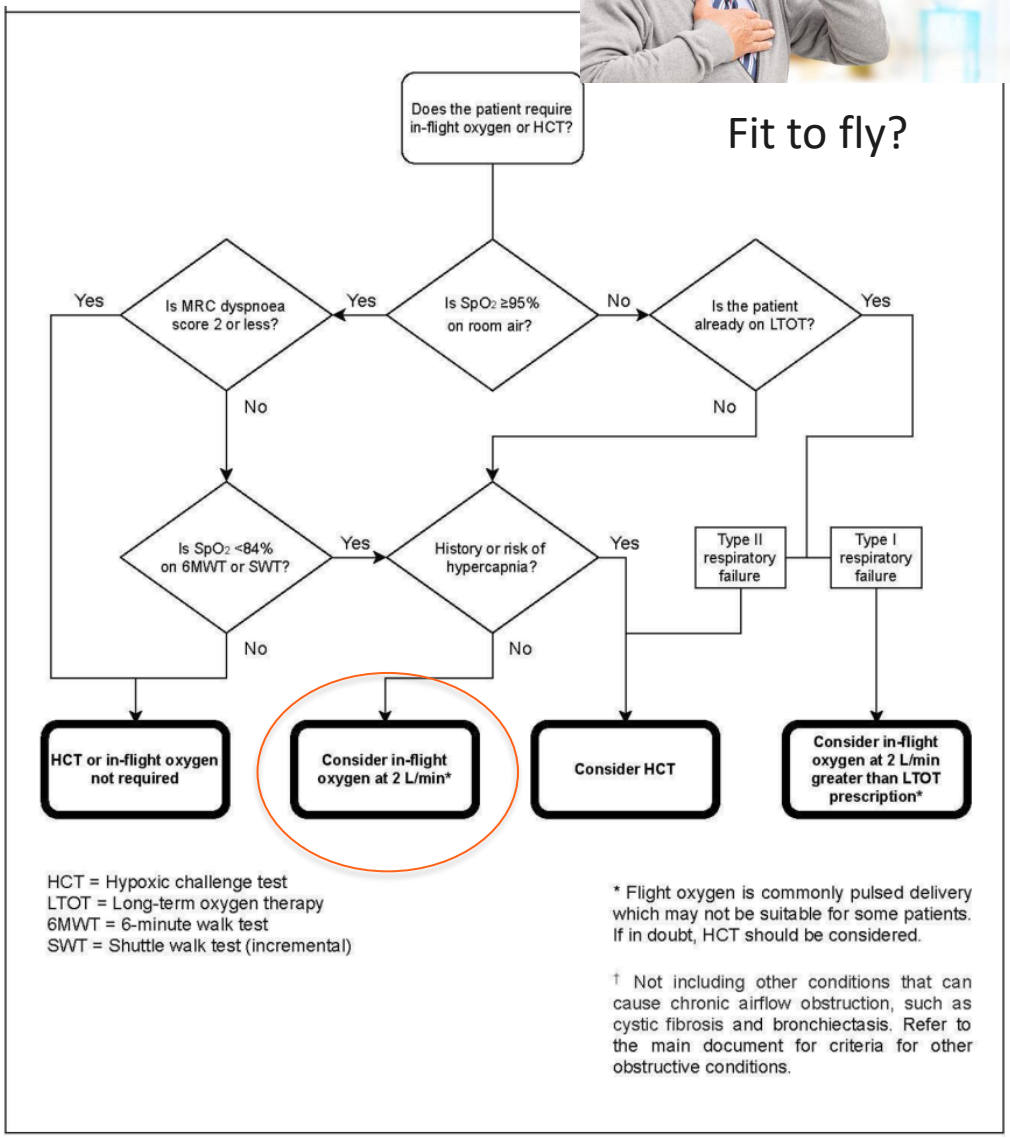
High-risk patients requiring further evaluation (see Figure 1):

