

Portable oxygen therapy in patients with COPD - Is it useful?

동국대의대 호흡기내과 윤영순

Oxygen therapy

- Long term oxygen therapy (LTOT)
- **Ambulatory/portable oxygen therapy (AOT)**
- Nocturnal oxygen therapy (NOT)
- Short-burst oxygen therapy
- Palliative oxygen therapy

우리나라 보험

- 2006년 11월 가정산소요법 보험적용
- 2017년 1월 휴대용 산소발생기 보험적용: 산소치료처방전을 발급 받은 경우

	가정용	휴대용	장비기준
기준금액	12만원/월	20만원/월	- 소음 : 60dB 이하 - 모드 : 흡입모드 - 경보기능: 기기고장, 배터리잔량, 호흡수이상감지, 호흡미감지 중 1가지 이상
최고금액	16만원/월	24만원/월	- 소음 : 60dB 이하 - 모드 : 연속모드 - 경보기능: 기기고장, 산소농도, 배터리잔량, 호흡수 이상감지, 호흡미감지 중 2가지 이상

Guidelines for AOT

	British guideline (BTS)	German guideline (DGP)
4. AOT for patients without classic indication criteria	Only during rehabilitation program	Indicated if resting PaO ₂ is ≤60 mm Hg, plus drop in PaO ₂ , or improvement with AOT in 6MWT; not indicated if resting PaO ₂ is >55 mm Hg without increasing dyspnoea during exercise Exercise test 필요

GOLD 2018: where benefit is demonstrated through a blinded trial of oxygen versus air, assessing outcomes such as exercise capacity or improvement in dyspnea

NZ and Australia: maximized O₂ use in patients with LTOT or where benefit is demonstrated through a blinded trial of oxygen versus air, assessing outcomes such as exercise capacity or improvement in dyspnea
→ should be educated about how and when to use their oxygen and should be reviewed early to establish any perceived benefit

AOT in patients eligible for LTOT

- AOT should not be routinely offered to patients already on LTOT. (Grade D)
 - to leave the house on an occasional basis, for example for hospital appointments
- AOT assessment should only be offered to patients already on LTOT if they are mobile outdoors. (Grade A)
 - to achieve 15 h per day usage
 - to optimize exercise capacity

AOT in patients not eligible for LTOT

- AOT should not be routinely offered to patients who are not eligible for LTOT. (Grade B)
- AOT should be offered to patients for use during exercise in a pulmonary rehabilitation (PR) programme or during an exercise programme following a formal assessment demonstrating improvement in exercise endurance. (Grade B)

Short term effects of AOT

SINGLE ASSESSMENT

Long term effects of AOT

IN PATIENTS NOT ELIGIBLE FOR LTOT

QOL and adherence in 41 domiciliary use

	Δ cylinder oxygen-cylinder air	p-value	after finishing PR during 6w
Disease specific HRQL			
CRQ[#]			
Dyspnoea (5–35)	2.0 (0.9)		2.5 for dyspnea (5)
Fatigue (4–28)	1.8 (0.7)		2 for fatigue (4)
Emotional function (7–49)	3.3 (1.2)		3.5 for emotion (7)
Mastery (4–28)	1.8 (0.7)		2 for mastery (5)
Total (20–140)	8.8 (2.8)		10 for the total CRQ (20)
HAD[¶]			
Anxiety (0–21)	-1.6 (0.6)	0.009	
Depression (0–21)	-1.0 (0.5)	0.05	

	Acute response		Total	responder			
	Yes	No		acute	short	both	
Short-term response							
Yes	17	6	23	No use	14		
No	11	7	18	Use	20	6	2
Total	28	13	41				12

Domiciliary use

		n	기간	Restin g O2	산소 반응	O2 (l/m)	기구	산소사용량	Outcome
McDonald 1995 (Australia)	Sx	26	12w (CO)	>60mm Hg	+	4	C 5.0kg	5.1 for 6w <30min/d	6MWT(14m), step test CRQ Borg score
Eaton 2002 (NZ)	EID	41	12w (CO)	≥55mm Hg	+	4	C 2.0kg	1.75h/d	CRQ 1.8-3.3 6MWT (358 vs 283m) Borg score HADS -1.0~-1.6
Nonoyama 2007 (Can)	EID + Sx	27	6(2w*3) N-of-1		+ ET↑	2	C	3.5h/d	CRQ, SGRQ 5MWT (427 vs 412 steps) Borg score (2.8 vs 3.2)
Moore 2011 (Australia)	Sx MMR C≥3	139	12w	>55mm Hg	+ 10.7 m	6	C 4.2kg	8.9 cylinder for 12w (45min/d)	CRQ D 1.3 HADS 0.6 6MWT TDI, Physical activity

Clinically small

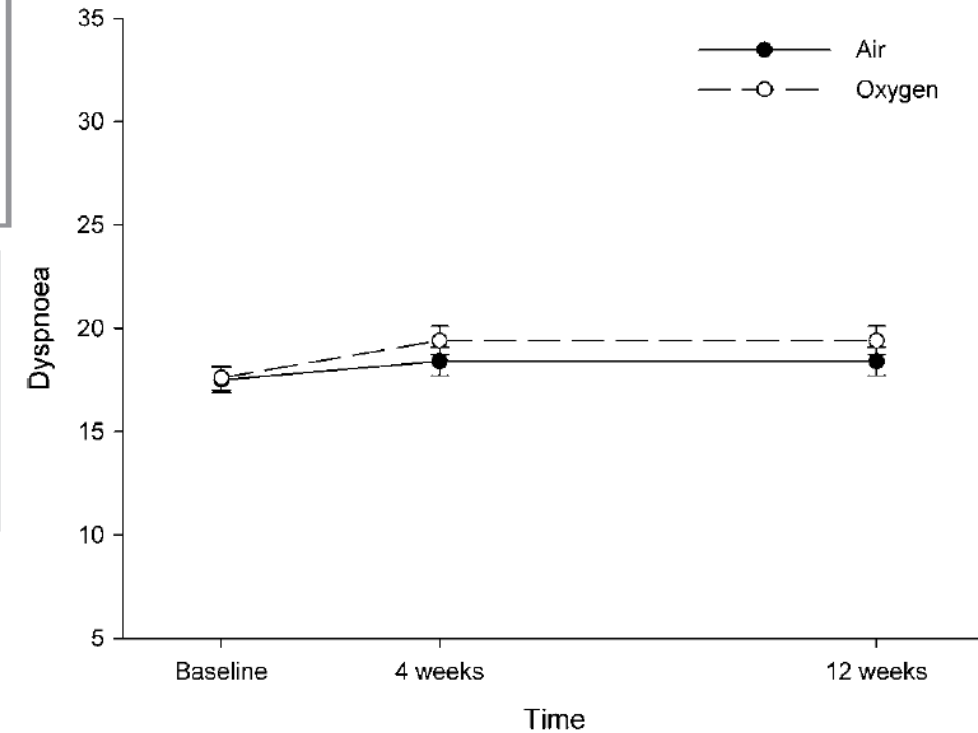
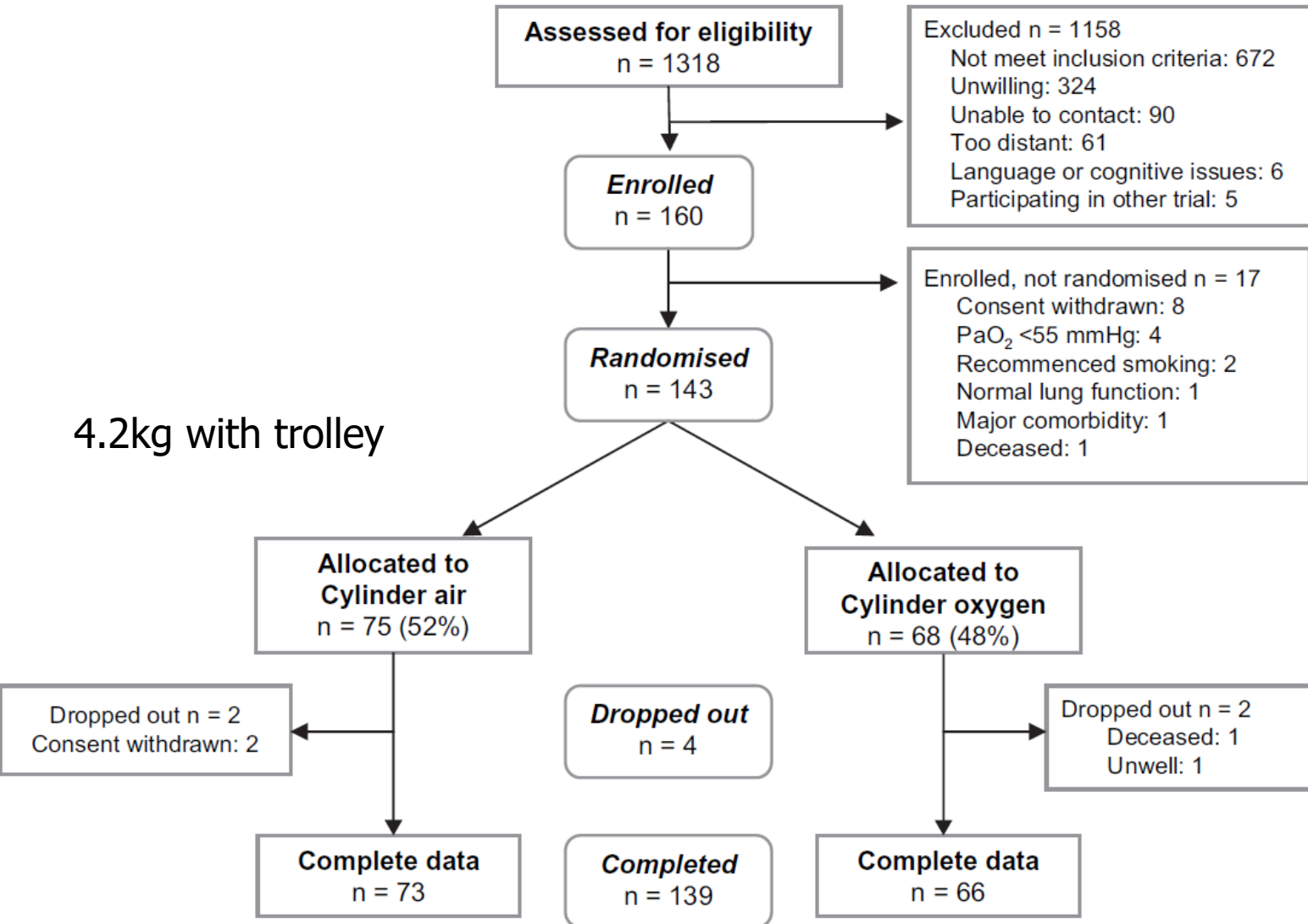
EID: exercise induced desaturation (≤88%), CR: cross over, C: cylinder, L: liquid, UB: unblinded, SB: single blinded, ET: endurance time

