AUTOMATICALLY ADJUSTING OXYGEN IN RESPONSE TO SATURATION DURING ACTIVITY

In patients with COPD

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I have no conflicts of interest.

Before 1917

Dosing oxygen

O_2 in l/min

Saturation = SpO_2

SUNDHEDSSTYRELSEN 2019

Iltbehandling til den akut syge voksne patient

Overvej restriktiv og målrettet iltbehandling til den akut syge voksne patient med nedsat iltmætning.

Thorax
AN INTERNATIONAL JOURNAL OF RESPIRATORY

BTS GUIDELINE FOR OXYGEN USE IN ADULTS IN HEALTHCARE AND EMERGENCY SETTINGS

- These staff should use appropriate devices and flow rates in order to achieve the target saturation range (figure 2 (chart 2)).

Mortality and morbidity in acutely ill adults treated with liberal versus conservative oxygen therapy (IOTA): a systematic review and meta-analysis

Derek K Chu†, Lisa H-Y Kim*†, Paul J Young, Nima Zamiri, Saleh A Almenawer, Roman Jaeschke, Wojciech Szczeklik, Holger J Schünemann, John D Neary, Waleed Alhazzani*

Summary

Background Supplemental oxygen is often administered liberally to acutely ill adults, but the credibility of the evidence for this practice is unclear. We systematically reviewed the efficacy and safety of liberal versus conservative oxygen therapy in acutely ill adults.

Methods In the Improving Oxygen Therapy in Acute-illnes
the Cochrane Central Register of Controlled Trials, MEDI
WHO International Clinical Trials Registry from inception
liberal and conservative oxygen therapy in acutely ill adult
respiratory diseases or psychiatric disease, patients on extr
oxygen therapy or elective surgery were excluded. We screen
and in duplicate. We also extracted individual patient-le
mortality (in-hospital, at 30 days, and at longest follow-u
hospital-acquired pneumonia, any hospital-acquired infect
meta-analyses. We assessed quality of evidence using the grading of recommendations assessment, development, and evaluation approach. This study is registered with PROSPERO, number CRD42017065697.

Findings 25 randomised controlled trials enrolled 16 037 patients with sepsis, critical illness, stroke, trauma, myocardial infarction, or cardiac arrest, and patients who had emergency surgery. Compared with a conservative oxygen strategy, a liberal oxygen strategy (median baseline saturation of peripheral oxygen [SpO_2] across trials, 96% [range 94–99%, IQR 96–98]) increased mortality in-hospital (relative risk [RR] 1·21, 95% CI 1·03–1·43, I^2=0%, high quality), at 30 days (RR 1·14, 95% CI 1·01–1·29, I^2=0%, high quality), and at longest follow-up (RR 1·10, 95% CI 1·00–1·20, I^2=0%, high quality). Morbidity outcomes were similar between groups. Findings were robust to trial sequential, subgroup, and sensitivity analyses.

Lancet 2018; 391: 1693–705

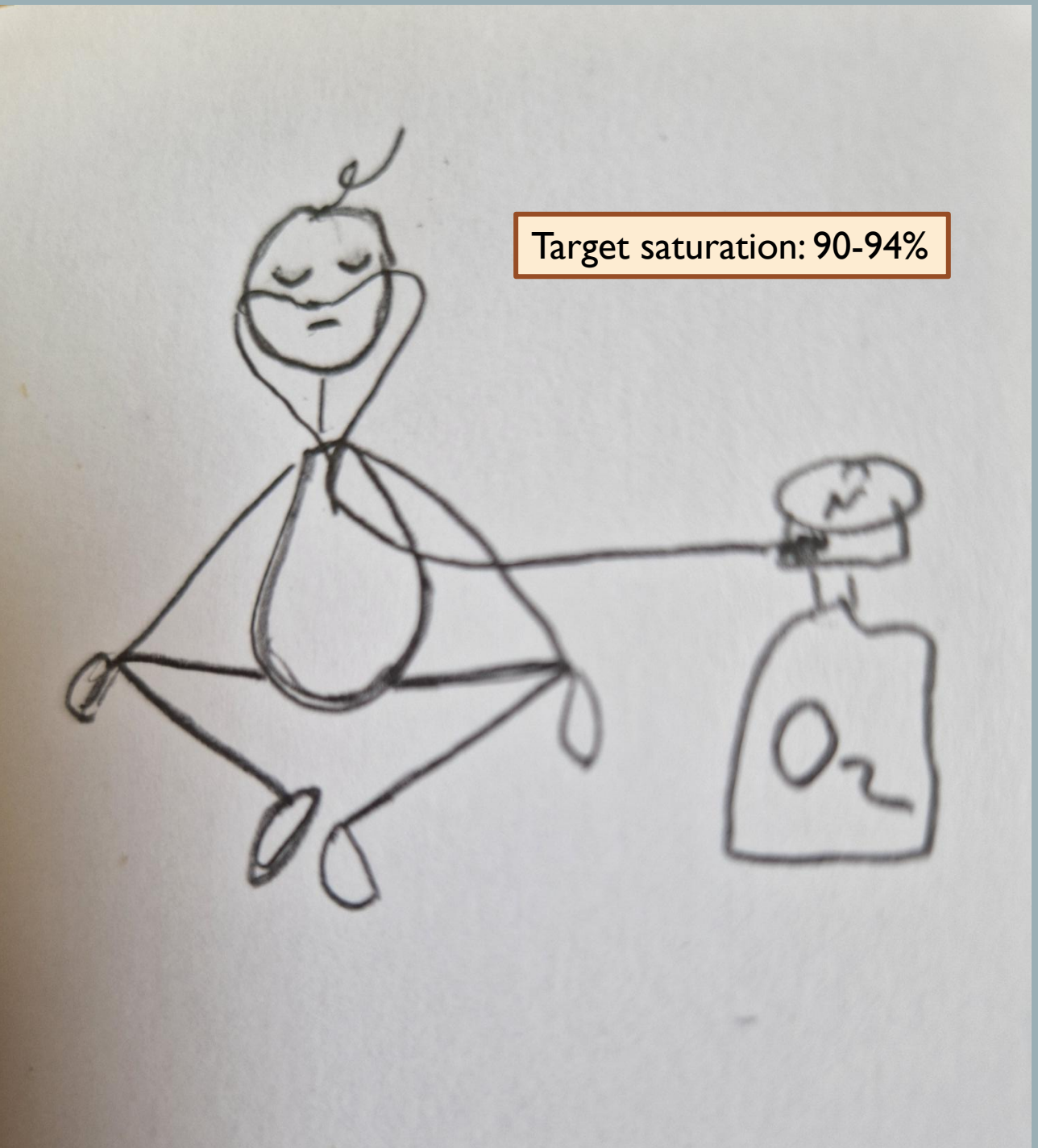
See Comment page 1640

*Contributed equally

(Prof R Jaeschke, Prof H J Schünemann, W Alhazzani), **McMaster University, Hamilton, ON, Canada; Medical Research Institute of New Zealand, Wellington, New Zealand** (P J Young MBChB); **Intensive Care Unit, Wellington Regional Hospital, Wellington, New Zealand** (P J Young); **and Department of Intensive Care and Perioperative Medicine,**

