Oxygen Therapy

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만성 폐질환 환자에게 호흡재활은 도움이 되는가?

Respiration

Clinical Investigations

Respiration
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Scientific Review

Impact
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patie
com
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International Journal of COPD

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ORIGINAL RESEARCH

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Respiratory Medicine

ELSEVIER

CURRENT OPINION

Pulmonary rehabilitation for patients with acute

Cardiova
related t
pulmona

Open Access Protocol

BMJ Open Effect of an intensive 3-week

Original Paper

Chronic Respiratory Disease

Health status of COPD patients undergoing pulmonary rehabilitation: A comparative responsiveness of the CAT and SGRQ

Chronic Respiratory Disease
2017, Vol. 14(4) 352–359

DOI: 10.1177/1479972317694622
journals.sagepub.com/home/crd
SAGE

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만성 폐질환 환자에게 호흡재활은 도움이 되는가?

Table 1. Benefits of Pulmonary Rehabilitation

- Reduced hospitalization
- Reduced unscheduled healthcare visits
- Improved exercise capacity
- Reduced symptoms of dyspnea and leg discomfort
- Improved limb muscle strength and endurance
- Improved health-related quality of life
- Improved functional capacity (e.g., activities of daily living)
- Improved emotional function
- Enhanced self-efficacy and knowledge
- Enhanced collaborative self-management
- Potential for increased daily physical activity levels

Am J Respir Crit Care Med 2015;192:1373-1386

호흡재활의 변화

http://blog.kcomwel.or.kr/tag/2394

http://www.meridianathome.com/MAH/services/HomeRehabilitationNursing/index.cfm

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Home-based rehabilitation

Table 1

Comparison of Studies Evaluating Home Exercise in Lung Disease

Study and Methodology	Sample Size	Exercise Features	Exercise Results	Additional Findings
Maltais et al (2008)[4] Randomized multicenter trial	252	4 wk of self-management education, followed by 8 wk of home vs outpatient cycle-based exercise, 12-mo follow-up	Similar, significant improvement in endurance time in both groups; maintained at 12 mo; home exercise found to be safe	Significant improvement in depression maintained at 12 mo
Güell et al (2008)[5] Randomized prospective multicenter trial	51	Home vs hospital-based PR. Home: low-intensity exercise with 2 education sessions and 4 PT sessions	Similar improvements in 6MWD; benefits maintained in both groups for 6 mo	Hospital-based PR was associated with greater improvement in HRQOL
Fernández et al (2009)[6] Randomized prospective trial	42	Home exercise training program (including some home visits) in severe, oxygen-dependent COPD	Safe; clinically and statistically significant improvement in 6MWD	Clinically and statistically significant improvement in HRQOL
Burkow et al (2015)[7] Descriptive trial evaluating acceptability, technology usability, and economics of home PR	10	9-wk home-based PR with exercise training, online group self-management education, and individual online consultations	Not reported	Participants found the program acceptable and technology easy to learn and use. Economic calculations indicated that program cost was feasible
Vorrink et al (2016)[8] 12-mo randomized controlled trial	157 (121 completed trial)	Mobile health (smartphone app) intervention to improve or maintain physical activity in COPD following PR. Monitoring website for physiotherapists	No significant positive effects on physical activity or 6MWD	No significant differences were found in fatigue or HRQOL

Abbreviations: COPD, chronic obstructive pulmonary disease; HRQOL, health-related quality of life; PR, pulmonary rehabilitation; PT, physical therapy; 6MWD, 6-min walk distance.

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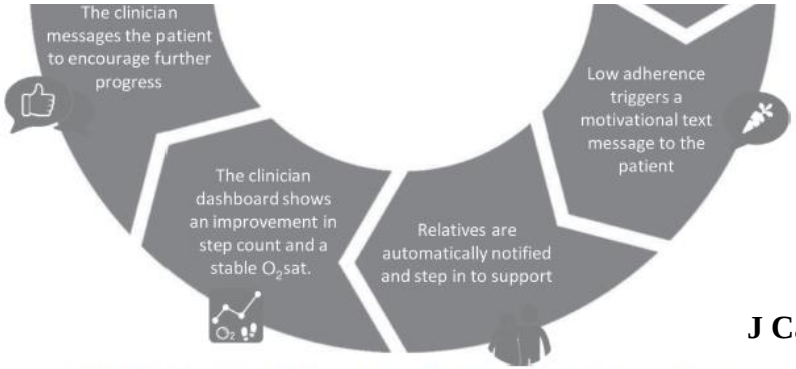
J Cardiopulm Rehabil Prev 2018;38:8-16

Home-based rehabilitation

When to Stop Exercise and Seek Help

- Breathlessness, fatigue and/or weakness beyond normal levels that does not improve with rest or usual management (eg, oxygen, rescue inhaler or nebulizer, tripod position)
- Chest pain or tightness
- Muscle pain that does not improve
- Feeling dizzy or faint
- Leg pain, weakness, and/or cramping
- Sweating more than usual with exercise



J Cardiopulm Rehabil Prev 2018;38:8-16

Figure. Example of using home PR technology with a COPD patient. Abbreviations: CAT, COPD Assessment Test; COPD, chronic obstructive pulmonary disease; PR, pulmonary rehabilitation; O_2sat, oxygen saturation.

Home-based rehabilitation & Oxygen therapy

https://www.intechopen.com/books/copd-clinical-perspectives/advances-in-comprehensive-pulmonary-rehabilitation-for-copd-patients

Long Term Oxygen Therapy

✓ **Definition:**

Oxygen used for at least 15h per day in chronically hypoxemic patients

✓ **Chronic hypoxemic patients:**

PaO2 ≤55 mmHg

PaO2 ≤60 mmHg (polycythemia, peripheral edema, pulmonary hypertension)

Long Term Oxygen Therapy

Variables	NOTT trial (1980)	MRC trial (1981)
Subjects	203 COPD	87 chronic bronchitis, emphysema
Randomization	12hr nocturnal oxygen (102) vs. continuous oxygen (101)	No oxygen vs. 15 h/day oxygen
Outcome	Mortality (1.94 times) 12hr oxygen > continuous oxygen	Mortality No oxygen (30/45) 15 h/day oxygen (19/42)
	Low pulmonary artery pressure 12hr oxygen < continuous oxygen	
	Well-preserved exercise capacity 12hr oxygen < continuous oxygen	

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NOTT: Nocturnal Oxygen Therapy Trial, Ann Int Med 1980;93:391-8
MRC: UK Medical Research Council domiciliary Oxygen Trial, Lancet 1981;1:681-6

Pulse oximetry vs. ABGA

113 COPD patients

Oxygen saturation level of ≤92% can be used safely to identify patients for referral for LTOT

Eur Respir J 1993;6:559-562

ISSUE

✓ **Hypercapnic COPD patients**

- Survival benefit

- Blunted CO_2 response (12hr < 24hr): Monitoring !!

✓ **Pulmonary hypertension**

- Improvement in PAP (12hr < 24hr)

✓ **Sleep**

- Nocturnal hypoxemia: VQ mismatch, Hypoventilation (REM)

- Nocturnal SaO_2, Sleep latency, Sleep quality

✓ **Others**

- QOL, Reduced secondary polycythemia

Nocturnal oxygen requirements

✓ **Desaturation during sleep**

- **Reduced minute ventilation**
- **Impaired ventilator responses**

✓ **Current guideline**

- **Routinely increasing the oxygen flow rate by 1 L/min during sleep**
- **Small group study**