Pulmonary Rehabilitation use

		n	기간 (세션)	Resti ng O2	산소 반응	O2 (l/m)	기구	산소 사용량	Outcome
Rooyackers 1997 (Neth)	EID<90% kept at >90%	24	10w (50)	≥64m mHg	+	4 (UB)			Maximal cycle ergometry Endurance cycling time 6MWT RA>O2 123 vs 86 CRQ, Borg score
Janaudis-F, 2009 (Sweden)	EID≤92% kept at >90%	20	8w (24)	≥60m mHg		5 (SB)			6MWT RA>O2 40 vs 35 Time<90% Borg score
Dyer 2012 (UK)	EID >4% ↑>10% with O2	47	7w (14)		-	2-6 (SB)	C L(일 부)		ESWT CRQ (M 0.7) HADS
Ringbaek 2013 (Denmark)	EID on ISWT/ES WT+Sx	45	33w	>90%	+	2 (UB)	POC 2.3 kg	7.9 h/w	ESWT SGRQ AECOPD
Emtner 2003 (US)	≥88% (no EID)	29	7w (21)	>55m mHg	+	3	C(H)		Maximal cycle ergometry Constant power cycle ergometry (14.5 vs 10.5min) CRQ (M), Borg score, SF36 (general)
Spielmanns 2015 (Germany)	>90% (no EID)	36	24w	>90%		4	C		6MWT

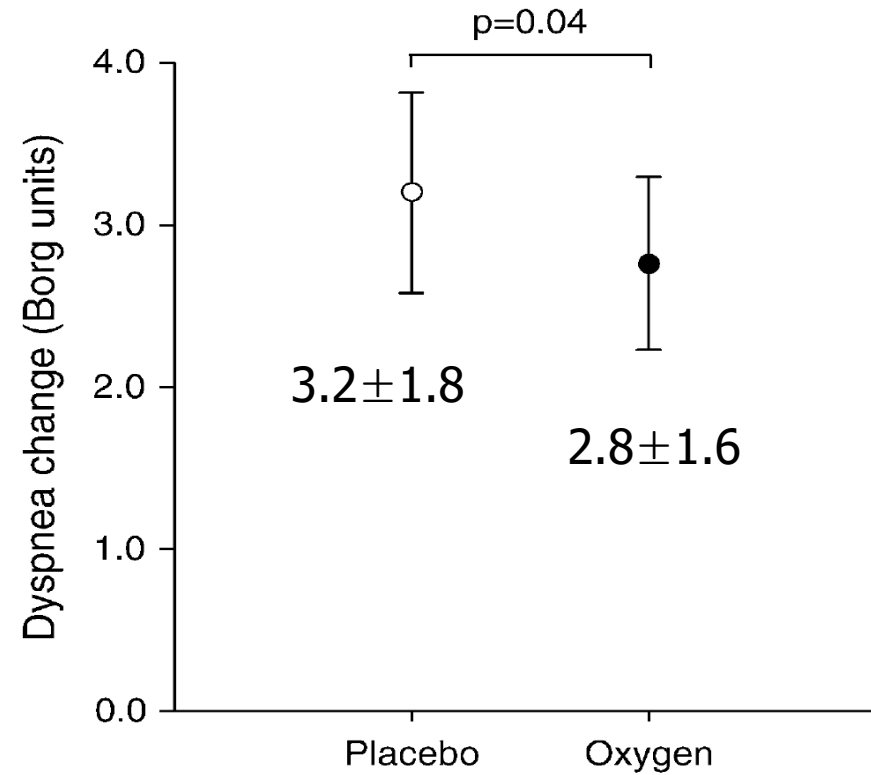
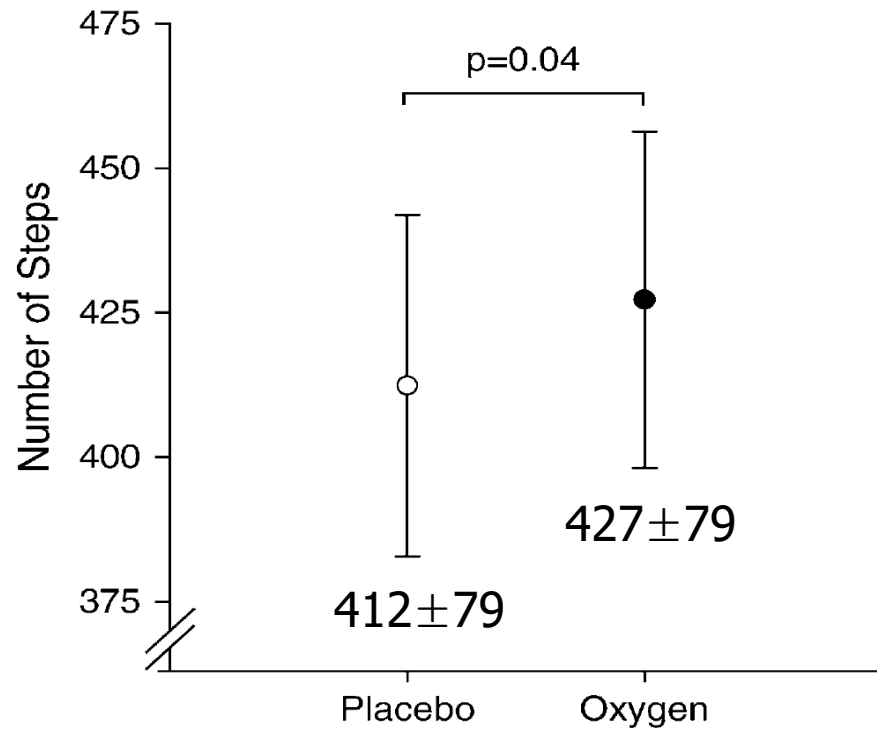
Domiciliary AO in patients with exertional dyspnea

4.2kg with trolley



46% in OG, 45% in AG: cease using cylinders
50%: difficulties with the apparatus including poor portability

N-of-1 trial of 3 pairs for 2 w – Group (n=27)



N-of-1 trial of 3 pairs for 2 w – individual

27

4

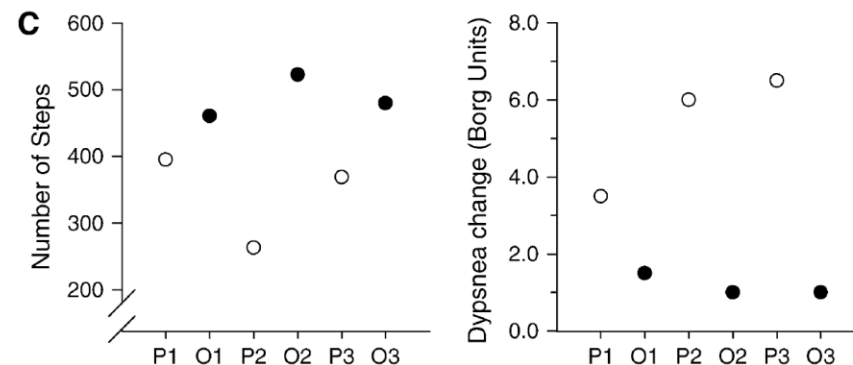
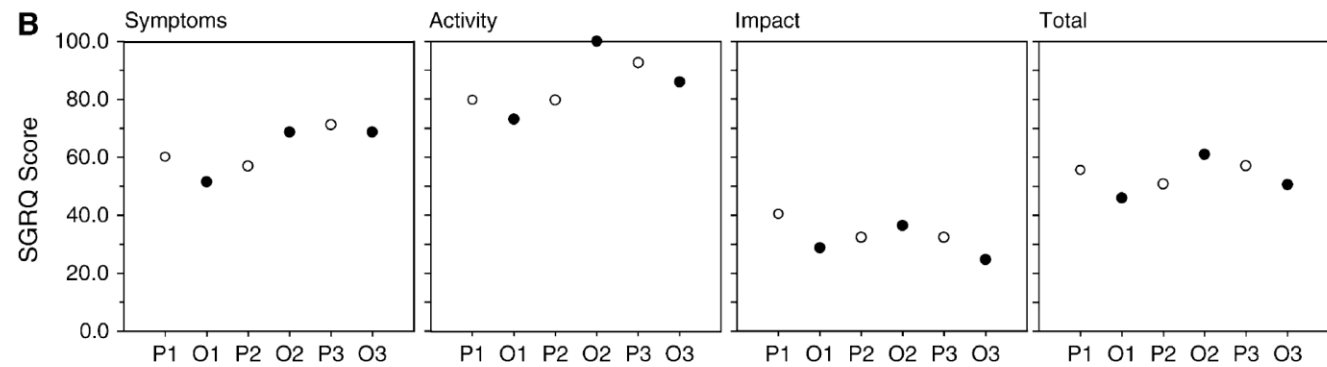
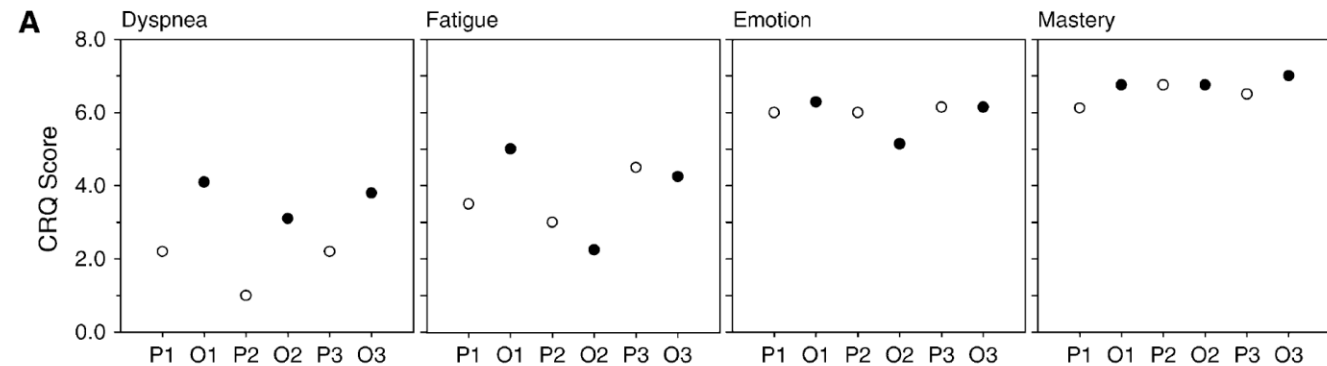
CRQ-D in O2 > air in all 3 pairs