16.037 patients with stroke, sepsis, myocardial infact or critical illness:
A mortality increase of 21 % with liberal oxygen treatment compared to less oxygen dose (SAT 92-96 %).

Dosing oxygen in the stable stetting:
Patients with COPD needing home oxygen



The Oxygen dose is determined based on an arterial blood gas analysis – taken AT REST

Exercising with COPD

Oxygen need increases

⬇

Desaturation

⬇

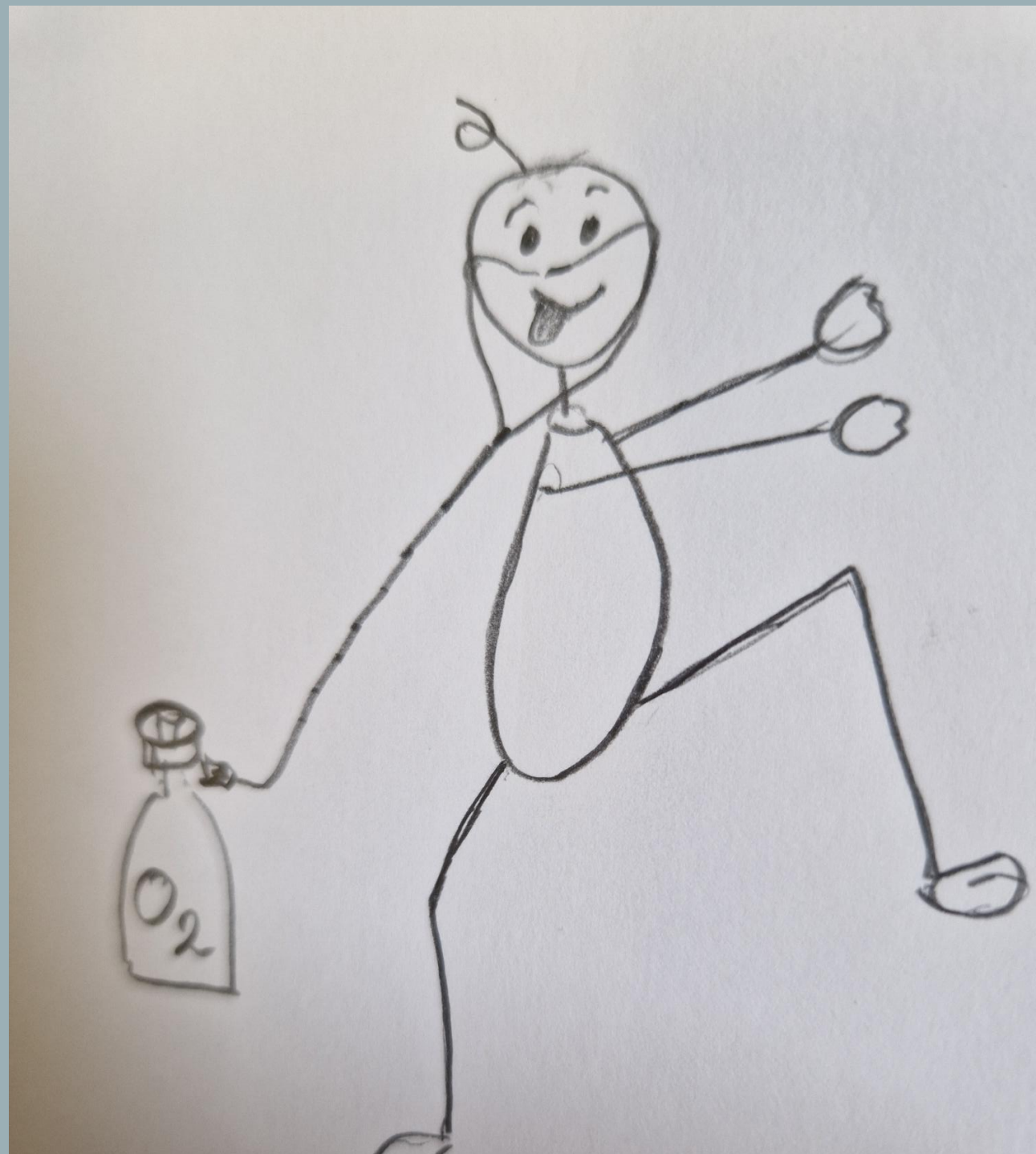
Hypoxemia

⬇

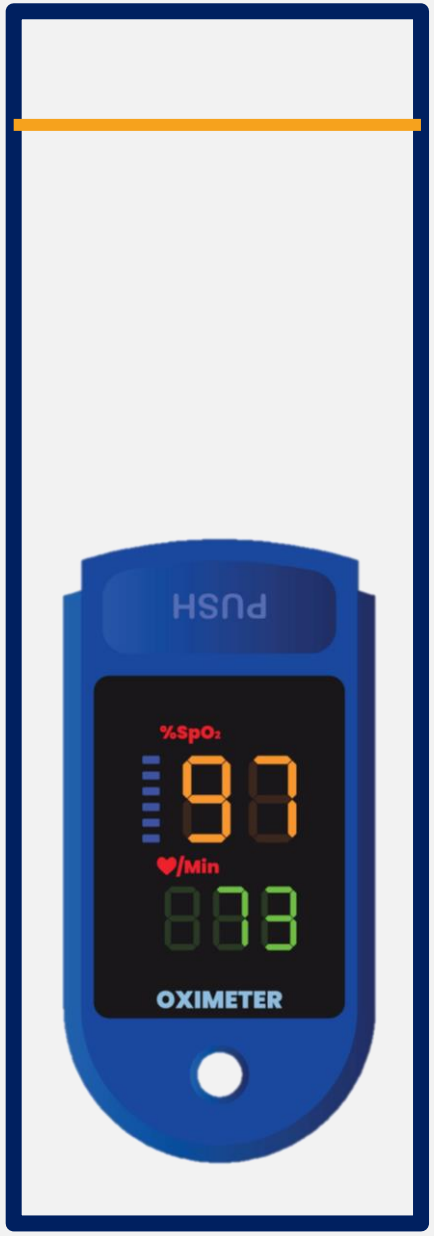
Dyspnea

⬇

Activity stop




O2


PUSH
%SpO2
98
♥/Min
888
OXIMETER

O2Matic = automated oxygen titration

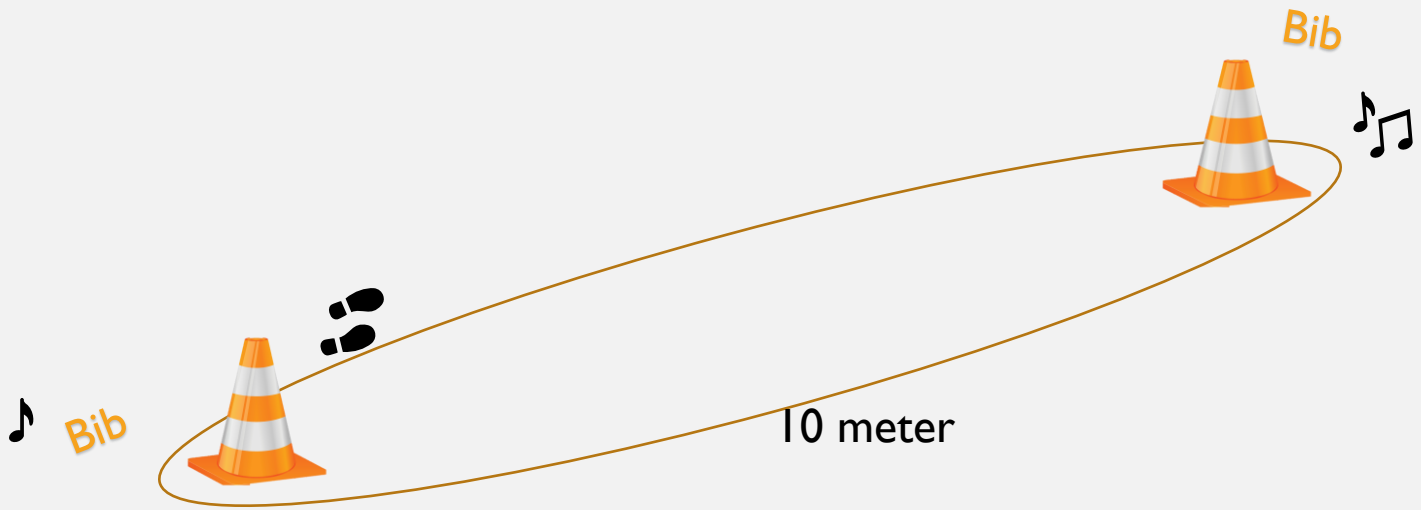
METHODE

Randomized Crossover double-blind study

N= 33 patients

‘From 0–10, how much difficulty is your breathing causing you right now?’

The Endurance Shuttle Walk Test = ESWT



Dyspnea score (Borg CR10);
The minimal clinically important difference is 1 point in the Borg score