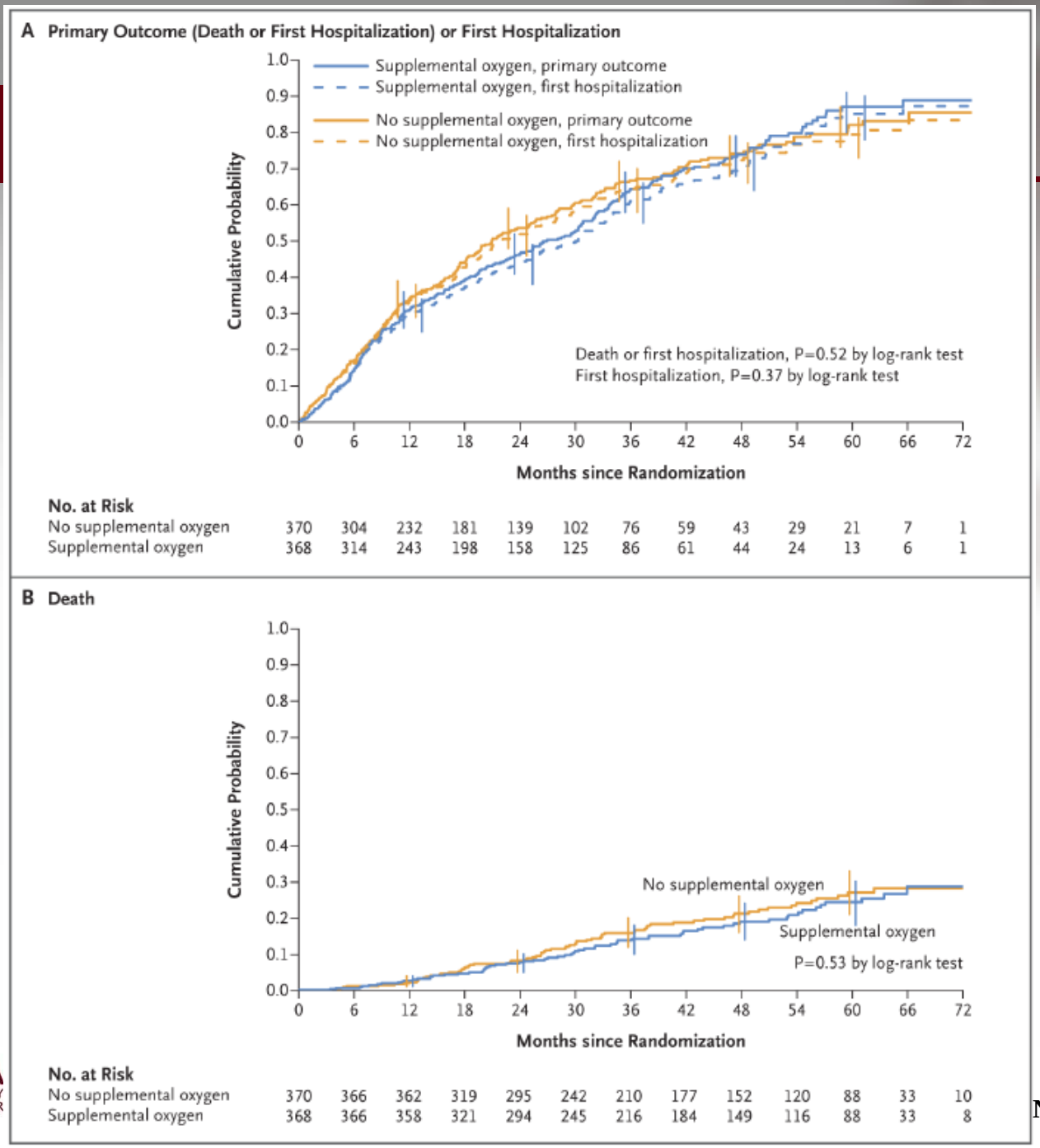
Nocturnal oxygen requirements

Table 2 HRQL and sleep quality in desaturators and non-desaturators

	Non-desaturators (n = 32)	Desaturators (n = 6)	Mean difference (95% CI)	p value
SF-36				
Physical functioning	26.1 (20.94)	17.5 (17.54)	8.6 (−9.9 to 27.1)	0.35
Role limitations – physical	35.9 (37.53)	16.7 (12.91)	19.3 (−12.5 to 51.0)	0.23
Bodily pain	76.4 (22.52)	73.2 (25.16)	3.2 (−17.5 to 23.9)	0.75
General medical health	37.4 (21.01)	41.0 (18.63)	−3.6 (−22.3 to 15.0)	0.70
Vitality	43.4 (17.20)	50.8 (13.93)	−7.4 (−22.5 to 7.7)	0.33
Social functioning	62.9 (28.14)	75.0 (31.62)	−12.1 (−37.9 to 13.8)	0.35
Role limitation – emotional	67.7 (41.03)	88.9 (17.21)	−21.2 (−56.0 to 13.7)	0.23
Mental health	72.1 (17.93)	76.0 (15.18)	−3.9 (−19.7 to 12.0)	0.62
CRQ Total* (20–140)	83.7(17.36)	91.5 (13.23)	−7.8 (−23.0 to 7.4)	0.30
Dyspnoea (5–25)	17.5 (5.16)	20.2 (4.12)	−2.6 (−7.2 to 1.9)	0.25
Emotional (7–49)	32.9 (7.74)	36.2 (8.13)	−3.3 (−10.3 to 3.7)	0.35
Fatigue (4–28)	14.2 (4.24)	16.0 (8.13)	−1.8 (−5.4 to 1.8)	0.32
Mastery (4–28)	19.0(5.42)	16.0 (1.67)	−0.1 (−4.7 to 4.4)	0.95
PSQI Total †	7.1 (3.99)	6.7 (3.78)	0.4 (−3.2 to 4.0)	0.82

*Higher scores in CRQ and SF-36 indicate better HRQL.
†PSQ Total >5 indicative of poor sleep.

Thorax 2006;61:779-82



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N Engl J Med 2016;375:1617-27

Oxygen therapy during exercise

TABLE 1 Baseline demographic and clinical features of patients

Variable	LTOT(+) (n = 27)	LTOT(−) (n = 34)	*P*
Age (years)	63(57,68)	61(53,62)	.428
BMI(kg/m2)	25(22,32)	25(23,28)	.694
Male Gender (n)	22/27	28/34	.930
Stage 3 (n)	8/27	11/34	.819
Stage 4 (n)	19/27	23/34	
Smoking (p/years)	50(30,79)	60(40,82)	.460
FEV1 (% predicted)	26(21,31)	28(24,33)	.312
FEV1/FVC	47(40,54)	51(41,56)	.330
TLCO (% predicted)	28(10,34)	28(14,42)	.541
PaO_2	51(46,55)	68(63,76)	**.006**
$PaCO_2$	48(44,55)	42(40,47)	**.001**
SaO_2	85(80,88)	94(92,96)	**.009**
6MWD (m)	260(170,300)	320(175,375)	**.034**
MMRC	4(4,5)	4(3,4)	**.005**

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Clin Respir J 2017 DOI:10.1111/crj.12680

Oxygen therapy during exercise

TABLE 3 Comparison of changes in outcomes in 2 groups

Variables	LTOT(+) (n = 27)	LTOT(−) (n = 34)	*P*
Δ6MWTD (m)	80(60,110)[a]	48(20,130)[a]	**.046**
ΔMMRC	−1(−1,0)[a]	0(−1,0)[a]	**.012**
ΔFEV_1 (% predicted)	4(1,6)[a]	5(−1,10)[a]	.492
ΔFEV1/FVC	3(−5,1)[b]	1(−7,6)[b]	.272
ΔDLCO (% predicted)	9(−2,13)[c]	6(1,13)[c]	.748
ΔPaO_2 (mm Hg)	8(−2,15)[d]	8(−1,12)[d]	.977
$\Delta PaCO_2$ (mm Hg)	−3(−7,1)[c]	−1(−5,2)[b]	.154
ΔSaO_2	3(−1,7)[d]	2(−1,3)[a]	.163
SGRQ			
ΔSymptom	−13(−28,−4)[a]	−5(−15,3)[c]	**.035**
ΔActivity	−7(−18,0)[a]	−1(−20,1)[d]	.692
ΔImpact	−12(−20,−3)[a]	−11(−24,0)[d]	.910
ΔTotal	−9(−20,−5)[a]	−10(−15,0)[a]	.544
SF-36			
ΔPhysical Functioning	15(0,25)[a]	15(3,25)[a]	.929
ΔSocial Functioning	0(0,25)[b]	0(−13,13)[b]	.413
ΔRole Physical	0(0,50)[c]	0(0,50)[d]	.986
ΔRole Emotional	3(0,58)[b]	0(0,67)[c]	.835
ΔGeneral Health	0(0,10)[b]	5(0,19)[c]	.210
ΔMental Health	8(−3,16)[d]	4(−8,8)[b]	.274
ΔBodily Pain	25(0,42)[a]	10(0,40)[a]	.739
ΔVitality	15(0,34)[a]	15(−5,30)[d]	.537
$\Delta HAD_{anxiety}$	−3(−4,0)	−2(−6,1)	.739
$\Delta HAD_{depression}$	−1(−4,0)	−2(−4,0)	.881

