Taiwan Society of Pulmonary and Critical Care Medicine Meeting

CPAP and NIV in Japan

Dept. of Respiratory Care and Sleep Control Medicine,
Graduate School of Medicine, Kyoto University, Japan
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(TAIWAN, Kaohsiung:
Kaohsiung Exhibition Center
2019.12.8.)

Conflict of Interest Disclosures
– Authors/Presenters

☐ The authors do not have any potential conflicts of interest to disclose,

OR

☒ The authors wish to disclose the following potential conflicts of interest related to content in this lecture:

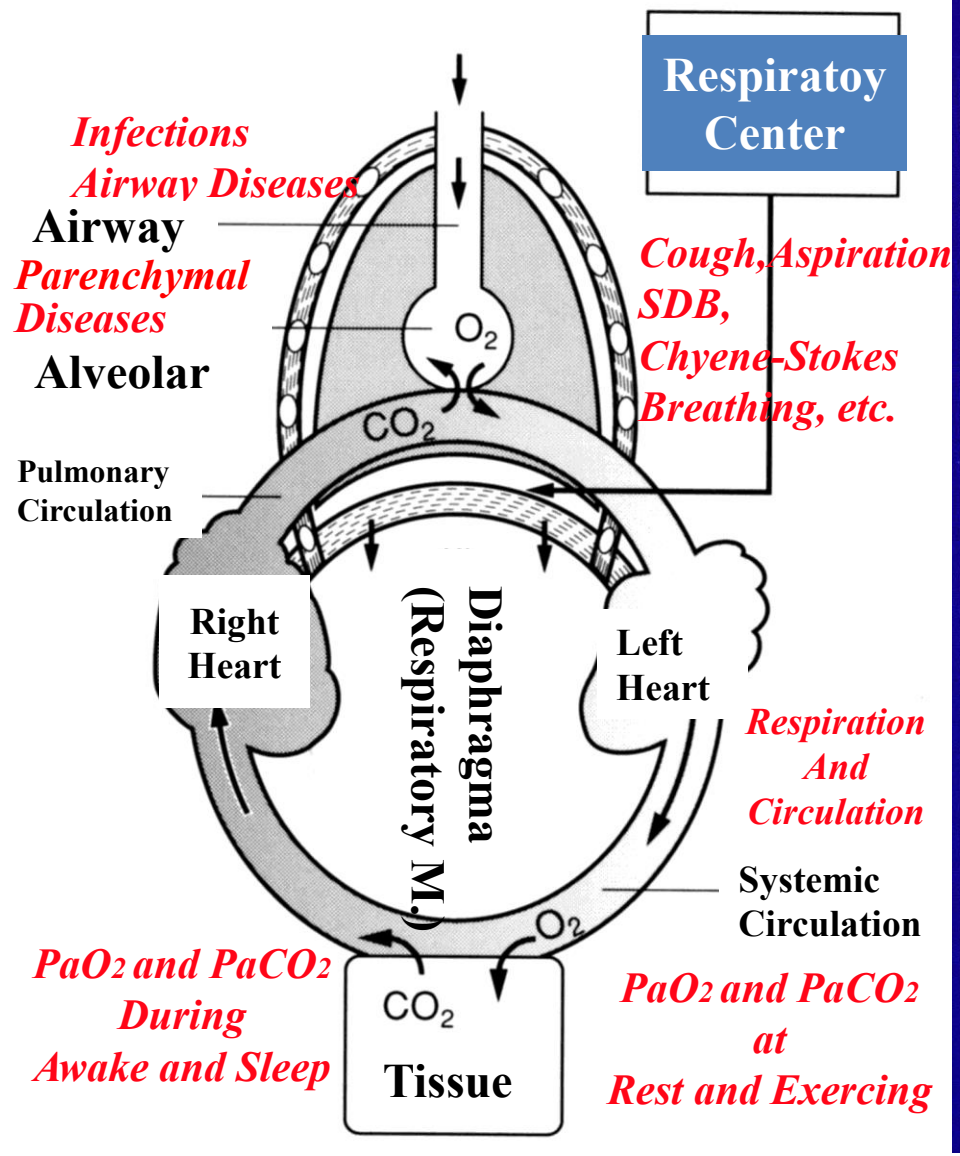
Type of Potential Conflict	Details of Potential Conflict
Grant/Research Support	
Consultant	
Speakers' Bureaus	
Financial support	
Other	Kazuo Chin belongs to the department which are donated by 4 companies; Philips-Respironics, Resmed Japan, Fukuda Denshi, and Fukuda Lifetec Keiji.

This talk presents material that is related to one or more of these potential conflicts, and the following objective references are provided as support for this lecture:

1.
2.
3.

Today's presentation

- Respiratory care and sleep disordered breathing
- The history of home respiratory care in Japan
- Telemedicine of CPAP in Japan
- Future home respiratory care



Respiratory System

Several Systems Induce Hypoxemia

Factors for Respiratory Failure

Brain	脳血管障害，脳腫瘍，外傷，炎症 薬物中毒 睡眠時無呼吸症候群，原発性肺胞低換気症候群
Spine	ギランバレー症候群 脊髄損傷 灰白髄炎
Neuro -Mus.	筋萎縮性側索硬化症，多発性硬化症 重症筋無力症 筋遮断性薬物（クラーレ様薬剤，コリン拮抗剤） 抗生剤（アミノグリコシド系，ポリミキシン系） ボツリヌス中毒 末梢神経炎 筋ジストロフィー，多発性筋炎
Thorax	高度の肥満 脊柱後側彎症 flail chest 胸郭成形術後，胸膜肺胞，胸腹水
Upper Airway	睡眠時無呼吸症候群 気道閉塞（異物，咽喉頭炎・浮腫，腫瘍など） 声帯麻痺
CVD	肺水腫（心性） 肺塞栓 原発性肺高血圧症 血管炎
Lo･A Alv	慢性閉塞性肺疾患，気管支喘息 ARDS（ショック，外傷，DIC などによる） 間質性肺炎，肺線維症 肺炎，肺腫瘍，各種慢性肺疾患（塵肺，気管支拡張症など）
Liver Kidney Etc.	肝疾患，腎疾患，急性膵炎 悪性リンパ腫など

It is important to manage or control sleep disorders including sleep disordered breathings from ICU to Home.

Sleep Disorders (over 60 diseases)

(International Classification of Sleep Disorders: ICSD-3, 2014)

1) Insomnia: 3+2

2) Sleep Related Breathing Disorders: 17+2

3) Central Disorders of Hypersomnolence: 8+1

4) Circadian Rhythm Sleep-Wake Disorders: 7

5) Parasomnias: 14+1

6) Sleep Related Movement Disorders: 10+3

pOther Sleep Disorder

- Apendix A: Sleep Related Medical and Neurological Disorders: 6 Fatal Familial Insomina , Sleep Related Epilepsy, Sleep Related Headaches,Sleep Related Laryngospasm, Sleep Related Gastroesophageal Reflux, Sleep Related Myocardial Ischemia7)

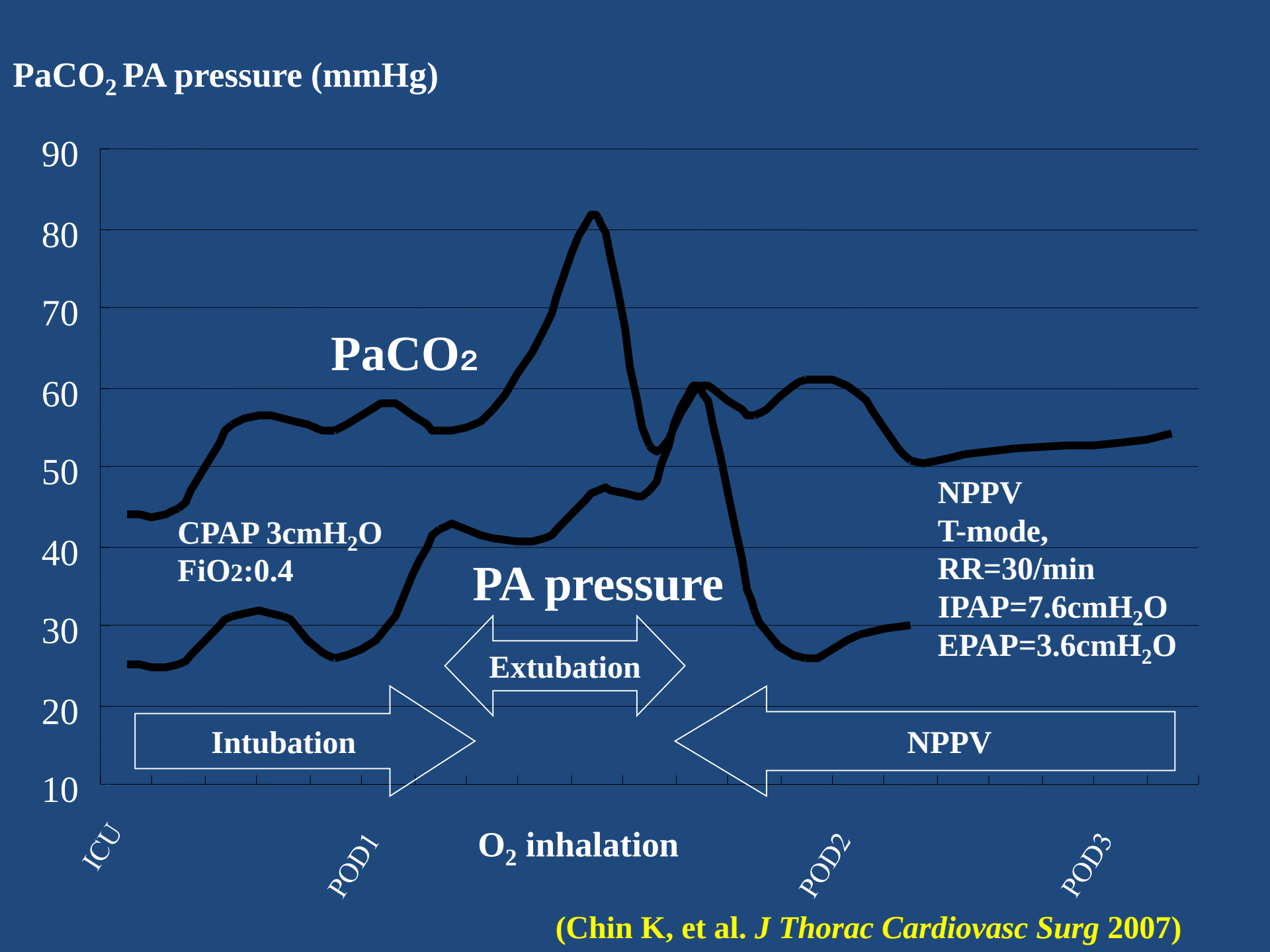
Case 1

- 7 mo. Female
- Diagnosis：Atrial Septal Defect, Pulmonary Hypertension, R-phrenic nerve palsy
  Cervical bone abnormality

- Therapy：Closure of ASD

Chest X-rays

- Elevation of r-diaphragm
- CTR:57%
- Bilateral pulmonary vascular shadow increase



(Chin K, et al. *J Thorac Cardiovasc Surg* 2007)

TcPCO2(mmHg)

100
95
90
85
80
75
70
65
60
55
50

Without NPPV

With NPPV

0h 1h 2h 3h 4h 5h

***J Thorac Cardiovasc Surg* 2007**

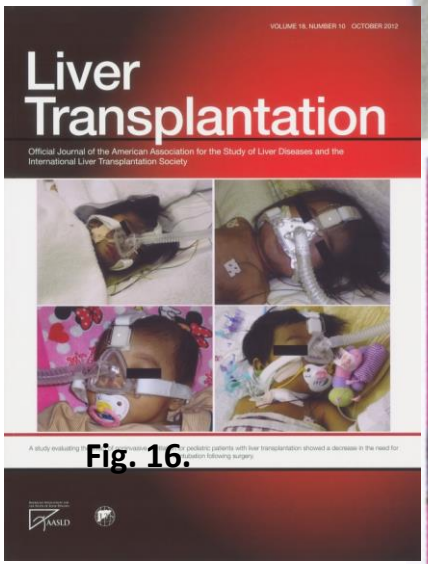


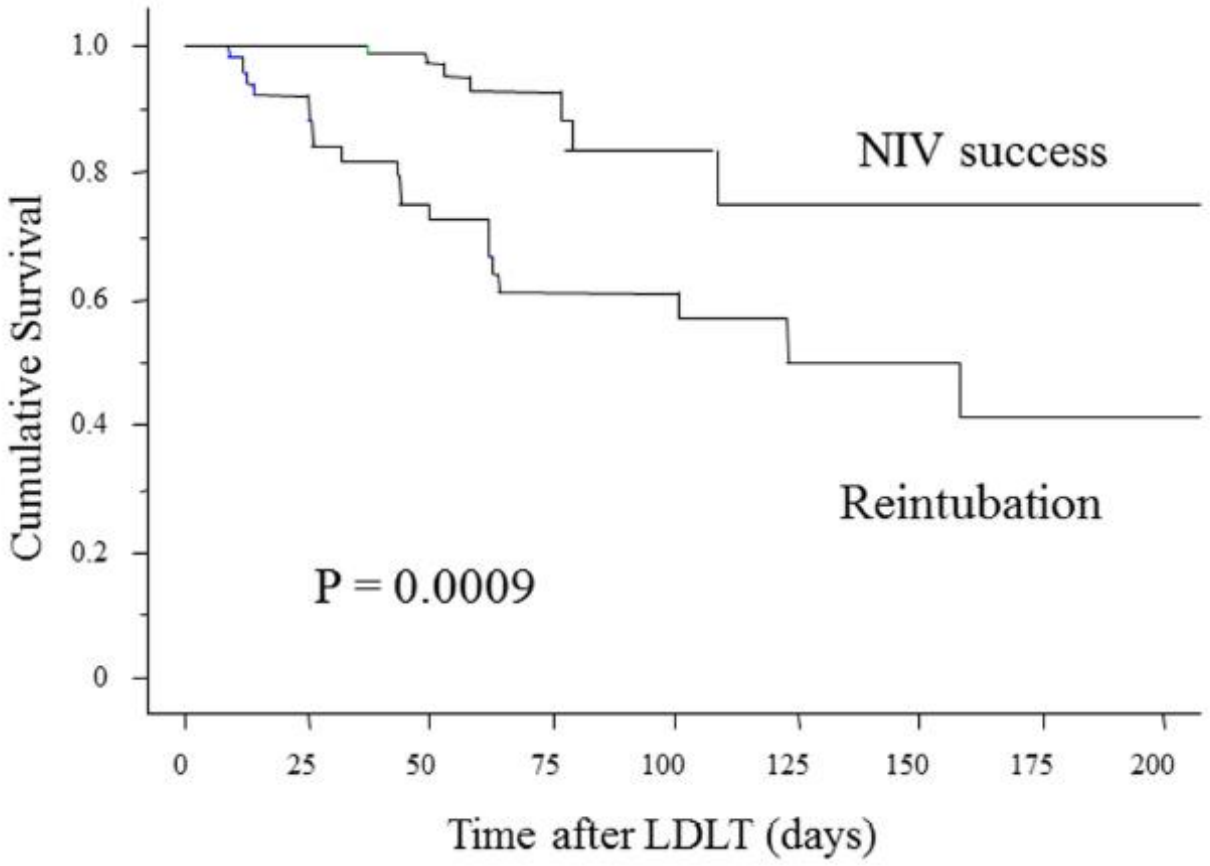
Fig. 16.