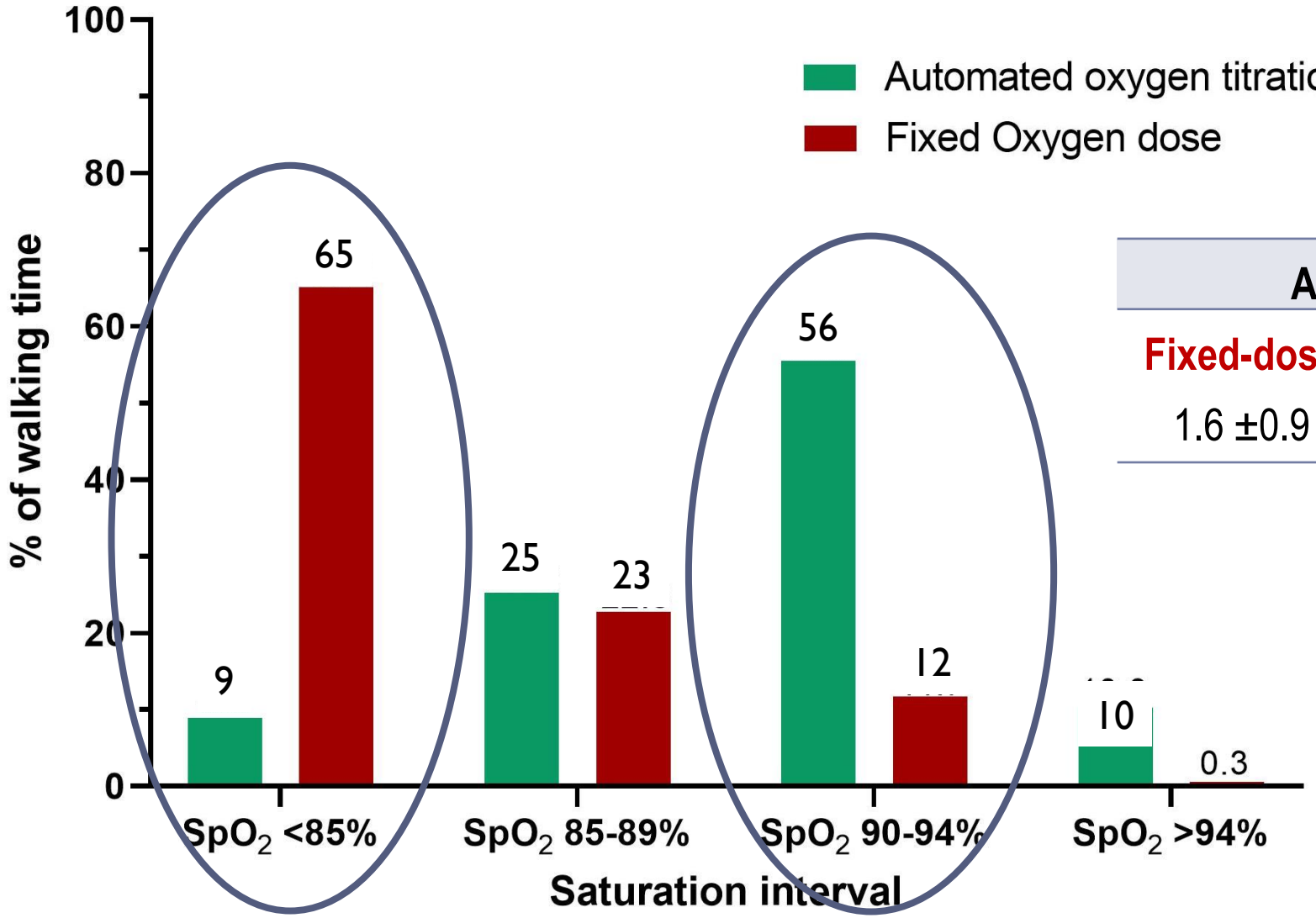
Usual oxygen dose

Target saturation

N=33	Fixed-dose	Automated dose	P–value
Dyspnea score, 0-10	8 (5–9)	4 (3–6)	<0.001
Walking time in minutes	5.5 (3.3–7.9)	10.9 (6.5–14.9)	<0.001

Results

Results



Avg. oxygen dose (l/min)		
Fixed-dose	Automatic dose	P–value
1.6 ±0.9	7.9 ±3.1	<0.001

- Kofod LM, Westerdahl E, Kristensen MT, Brocki BC, Ringbæk T, Hansen EF. Effect of Automated Oxygen Titration during Walking on Dyspnea and Endurance in Chronic Hypoxemic Patients with COPD. J Clin Med. 2021 Oct

Konklusion

- ✓ More well-matched oxygen demand
- ✓ 50% reduction in percieved dyspnea
- ✓ Walking distance 98% increase

Original research

Automatic oxygen titration versus constant oxygen flow rates during walking in COPD: a randomised controlled, double-blind, crossover trial

Tessa Schneeberger,[1,2] Inga Jarosch,[1,2] Daniela Leitl,[1,2] Rainer Gloeckl,[1,2] Wolfgang Hitzl,[3,4,5] Clancy John Dennis,[6] Tatjana Geyer,[7] Carl-Peter Criée,[8] Andreas Rembert Koczulla,[1,2,9,10] Klaus Kenn[1,2,9]

50 patients with COPD and LTOT

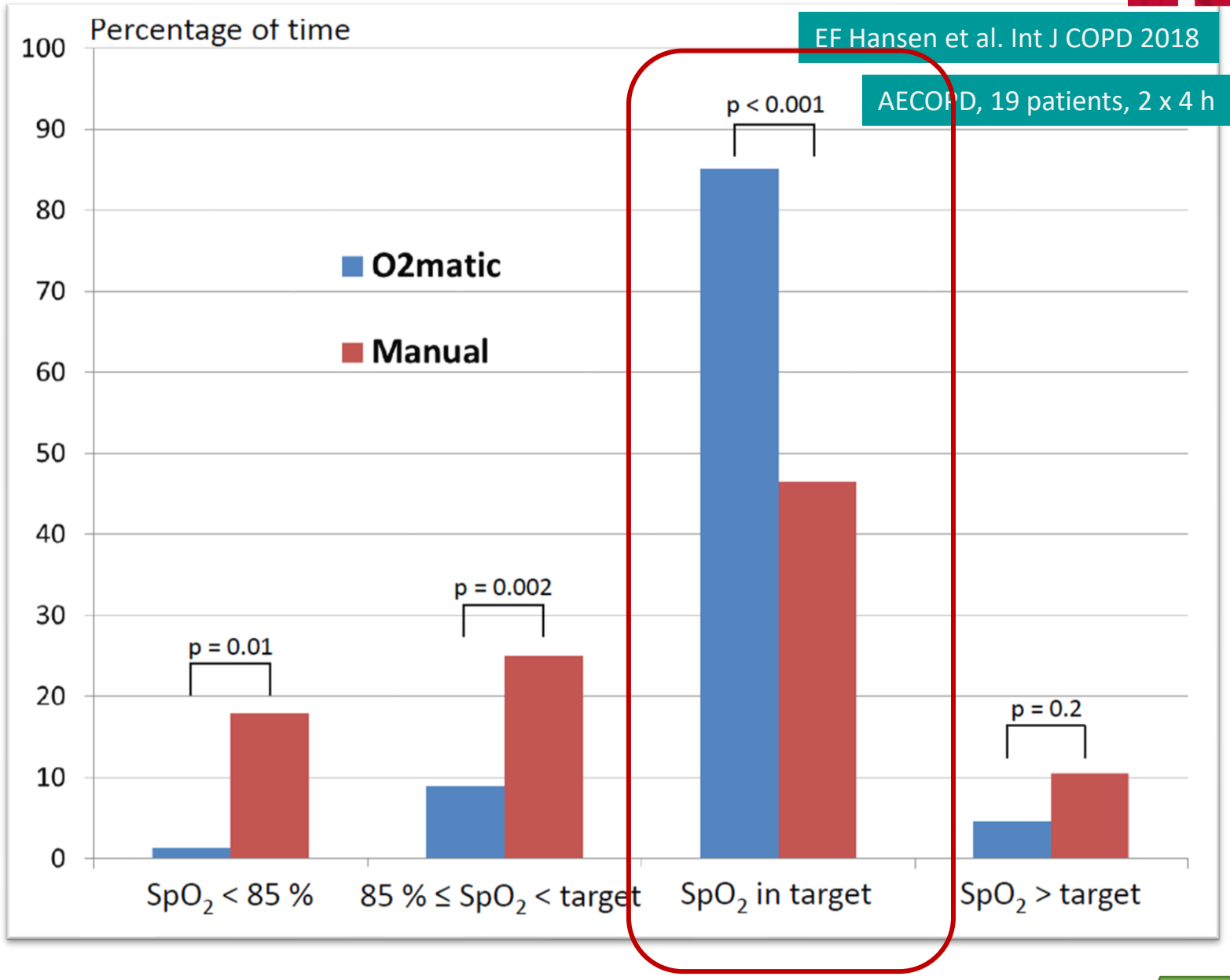
CONCLUSION

As shown by this randomised, double-blinded, crossover trial, we found that the use of an automatically titrating supplemental O_2-system, capable of adjusting O_2-flows during exercise in response to SpO_2, leads to significantly and clinically relevant improvements in walking endurance time, oxygenation and dyspnoea compared with an individually, exercise titrated constant O_2-flow system as commonly used in practice.