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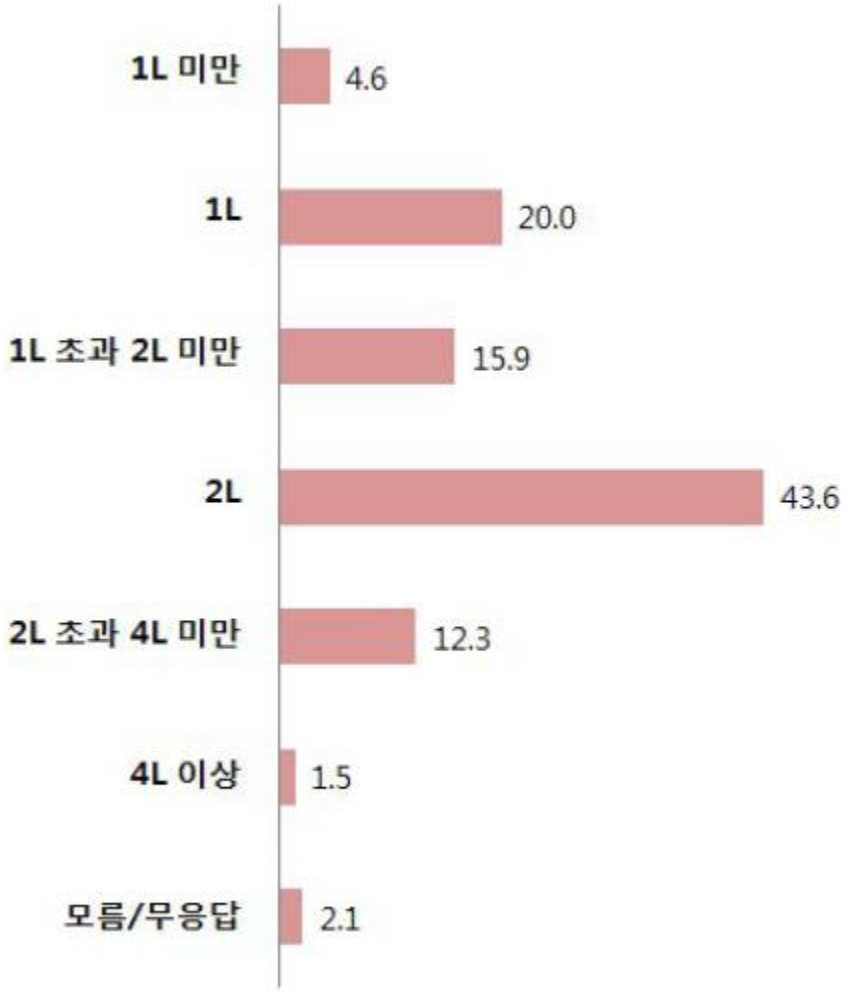
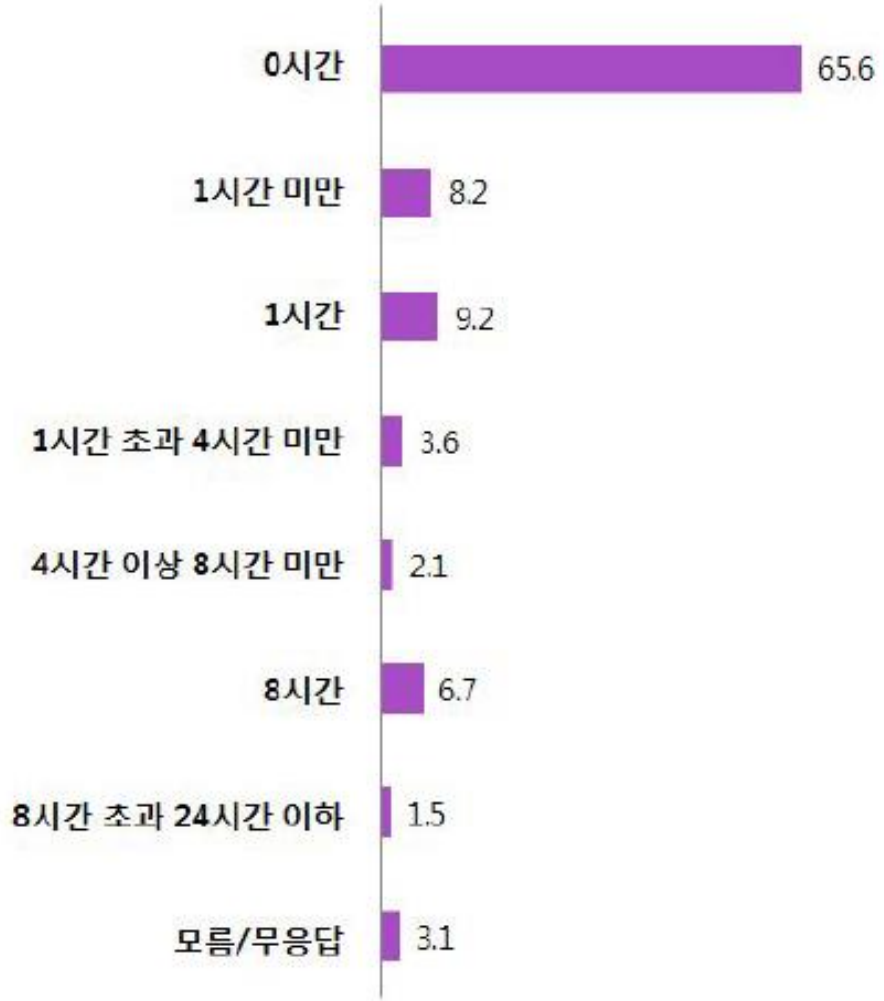
Clin Respir J 2017 DOI:10.1111/crj.12680