Pictures of pediatric patients receiving noninvasive ventilation during the perioperative stage of liver transplantation. And the cover of the Journal.

Murase K, Chin K et al. ***Liver Trsnspl*** 2012.

Predictive Factors for Reintubation following Noninvasive Ventilation in Patients with Respiratory Complications after Living Donor Liver Transplantation

Chihara Y, Chin K et al. PlOS ONE 2013



N=511, NPPV=179,
43 reintubated

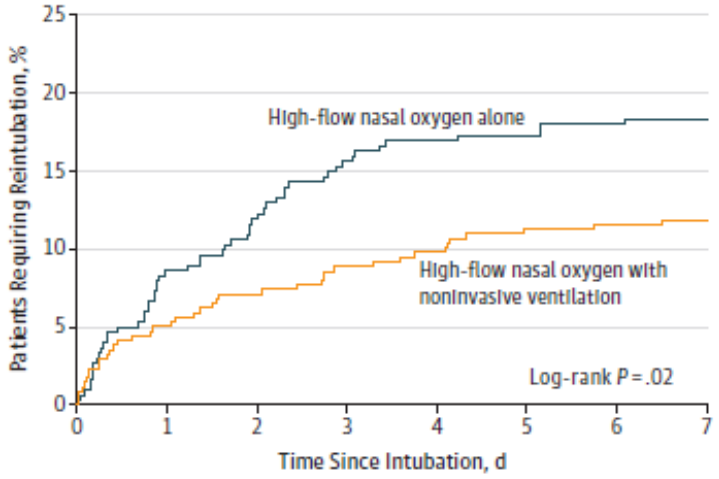
Figure 1. Survival curve following LDLT in NIV success group and reintubation group. Patients who failed NIV had a significantly poorer prognosis (p = 0.0009). Abbreviations: LDLT, living-donor liver transplantation; NIV, noninvasive ventilation.
doi:10.1371/journal.pone.0081417.g001

Effect of Postextubation High-Flow Nasal Oxygen With Noninvasive Ventilation vs High-Flow Nasal Oxygen Alone on Reintubation Among Patients at High Risk of Extubation Failure

A Randomized Clinical Trial

JAMA. 2019;322(15):1465-1475. doi:10.1001/jama.2019.14901
Published online October 2, 2019.

Figure 2. Kaplan-Meier Analysis of Time From Extubation to Reintubation for the Overall Study Population



No. at risk

High-flow nasal oxygen								
Alone	302	276	265	253	248	246	244	243
With noninvasive ventilation	339	321	314	308	305	294	292	291

The median observation time was 7 days (interquartile range, 7-7) in both treatment groups.

RESPIRATORY INVESTIGATION 55 (2017) 83–92

Contents lists available at ScienceDirect

Respiratory Investigation

journal homepage: www.elsevier.com/locate/resinv

Guideline

The Japanese Respiratory Society Noninvasive Positive Pressure Ventilation (NPPV) Guidelines (second revised edition)

Tsuneto Akashiba[a,1], Yuka Ishikawa[b,1], Hideki Ishihara[c,1], Hideaki Imanaka[d,1], Motoharu Ohi[e,1], Ryoichi Ochiai[f,1], Takatoshi Kasai[g,1], Kentaro Kimura[h,1], Yasuhiro Kondoh[i,1], Shigeru Sakurai[j,1], Nobuaki Shime[k,1], Masayuki Suzukawa[l,1], Misa Takegami[m,1], Shinhiro Takeda[n,1], Sadatomo Tasaka[o,1], Hiroyuki Taniguchi[i,1], Naohiko Chohnabayashi[p,1], Kazuo Chin[q,*,1], Tomomasa Tsuboi[r,1], Keisuke Tomii[s,1], Koji Narui[t,1], Nobuyuki Hasegawa[u,1], Ryuichi Hasegawa[v,1], Yoshihito Ujike[w,2,3], Keishi Kubo[x,2,4], Yoshinori Hasegawa[y,2,4], Shin-ichi Momomura[z,2,5], Yoshitsugu Yamada[aa,2,6], Masahiro Yoshida[ab,2,7], Yukie Takekawa[ac,8], Ryo Tachikawa[ad,8], Satoshi Hamada[ad,8], Kimihiko Murase[ad,8]

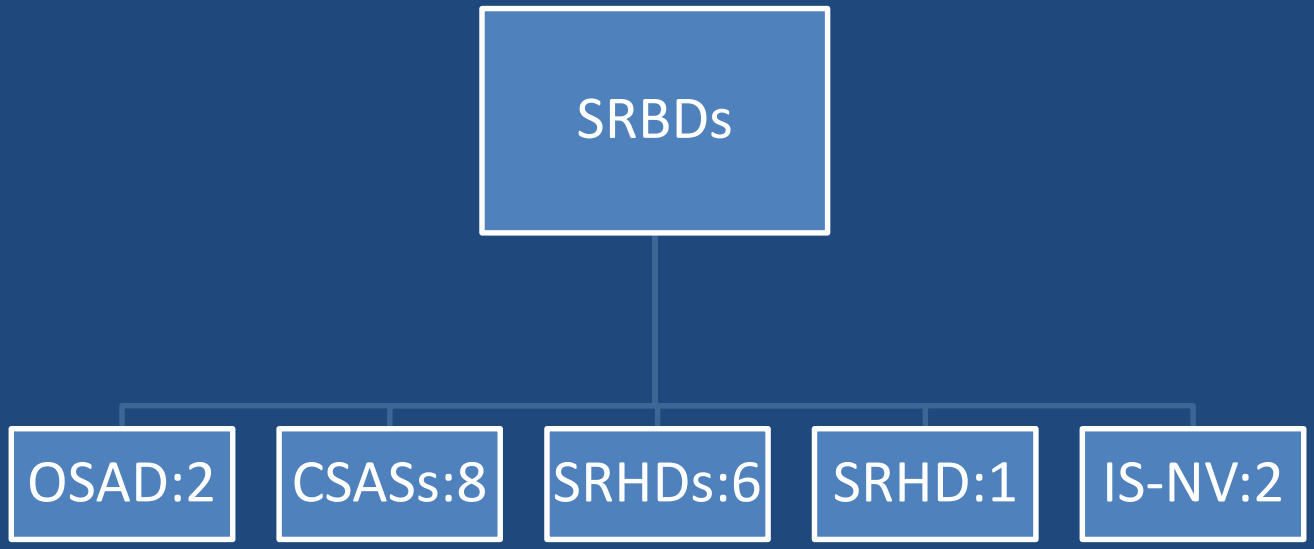
*Corresponding author. Tel.: +81 75 751 3852; fax: +81 75 751 3854.
E-mail address: chink@kuhp.kyoto-u.ac.jp (K. Chin).

Sleep Related Breathing Disorders(17+2) (ICSD-3)

- **OBSTRUCTIVE SLEEP DISORDERS**
  - Obstructive Sleep Apnea, Adult
  - Obstructive Sleep Apnea, Pediatric
- **CENTRAL SLEEP APNEA SYNDROMES**
  - Central Sleep Apnea with Cheyne-Stokes Breathing (CSB)
  - Central Apnea Due to a Medical Disorder without CSB
  - Central Sleep Apnea Due to High Altitude Periodic Breathing
  - Central Sleep Apnea Due to a Medication or Substance
  - Primary Central Sleep Apnea
  - Primary Central Sleep Apnea of Infancy
  - Primary Central Sleep Apnea of Prematurity
  - Treatment-Emergent Central Sleep Apnea
- **SLEEP RELATED HYPOVENTILATION DISORDERS**
  - Obesity Hypoventilation Syndrome
  - Congenital Central Alveolar Hypoventilation Syndrome
  - Late-Onset Central Hypoventilation with Hypothalamic Dysfunction
  - Idiopathic Central Alveolar Hypoventilation
  - Sleep Related Hypoventilation Due to a Medication or Substance
  - Sleep Related Hypoventilation Due to a Medical Disorder
- **SLEEP RELATED HYPOXEMIA DISORDER**
  - Sleep Related Hypoxemia
- **ISOLATED SYMPTOMS AND NORMAL VARIANTS**
  - Snoring
  - Catathrenia

Sleep-Related Breathing Disorders (SRBDs)

（2014 ICSD-3）



Body weight reduction, CPAP, Oral appliance, Surgery, Oxygen, NPPV, ASV, Artificial ventilation with tracheostomy, Nasal high flow

Managing respiratory care is managing respiratory events during sleep.

Home Respiratory Care in Japan I

- **LTOT** (long-term oxygen therapy), **HOT** (home oxygen therapy) in Japan
- **TIPPV** (tracheostomy intermittent positive pressure ventilation)
- **NPV** (negative pressure ventilation)
- **NPPV** (noninvasive positive pressure ventilation)
- **CPAP** (continuous positive airway pressure)
- **ASV** (adaptive servo ventilation)

Home Respiratory Care in Japan II

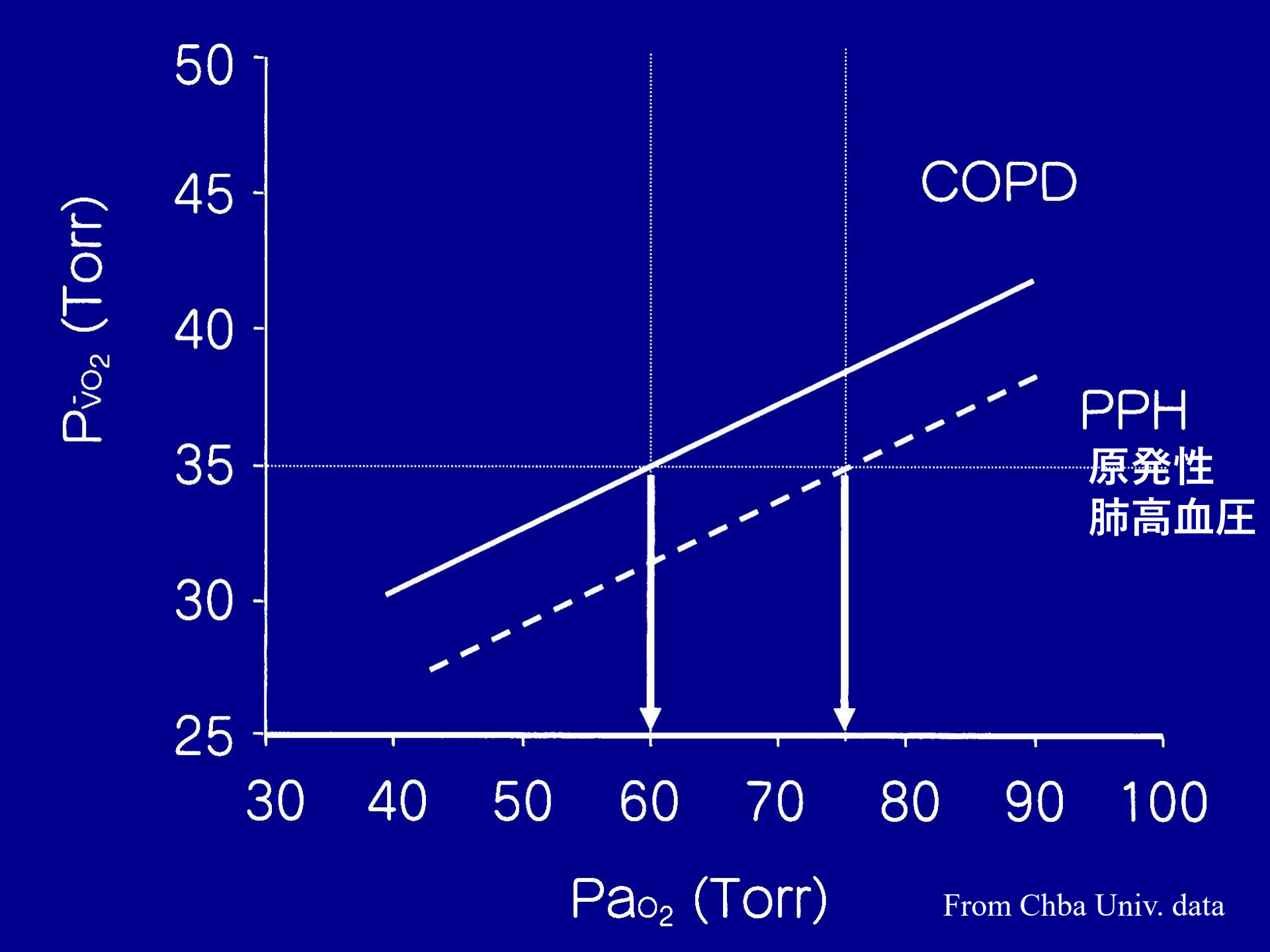
- **LTOT: long-term oxygen therapy**

  1985.3: PaO2 ≦ 50 mmHg or ≦ 60 mmHg with Cor Pulmonale

  1988.4: PaO2 ≦ 55 mmHg or ≦ 60 mmHg with desaturation during sleep or exercise, and portable oxygen tank was permitted.