No impact on PCO2

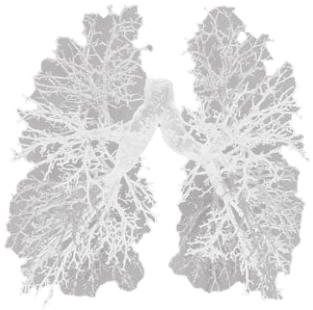
Schneeberger T, Jarosch I, Leitl D, et al. Thorax 2023

Automated devises to keep target saturation



EF Hansen et al. Int J COPD 2018

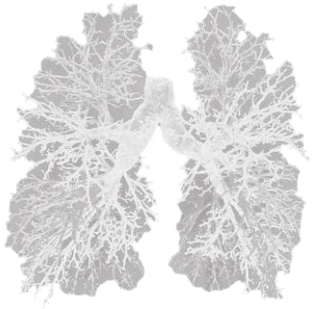
AECOPD, 19 patients, 2 x 4 h



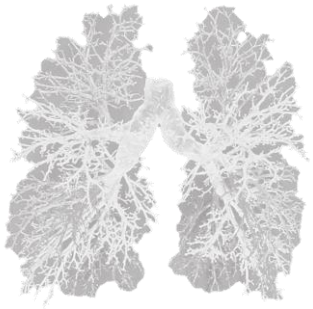
Automated devises to keep target saturation