2

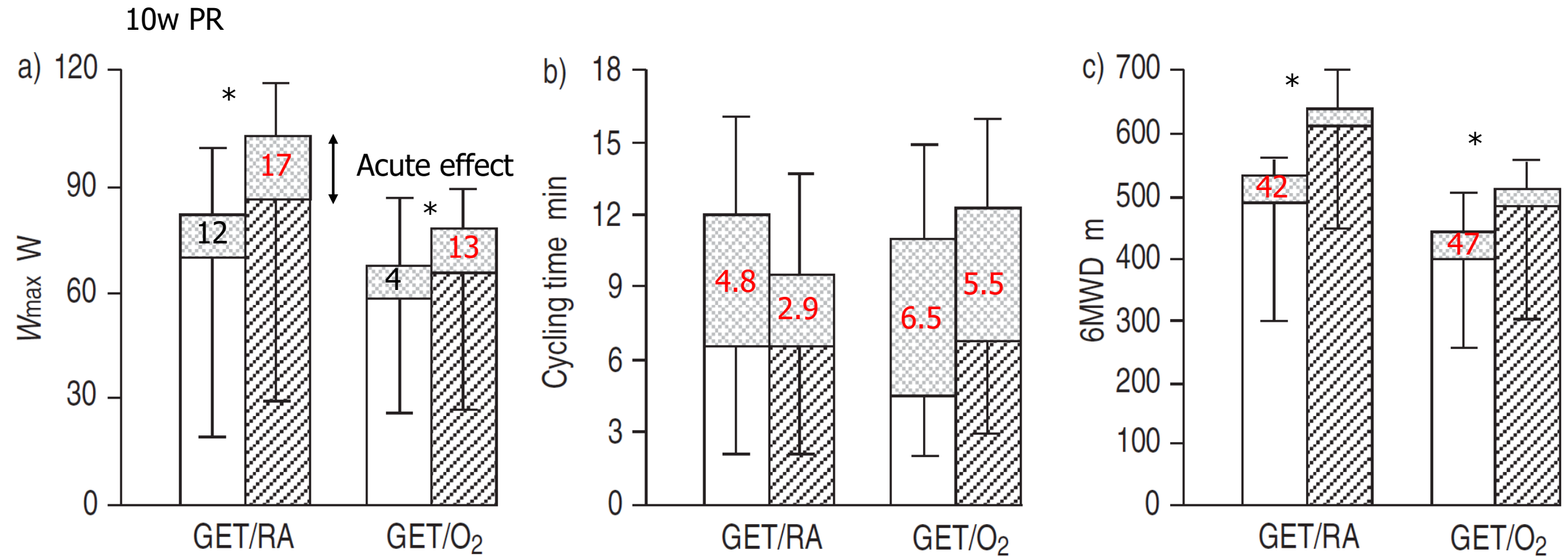
Difference of CRQ-D in 2/3 pairs >0.5

no response of CRQ, SGRQ, walk test

	1	2	3
O2 (h/d)	17.5	18	21
Air (h/d)	2.2	3.6	6.6



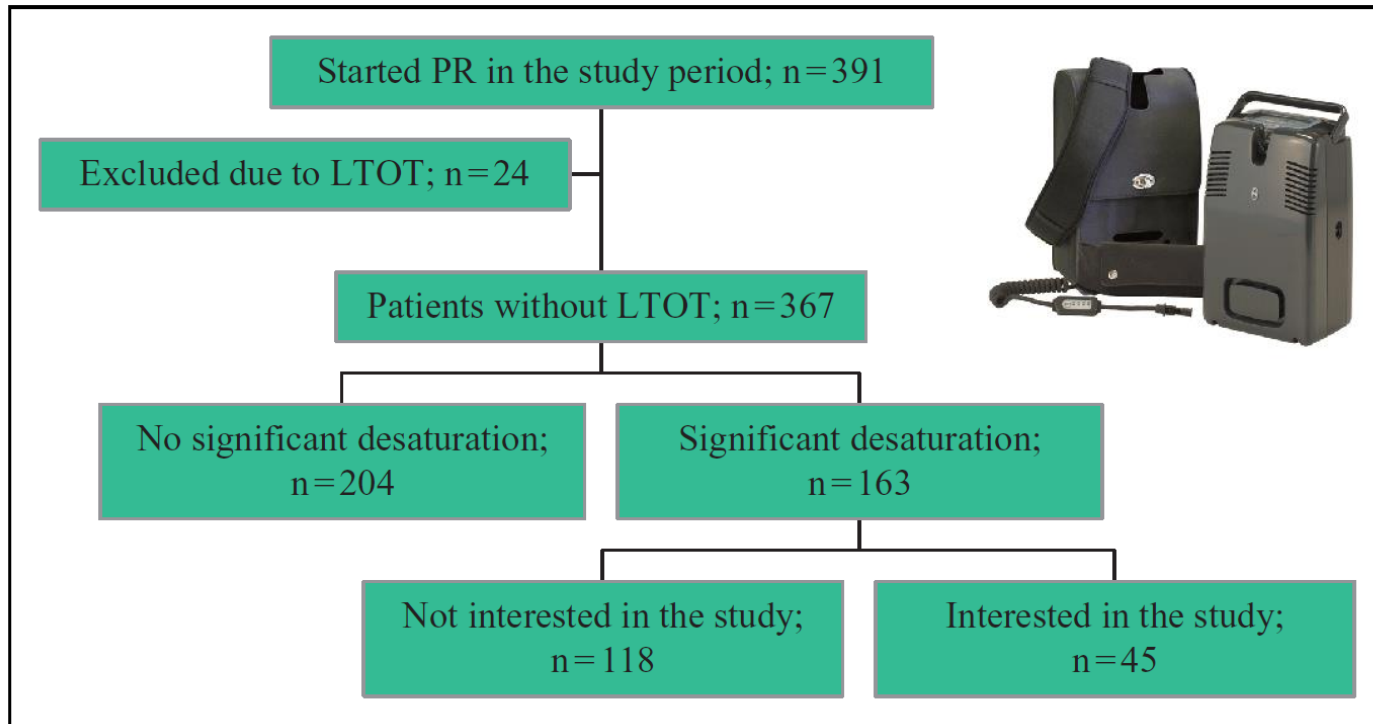
Acute effect and exercise performance in 24 PR use



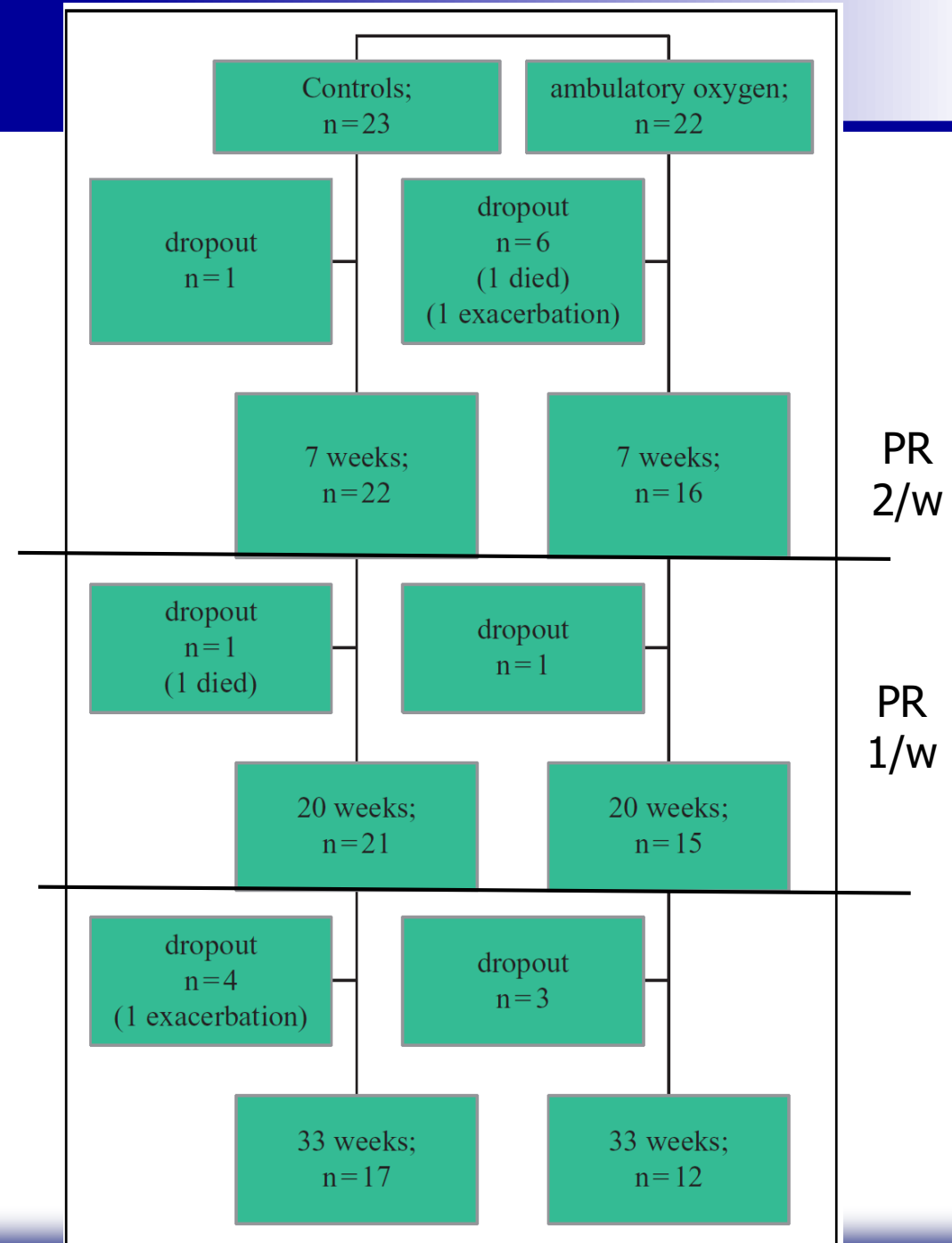
PR effect over O₂, acute effect, no long term effect