  1996.4: Pulmonary hypertension

- **2004.4: Chronic heart failure with Cheyne-Stokes breathings and apnea and hypopnea index ≧20.**
- **2008.3: Demand valve was permitted**


50
45
40
35
30
25
$P_{\dot{V}O_2}$ (Torr)
COPD
PPH
原発性
肺高血圧
30
40
50
60
70
80
90
100
Pa_{O_2} (Torr)
From Chba Univ. data

Home Respiratory Care in Japan III

- **TIPPV: tracheostomy intermittent positive pressure ventilation**

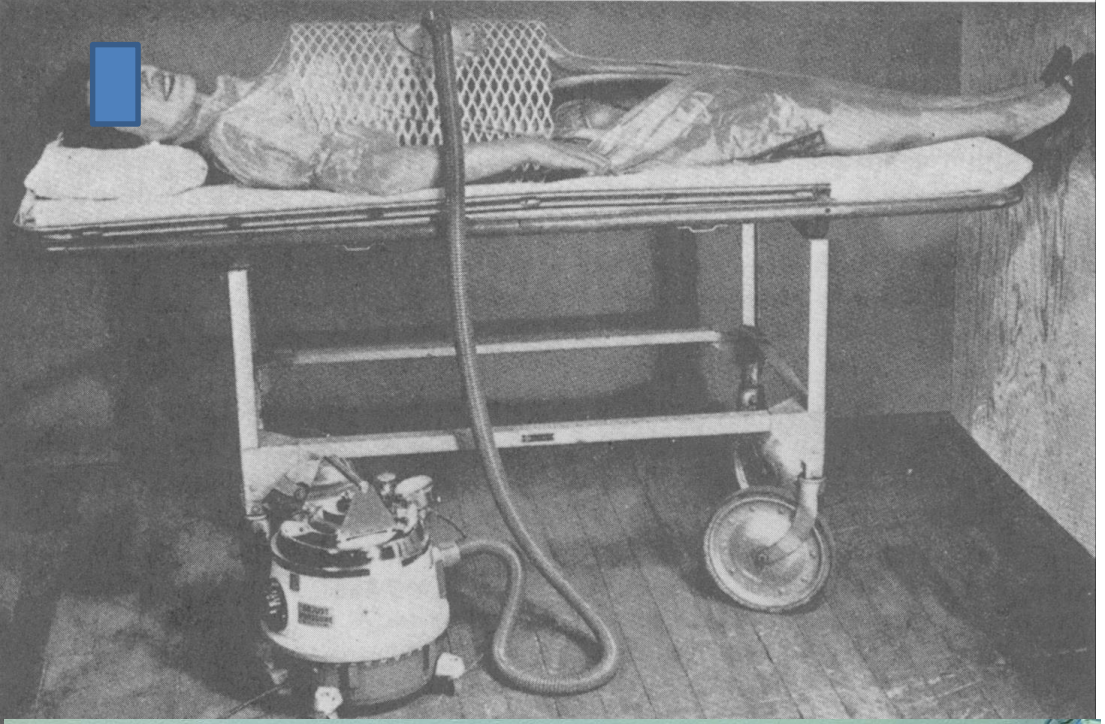
  1990.4:ALS, Muscular dystrophy, Multiple myositis, and etc. neuro-mascular disease

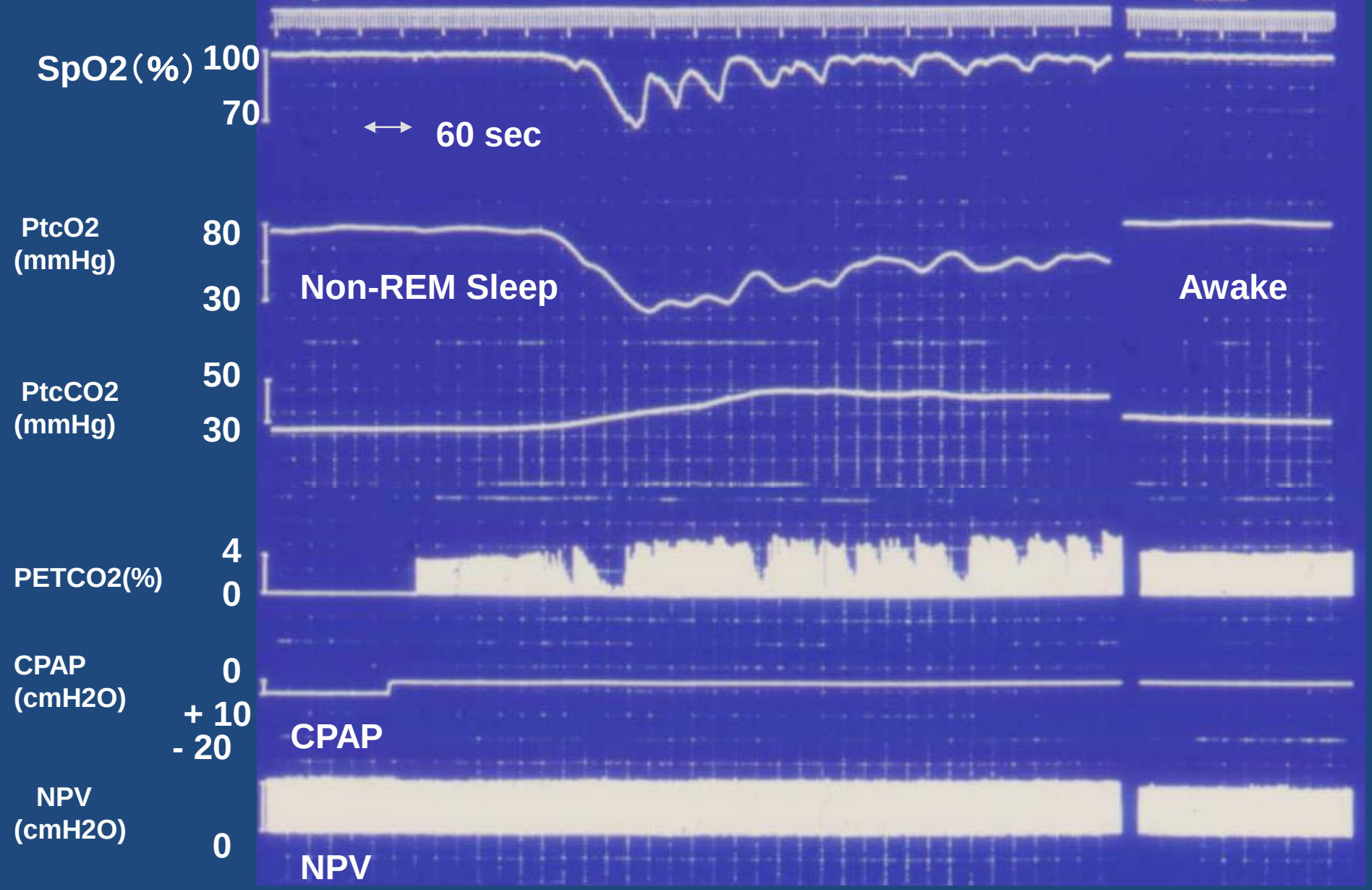
- **NPV: negative pressure ventilation**

  1992.4: ALS, Muscular dystrophy, Multiple myositis, and etc. neuro-mascular disease

- **TIPPV, NPV**

  1994.4: Patients who are needed home mechanical ventilation (HMV), which are diagnosed by doctors





CPAP
＋
CNPV

NPV without CPAP could not maintain airway opening during sleep.

Summary of Pathophysiology of Sleep-Disordered Breathing

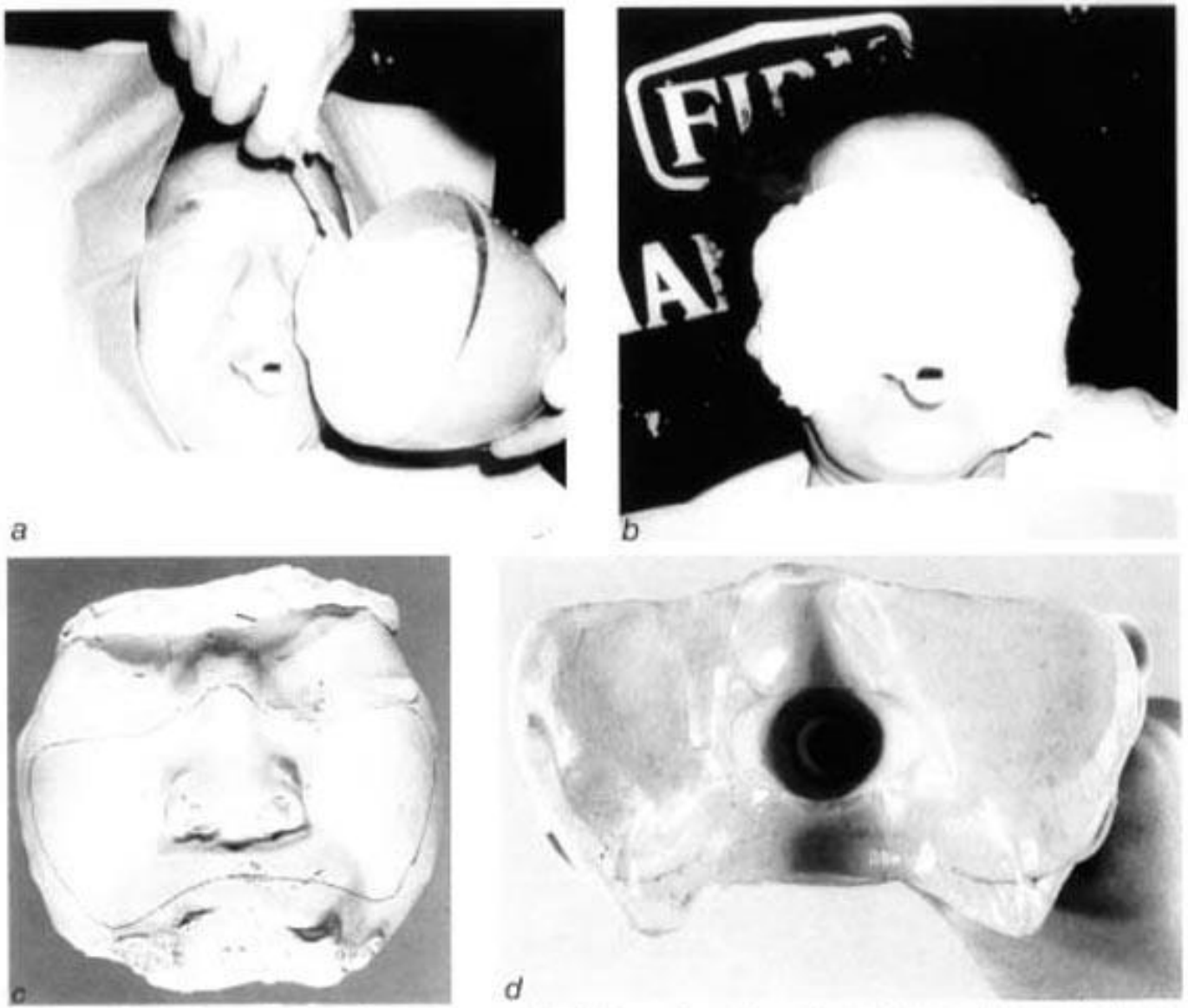
Pathophysiology of SDB

SDB	Factors
CSA	Control of Breathing
OSA	Upper Airaway
Hypo (REM)	Inspiratory M.