- Patients with previous significant respiratory symptoms associated with air travel.
- Severe chronic obstructive pulmonary disease (FEV_1 <30% predicted), bullous lung disease, difficult-to-control asthma, cystic fibrosis, or pulmonary tuberculosis.
- Severe restrictive disease (vital capacity <1L) including interstitial lung disease, chest wall and respiratory muscle disease, especially if associated with hypoxaemia and/or hypercapnia.
- Co-morbidity with conditions made worse by hypoxaemia (e.g. cerebrovascular disease, cardiac disease, pulmonary hypertension).
- Recent pneumothorax or within six weeks of an acute respiratory illness.
- Risk of, or previous history of, venous thromboembolism.
- Pre-existing requirement for oxygen, continuous positive airways pressure or ventilator support.

Casus 1

- Saturatie >95%
- MRC score 3
- 6MWT desaturatie 83%
- Geen hypercapnie in het verleden
- Mogelijk pulmonale hypertensie

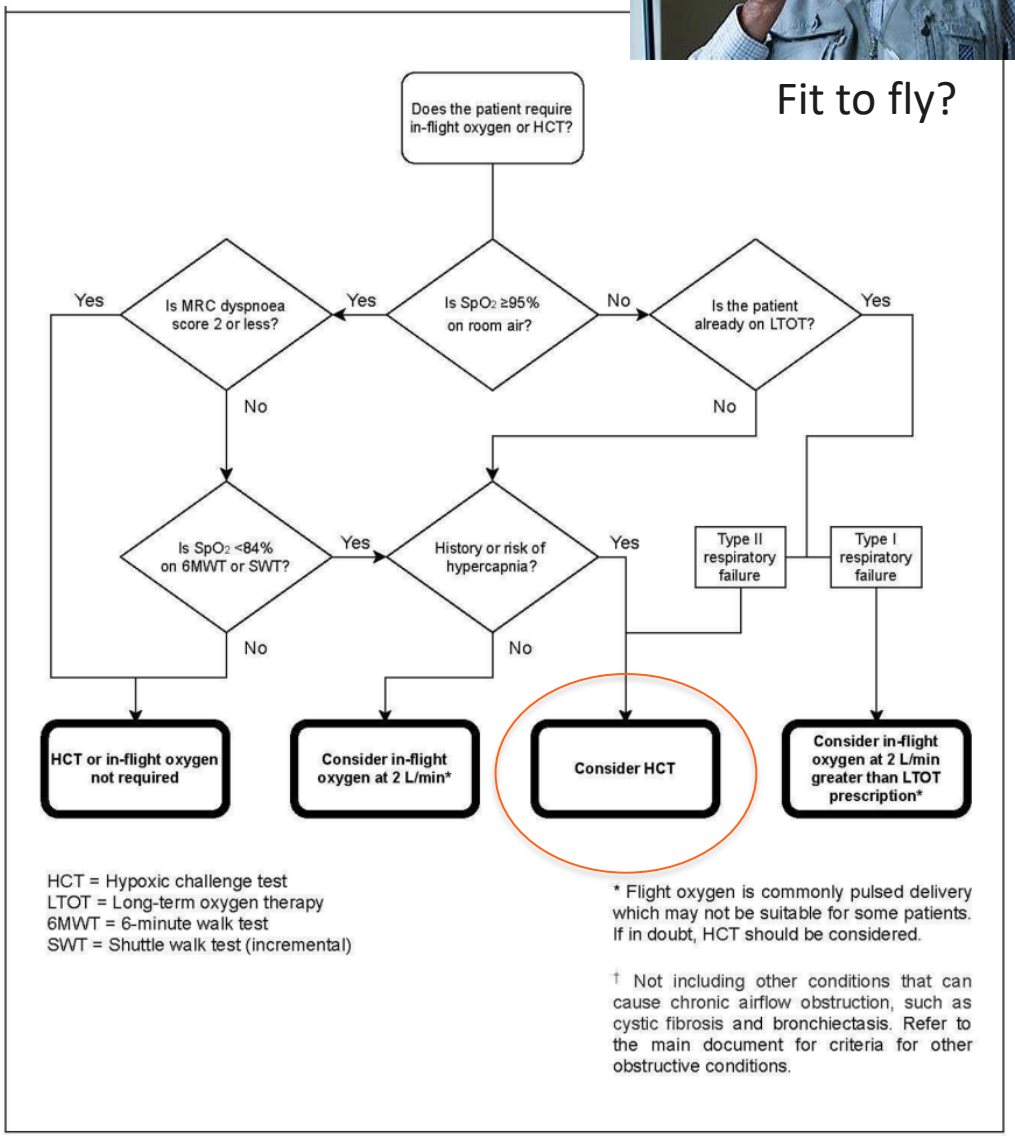
Fit to fly?