Acute effect: no predictor of long term effect

ESWT in 29 PR use for 33w



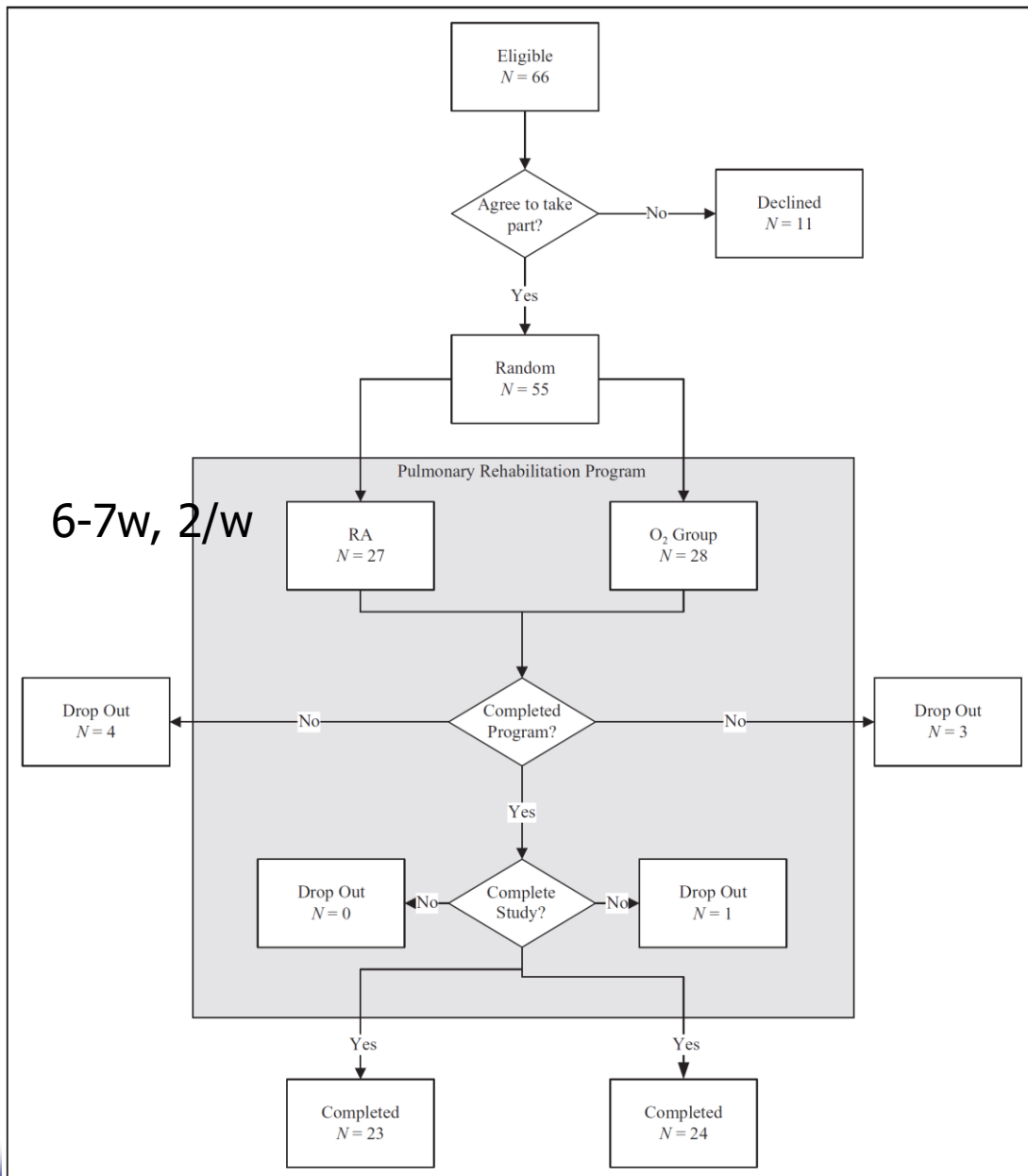
SaO2 after ESWT 85.9 83.8 p=0.006



ESWT after PR of 29 for 33w

Periods	Effect parameters	AO, n = 22	p Level	Controls, n = 23	p Level	p Level for difference between groups								
0 to 7 weeks	Mean change in <u>ESWT, seconds</u>	186 (213)	<0.001	169 (253)	<0.001	0.75	6	7	7–20	20–33				
	Mean change in <u>ESWT, meter</u>	168 (183)	0.001	167 (239)	0.001	0.77								
	Mean change in <u>SGRQ, units</u>	–1.8 (8.0)	0.38	–3.2 (7.2)	0.07	0.80								
	Mean number of <u>AECOPD per patient (minimum–maximum)</u>	0.44 (0–2)		0.91 (0–2)		0.09					3.4	12.1	8.5	5.5
	Mean number of <u>hospital admissions per patient (minimum–maximum)</u>	0.06 (0–1)		0.14 (0–1)		0.72					2.9	5.4	4.1	1.7
	Patients with AECOPD, hospital admission or dropout, N	11		12		0.88								
0 to 20 weeks	Mean change in ESWT, seconds	193 (256)	<0.001	215 (319)	<0.001	0.91								
	Mean change in ESWT, meter	170 (257)	0.001	184 (314)	0.002	0.83								
	Mean change in SGRQ, units	–3.5 (7.2)	0.08	–2.9 (8.6)	0.44	0.81								
	Mean number of AECOPD per patient (minimum–maximum)	1.07 (0–3)		1.57 (0–4)		0.20								
	Mean number of hospital admissions per patient (minimum–maximum)	0.07(0–1)		0.24 (0–2)		0.53								
	Patients with AECOPD, hospital admission or dropout, N	16		18		0.87								
0 to 33 weeks	Mean change in ESWT, seconds	223 (277)	0.004	241 (402)	0.015	0.32								
	Mean change in ESWT, meter	160 (191)	0.009	267 (425)	0.06	0.78								
	Mean change in SGRQ, units	–3.6 (7.9)	0.16	–4.5 (11.3)	0.16	0.91								
	Mean number of AECOPD per patient (minimum–maximum)	1.50 (0–5)		2.00 (0–5)		0.30								
	Mean number of hospital admissions per patient (minimum–maximum)	0.17 (0–1)		0.35 (0–2)		0.56								
	Patients with AECOPD, hospital admission or dropout, N	17		20		0.59								

AO during PR in 51 'acute responders'



ESWT(a) and O₂ 2, 4, 6l/m → 90% 로 유지

AO during PR in 51 'acute responders'

Table 2. Change in endurance shuttle walking test with PR

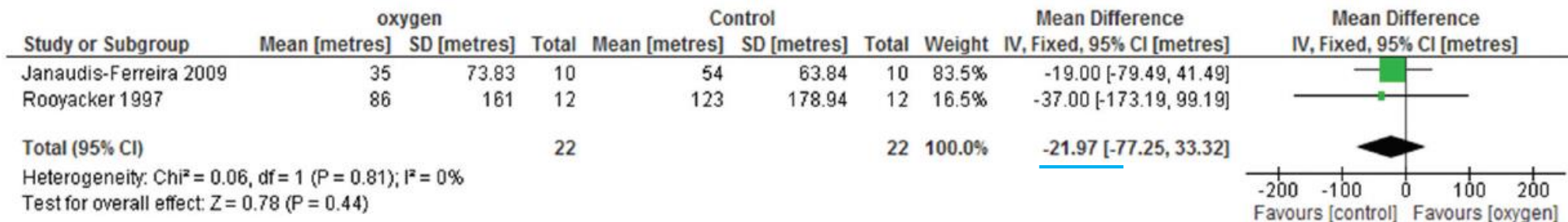
	RA group	O ₂ group	Difference	95% CI	p value
Mean change, seconds ^a (SD)	378 (364)	679 (317)	301	101–501	0.004
Mean change, m ^b (SD)	393 (395)	883 (484)	<u>489</u>	228–750	0.0005
Mean change, % ^c (SD)	77 (59)	204 (468)	127	31–223	0.01

A weak negative correlation ($r=-0.19$; $p = 0.197$) between the magnitude of the acute response to ambulatory oxygen at baseline and change in ESWT post PR

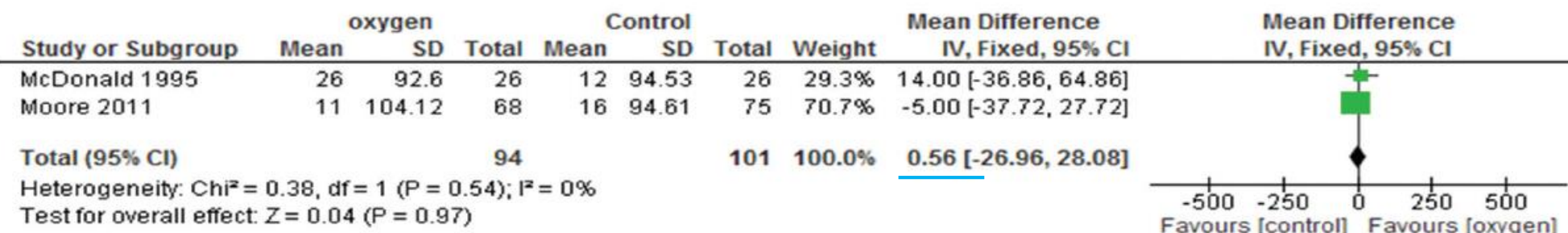
No adherence data

69% use O₂ during exercise not daily activity: awkward, difficult to carry, embarrassment