EF Hansen et al. Eur Clin Resp J 2020

COVID-19, 19 patients, 987 h

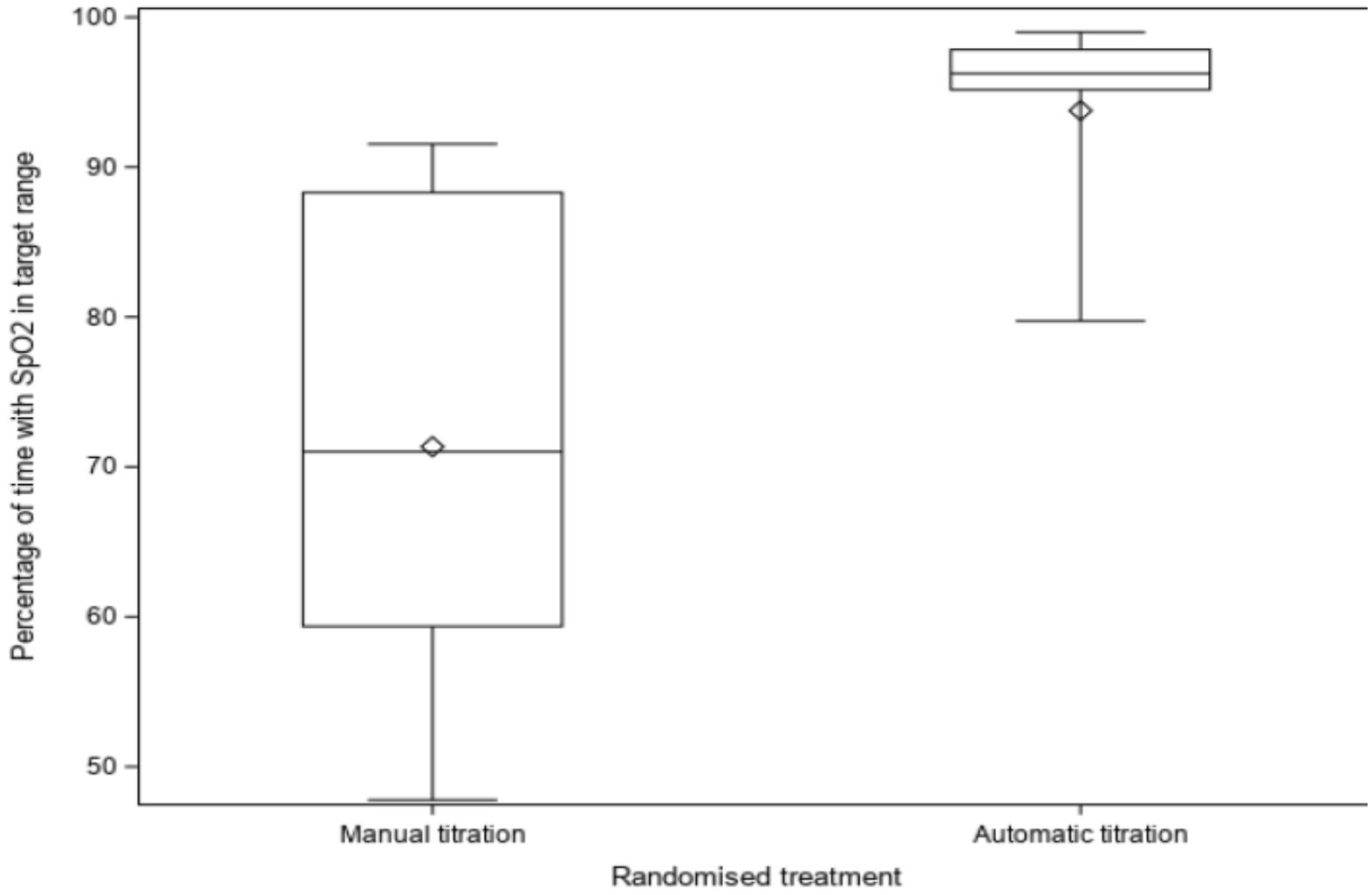


Automated devises to keep target saturation



J Harper et al. BMJ Open Resp Res 2021

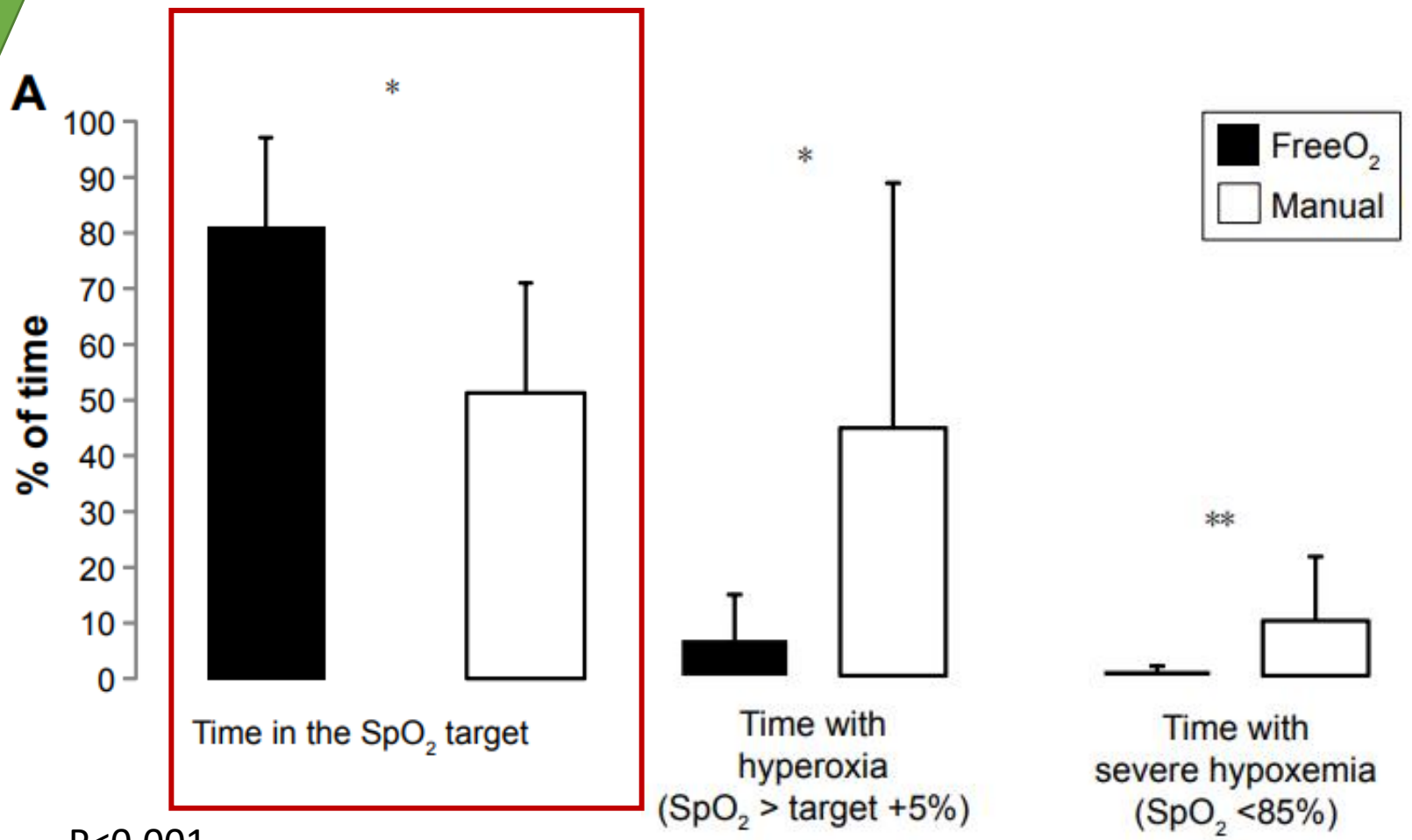
Critical ill, 20 patients, 23 h



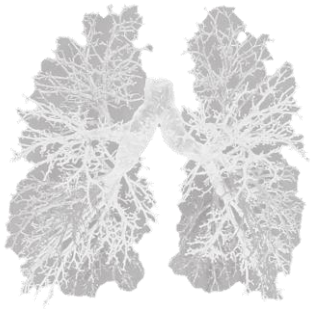
Automated devises to keep target saturation

F Lellouche et al. Int J COPD 2016

AECOPD, 50 patients



P<0.001

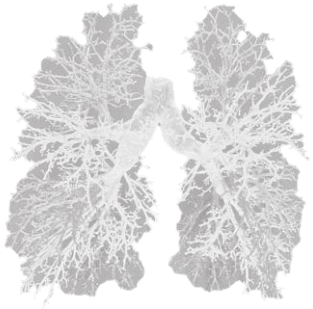


Automated devises to keep target saturation

L´Her et al. Eur Respir J 2017

Emergency room, 190 patients, 3 h

	FreeO$_2$	Manual O$_2$	Adjusted difference (95% CI)	p-value
Primary outcome				
Time within S_{pO_2} range %				
Total	81.3±20.7	51.8±30.0	29.4 (25.7; 33.2)	<0.001
Hypoxaemic respiratory failure	82.8±18.5	56.8±29.3	26.0 (20.5; 31.5)	<0.001
Hypercapnic respiratory failure	77.0±25.7	38.3±28.4	38.7 (19.9; 57.4)	<0.001
Secondary outcomes				
Time with hypoxaemia %				