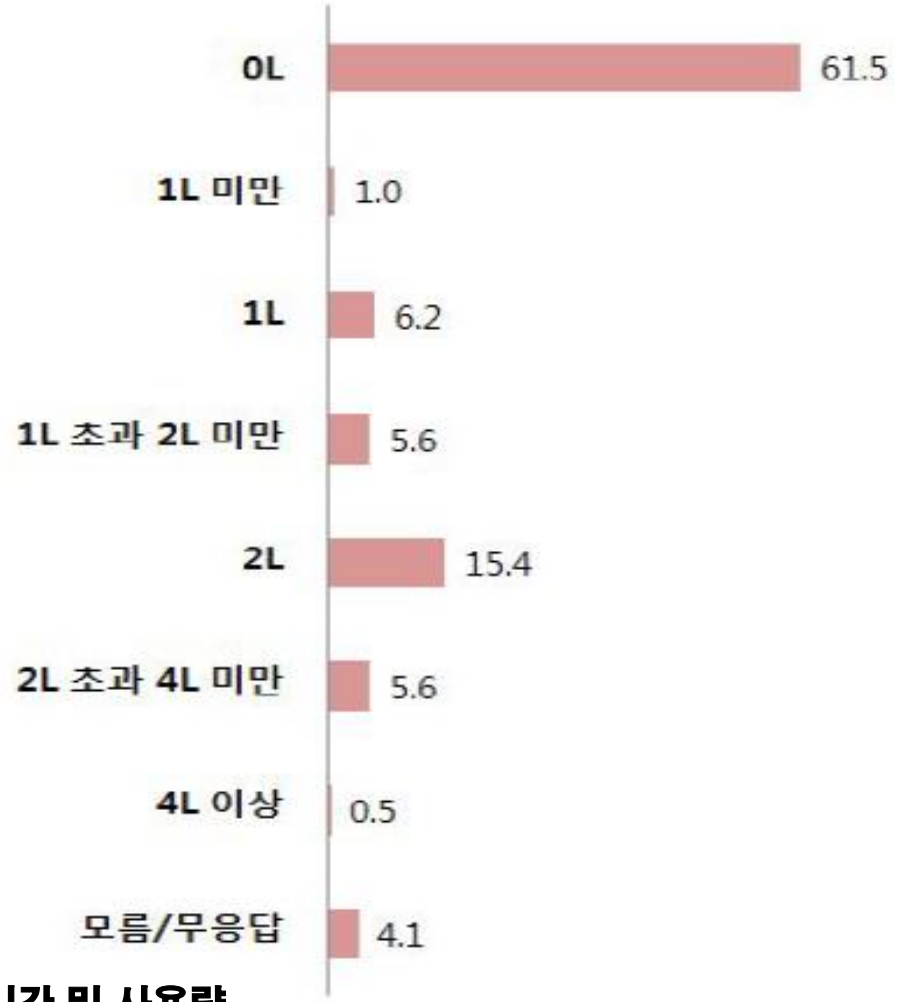
만성폐쇄성폐질환 환자의 산소치료에 대한 설문



안정시 산소 사용 시간 및 사용량

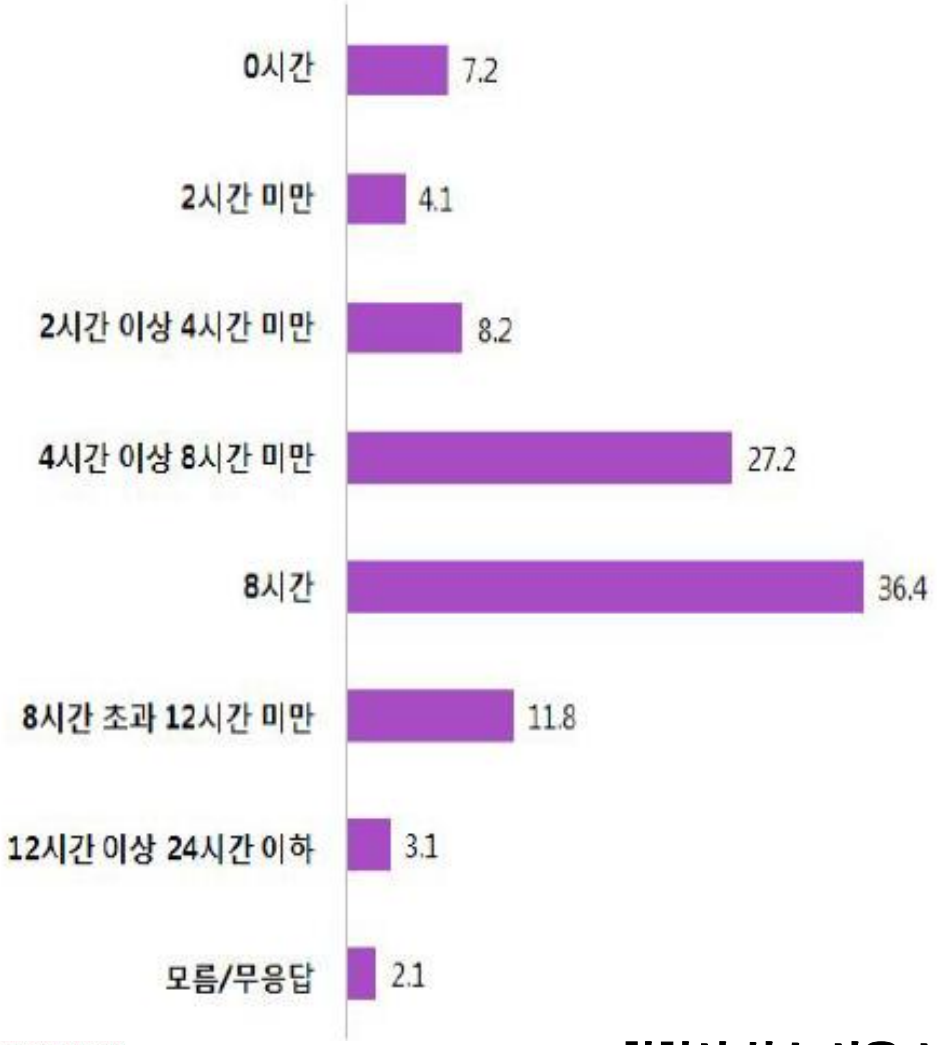
만성폐쇄성폐질환 환자의 산소치료에 대한 설문





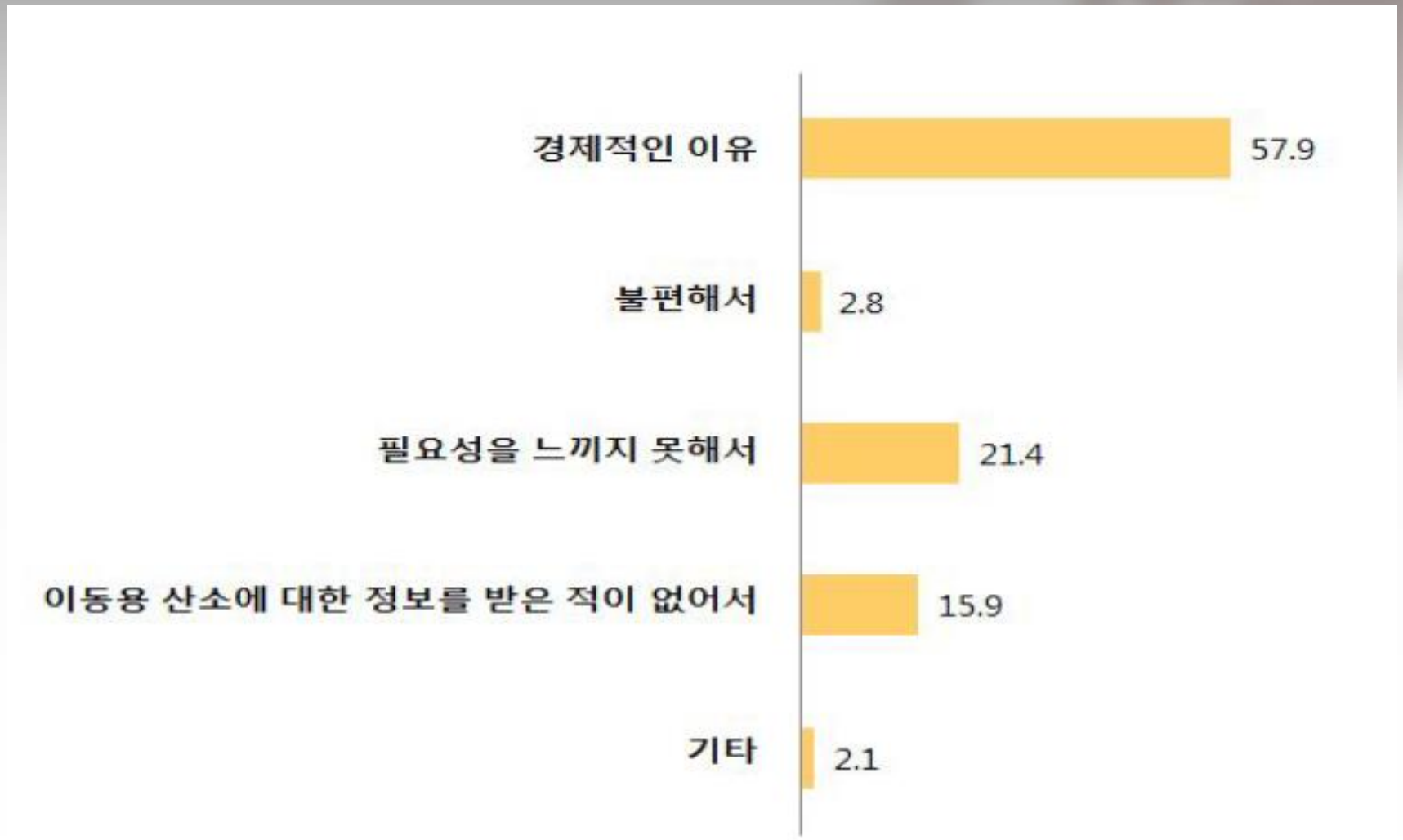
운동시 산소 사용 시간 및 사용량

만성폐쇄성폐질환 환자의 산소치료에 대한 설문



취침시 산소 사용 시간 및 사용량

만성폐쇄성폐질환 환자의 산소치료에 대한 설문



이동용 산소에 대한 설문조사

산소치료 요양급여 기준

1. 중증의 만성심폐질환자 (90일 동안 치료 후에도 조건 만족시)

   1) 동맥혈 가스 검사 (**ABGA**)
      가) **PaO2 ≤ 55 mmHg**
      나) **SaO2 ≤ 88%**
      다) **PaO2** 가 **56-59 mmHg** + 저산소증 증거
      라) **SaO2 ≥ 89%** + 저산소증 증거
   2) 산소포화도 검사 (**Pulse oximetry**)
      가) **Saturation ≤ 88%**
      나) **Saturation ≥ 89%** + 저산소증 증거

- 저산소증 증거: 적혈구 증가증 (**Hct >55 %**) **or** 울혈성 심부전을 시사하는 말초부종 **or** 폐동맥 고혈압이 있는 경우

2. 호흡기 1급 및 2급 장애인인 경우 전문의 판단에 따라

산소치료 요양급여 상병

상병기호	상병명
A150 ~ A169	호흡기결핵
B909	호흡기 및 상세불명 결핵의 후유증
C32 ~ C349	기관지 및 폐의 악성 신생물
C73	갑상선의 악성신생물
C78 ~ C783	호흡기및소화기관, 폐의 이차성 악성 신생물
D021 ~ D022	기관의 제자리암종 등
I21 ~ I25	심근경색 관련 상병
I26 ~ I289	폐성심장병 및 폐순환의 질환
I500 ~ I509	울혈성 심부전 등
J43 ~ J47	폐기종 등
J60 ~ J65	진폐증 등
J70	호흡기병태 및 폐장애 등
J80 ~ J99	성인호흡곤란증후군 등
P22 ~ P229	신생아의 호흡곤란
P270 ~ P289	윌슨미키티증후군 등
Q20 ~ Q349	심방실 및 연결의 선천기형 등
R060 ~ R068	호흡곤란 등
하단 참고*	폐렴 관련 상병

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※ A202, A403, A482, B012, B052, B206, B221, B250, B953, B960, B961, G001, J12, J15, J16, J17, J18, J100, J110, J120 ~ J129, J13, J14, J150 ~ 159, J160, J168, J170 ~ J178, J180, J181, J182, J188, J189, J200, J67, J69, J678, J679, J680, J690, J691, J698, J8410, J851, J852, M001, M0010 ~ M0019, O740, P23, P230 ~ P239

고가형 산소발생기 (17,000대중 2200대)

제 품	하이산소3R	하이산소2U	라꾸라꾸산소	아이산소3N
				
최대유량	3ℓ/분	2ℓ/분	3ℓ/분	3ℓ/분
산소농도(%)	90(-3/+6)%	91(-3/+5)%	95%	92(±3)%
소비전력(W)	1ℓ:70W,2ℓ:80W, 3ℓ:110W	1ℓ:77W, 2ℓ:97W	300VA	1ℓ:190W,2ℓ:210W, 3ℓ:230W
소음(dBA)	25~35(30±5)	25~35(30±5)	30(1ℓ/분기준)	25~35(30±5)
크기(cm)	537×230×553mm	402×334×410mm	370×330×650mm	360×370×640mm
무게(kg)	26.5kg	12.5kg	33kg	33kg
월임대료	본 인 부 담 금			
건강보험	51,000원			27,000원
의료보호/차상위계층	39,000원			15,000원

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일반형 산소발생기 (17,000대중 14,800대)