Casus 2

- Saturatie nu 93% met 1L02/min
- 4 weken geleden exacerbatie
- MRC 4
- Hypercapnie eerder tijdens opname met pC02 7,6kPa

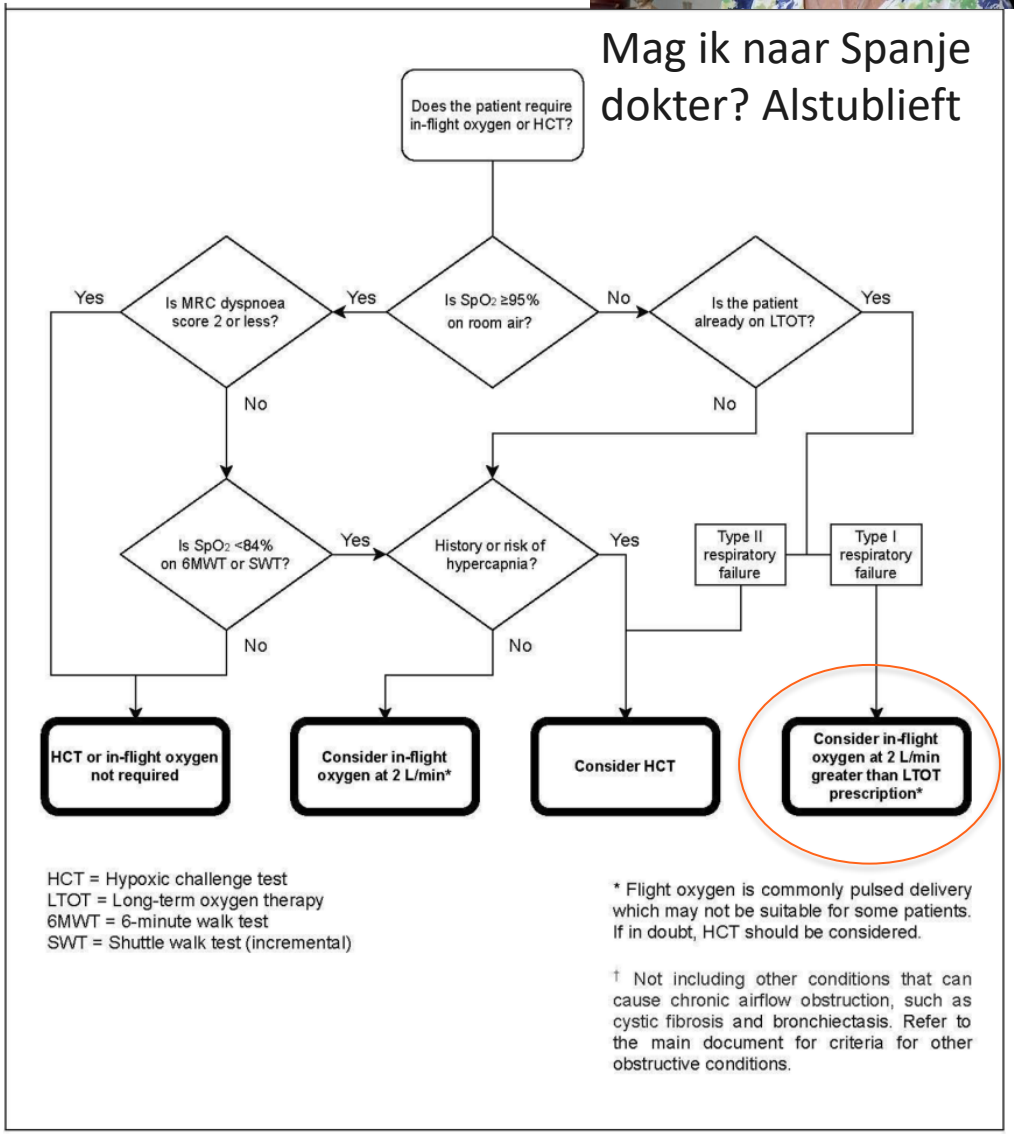
Fit to fly?