Total	3.2±8.9	5.1±11.5	2.0 (0.1; 3.9)	0.04



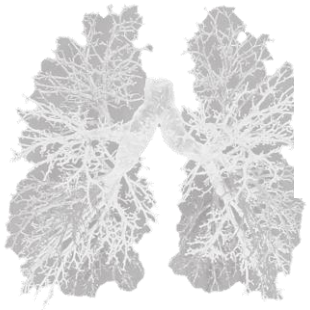
P<0.001

Automated devi… to keep targ… satu…

C Sandau et al. Int J COPD 2023

AECOPD, 157 patients, 40 h

Changes in Symptom Intensities within and Between Intervention and Control Group				
Variable	**Within intervention-group changes; median [IQR]**	**Within control-group changes; median [IQR]**	**Difference in median change between the intervention and the control group**	***p*-Value for between groups differences**
Dyspnea overall unpleasantness, scale A1 MDP (range 0–10)				
Dyspnea overall unpleasantness	−5 [−6: −2]	−2 [−6: 0]	−3	0.003*
Intensity of five sensory qualities on the MDP (item range 0–10)				
Physical breathing effort	−3 [−6: 0]	−1 [−3: 1]	−2	0.005*
Air hunger	−4 [−7: −1.25]	−1 [−3: 0]	−3	<0.001*
Chest tightness	−1 [−5: 0]	0 [−1: 0]	−1	<0.001*
Mental breathing effort	−4 [−7: 0]	−1 [−4: 0.5]	−3	0.029*
Hyperpnea	−3 [−6: 0]	−2 [−4.5: 0]	−1	0.032*