제 품	Q5	Visionaire	Everflo	Krober02-4.0	Aeroplus 5
					
등록대수	1153	4456	2378	1723	3739
최대유량	5ℓ/분	5ℓ/분	5ℓ/분	5ℓ/분	5ℓ/분
산소농도(%)	1~4ℓ:92±3% 4~5ℓ:90±3%	90(-3/+5.5)%	93(±3)%	1~4ℓ:95-3% 4~5ℓ:85±3%	1~4ℓ:93±3% 4~5ℓ:90±3%
소비전력(W)	285W	290W	300W	280W	243W
소음(dBA)	40이하	37~43(40±3)	43	31	34.7
크기(cm)	419×368×699 mm	358×292×528 mm	380×240×580 mm	520×203×535 mm	290×400×600 mm
무게(kg)	26kg	13.6kg	15kg	16kg	15kg
월임대료	본 인 부 담 금				
건강보험	12,000원				
의료보호/차상위	0원				

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가정용 산소발생기 보험고시

구분	장비기준			서비스내용	
	순도	소음	모드	정기방문	직영영업소
12만원/월	90%이상	45dB이하	300W이하	4개월마다 1회 이상	3개 이하
12만원~16만원/월	90%이상	35dB초과 ~ 45dB미만	250W초과 ~ 300W미만	3개월마다 1회 이상	4개 이상
16만원/월	90%이상	35dB이하	250W이하	3개월마다 1회 이상	6개 이상

휴대용 산소발생기 (Shoulder, 6000대)

	FOCUS	Freestyle3	Freestyle5	INNOGEN G3	SIMPLY GO MINI	RS-00600
제 품						
Max. flow	330ML	498ML	1000ML	1050ML	1000ML	1050ML
Flow rate	SETTING 2	SETTING 1-3	SETTING 1-5	SETTING 1-5	SETTING 1-5	SETTING 1-5
Method	Pulse	Pulse	Pulse	Pulse	Pulse	Pulse
B-TIME	1.5 H (2EA)	3.5H	2.5 H	4 H	4 .5H	4 H
B-TYPE	DOUBLE	SINGLE	SINGLE	SINGLE DOUBLE	SINGLE DOUBLE	SINGLE
크기(mm)	122*64*163	155*91*218	168*112*272	184*76*222	211*91*239	249*97*231
무게(kg)	0.8kg	2.3kg	3kg	2.3kg	2.3kg	2.5kg

휴대용 산소발생기 (Cart, 1000대)

	Eclipse5	RS-00500	RS-00410	Oxy300
제 품				
Max. flow	3000ML	2000ML	850ML	750ML
Flow rate	SETTING 1-9	SETTING 1-6	SETTING 1-5	SETTING 1-5
Method	Pulse, continue	Pulse, continue	Pulse	Pulse, Semi-continue
B-TIME	5 H, 2 H(지속시)	4 H, 0.75 (지속시)	3 H	4 H
B-TYPE	SINGLE	SINGLE, DOUBLE	SINGLE	SINGLE, DOUBLE
크기(cm)	312*180*490mm	211*168*312mm	168*112*272mm	247*229*155mm
무게(kg)	8kg	4.7kg	4.5kg	4.3kg

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휴대용 산소발생기 보험고시

구분	장비구분				서비스 내용	
	순도	소음	모드	경보기능	정기방문	직영영업소
1) 20만원/월	90% 이상	60dB이하	Pulse	기기고장, 배터리 잔량, 호흡수 이상감지, 호흡미감지 중 1가지 이상	3개월마다 1회 이상	3개 이하
2) 24만원 미만/월	90% 이상	60dB이하	Continue	기기고장, 배터리 잔량, 호흡수 이상감지, 호흡미감지 중 2가지 이상	3개월마다 1회 이상	4개 이상

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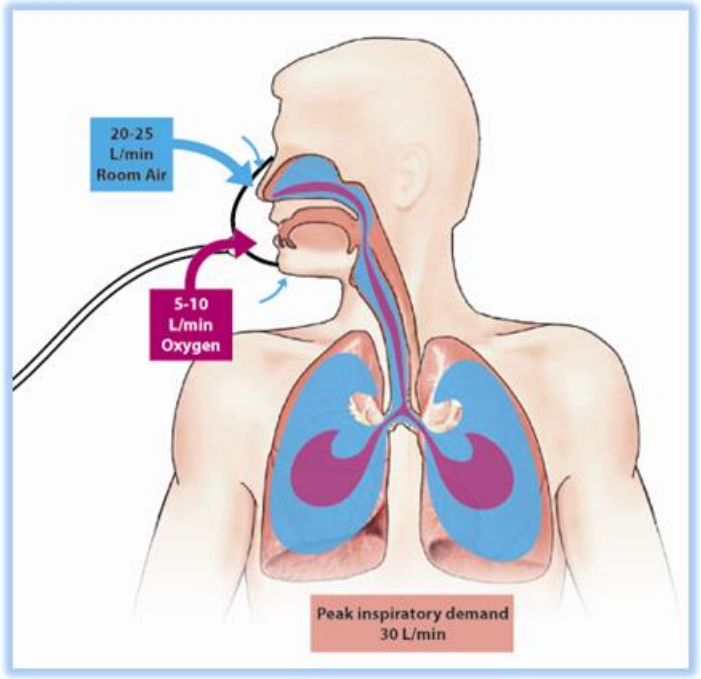
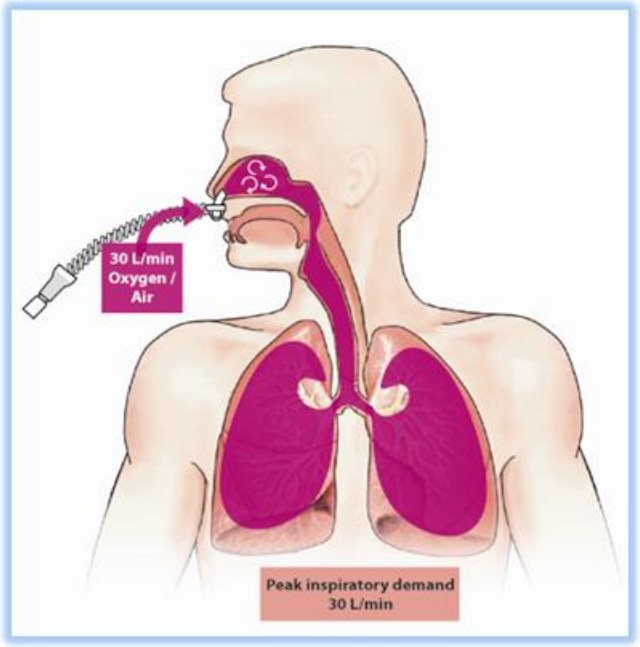
High flow nasal cannula