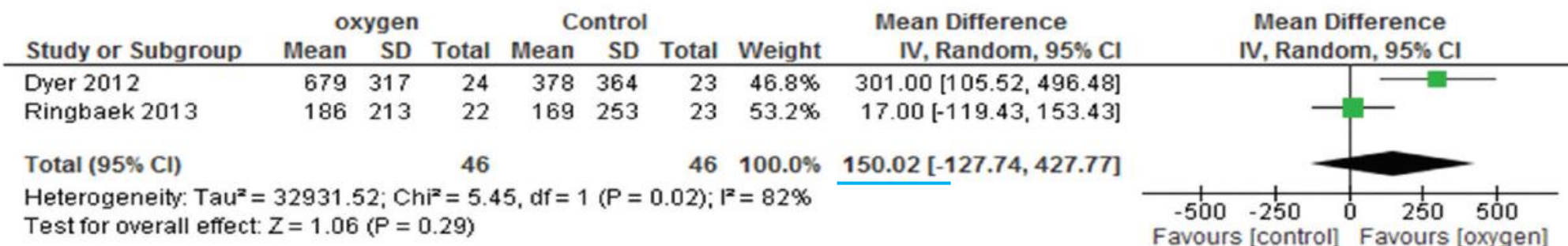
Exercise capacity



**2.1 6MWT
(metres)**



**2.2 6MWT
(domiciliary
studies)**

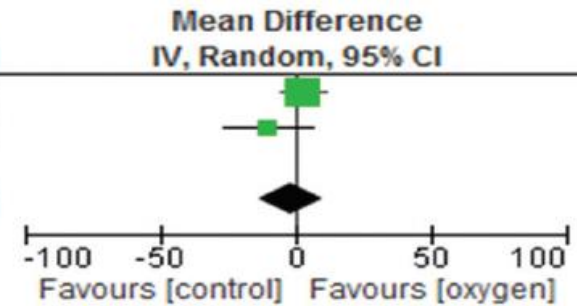


**2.3 ESWT
(seconds)**

Exercise capacity

Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Emtner 2003	13	13	14	10	9	15	65.8%	3.00 [-5.19, 11.19]
Rooyacker 1997	7	25	12	17	15	12	34.2%	-10.00 [-26.50, 6.50]
Total (95% CI)	26			27			100.0%	-1.45 [-13.54, 10.64]

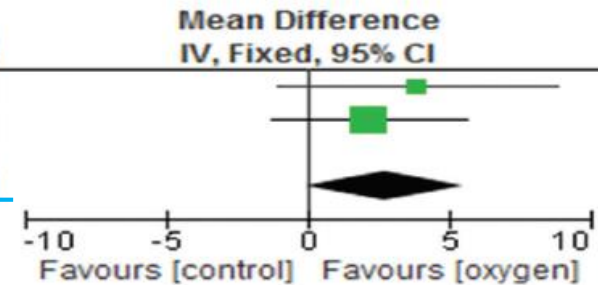
Heterogeneity: Tau² = 40.35; Chi² = 1.91, df = 1 (P = 0.17); I² = 48%
 Test for overall effect: Z = 0.23 (P = 0.81)



2.4 Incremental power exercise (watts)

Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Emtner 2003	14.8	7.5	14	10.9	5.9	15	32.7%	3.90 [-1.03, 8.83]
Rooyacker 1997	2.2	4.2	12	0	4.4	12	67.3%	2.20 [-1.24, 5.64]
Total (95% CI)	26			27			100.0%	2.76 [-0.07, 5.58]

Heterogeneity: Chi² = 0.31, df = 1 (P = 0.58); I² = 0%
 Test for overall effect: Z = 1.91 (P = 0.06)

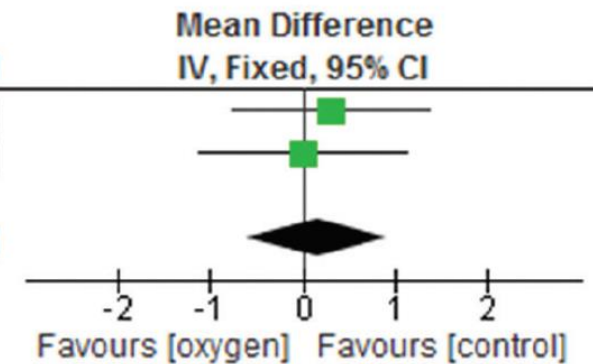


2.5 Constant work rate (mins)

Exercise-induced dyspnea

Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Janaudis-Ferreira 2009	1	1.5	10	0.7	0.8	10	53.1%	0.30 [-0.75, 1.35]
Rooyacker 1997	0.3	1.4	12	0.3	1.4	12	46.9%	0.00 [-1.12, 1.12]
Total (95% CI)			22			22	100.0%	0.16 [-0.61, 0.93]

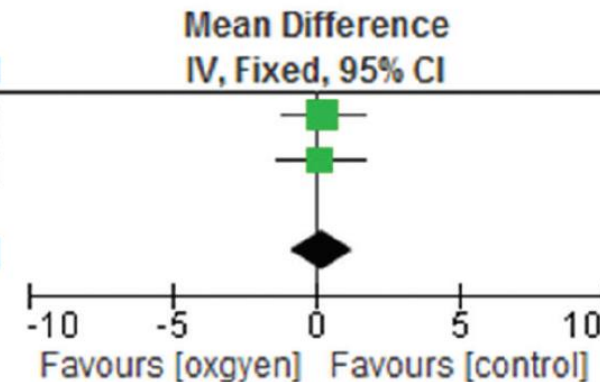
Heterogeneity: $\text{Chi}^2 = 0.15$, $\text{df} = 1$ ($P = 0.70$); $I^2 = 0\%$
 Test for overall effect: $Z = 0.41$ ($P = 0.68$)



3.1 Borg Score 6MWT

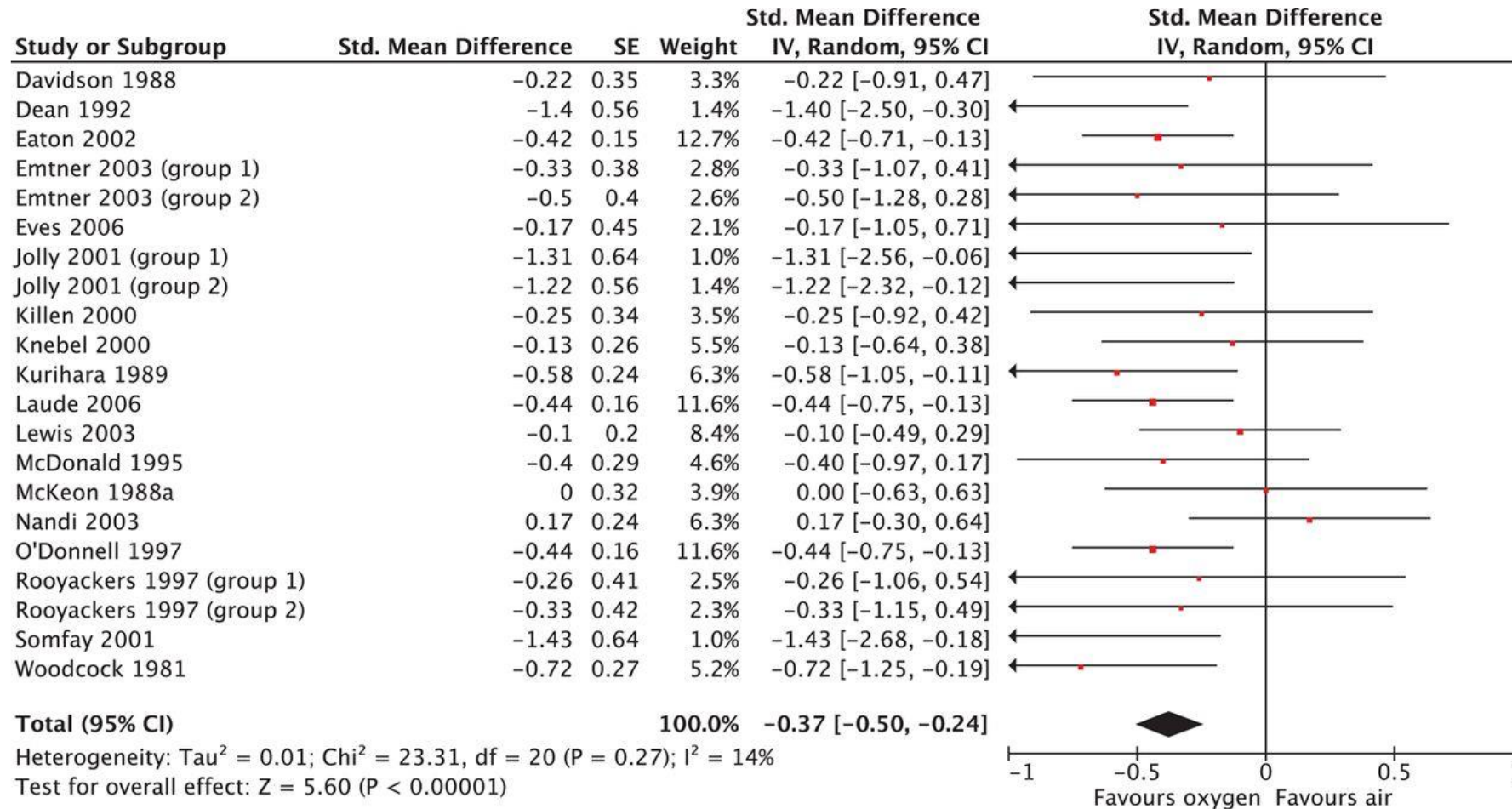
Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Emtner 2003	0.4	2.3	14	0.1	1.6	15	53.4%	0.30 [-1.15, 1.75]
Rooyacker 1997	-1.3	1.7	12	-1.5	2.16	12	46.6%	0.20 [-1.36, 1.76]
Total (95% CI)			26			27	100.0%	0.25 [-0.81, 1.31]

Heterogeneity: $\text{Chi}^2 = 0.01$, $\text{df} = 1$ ($P = 0.93$); $I^2 = 0\%$
 Test for overall effect: $Z = 0.47$ ($P = 0.64$)



3.2 Borg Score incremental power exercise

Breathlessness



Short term: 29
 Long term: 3

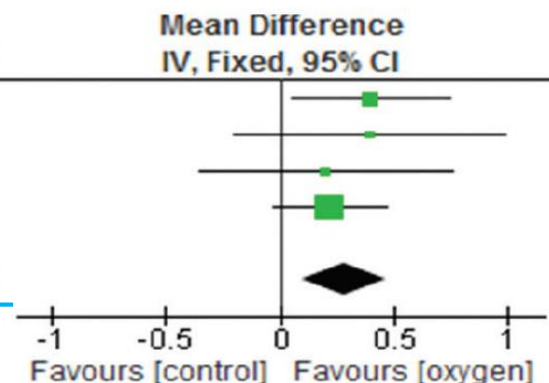
HRQoL (domiciliary studies)