We know that…

Acute setting

- A target saturation is beneficial

  + Mortality

  +Dyspnea

- Automated oxygen devises keep the patients better in target interval

Non-acute setting

- Target saturation **during physical tests**

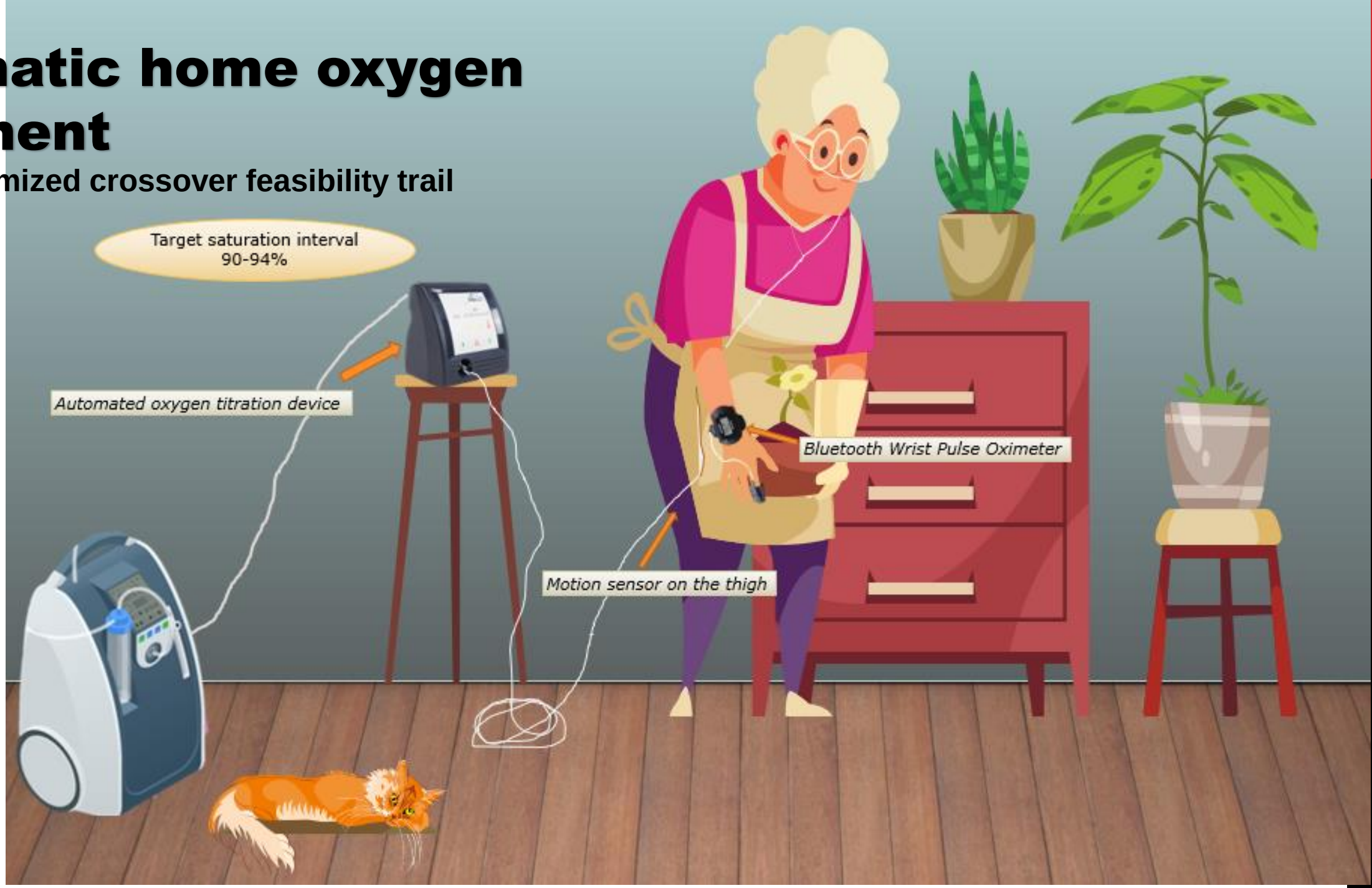
  + Dyspnea

  + Exercise capcity

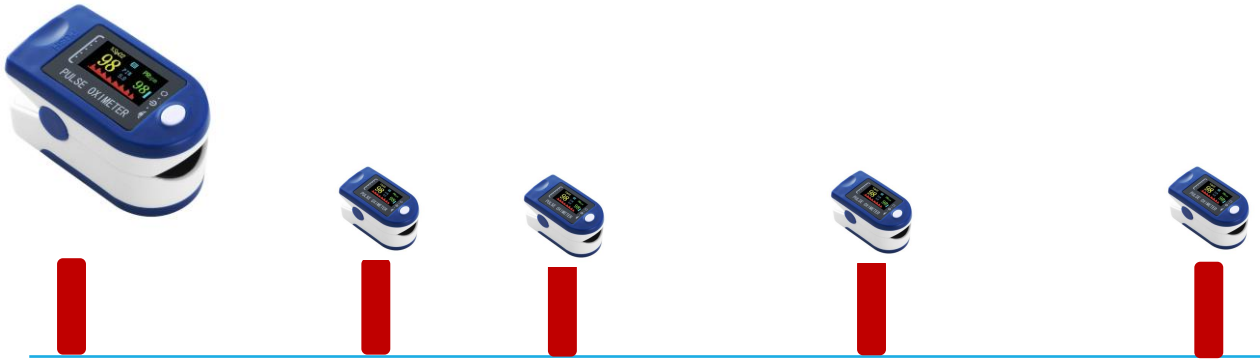
At home

Automatic home oxygen treatment

A pilot randomized crossover feasibility trail
12 patients



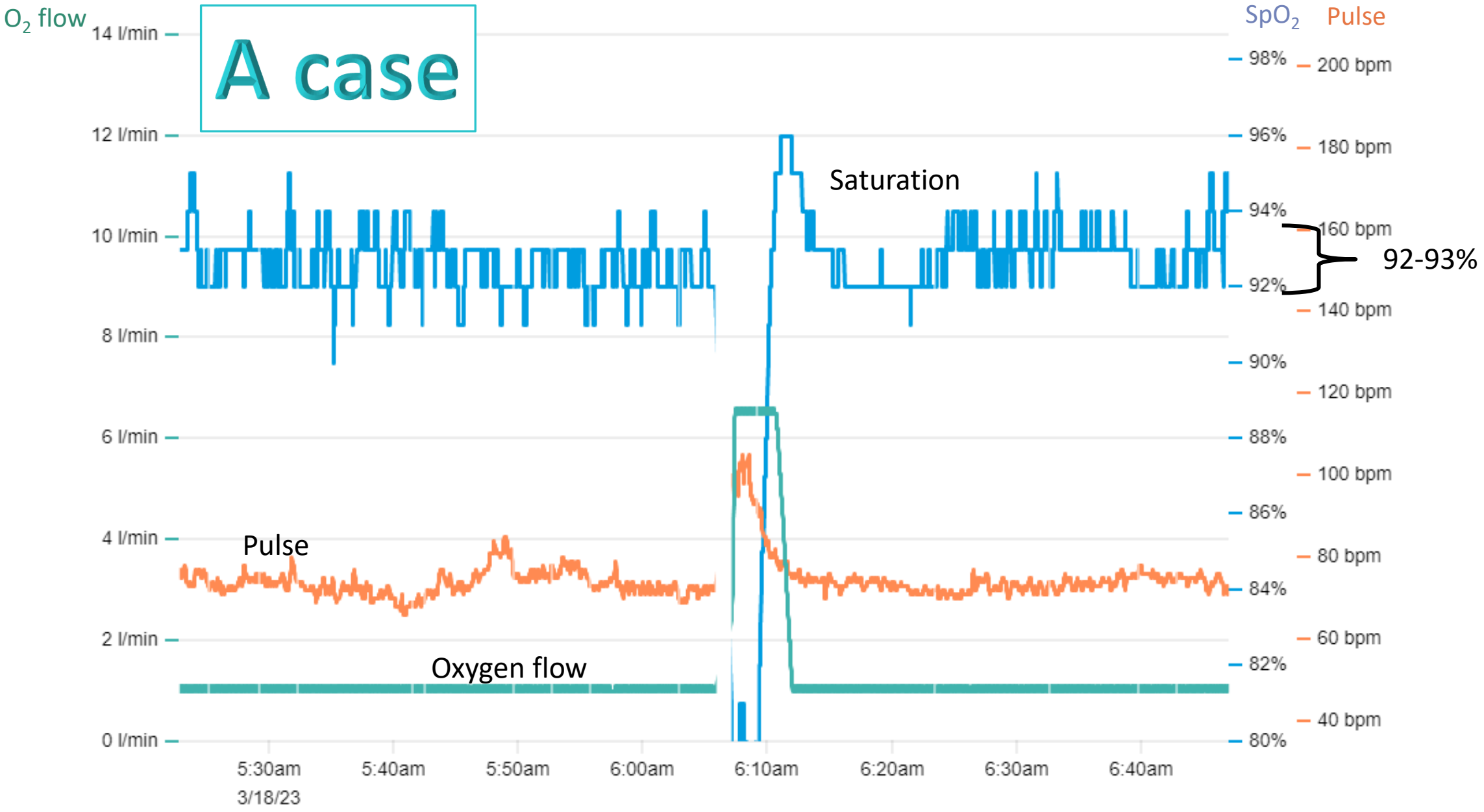
DaiLiHOT – part 2



1-5 l/min

1-8 l/min

A case


O_2 flow
14 l/min
12 l/min
10 l/min
8 l/min
6 l/min
4 l/min
2 l/min
0 l/min
SpO_2
98%
96%
94%
92%
90%
88%
86%
84%
82%
80%
Pulse
200 bpm
180 bpm
160 bpm
140 bpm
120 bpm
100 bpm
80 bpm
60 bpm
40 bpm
Saturation
92-93%
Pulse
Oxygen flow
5:30am
3/18/23
5:40am
5:50am