High flow nasal cannula

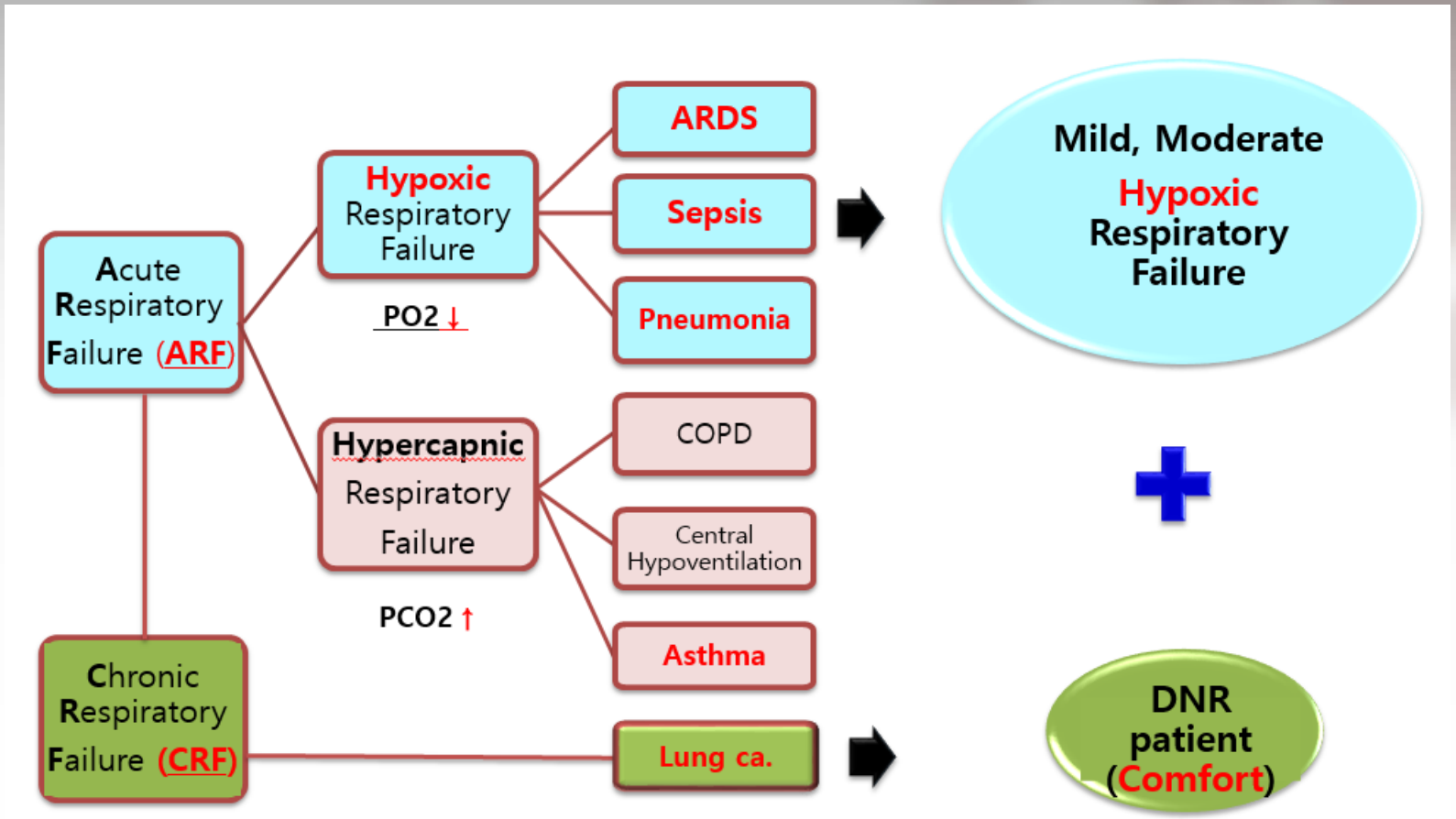


Simple Face Mask Example

Nasal High Flow



High flow nasal cannula



High flow nasal cannula 와 재활

Table 1
Anthropometric and functional data.

Age, yr	70 ± 8
Male:female, n	10:2
FEV1/FVC, %	40 ± 10
FEV1, % predicted	35 ± 12
PaO_2, mmHg	73 ± 13
$PaCO_2$, mmHg	41.7 ± 5.3
peakVe/MVV, %	87 ± 12
MVV-peakVe, L/min	3 ± 4

Data are presented as mean ± SD. FEV1: forced expiratory volume in 1 s; FVC: forced vital capacity; PaO_2: arterial oxygen tension; $PaCO_2$: arterial carbon dioxide tension; peakVe: maximal minute ventilation at the end of six minute walking test; MVV: maximal voluntary ventilation.

Respir Med 2016;118:128-32

High flow nasal cannula와 재활

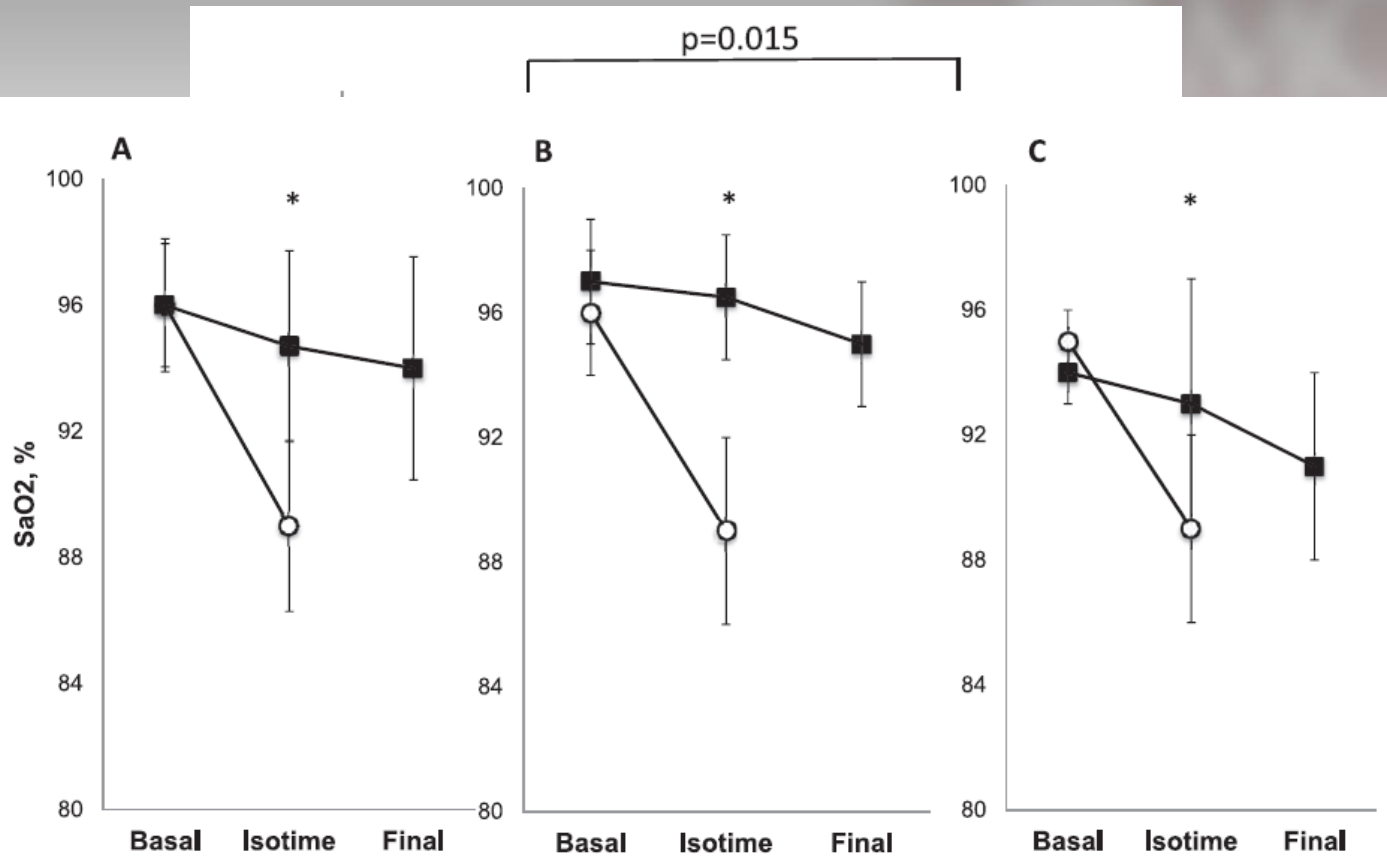


Fig. 3. Oxyhemoglobin saturation (SaO_2) during HFNC-test (*solid squares*) and Control-test (*open circles*) in the whole group (A), in the 8 patients who performed exercise with additional oxygen (B) and in the 4 patients who performed it at FiO_2 of 0.21 (C). In all groups meanSaO_2 at isotime was significantly higher during HFNC-test (*p = 0.0002). Values are represented as mean and standard deviation.

Fig. 1. Effect of the HFNC on exercise capacity during a constant-load test compared to a control condition in which the test was performed at the same FiO_2. In all patient HFNC significantly increased the exercise performance. Tlim = exercise duration. *Solid line* = mean value.

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Respir Med 2016;118:128-32

High flow nasal cannula

		Airvo2 oxygen chart - Adult										
		Airvo2 Target Flow Setting (L/mim)										
		Flow10	Flow15	Flow20	Flow25	Flow30	Flow35	Flow40	Flow45	Flow50	Flow55	Flow60
oxygen flow (L/mim)	1.0L	26%	25%	21%	21%	21%	21%	21%	21%	21%	21%	21%
	2.0L	35%	31%	29%	27%	25%	25%	25%	25%	25%	25%	25%
	3.0L	42%	36%	32%	30%	27%	27%	26%	26%	26%	25%	25%
	4.0L	50%	41%	36%	33%	31%	30%	29%	27%	27%	26%	26%
	5.0L	58%	46%	40%	36%	34%	32%	30%	29%	29%	28%	27%
	6.0L	66%	51%	44%	39%	36%	34%	32%	31%	30%	29%	29%
	7.0L	74%	56%	47%	42%	39%	36%	34%	33%	32%	31%	30%
	8.0L	81%	61%	51%	45%	41%	38%	36%	34%	33%	32%	31%
	9.0L	89%	66%	55%	48%	44%	40%	38%	36%	35%	33%	32%
	10L		71%	59%	51%	46%	42%	40%	38%	36%	35%	34%

High flow nasal cannula

종류	기본구성품	서비스 소모품	서비스 항목	금액(월)
임대	 Airvo2  산소발생기  Mobile Cart	 Nasal Cannula  Heated Circuit  Water bag  Air filter	· 24시간 call 서비스 · 지역별 서비스 담당자 운영 · 월 1회 서비스 방문 · 장비 점검표를 통한 주기적 체크 · 서비스 소모품 교체 (월1회)	월1회 서비스 550,000원

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Non invasive ventilation

Respir Care 2013;58:950-69

Non invasive ventilation

TABLE 2 Recommendations for actionable PICO questions

Clinical indication[#]	Certainty of evidence[¶]	Recommendation
Prevention of hypercapnia in COPD exacerbation	⊕⊕	Conditional recommendation against
Hypercapnia with COPD exacerbation	⊕⊕⊕⊕	Strong recommendation for
Cardiogenic pulmonary oedema	⊕⊕⊕	Strong recommendation for
Acute asthma exacerbation		No recommendation made
Immunocompromised	⊕⊕⊕	Conditional recommendation for
De novo respiratory failure		No recommendation made
Post-operative patients	⊕⊕⊕	Conditional recommendation for
Palliative care	⊕⊕⊕	Conditional recommendation for
Trauma	⊕⊕⊕	Conditional recommendation for
Pandemic viral illness		No recommendation made
Post-extubation in high-risk patients (prophylaxis)	⊕⊕	Conditional recommendation for
Post-extubation respiratory failure	⊕⊕	Conditional recommendation against
Weaning in hypercapnic patients	⊕⊕⊕	Conditional recommendation for

[#]: all in the setting of acute respiratory failure; [¶]: certainty of effect estimates: ⊕⊕⊕⊕, high; ⊕⊕⊕, moderate; ⊕⊕, low; ⊕, very low.