Casus 3

- Sat 94% met zuurstof 1L/min
- MRC3
- Nog wel hulp thuis nodig bij aankleden
- Ze kan weer bijna 100 meter lopen
- Geen hypercapnie

Mag ik naar Spanje dokter? Alstublieft



Casus 1,2 en 3 en advies/ voorstel

Fit to fly?

- Desatureert bij inspanning en geringe pulmonale hypertensie en 6MWT <84% dus indicatie voor zuurstof tijdens de vlucht
- Cardiale beoordeling overwegen, cardiaal stabiel dan kan hij vliegen

Fit to fly?

- Hij gebruikt zuurstof sinds recente exacerbatie en respiratoire symptomen
- tijdens vlucht mogelijk toename symptomen
- NIV overwegen/ Optimalisatie medicatie/begeleiding/revalidatie
- <u>Twijfel of deze patient in staat is om veilig te vliegen</u>

Mag ik naar Spanje dokter?
Alstublieft

- Patiente is herteld
- Zuurstof ophogen tijdens de vlucht naar 3L/min
- Adviezen over training/inhalatie medicatie/begeleiding
- Ze kan vliegen

Conclusion

- COPD patients have a 3-fold increased presence of hypoxic related symptoms and 7-fold increase in dyspnoea
- there seems to be a poor relationship between dyspnoea and the degree of hypoxaemia both at sea level and, during air travel.
- respiratory-related medical problems are the third most reported cause of in-flight emergencies
- A new algorithm may increase accurate oxygen supply in COPD patients
- COPD and related comorbidity has to be taken into account
- No real RCT are present to prove the benefit of oxygen supply in patients having symptoms of dyspnoea during air travel

Zuurstof gebruik

Draagbare Zuurstofconcentrator (Portable Oxygen Concentrator, POC)

U mag de volgende POC-types mee aan boord nemen:

AirSep FreeStyle (Fed. Reg. Sep 12/06)
Airsep LifeStyle met een RTCA-sticker (SFAR No. 106, Aug 11/2005)
Delphi RS-00400
DeVilbiss Healthcare iGo
Inogen One (SFAR No. 106, Aug 11/2005)
Inogen One G2
Invacare SOLO2
International Biophysics LifeChoice
Invacare XPO100
Oxlife Independence Oxygen Concentrator
Respironics EverGo (Fed. Reg. Sep 12/06)
SeQual Technologies Eclipse (Fed. Reg. Sep 12/06)

Vanuit www.klm.nl

So you can think you can fly ?

- Hoeveel zuurstof is mogelijk?

  "..Given that airlines can usually only provide oxygen up to 4 L/min by nasal prong, patients requiring oxygen at 4 L/min on the ground who do not achieve a saturation better than 95% are not fit to fly by commercial aircraft."
- Zelf O2 meebrengen via POC