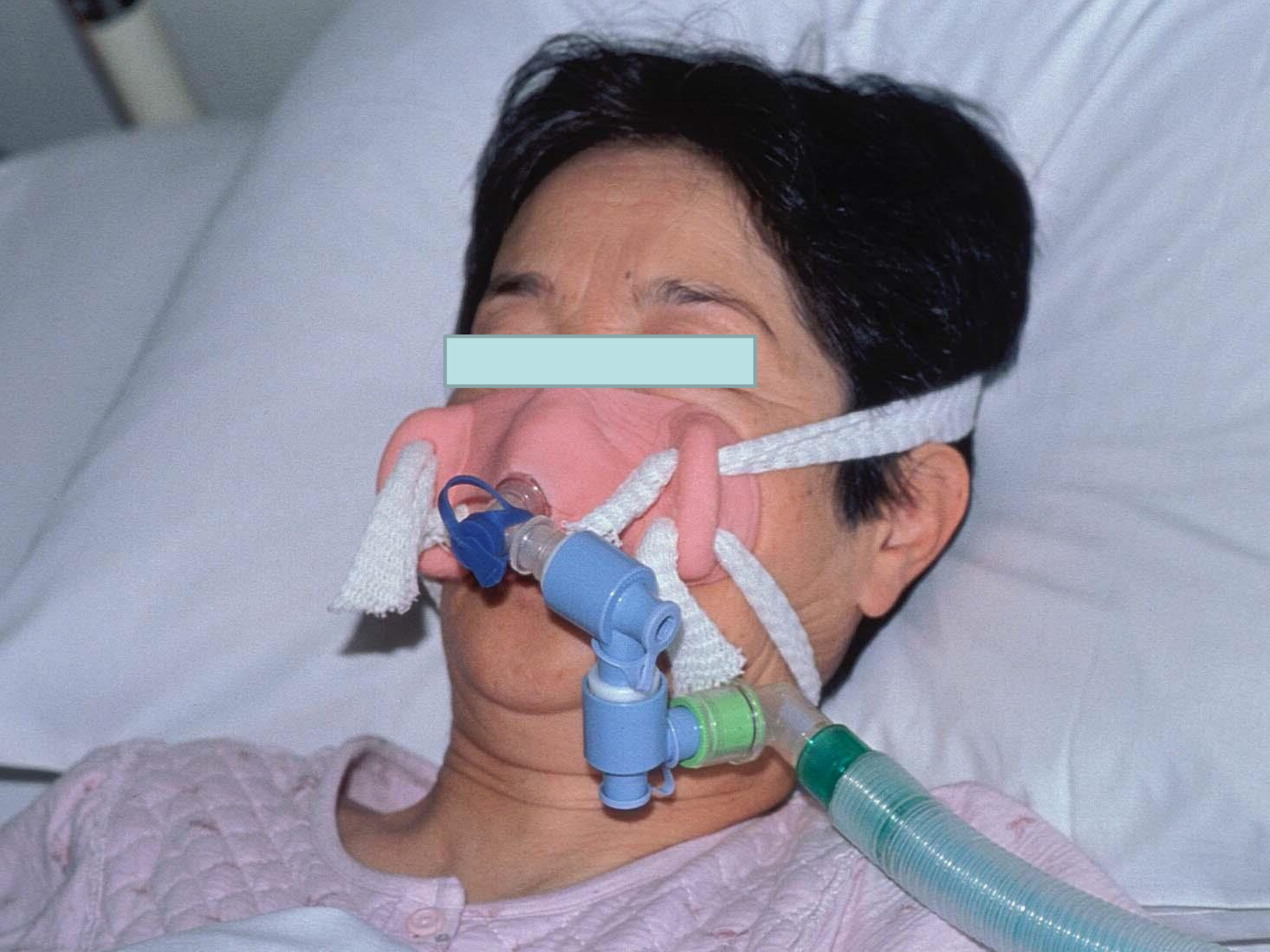
Respiratory support during sleep

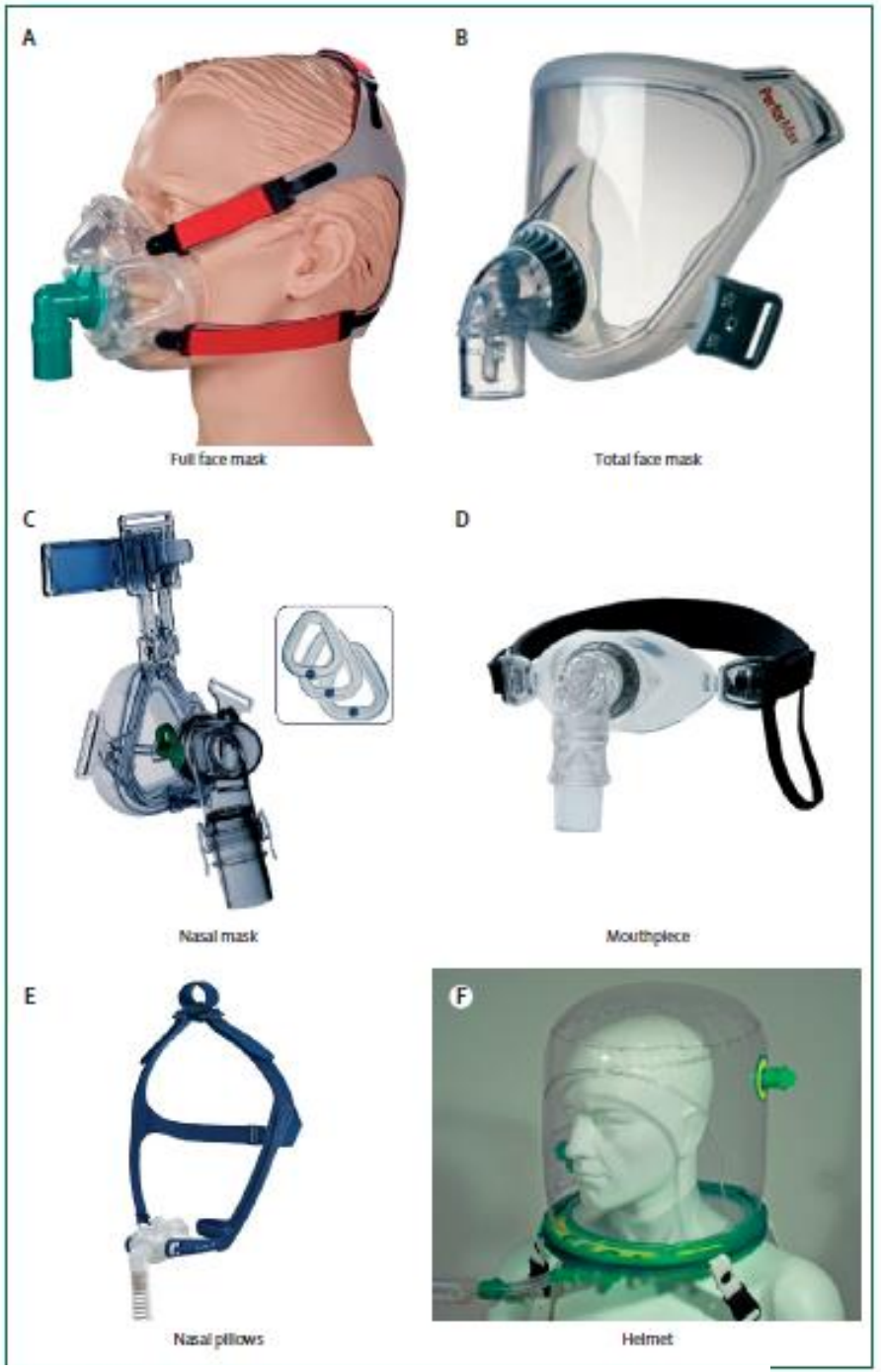
	Patency of Upper Airway		Respiratory Support
CPAP	+		—
NPPV	+		+
NPV	—		+

The efficacy of a custom-fabricated nasal mask on gas exchange during nasal intermittent positive pressure ventilation.



Tsuboi T, Chin K, Ohi M et. al. *Eur Respir J* 1998





Stefano Nava, Nicholas Hill **Lancet** 2009; 374: 250–59

Panel 3: Advantages and disadvantages of different types of interfaces

Total face mask—covers mouth, nose, and eyes

Advantages

- Minimum airleaks
- Little cooperation required
- Easy fitting and application

Total Face

Disadvantages

- Vomiting (risk of aspiration)
- Claustrophobia
- Speaking difficult

Full face (or oronasal) mask—covers mouth and nose

Advantages

- Few air leaks
- Little cooperation required
- Can be adjusted for comfort

Full Face

Disadvantages

- Vomiting
- Claustrophobia
- Possible nasal skin damage
- Speaking and coughing difficult

Nasal mask—covers nose and not mouth

Advantages

- Possibility of speaking and drinking
- Allows cough
- Reduced danger of vomiting
- Minimum risk of asphyxia

Nasal

Disadvantages

- Air leaks if mouth opens
- Possible nasal skin damage
- Needs patent nasal passages

Home Respiratory Care in Japan IV

- **CPAP: continuous positive airway pressure**

  1998.4: Patients who are diagnosed as sleep apnea by polysomnography and apnea and hypopnea index (AHI) ≧20 with symptoms and complications (hypertension, IHD,--).

  The diagnosis should be done by PSG.

  2000.4:AHI ≧20 with symptoms and complications. If AHI ≧40 with portable monitorings, CPAP can be used.

Home Respiratory Care in Japan V

- **NPPV: noninvasive positive pressure ventilation**

  1998.4: Patients who are needed home mechanical ventilation (HMV), which are diagnosed by doctors, but should not used for patients with sleep apnea

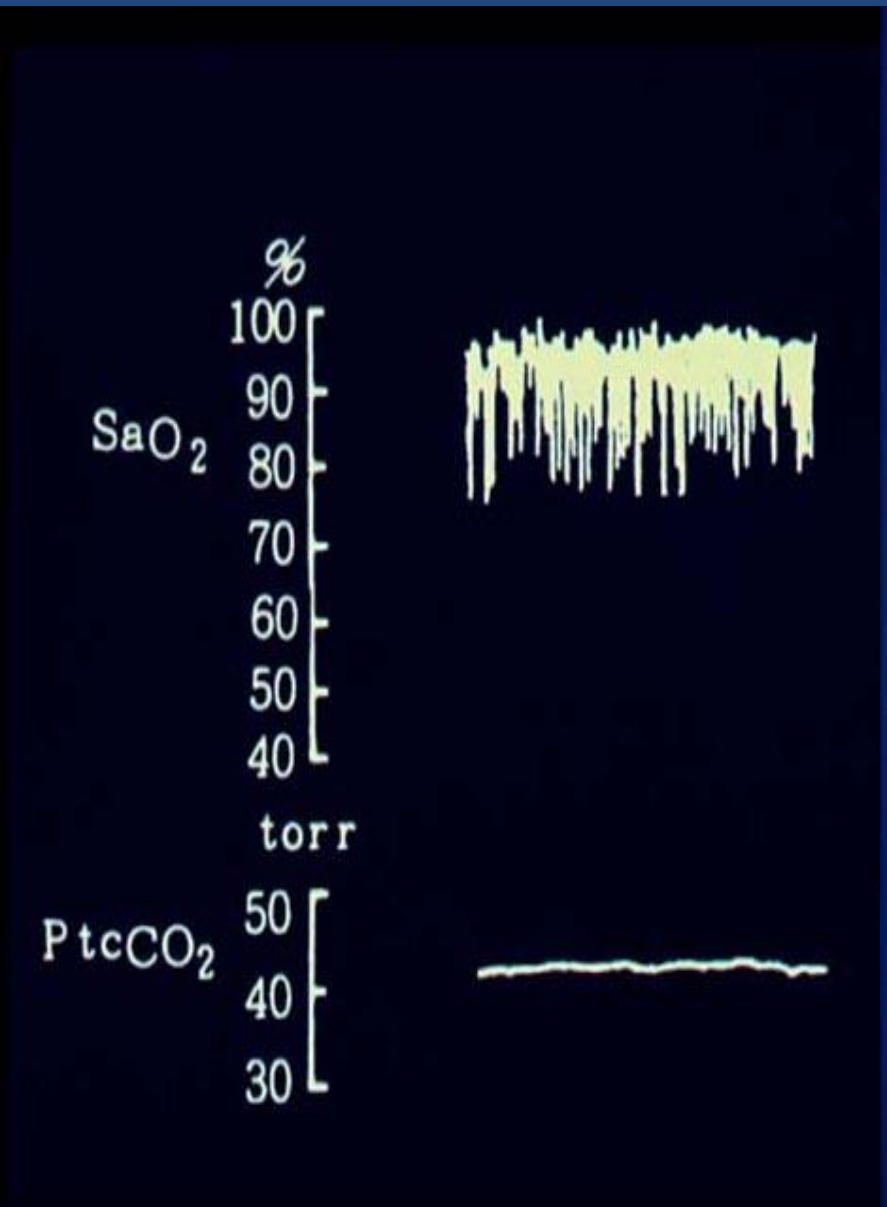
- **ASV: adaptive servo ventilation**
- **Advanced ASV: ASV is firstly used as one of NPPV machines.**

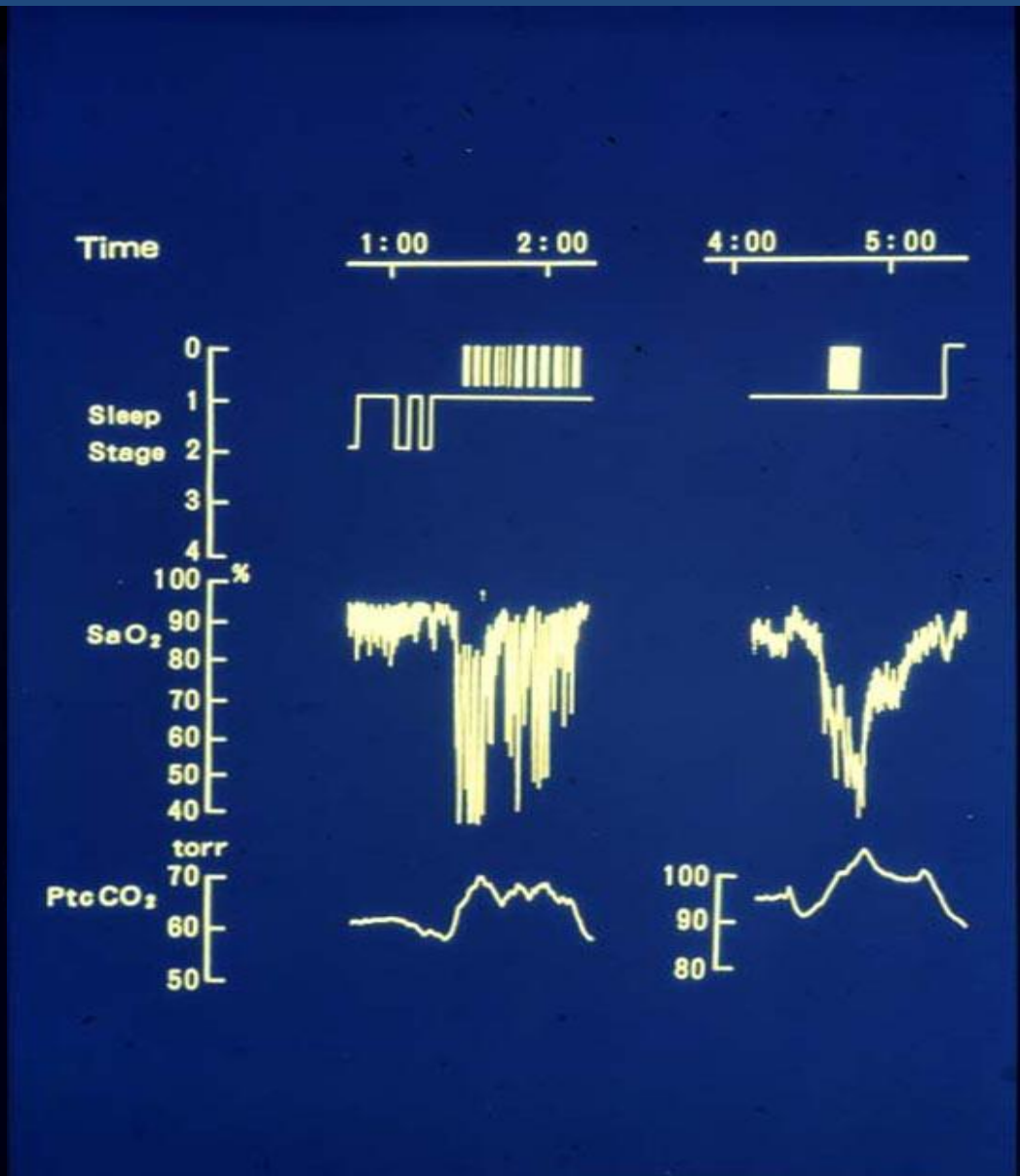
  2018:In addition, it is also permitted for patients with congestive heart failure as one of CPAP categolized machine.