Eur Respir J 2017;50:1602426

NIV 와 재활

Table 1 Demographic, anthropometric and clinical characteristics: mean (SD)

	NIV (n = 21)	Control (n = 21)
Age (years)	63.4 (11.8)	64.6 (11.7)
Male (%)	62	81
COPD, n (%)	13 (62)	14 (67)
Kyphoscoliosis, n (%)	6 (28)	6 (28)
TBC sequelae, n (%)	2 (10)	1 (5)
BMI (kg/m^2)	29.0 (9.8)	30.5 (7.1)
CIRS 1	1.75 (0.27)	1.81 (0.30)
CIRS 2	2.90 (1.39)	3.18 (1.40)
FEV_1/FVC (% predicted)	52.9 (20.1)	56.8 (19.1)
FEV_1 (% predicted)	40.3 (23.1)	42.8 (20.2)
FVC (% predicted)	61.9 (26.8)	64.5 (23.9)
RV (% predicted)	151.4 (99.1)	138.0 (70.1)
MIP (% predicted)	58.4 (31.0)	48.7 (25.9)
MEP (% predicted)	54.3 (17.2)	52.5 (23.5)
PaO_2† (mm Hg)	70 (11)	66 (14)
$PaCO_2$† (mm Hg)	51.1 (10.6)	45.8 (7.2)
pH†	7.40 (0.04)	7.40 (0.03)
MRF-28	50.4 (28.8)	44.9 (31.2)
MRC	2.7 (1.1)	2.6 (1.1)
6MWD (m)	298.9 (107.4)	314.8 (127.9)
Peak watts	48.5 (17.9)	61.1 (29.5)
Endurance time (s)	1247.94 (977.01)	1036.2 (580.26)
Borg dyspnoea	1.07 (1.34)	0.62 (1.02)
Borg fatigue	1.43 (1.80)	1.48 (2.14)

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Respirology 2018;23:182-9

NIV 와 재활

Table 3 Pre-to-post changes in secondary outcomes

	NIV	*P* (pre-to-post)	Control	*P* (pre-to-post)	*P**	Cohen's d	95% CI
Δ endurance time (s)	754.1 (973.9)†	0.0074	51.2 (406.5)‡	0.6707	0.0271	0.913	0.207 to 1.607
Δ Peak watts	10.0 (8.5)†	0.0001	7.8 (10.6)‡	0.0102	0.5035	0.307	−0.364 to 0.974
Δ MIP (cm H_2O)	9.6 (12.9)	0.0329	5.5 (9.7)	0.0755	0.6557	0.359	−0.252 to 0.967
Δ MEP (cm H_2O)	14.1 (16.8)	0.0194	4.0 (9.8)	0.1850	0.4253	0.734	0.104 to 1.356
Δ MRF-28	−7.2 (21.7)	0.1652	−16.2 (23.5)	0.0148	0.2490	0.398	−0.216 to 1.006
Activity	−4.8 (20.0)	0.3131	−18,1 (29.2)	0.0253	0.1195	0.531	−0.087 to 1.144
Impairment	−7.596 (25.4)	0.2095	−14.812 (23.9)	0.0254	0.3962	0.293	−0.317 to 0.899
Δ Borg dyspnoea	−0.83 (1.34)	0.0101	−0.5 (0.95)	0.0254	0.3589	−0.284	−0.890 to 0.326
Δ Borg fatigue	−0.78 (1.46)	0.0223	−0.52 (1.44)	0.110	0.5630	−0.251	−0.857 to 0.357

†Available for 19 patients.
‡Available for 16 patients.

Δ, pre-to-post rehabilitation change; MIP, maximal static inspiratory pressure; MEP, maximal static expiratory pressure; MRF-28, Maugeri Respiratory Failure questionnaire.

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Respirology 2018;23:182-9

NIV 와 재활

Table 1 Main data at baseline (before the interventions).

	Whole sample (median [IQ])	NIV (median)	ET (median)	NIV-ET (median)	p
FVC%	74 [62–85]	73	76	71	0.87
FEV_1 %	34 [29–43]	35	39	28	0.4
TLC (%)	106 [98–120]	110	120	103	0.2
VR (%)	159 [140–187]	166	164	151	0.8
KCO (%)	75 [53–97]	77	61	82	0.4
IC (%)	69 [50–76]	67	70	67	0.6
PaO_2 (mmHg)	54 [51–57]	52	54	56	0.1
$PaCO_2$ (mmHg)	50 [48–53]	51	48	50	0.11
1RM chest pull (kg)	30 [24–36]	20	19	20	0.6
1RM leg extension (kg)	24 [18–32]	26	23	29	0.4
Power %	35 [27–47]	35	36	33	0.9
VO2%	55 [46–67]	60	56	54	0.5
6MWD (m)	343 [280–444]	350	361	329	0.2
Endurance (minutes)	10.25 [6.09–19.21]	6.4	15.7	9.7	0.06
BODE index	5 [4–6]	5	5	5	0.2
MRC score	3 [2–3]	3	3	3	0.6
Total CRDQ score	4.34 [3.82–4.93]	4.1	4.8	4.1	0.1
CRP (mg/l)	10.8 [5.2–24]	10.8	10.6	13.8	0.3
TNF-α (pg/ml)	1.81 [1.16–3.35]	1.8	1.8	1.9	0.8
IL-6 (pg/ml)	4.79 [2.78–9.23]	4.2	4.7	6.8	0.5
IL-8 (pg/ml)	3.31 [2.2–4.95]	2.2	3.3	3.1	0.07
SP-D (ng/ml)	160.57 [110–216]	131	174	192	0.5

IQ: interquartile range; NIV: non-invasive ventilation group; ET: exercise training group; FVC: forced vital capacity; FEV_1: forced expiratory volume in first second; TLC: total lung capacity; RV: reserve volume; KCO: carbon monoxide transfer coefficient; IC: inspiratory capacity; PaO_2: arterial oxygen pressure; $PaCO_2$: arterial carbon dioxide pressure; 1RM: 1 repetition maximum; VO_2%: oxygen consumption; 6MWD: 6 min walk distance; mMRC: modified Medical Research Council; CRDQ: Chronic Respiratory Disease Questionnaire; CRP: C-reactive protein; TNF-α: tumour necrosis factor- α; IL-6: interleukin 6; and SP-D: surfactant protein D.