4.1 CRQ Dyspnoea

Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Eaton 2002	3.72	0.815	41	3.32	0.815	41	26.8%	0.40 [0.05, 0.75]
McDonald 1995	1	1.1	26	0.6	1.1	26	9.3%	0.40 [-0.20, 1.00]
Moore 2011	0.38	2.12	68	0.18	1.08	75	10.6%	0.20 [-0.36, 0.76]
Nonoyama 2007	3.92	0.4687	27	3.7	0.4687	27	53.3%	0.22 [-0.03, 0.47]
Total (95% CI)			162			169	100.0%	0.28 [0.10, 0.47]

Heterogeneity: Chi² = 0.90, df = 3 (P = 0.83); I² = 0%

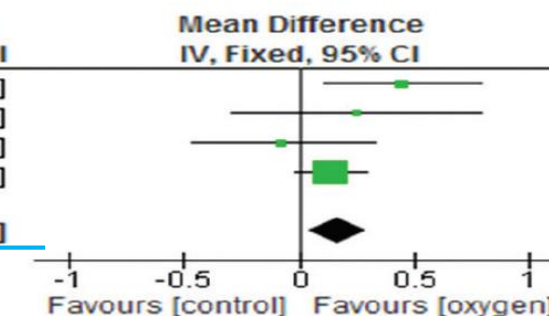
Test for overall effect: Z = 3.04 (P = 0.002)



Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Eaton 2002	4.28	0.7923	41	3.83	0.7923	41	14.9%	0.45 [0.11, 0.79]
McDonald 1995	0.75	1	26	0.5	1	26	5.9%	0.25 [-0.29, 0.79]
Moore 2011	0.05	1.26	68	0.125	1.18	75	10.9%	-0.07 [-0.48, 0.33]
Nonoyama 2007	4.04	0.2999	27	3.9	0.2999	27	68.3%	0.14 [-0.02, 0.30]
Total (95% CI)			162			169	100.0%	0.17 [0.04, 0.30]

Heterogeneity: Chi² = 4.21, df = 3 (P = 0.24); I² = 29%

Test for overall effect: Z = 2.51 (P = 0.01)

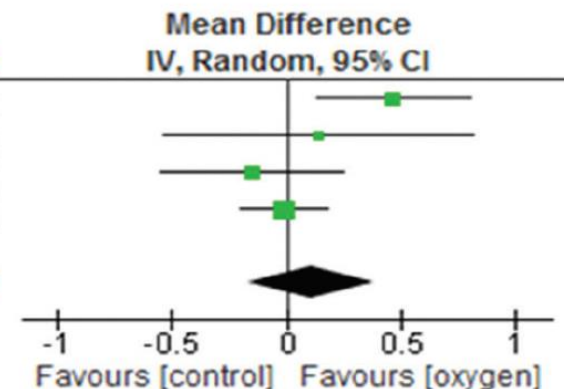


4.2 CRQ Fatigue

HRQoL (domiciliary studies)

Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Eaton 2002	5.371	0.7742	41	4.9	0.7742	41	27.3%	0.47 [0.14, 0.81]
McDonald 1995	0.43	1.2	26	0.29	1.29	26	12.3%	0.14 [-0.54, 0.82]
Moore 2011	-0.08	1.27	68	0.07	1.17	75	23.3%	-0.15 [-0.55, 0.25]
Nonoyama 2007	5.09	0.3562	27	5.1	0.3562	27	37.2%	-0.01 [-0.20, 0.18]
Total (95% CI)			162			169	100.0%	0.11 [-0.17, 0.39]

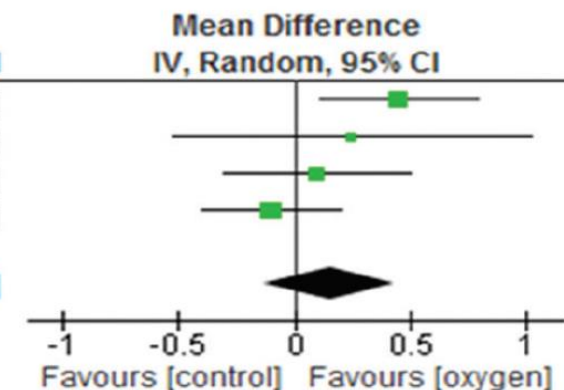
Heterogeneity: Tau² = 0.05; Chi² = 7.37, df = 3 (P = 0.06); I² = 59%
 Test for overall effect: Z = 0.75 (P = 0.45)



4.3 CRQ Emotion

Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Eaton 2002	5.325	0.7923	41	4.875	0.7923	41	30.2%	0.45 [0.11, 0.79]
McDonald 1995	0.75	1.5	26	0.5	1.38	26	10.5%	0.25 [-0.53, 1.03]
Moore 2011	0.12	1.24	68	0.02	1.24	75	25.6%	0.10 [-0.31, 0.51]
Nonoyama 2007	4.7	0.5624	27	4.8	0.5624	27	33.8%	-0.10 [-0.40, 0.20]
Total (95% CI)			162			169	100.0%	0.15 [-0.13, 0.44]

Heterogeneity: Tau² = 0.04; Chi² = 5.71, df = 3 (P = 0.13); I² = 47%
 Test for overall effect: Z = 1.07 (P = 0.28)



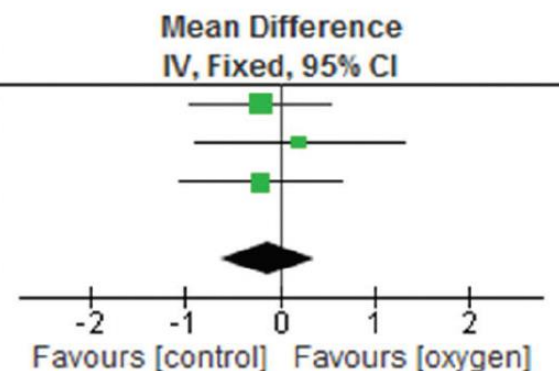
4.4 CRQ Mastery

HRQoL (PR studies)

Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Dyer 2012	0.4	1.3	24	0.6	1.3	23	45.1%	-0.20 [-0.94, 0.54]
Emtner 2003	1.6	1.2	14	1.4	1.8	15	20.3%	0.20 [-0.91, 1.31]
Rooyacker 1997	1.14	1.08	12	1.34	1.04	12	34.6%	-0.20 [-1.05, 0.65]
Total (95% CI)			50			50	100.0%	-0.12 [-0.62, 0.38]

Heterogeneity: $\text{Chi}^2 = 0.40$, $\text{df} = 2$ ($P = 0.82$); $I^2 = 0\%$

Test for overall effect: $Z = 0.47$ ($P = 0.64$)

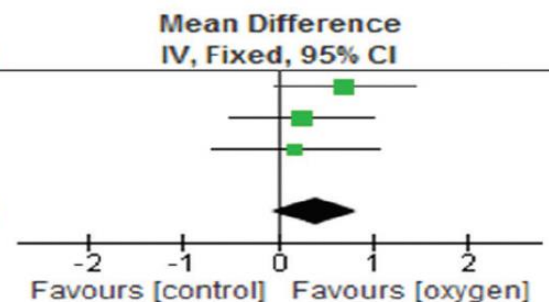


5.1 CRQ Dyspnoea

Study or Subgroup	oxygen			Control			Weight	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Dyer 2012	1.1	1.2	24	0.4	1.4	23	36.8%	0.70 [-0.05, 1.45]
Emtner 2003	1.25	1.03	14	1	1.03	15	36.5%	0.25 [-0.50, 1.00]
Rooyacker 1997	0.83	1.03	12	0.65	1.16	12	26.7%	0.18 [-0.70, 1.06]
Total (95% CI)			50			50	100.0%	0.40 [-0.06, 0.85]

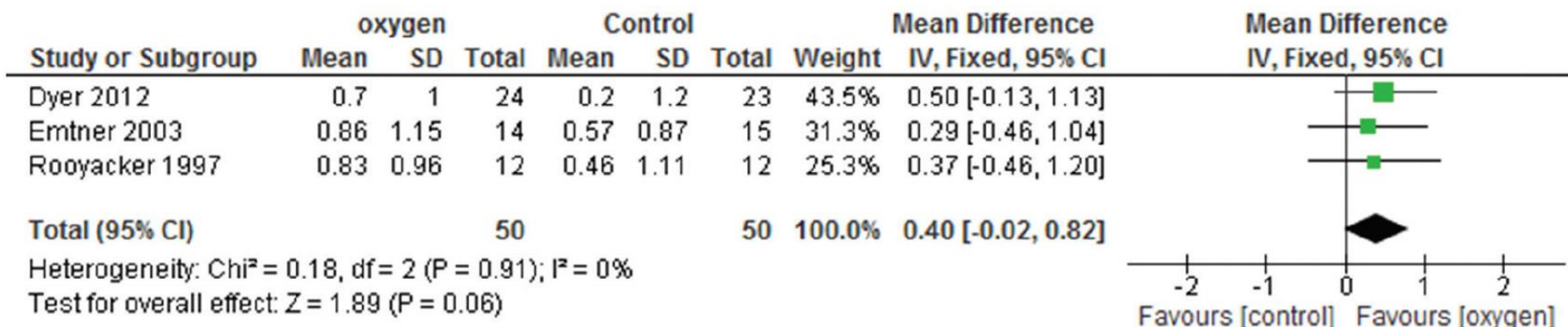
Heterogeneity: $\text{Chi}^2 = 1.01$, $\text{df} = 2$ ($P = 0.60$); $I^2 = 0\%$

Test for overall effect: $Z = 1.72$ ($P = 0.09$)