6:00am
6:10am
6:20am
6:30am
6:40am

We know, that

- Oxygen treatment decreases mortality
- Avoiding hyperoxemia and hyoxemia in an acute setting decreases mortality and dyspnea

We do not know, if

- hypoxemia- and hyperoxemia- “fluctuations” affect the health in stable COPD
- Target saturation during daily life would be beneficial for the patient with stable COPD

Iltmœtte

But we are going to investigate it…

Study team:
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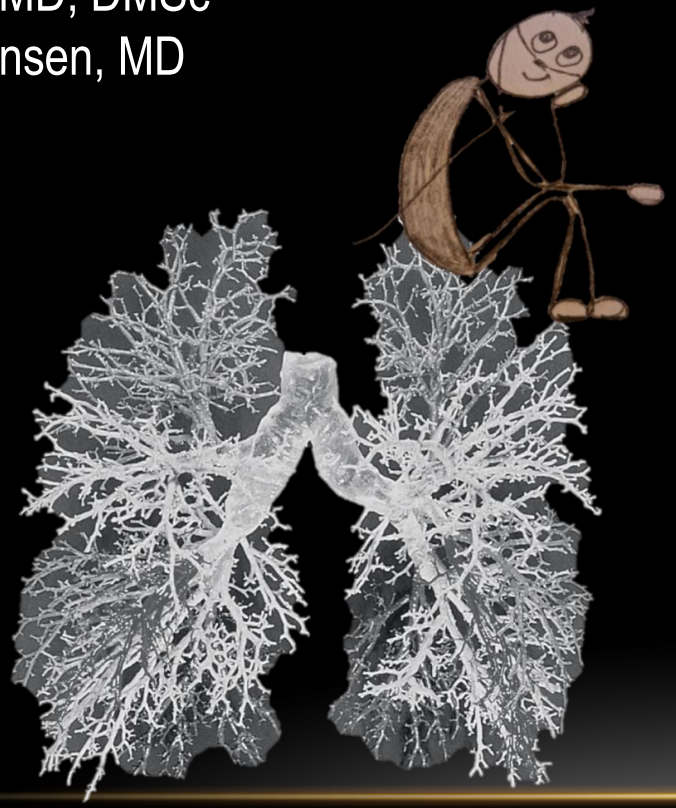
Barbara Cristina Brocki, PT, PhD
Dorthe Gaby Dove, RN, PhD
Thomas Ringbæk, MD, DMSc
Ejvind Frausing Hansen, MD

Linette



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REGION H Amager og Hvidovre Hospital
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Örebro University