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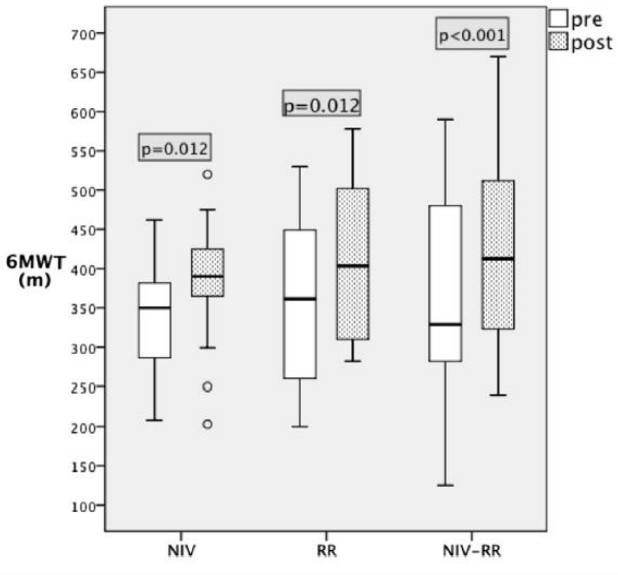
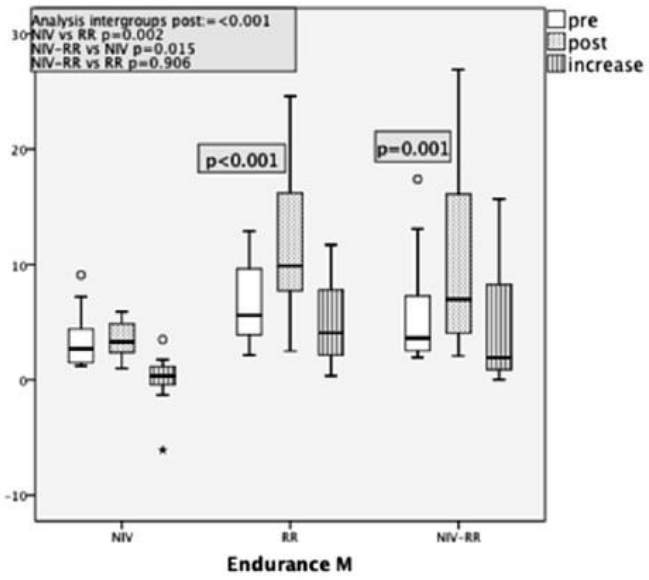
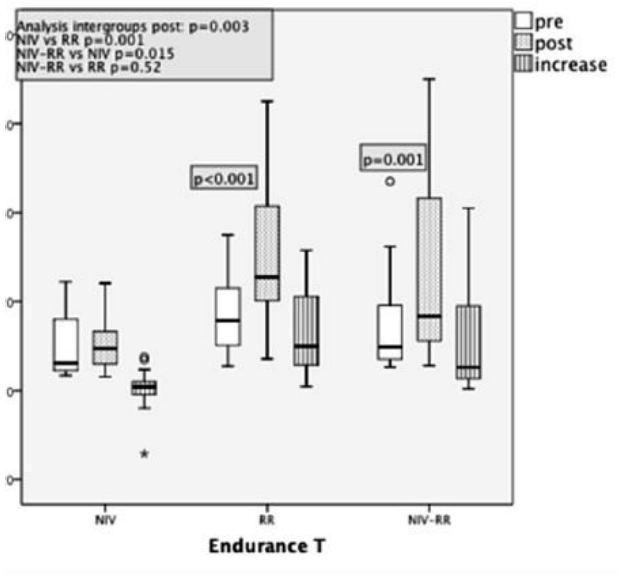
Respir Med 2014;108:1741-51

NIV 와 재활







Respir Med 2014;108:1741-51

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인공호흡기 요양급여 상병

상병기호	상병명
B90.9 + J96.1	호흡기 및 상세불명 결핵의 후유증 + 만성 호흡부전
I27.0 (V202) + J96.1	일차성 폐동맥고혈압 + 만성 호흡부전
I27.2 + J96.1	기타 이차성 폐성고혈압 + 만성 호흡부전
I27.9 + J96.1	폐성 심장(만성) NOS + 만성 호흡부전
J44 + J96.1	기타 만성 폐색성 폐질환 + 만성 호흡부전
J47 + J96.1	기관지확장증 + 만성 호흡부전
J84.18 (V236)	특발성 폐섬유증
J98.01 + J96.1	기관기관지의 허탈 + 만성 호흡부전
J98.8 + J96.1	기타 명시된 호흡장애 + 만성 호흡부전

기준금액	인공호흡기 월대여비 ○ 혼합형 535,000 원, 압력형·볼륨형 356,000 원 소모품 구입비 ○ 기본소모품 수량 및 금액(공통사용) 1 세트: 튜브 1 개, 필터 4 개, 가습기물통 1 개 / 60,000 원(월) 2 세트: 튜브 2 개, 필터 4 개, 가습기물통 1 개 / 80,000 원(월) ○ 침습적 환자 : 기관절개환자용 커넥터(월) 선택가능 일반 일체형 : 7,000 원 / 개 실리콘 연결형 : 14,500 원 / 개 ○ 비침습적 환자 : 마스크(연 기준금액총액 40 만원 범위내) 코마스크 : 개당 실리콘, 필로우(각 125,000 원), 겔(120,000 원) 코입마스크 : 개당 실리콘(72,000 원), 겔(148,000 원)
지급기준	인공호흡기 월대여료 ○ 기준금액의 90%에 해당하는 금액, 단 기준금액보다 낮은 금액으로 대여한 경우 실 대여금액의 90%에 해당하는 금액 소모품 구입비 ○ 기준금액 이내로 구입한 경우 실 구입금액의 90%에 해당하는 금액 ○ 기준금액을 초과하여 구입한 경우 기준금액의 90%에 해당하는 금액 ○ 단, 인공호흡기 선택소모품에 대한 요양비는 그 종류별로 다음 표에서 정하는 금액을 넘지 못한다. ○

구분		요양비 지급금액	차상위 본인부담 경감자 지급금액
기관절개 환자용 커넥터	일반 일체형	12,600 원/월	14,000 원/월
	실리콘 연결형	26,100 원/월	29,000 원/월
마스크		360,000 원/연	400,000 원/연

호흡재활과 장비들

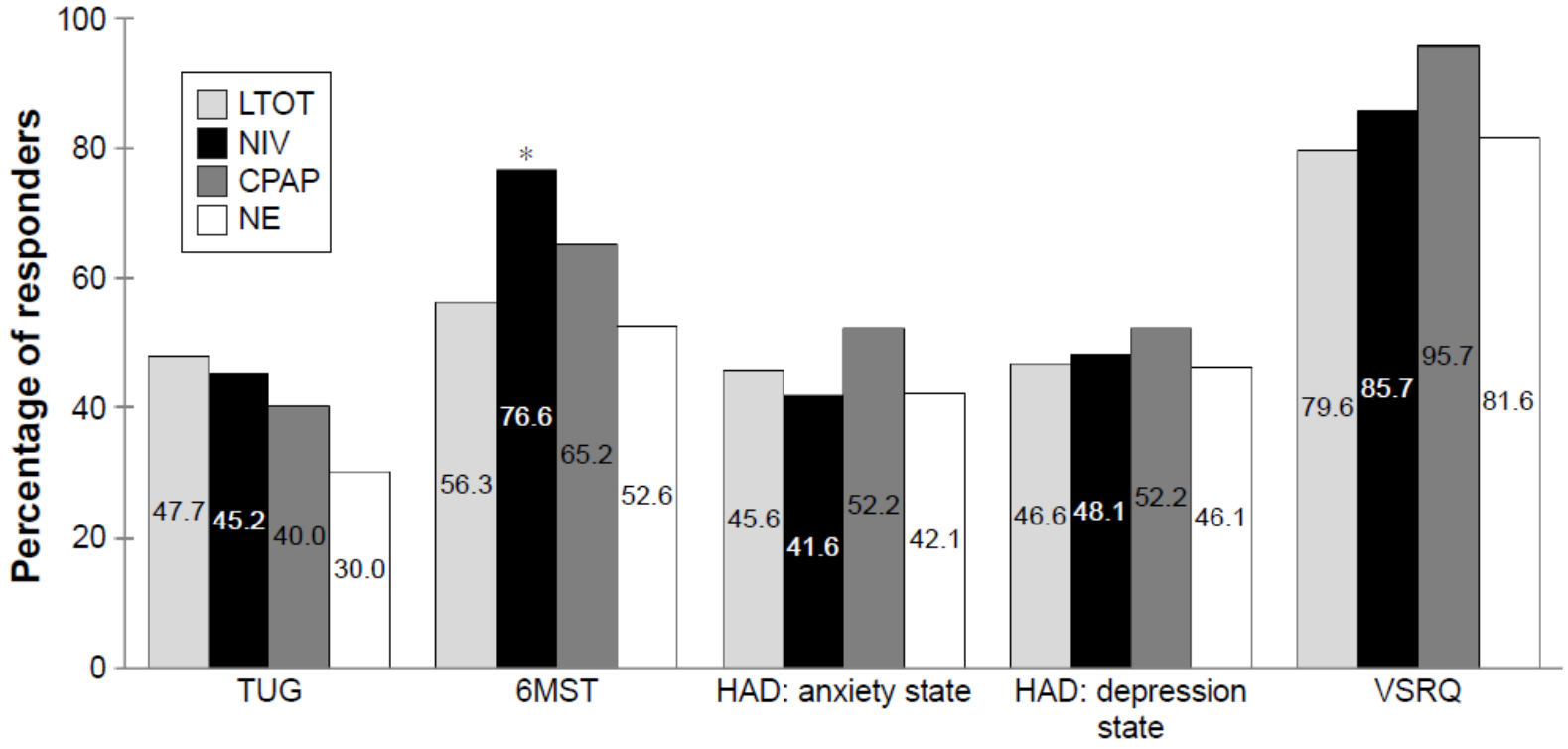

Figure 2 Percentage of patients who improved their exercise capacities, anxiety, depression, and health related quality of life.
Notes: Improvement was evaluated after 2 months of home-based pulmonary rehabilitation. Results are given according to patients' medical equipment. *$p<0.05$.
Abbreviations: 6MST, 6-minute stepper test; CPAP, continuous positive airway pressure; HAD, Hospital Anxiety and Depression; LTOT, long-term oxygen therapy; NE, no equipment; NIV, noninvasive ventilation; TUG, timed up-and-go test; VSRQ, Visual Simplified Respiratory Questionnaire.

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Int J Chron Obstruct Pulmon Dis 2017;12:3549-56

Questions??

경청해 주셔서

감사합니다

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