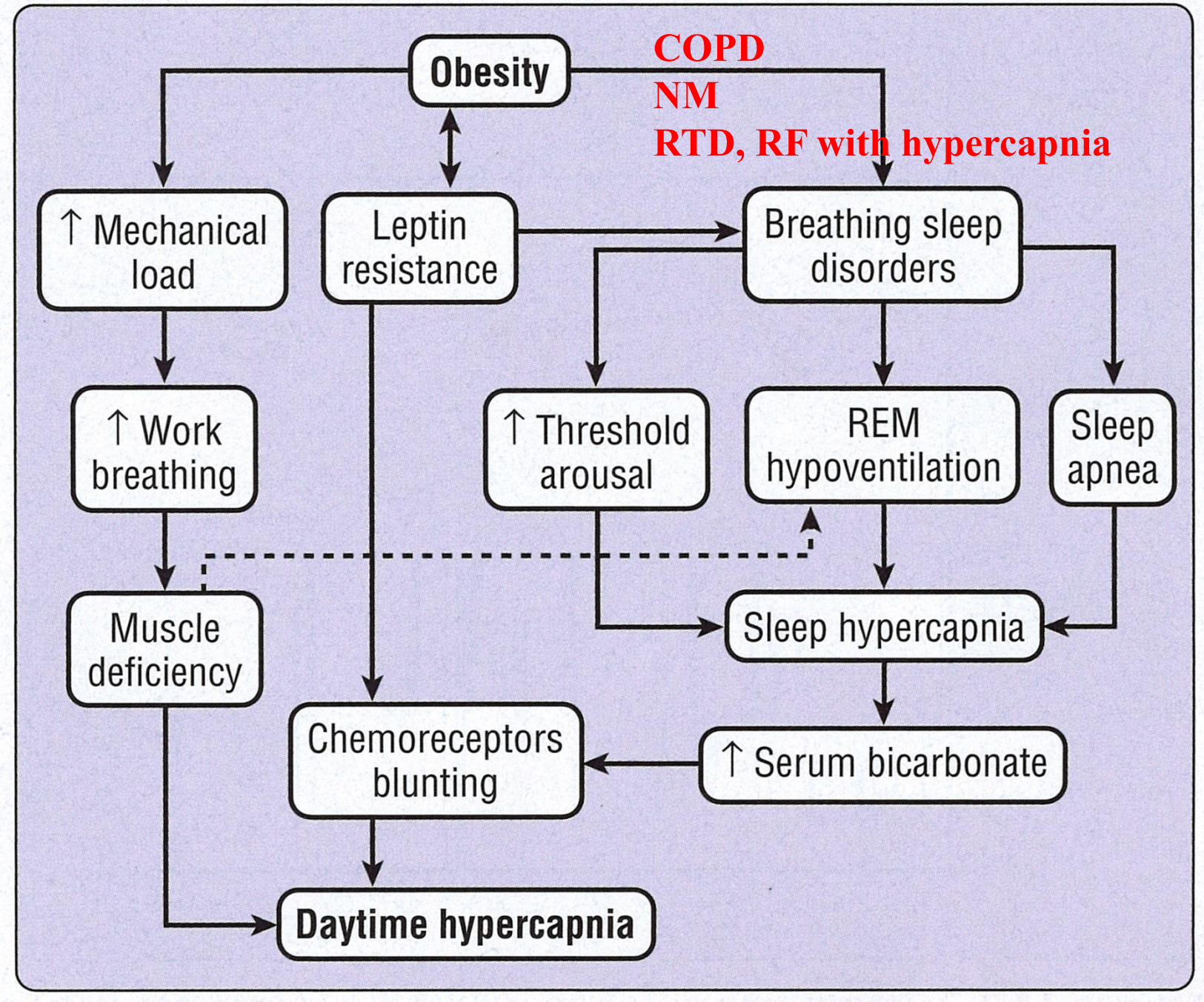
Usually, mild-moderate OSA don't show hypercapnia during sleep

Severe OSA (OHS: Pickwickian syn.) REM stage

Respiratory failure with hypercapnia REM stage







Kryger MH, et al. Sleep Medicine 5th ed. 2011

TcPCO2(mmHg)

100
95
90
85
80
75
70
65
60
55
50

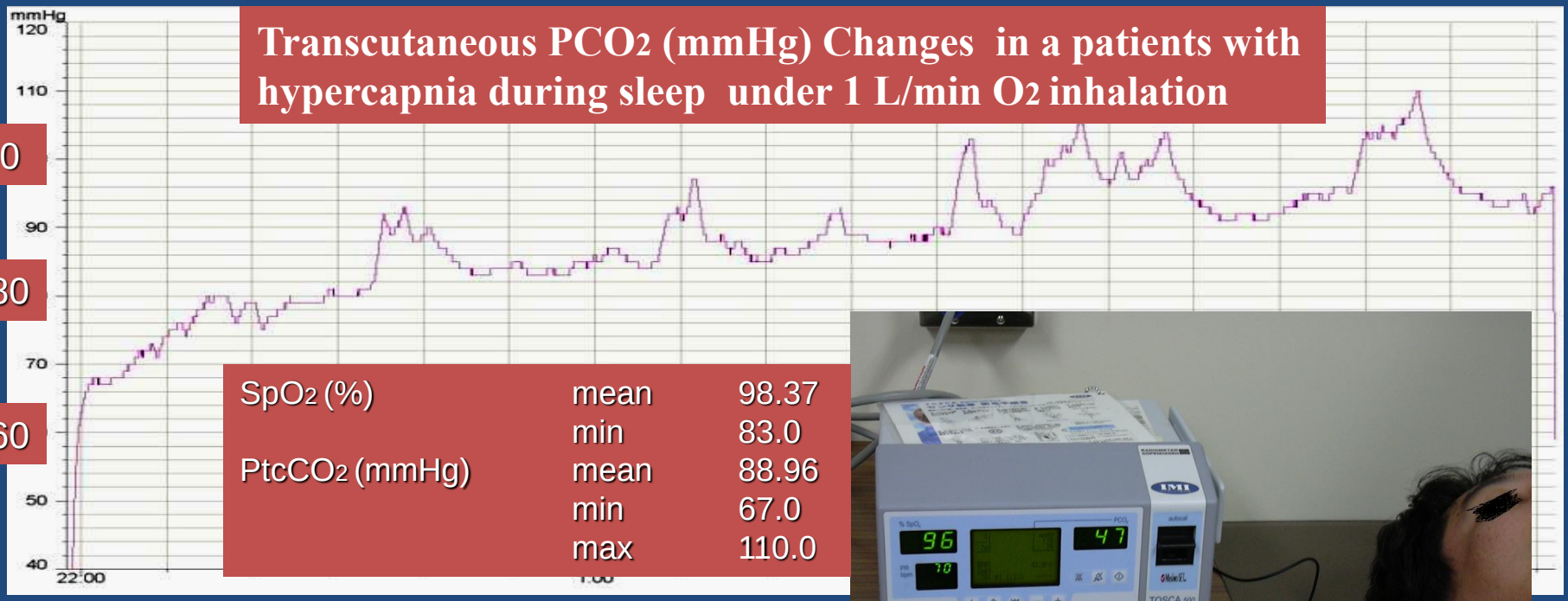
Without NPPV

With NPPV

0h 1h 2h 3h 4h 5h

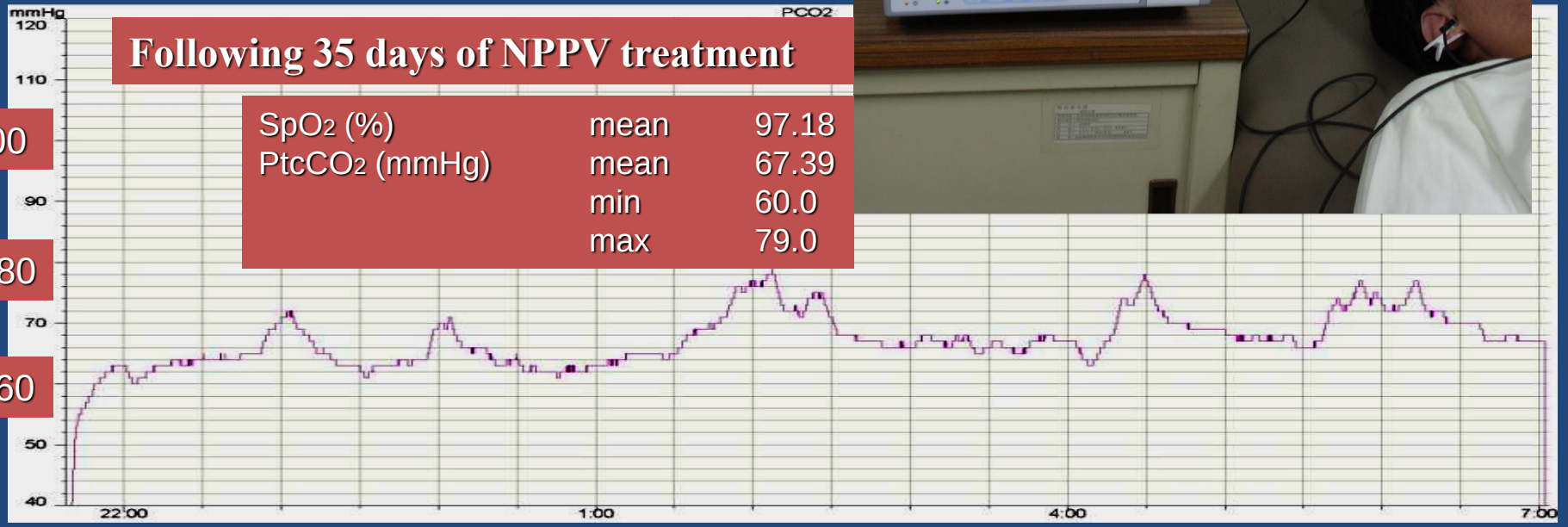
***J Thorac Cardiovasc Surg* 2007**

Transcutaneous PCO_2 (mmHg) Changes in a patients with hypercapnia during sleep under 1 L/min O_2 inhalation