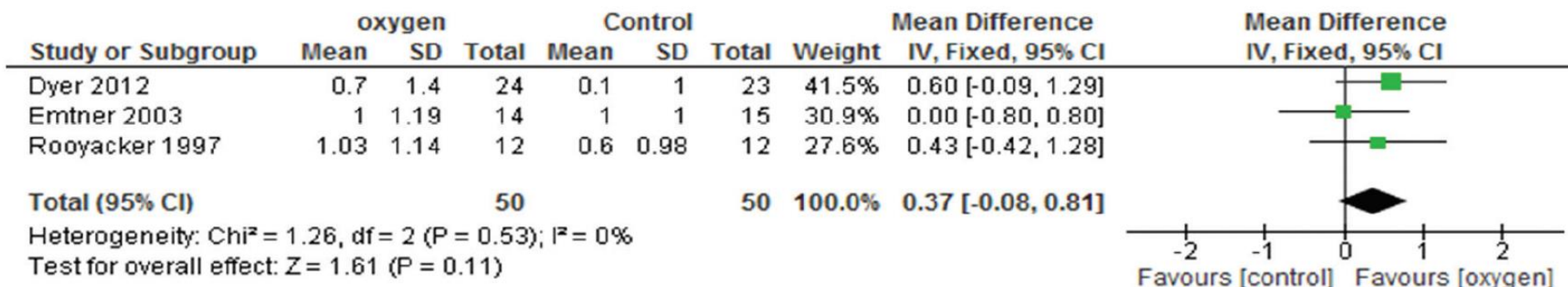


5.2 CRQ Fatigue

HRQoL (PR studies)

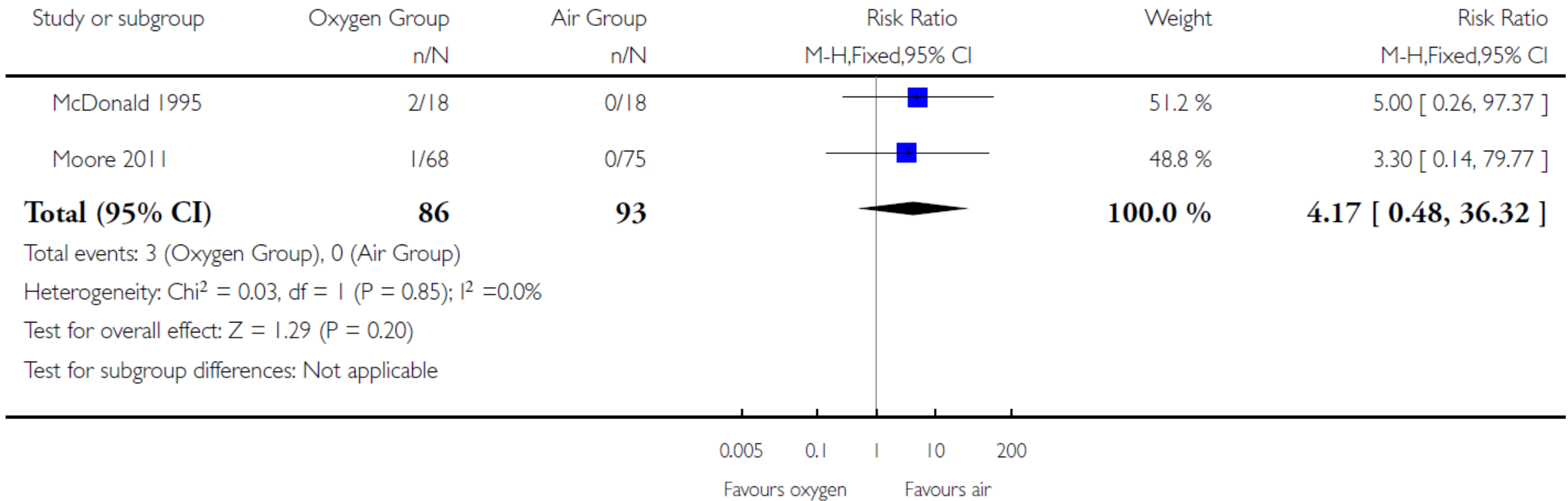


5.3 CRQ Emotion



5.4 CRQ Mastery

Mortality



Long term effect of AOT in
patients eligible for LTOT

AOT use in patients eligible for LTOT for 1y

Table 2. – Daily activities of patients, average values over the year of the study

n		Fixed oxygen 58		Portable oxygen 64
Indoors				
rest	h	13	NS	12.8
activities	h	9.2	NS	9.3
Outdoors				
activities	h	1.6	NS	1.8
distance walked	m	520±370		480±397

No difference between C and L

Only 60% of patients in AOT (55% of cylinder+OC; 67% of Liquid): outdoors and for walking

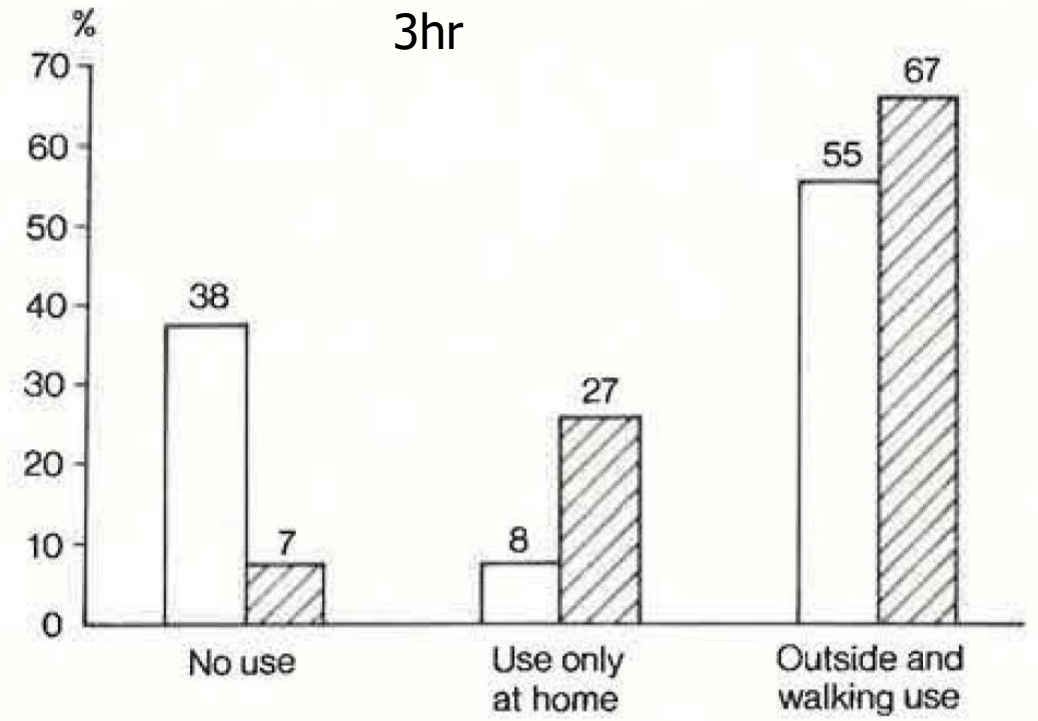


Fig. 1. – Daily duration of oxygen therapy. Percentage of patients according to the type of O₂ source.

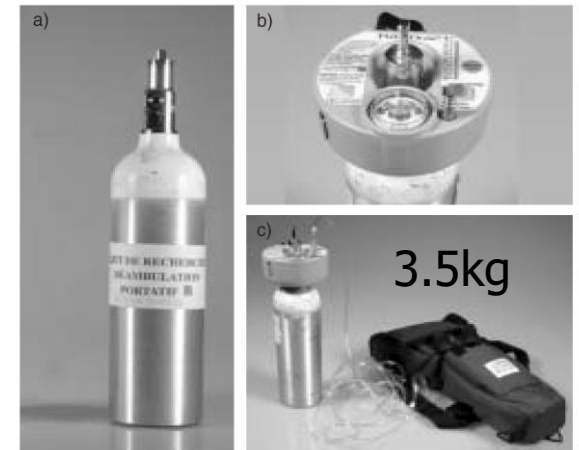
□ fixed O₂, n=58; ▨ Portable O₂, n=64.

Adherence in O₂ dependent patients

- 1-yr, three-period, cross-over trial, in patients on LTOT, 1999-2003, Canada, no PR
- 24 patients (PaO₂ at rest 53 mmHg)
 - 1) standard therapy (home oxygen therapy with an oxygen concentrator only)
 - 2) standard therapy plus as-needed ambulatory oxygen
 - 3) standard therapy plus ambulatory compressed air

Prematurely stopped at 3mon
d/t 7.5 O₂ cylinders vs 7.4 compressed air cylinders for 3mon

- Outings for 2 h/d, 3 times without cylinders, 30 min/d with cylinder
- No effect on any of the outcomes: CRQ, SF-36, exercise tolerance, compliance

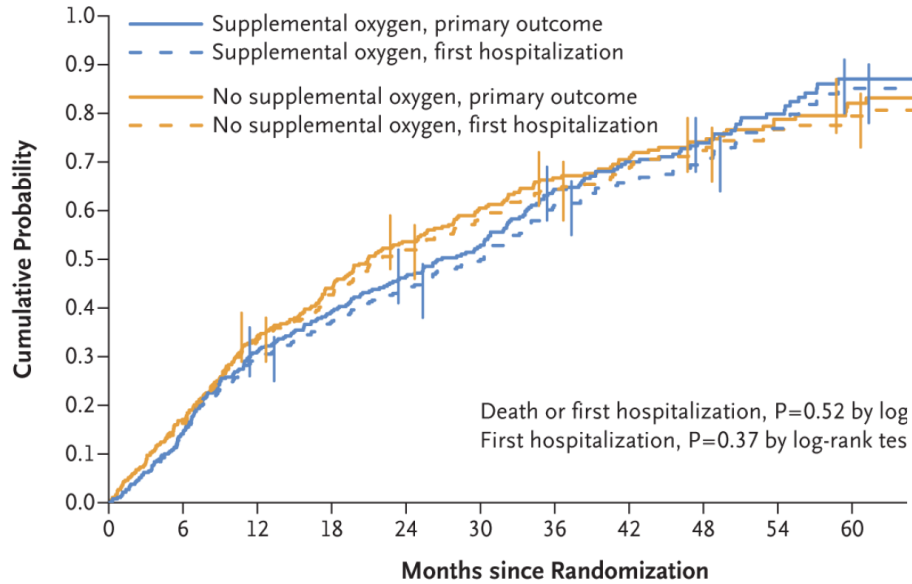


LTOT and AOT in moderate hypoxemia

- 738 pts at 47 centers from 2009 to 2014 in the US
- LTOT: unblinded
- Patients
 - Moderate resting desaturation (Spo₂, 89 to 93%)
→ O₂ 2l/min for 24 h
 - Moderate EID (6MWT, Spo₂ ≥80% for ≥5 minutes and <90% for ≥10 seconds)
→ sleep (2l/min) and exercise (individually, Spo₂ of 90% or more for at least 2 minutes during walking) median 2l/m
- Median 18.4 months FU