POC= portable oxygen concentrator

Carvalho et al, Can Fam Physician 2009

Predictive Equations

1. This relates PaO2 at altitude (Alt) to PaO2 at sea level (Ground)44:
PaO2 Alt (mm
Hg) [0.410 3 PaO2 Ground (mm Hg) + 17.652
2. This relates PaO2 Alt to PaO2 Ground & includes FEV1 in litres44:
PaO2 Alt [
0.519 3 PaO2 Ground (mm Hg) + 11.855 3 FEV1 (litres)1.760
3. This relates PaO2 Alt to PaO2 Ground and includes FEV1 as %
predicted44: PaO2
Alt [0.453 3 PaO2 Ground (mmHg) + 0.386 3 (FEV1% pred) +2.44
4. This relates PaO2 Alt to PaO2 Ground and includes flight or
destination altitude45:
PaO2 Alt [22.8(2.74 x altitude in thousands of feet) + 0.68 3 PaO2
Ground (mm Hg)

BTS guidelines Ahmedzai et al. Thorax 2011

Can we use an equation to predict hypoxemia in COPD patients?

- First step: is the passenger capable of walking 50metres?
- Next steps:
  - PaO2 (ground) had the highest correlation with PaO2
  - variability in PaO2 (Alt) could only be partially explained by PaO2 (ground), and that using lung function measurements as the additional predictor variables significantly increased the correlation between PaO2
  - Predictive equations considerably overestimate thee need for in-flight O2 in the majority of patients, but can also underestimate this need
  - The difference between predicted and measured in-flight Pa,O2 was -0.8±0.8 kPa (range -2.0–0.8 kPa, $p<0.001$).

Martin S. et al. QJM 2007;100:361-367. Akero ERJ2005

Dillard et al Ann Int Med 1989, Johnson Thorax 20003

Medical Forms

- Formulier A
- Door de patient in te vullen

- Formulier B
- Door de huisarts in te vullen
- Door medische specialist?

Vanuit www.klm.nl

Als een van onderstaande beschrijvingen op u van toepassing is

• Passagiers die lijden aan een besmettelijke ziekte.
• Passagiers die, door ziekte of een lichamelijk aandoening, gedrag vertonen dat mogelijk het comfort en welzijn van de andere passagiers en/of de bemanning zou kunnen beïnvloeden, of een risico zou kunnen vormen voor de veiligheid of punctualiteit van de vlucht.
• **Passagiers die tijdens de vlucht medische zorg nodig hebben of afhankelijk zijn van specifieke medische apparatuur.**
• **Passagiers van wie de medische aandoening tijdens de vlucht levensbedreigend kan worden of die voor hun veiligheid bijzondere medische zorg nodig zouden kunnen hebben.**
•**Passagiers die tijdens de vlucht persoonlijke verzorging nodig hebben (tijdens maaltijden, toiletbezoek, etc.) maar zonder persoonlijke begeleider reizen**.

Vanuit www.klm.nl

Gebruik eigen POC door patient

- eigen POC aan boord gebruikt, dient u:
- uw verzoek minimaal 48 uur voor vertrek in te dienen bij KLM Telefonische Reserveringen
- in overleg met uw huisarts de volgende informatie te verstrekken:

  - Het merk en type POC.
  - De medische noodzaak om zuurstof aan boord te gebruiken en het vermogen van de gebruiker om het alarm van de POC unit te zien, te horen en daarop te kunnen reageren.
  - De maximale zuurstoftoevoer die in overeenstemming is met de cabinedruk onder normale omstandigheden. N.B.: gebruik van de POC tijdens de vlucht in een drukcabine vereist ongeveer tweemaal zoveel zuurstof ten opzichte van gebruik op de grond.
  - De duur van het zuurstofgebruik gemeten in uren en minuten

Vanuit www.klm.nl

Different POC's

- Oxygen was delivered by each POC for 30 min to each patient at rest, blood gases were then drawn from the arterialized ear lobe.
- All POCs were able to deliver enough oxygen to increase the PaO_2 of our subjects by at least 1.40 kPa (10 mmHg).
- The two most lightweight POCs (Freestyle and Invacare XPO2) had to be run at their maximum level. This causes a significant reduction of battery life.
- The three other POCs (EverGo, Inogen One, Eclipse 3) and the WS120 were able to increase the PaO_2 by more than 2.55 kPa (20 mmHg), which provides extra safety for patients with more severe basal hypoxemia.

Fisher et al. Resp. Med 2013