SpO_2 (%)	mean	98.37
	min	83.0
$PtcCO_2$ (mmHg)	mean	88.96
	min	67.0
	max	110.0

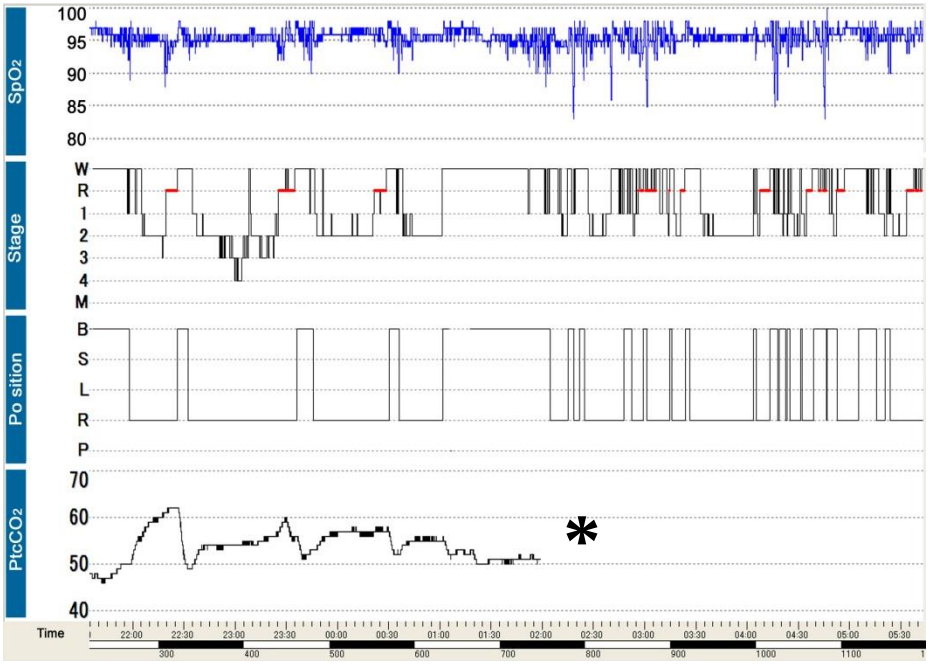
Following 35 days of NPPV treatment



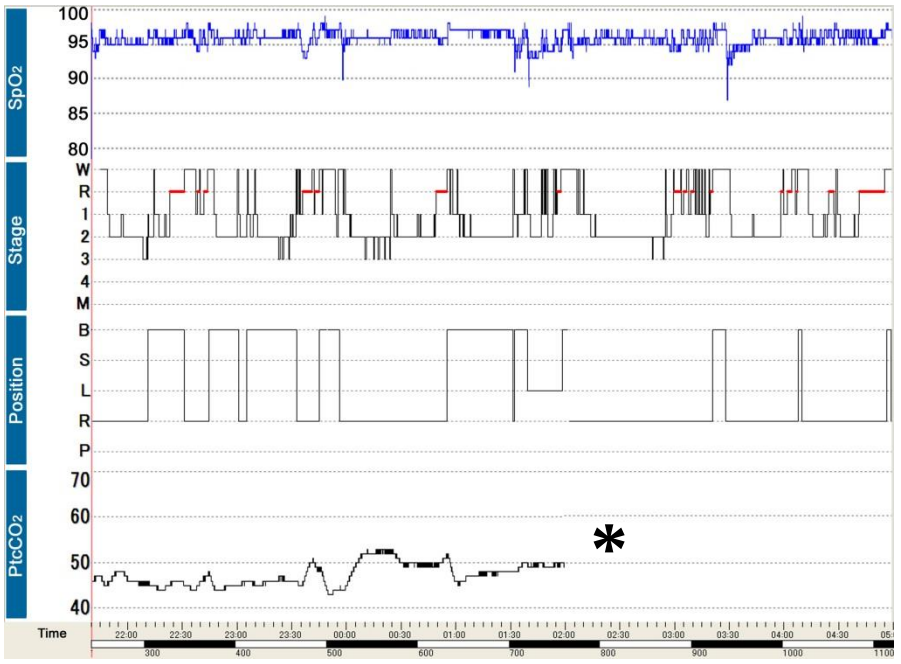
SpO_2 (%)	mean	97.18
$PtcCO_2$ (mmHg)	mean	67.39
	min	60.0
	max	79.0

Neurodegenerative disease: Multiple Atrophy

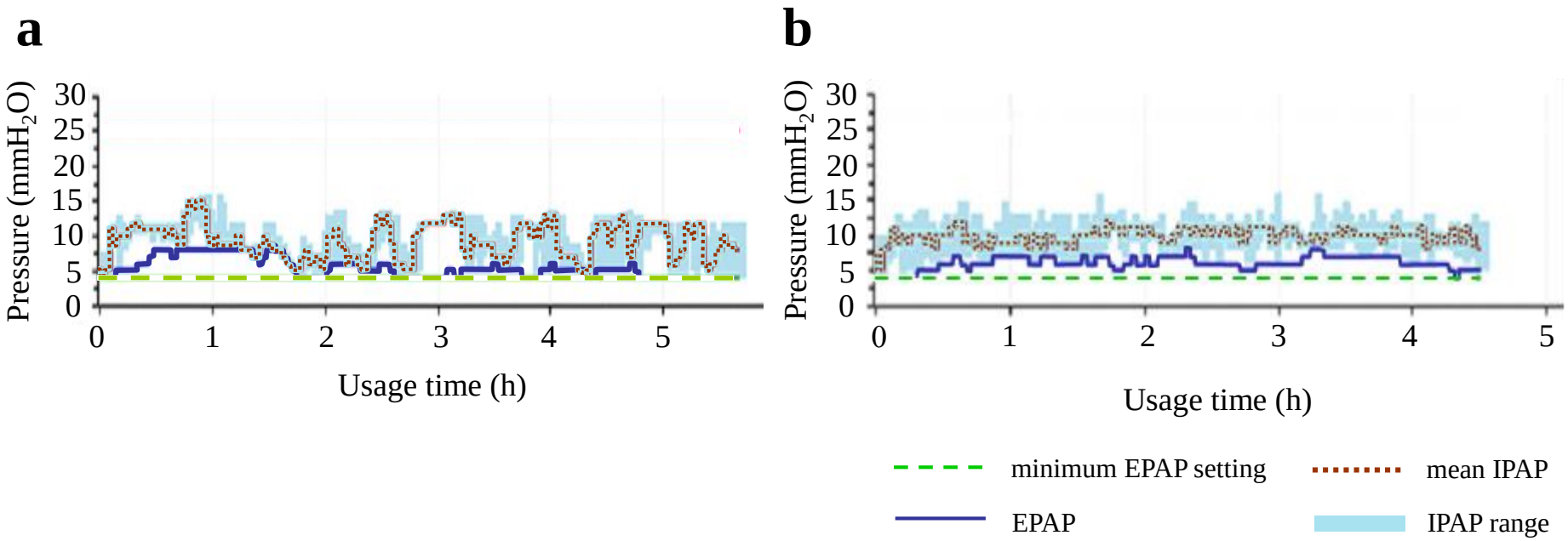
a



b



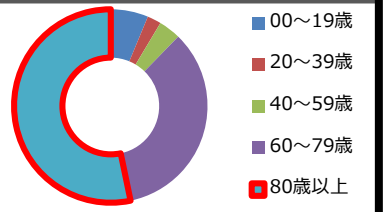
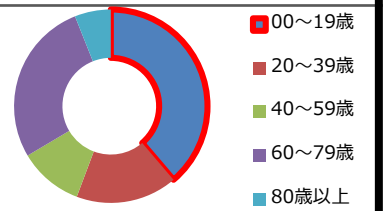
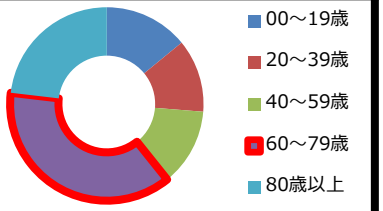
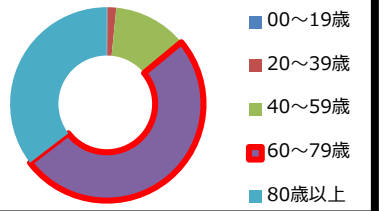
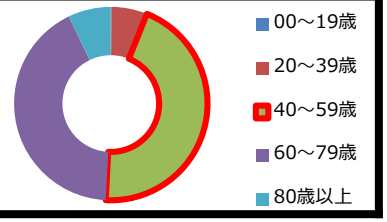
Several SDBs could be occurred in a patients.



OSA and hypoventilation occurred at once.
Several SDBs could be occurred in a patients.
(OSA and hypoventilation occurred.)

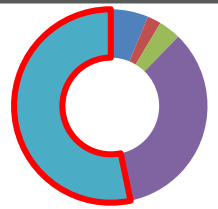
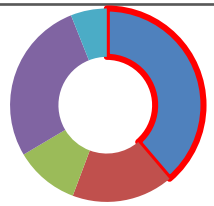
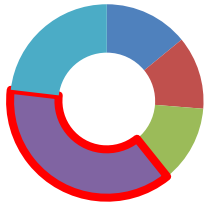
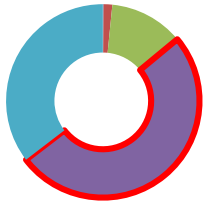
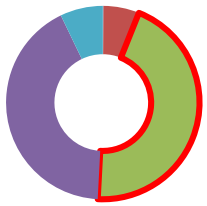
Hamada S, Chin K et al. *BMJ Case Rep*. 2015

Patients with Home Respiratory Care Instruments

	(Costs)	2014 (84,104)	2015 (86,529)	2016 (87,436)	2017 (88,349)	2018 (88,988)	（年齢別件数）
酸素濃縮装置　（濃縮器のみ） **（HOT:LTOT）**	40,000+ 20,000 y	137,308	139,681	140,820	143,494	**145,079**	
人工呼吸器加算　陽圧式人工呼吸器 **（TPPV）**	74,800+ 28,000 y	5,277	5,485	5,749	5,991	**6,285**	
人工呼吸器加算　人工呼吸器 **（NPPV）** ※2016年よりASV独立	64,800+ 28,000 y	19,483	21,256	12,604	12,110	**12,121**	
経鼻的持続陽圧呼吸療法用治療器加算 **（ASV）** ※2016年よりASV独立	37,500+ 22,500 or 2,500 y			7,111	7,828	**7,838**	
経鼻的持続陽圧呼吸療法用治療器加算 **（CPAP）**	10,000+ 2,500 y	315,389	353,835	384,253	411,732	**446,514**	

データ参照先：厚生労働省　社会医療診療行為別統計の概況

Patients with Home Respiratory Care Instruments

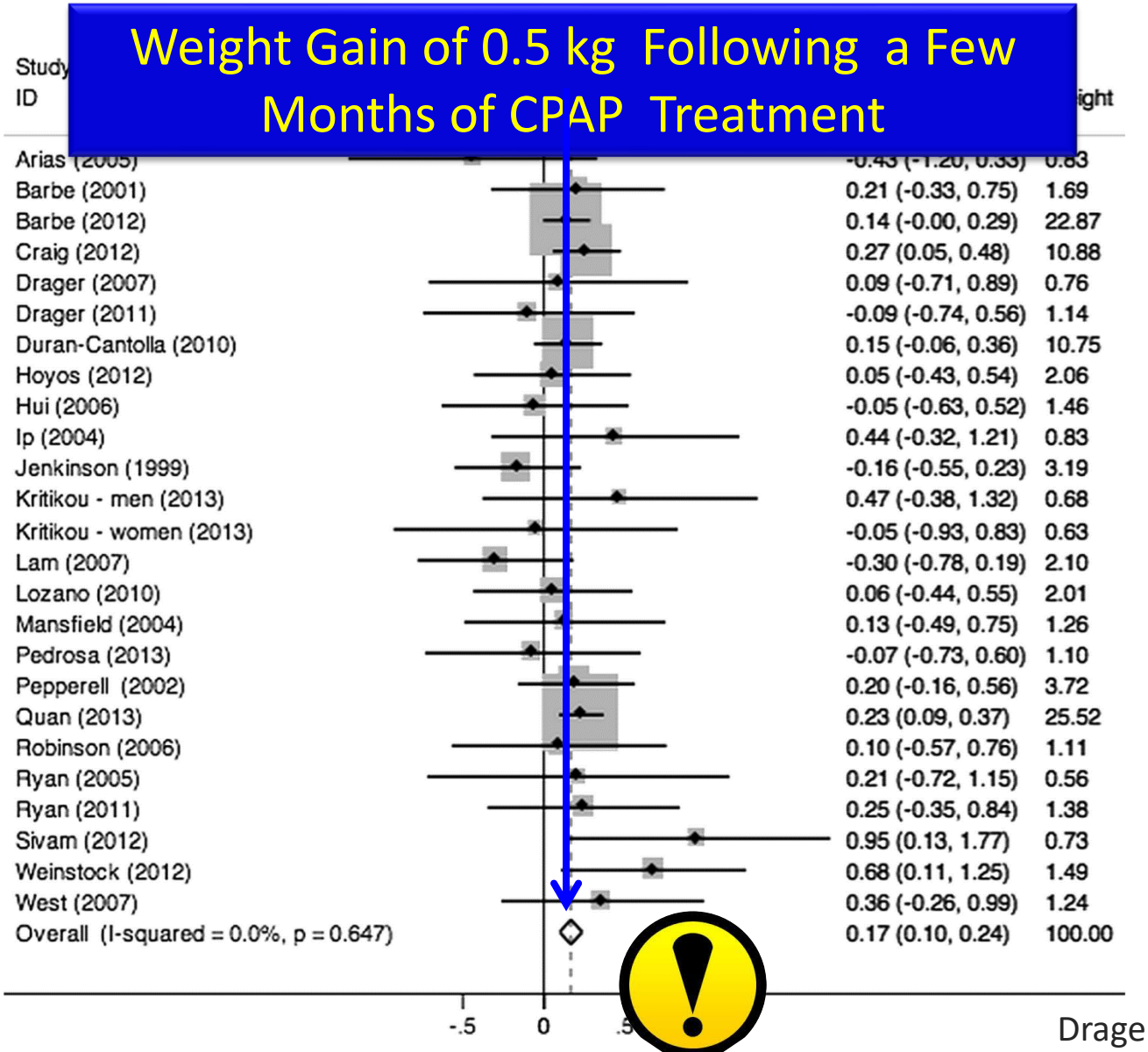
	(Costs)	2014 (84,104)	2015 (86,529)	2016 (87,436)	2017 (88,349)	2018 (88,988)	（年齢別件数）
酸素濃縮装置　（濃縮器のみ） **（HOT:LTOT）**	40,000+ 20,000 y	137,308	139,681	140,820	143,494	**145,079**	
人工呼吸器加算　陽圧式人工呼吸器 **（TPPV）**	74,800+ 2	5,277	5,485	5,749	5,991	**6,285**	
人工呼吸器加算　人工呼吸器 **（NPPV）** ※2016年よりASV独立	6 2				110	**12,121**	
経鼻的持続陽圧呼吸療法用治療器加算 **（ASV）** ※2016年よりASV独立	37,500+ 22,500 or 2,500 y			7,111	7,828	**7,838**	
経鼻的持続陽圧呼吸療法用治療器加算 **（CPAP）**	10,000+ 2,500 y	315,389	353,835	384,253	411,732	**446,514**	

Population
Taiwan: 23.6 millions
Japan 127 millions

データ参照先：厚生労働省　社会医療診療行為別統計の概況

Body Weight Gain Following CPAP Treatment

- Metanalysis From RCT Trials-



Drager LF, *Thorax* 2014

Changes in Energy Metabolism after Continuous Positive Airway Pressure for Obstructive Sleep Apnea