LTOT and AOT in moderate hypoxemia

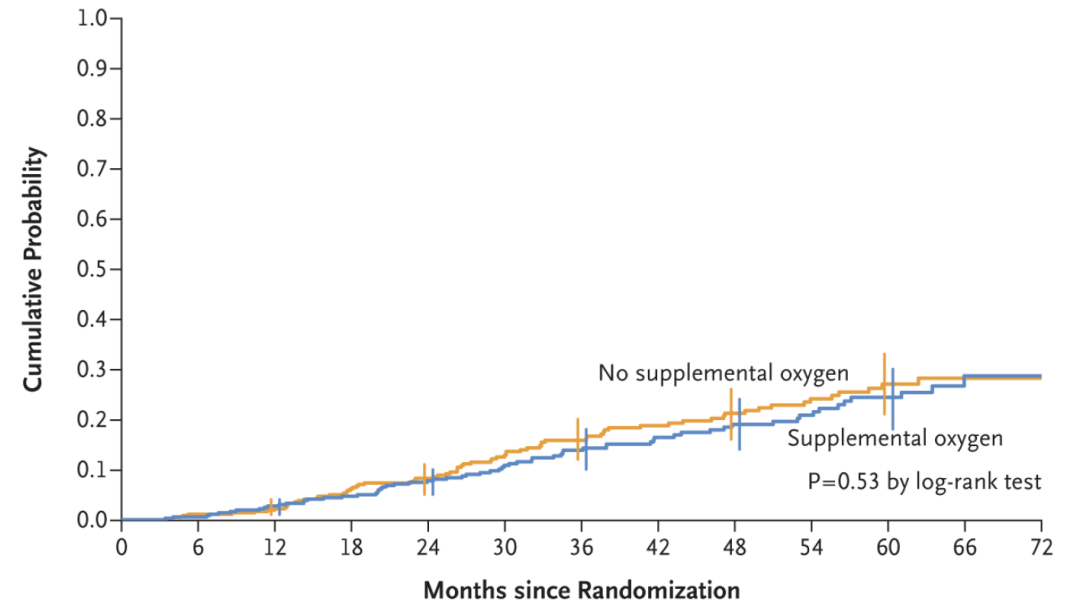
A Primary Outcome (Death or First Hospitalization) or First Hospitalization



No. at Risk

No supplemental oxygen	370	304	232	181	139	102	76	59	43	29	21
Supplemental oxygen	368	314	243	198	158	125	86	61	44	24	13

B Death



No. at Risk

No supplemental oxygen	370	366	362	319	295	242	210	177	152	120	88	33	10
Supplemental oxygen	368	366	358	321	294	245	216	184	149	116	88	33	8

LTOT and AOT in moderate hypoxemia

Time to death or first hospitalization

	N	Events	Rate/ 100 p-y	HR (95% CI)	P*	Interaction P†
All patients						
No LTOT	370	250	36.4	1.0		
LTOT	368	248	34.2	0.94 (0.79, 1.12)	0.52	
LTOT prescription type						
No LTOT	370	250	36.4	1.0		
LTOT during sleep and exercise	148	102	37.9	1.05 (0.83, 1.32)	0.68	0.18
24-hour LTOT	220	146	32.1	0.88 (0.72, 1.08)	0.23	
Desaturation qualifying for LOTT						
At rest only						
No LTOT	60	38	34.4	1.0		
LTOT	73	50	32.6	0.96 (0.63, 1.47)	0.86	
On exercise only						
No LTOT	171	119	39.3	1.0		0.99
LTOT	148	102	37.9	0.95 (0.73, 1.24)	0.71	
At rest and on exercise						
No LTOT	139	93	34.0	1.0		
LTOT	147	96	31.8	0.95 (0.72, 1.27)	0.74	

Adverse events of LOTT

	No. of reports	Reports per 100 person-years
Expected, related events		
Fires related to oxygen use	2	0.08
Burn from smoking around oxygen equipment	3	0.12
Burn from using oxygen equipment around open flame	1	0.04
Burn from liquid oxygen frost	4	0.16
Nosebleed	9	0.35
Tripping/falling over oxygen equipment	23*	0.90
Total no. of expected, related events	42	1.64
Unexpected, related events		
Blisters, ear pain	3	0.12
Dry eyes	1	0.04
Funny feeling in sinus area	1	0.04
Increased intestinal gas	1	0.04
Headache	2	0.08
Nausea	1	0.04
Total no. of unexpected, related events	9	0.35
Total no. of all related events	51	1.99
Total no. of patients ever using supplemental oxygen during follow-up	490	
No. (%) reporting at least 1 related adverse event	42 (8.6%)	

Safety issues

- Smoking cessation
- Dangers of
 - using home oxygen within the vicinity of any naked flame such as pilot lights, cookers, gas fires and candles
 - patients and family members who continue to smoke
- Liquid O₂: cold burn, gas leakage, transport in an upright position

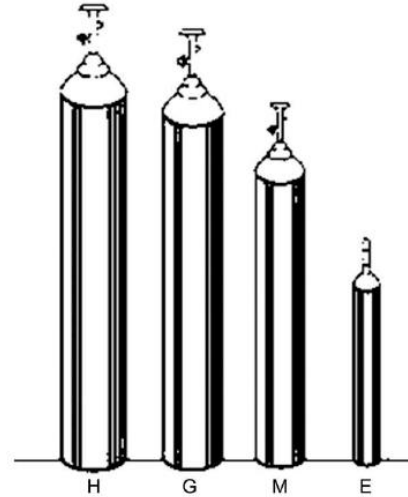
Ambulatory oxygen: why do COPD patients not use their portable systems as prescribed?

A qualitative study 27, Cylinder 3.4kg, a shoulder bag

- Lack of specific information provision (25)
- Lack of benefit
- Fear that the AO might run out
- Important carer issues surrounding managing and using AO equipment
- Embarrassment: not wishing to be seen using AO (21)
- Weight: AO is too heavy: (25)

Oxygen supply systems

- Liquid oxygen (LOX)
- Cylinder
 - Home fill cylinder
 - Portable cylinder
 - Lightweight cylinder
- Concentrator
 - Portable oxygen concentrator (POC)
 - Transportable oxygen concentrator



Oxygen supply systems

	Portable gas cylinder	Portable concentrator	Liquid oxygen
Advantages	Limited mobility outside the home	Unlimited autonomy provided there is access to electricity supply and/or batteries	Autonomy limited by the charge in the backpack Rechargeable from supply source Indicated if flows >3 l/min are required
Disadvantages	Weight Requires distribution network Poor autonomy Non-rechargeable	Weight Loss of efficacy with high flow rates and changes in respiratory rate Not indicated if flows >3 l/min are required Noisy vibration	Requires distribution network Weight
Cost/usefulness ratio		High	High

Oxygen supply systems

Oxygen System*	Pre-Walk Versus Post-Walk S _{pO₂} Difference (%)			
	Mean ± SD	Median	Minimum	Maximum
Cylinder	-6 ± 4	-6	-15	2
FreeStyle	-7 ± 5	-5	-22	1
HomeFill	-7 ± 5	-7	-21	1
Helios	-6 ± 5	-5	-21	1

* Each system was used by 39 subjects.

S_{pO₂} = arterial oxygen saturation measured via pulse oximetry

Cost

- Home O2: 2.2 billion in the US Medicare
- AO: UK and norther Ireland in 2002-2003 >19 million for cylinder O2

Table 3. – Total treatment cost distributed over the two subgroups at 1996 prices (US\$); mean \pm SD during a six-month period

Type of cost	L (n=27)	C/C (n=21)
Oxygen	2200 \pm 1360	260 \pm 500
Rent, freight and depreciation	3340 \pm 2650	500 \pm 280
Consumption of healthcare services	390 \pm 370	340 \pm 350
Medical technician	110 \pm 70	120 \pm 70
Total cost*	4950 \pm 2340	1310 \pm 650

No response predictors

- EIH
- Resting oxygenation
- Acute responder
- Adherence
- Device

AOT needs

- More evidence of long term outcomes
- Technical improvement, Single device anywhere
- Good patients selection and choice of equipment
- System and education to improve adherence
- Less cost

Oxygen is not



but



Table 1. Main characteristics for some portable (only able to intermittent flow delivery) oxygen concentrators.

Device, manufacturer	Focus, AirSep	FreeStyle3, AirSep	FreeStyle 5, AirSep	XPO ₂ , Invacare	Platinum Mobile, Invacare	One G2, Inogen	One G3, Inogen	One G4, Inogen	EverGo, Philips Respironic
Flow settings, No	NA	1–3	1–5	1–5	1–4	1–6	1–5	1–3	1–6
Maximum O ₂ pulse delivered in ml (at a certain breathing frequency per minute)	22 (at 15) 11 (at 30)	33 (at 15) 16 (at 30)	66 (at 15) 33 (at 30)	15–42 (at 20)	44 (at 20) 29 (at 30)	60 (at 15) 30 (at 30)	56 (at 15) 28 (at 30)	31.5 (at 20)	70 (at 15) 35 (at 30)
Maximum minute volume output in ml	0.33	0.5	1.0	0.84	0.88	1.2	0.84	0.63	1.05
Weight in Kg with battery	1.3	2.2	2.8	2.7	2.3	3.2	2.2	1.6	3.1
Duration battery in hours	1.5	2–3	1.25–4.25	2.5	1.45–5	2–5.45	1.7–4.5	1.25–3	4
Time of battery recharge in hours	4	4–5	4–5	4	2–5	4	4	3.25	2
Dimensions in cm	16.4 × 12.2 × 6.1	21.8 × 15.5 × 9.1	27.2 × 16.8 × 11.2	25 × 18 × 10	24 × 19 × 9.9	27.4 × 24.1 × 10.1	22.2 × 18.4 × 7.6	18.2 × 15 × 6.8	30.5 × 21.6
Noise level in dBA	45	41 at 2	41 at 2 48 at 3	44–46	40	38 at 2	39 at 2	40 at 2	42–44