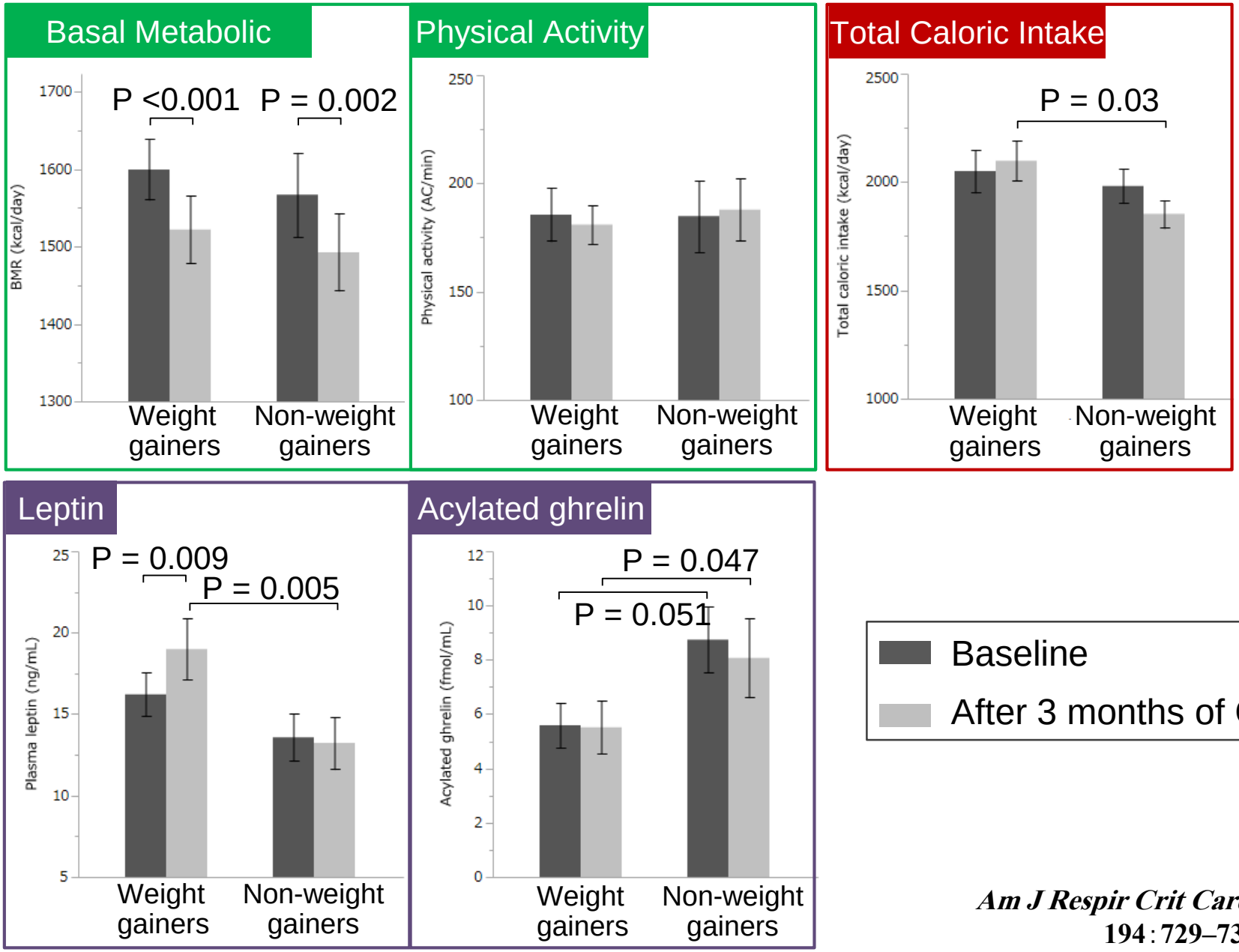
Tachikawa R, Chin K et al. *Am J Respir Crit Care Med* 194 : 729–738, 2016

Rationale: Disrupted energy homeostasis in obstructive sleep apnea (OSA) may lead to weight gain. Paradoxically, treating OSA with continuous positive airway pressure (CPAP) may also promote weight gain, although the underlying mechanism remains unclear.

Objectives: To explore the underlying mechanism by which patients with OSA gain weight after CPAP.

Methods: A comprehensive assessment of energy metabolism was performed in 63 newly diagnosed OSA study participants (51 men; 60.8±10.1 yr; apnea hypopnea index >20 /h) at baseline, CPAP initiation, and at a 3-month follow-up. **Measurements included polysomnography, body weight, body composition, basal metabolic rate (BMR), hormones (norepinephrine, cortisol, leptin, ghrelin, insulin-like growth factor-1), dietary intake, eating behavior, and physical activity.**

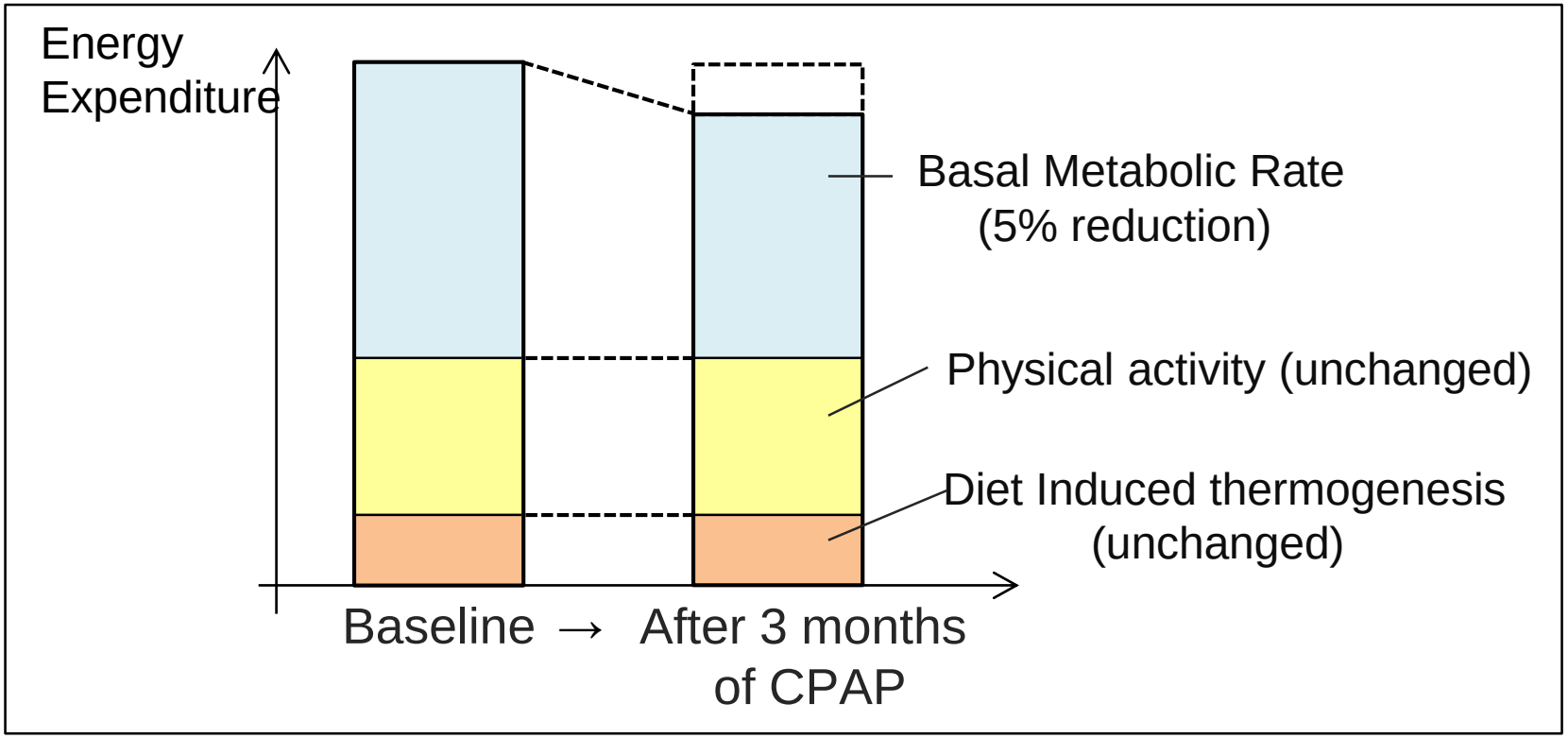
Increased energy intake had a greater impact on weight change



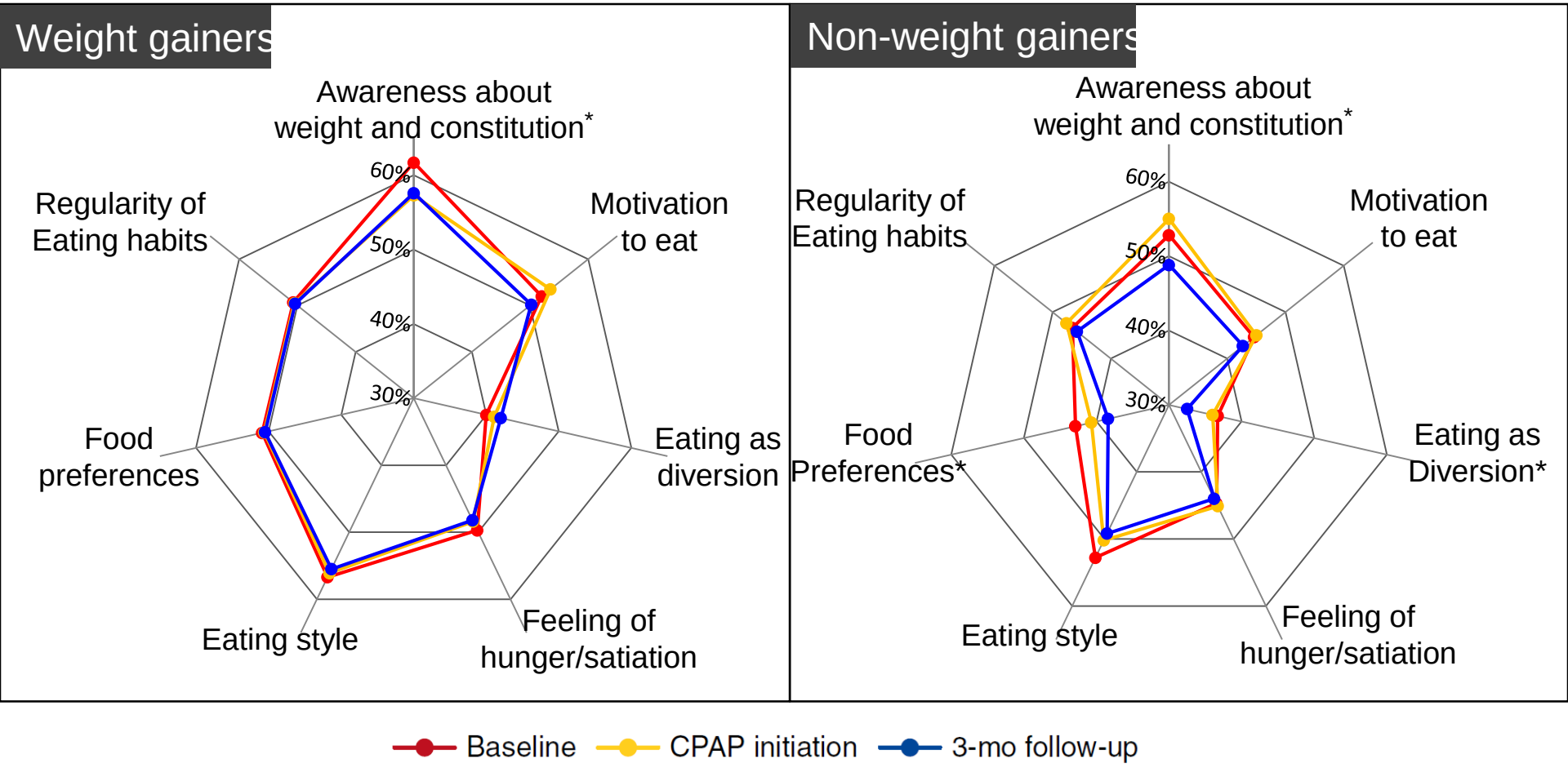
Am J Respir Crit Care Med
194 : 729–738, 2016

BMR reduction after CPAP may favor a positive energy balance

	Baseline	CPAP initiation	3-month follow-up	P value*
Basal metabolic rate(kcal/d)	1584 ± 261	1561 ± 252	1508 ± 258	<0.001
Physical activity (activity counts/min)	185 ± 80		184 ± 65	0.95
Body weight (kg)	77.8 ± 12.6	77.6 ± 12.5	78.2 ± 12.3	0.01



Traits of disordered eating behavior in the weight gainers



Tachikawa R, Chin K et al. *Am J Respir Crit Care Med* 194:729–738, 2016

敦賀
小浜
舞鶴
若狭町
高島
伊吹山
長浜
大垣
京都府
彦根
滋賀県
京丹波町
京都
大津
草津
御在所山
甲賀
四日市
高槻
亀山
鈴鹿
伊賀
尼崎
大阪
奈良
名張
津
堺
松阪
Google

- **Measurements in Nagahama Cohort.**

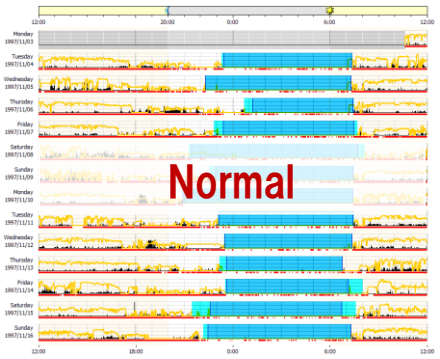
		Measurements						
		1	2	3	4	5	6	7
BP in Home	Mor・Eve.	●	●	●	●	●	●	●
	During Sleep			●	●	●	●	●
SpO_2 Monitoring		●	●	●	●			
Actigraph		●	●	●	●	●	●	●

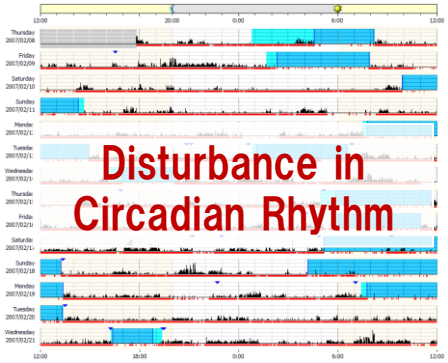
Bp in home

- ガイドラインに従った朝・夕の血圧
- 睡眠時（0/1/2時）の血圧

Sleep

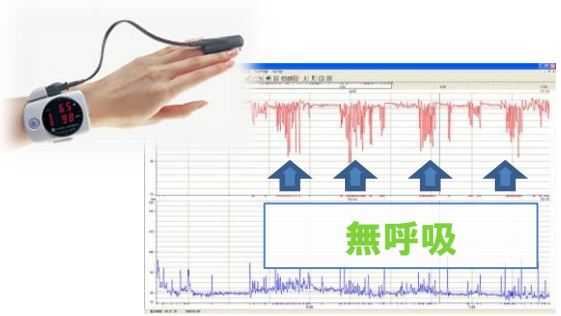
- Objective sleep duration





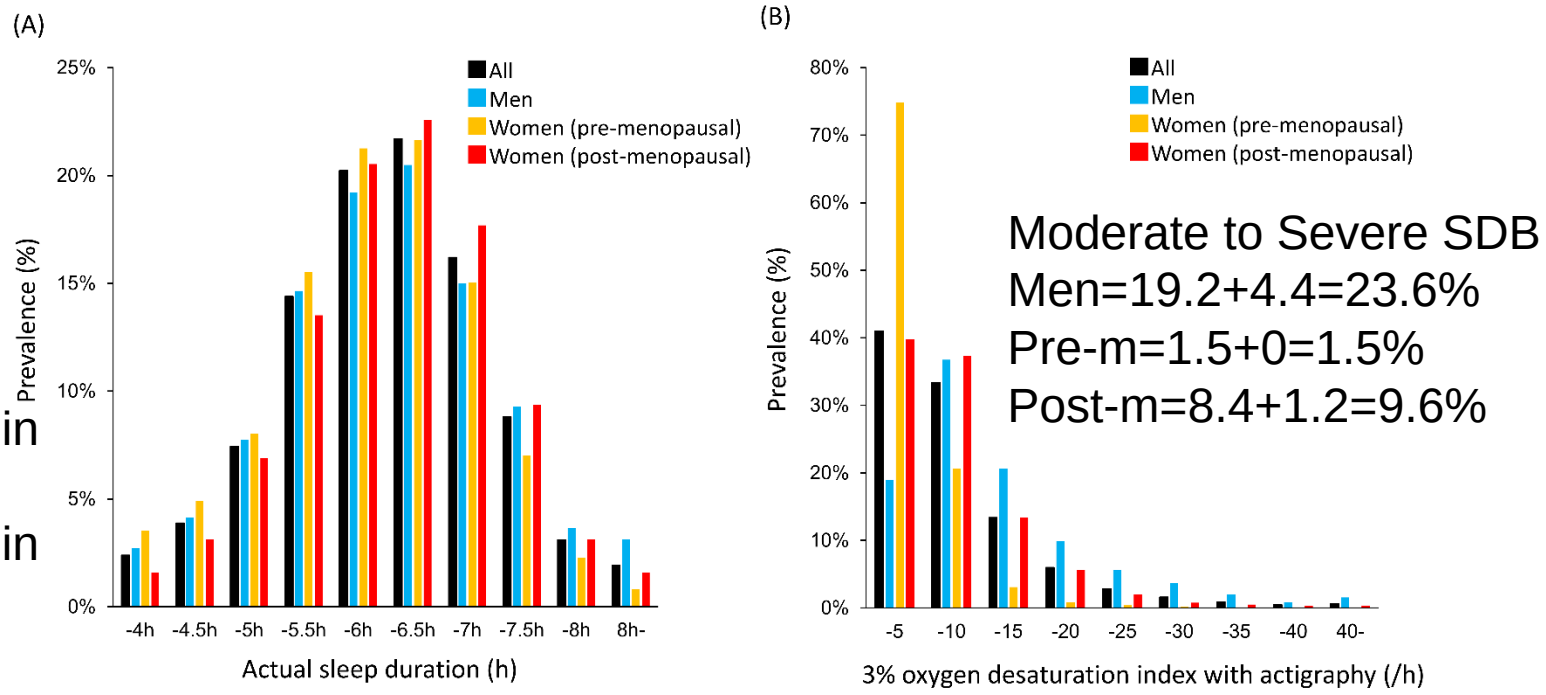
SpO2

- 連続４日間のモニタリング



Body mass index (kg/m2)	All	Mild	Moderate	Severe
Men	21.7 ± 2.3	23.0 ± 2.8	24.6 ± 3.3,	25.5± 3.9
Pre-Women	20.7 ± 2.7	22.7 ± 3.9	27.3 ± 4.6	—
Post-Women	20.9 ± 2.6	22.4 ± 3.2	24.3 ± 3.5	26.5 ± 4.8

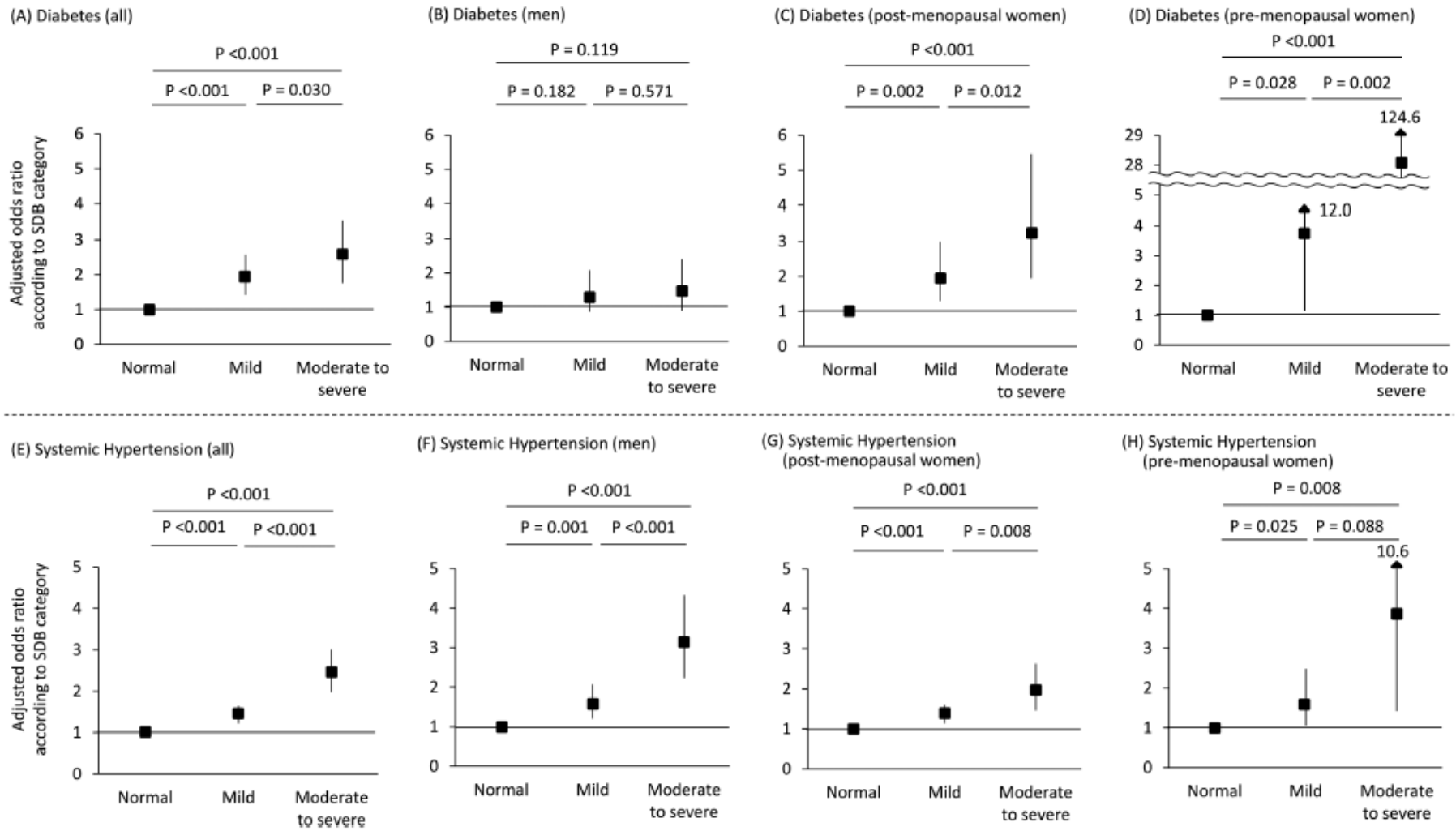
N=7,051
Men=2,274
Women=4,774
Pre-m=1,585
Post-m=3,123
T-Sleep:
401.2±64.0 min
A-Sleep:
360.5±57.7 min

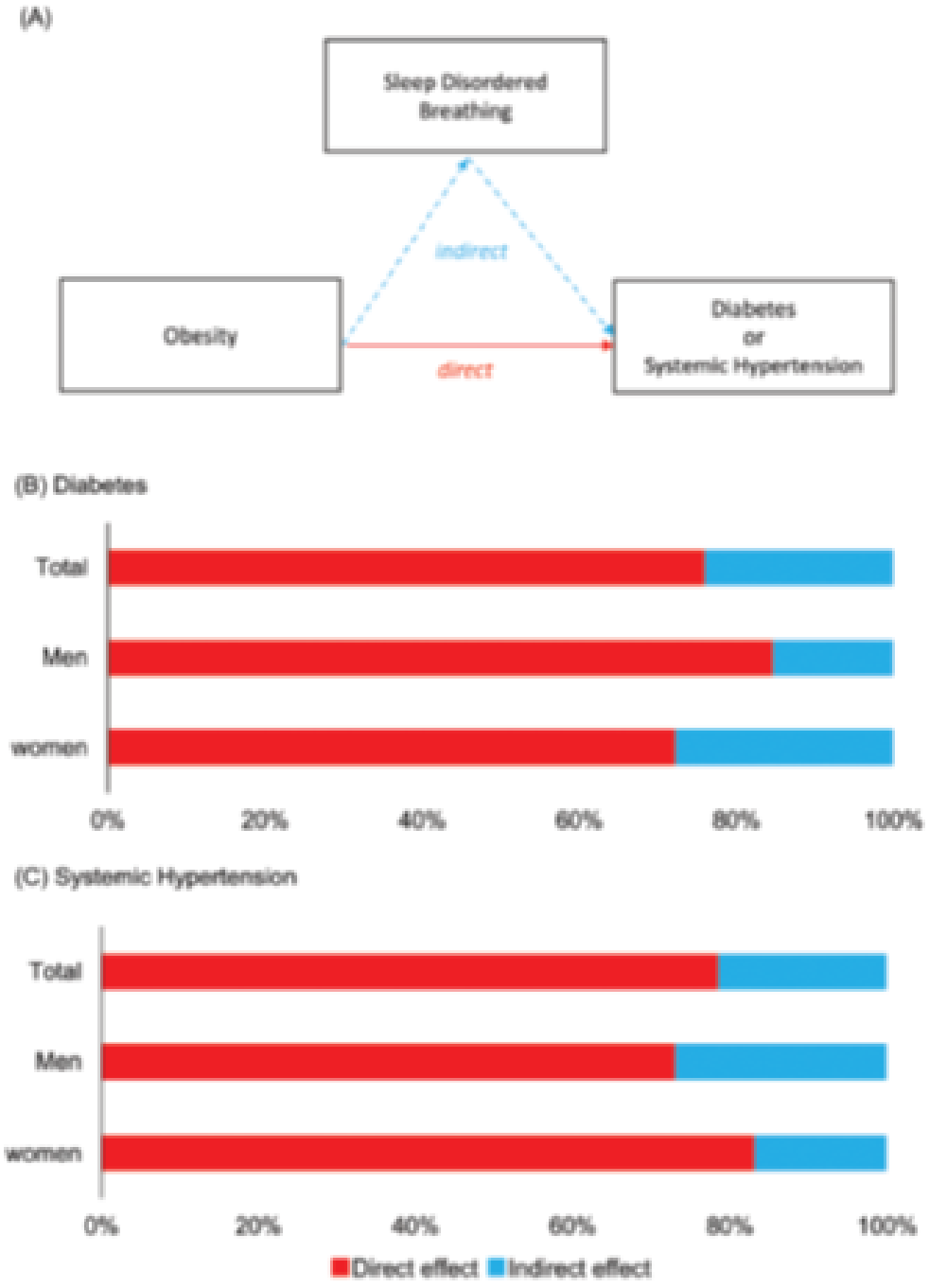


Moderate to Severe SDB
Men=19.2+4.4=23.6%
Pre-m=1.5+0=1.5%
Post-m=8.4+1.2=9.6%

Sleep parameter distributions.
(A) Distribution according to actual sleep duration, (B) distribution according to 3% oxygen desaturation index with actigraphy.

Matsumoto T, Chin K et al. ***Sleep*** 2018

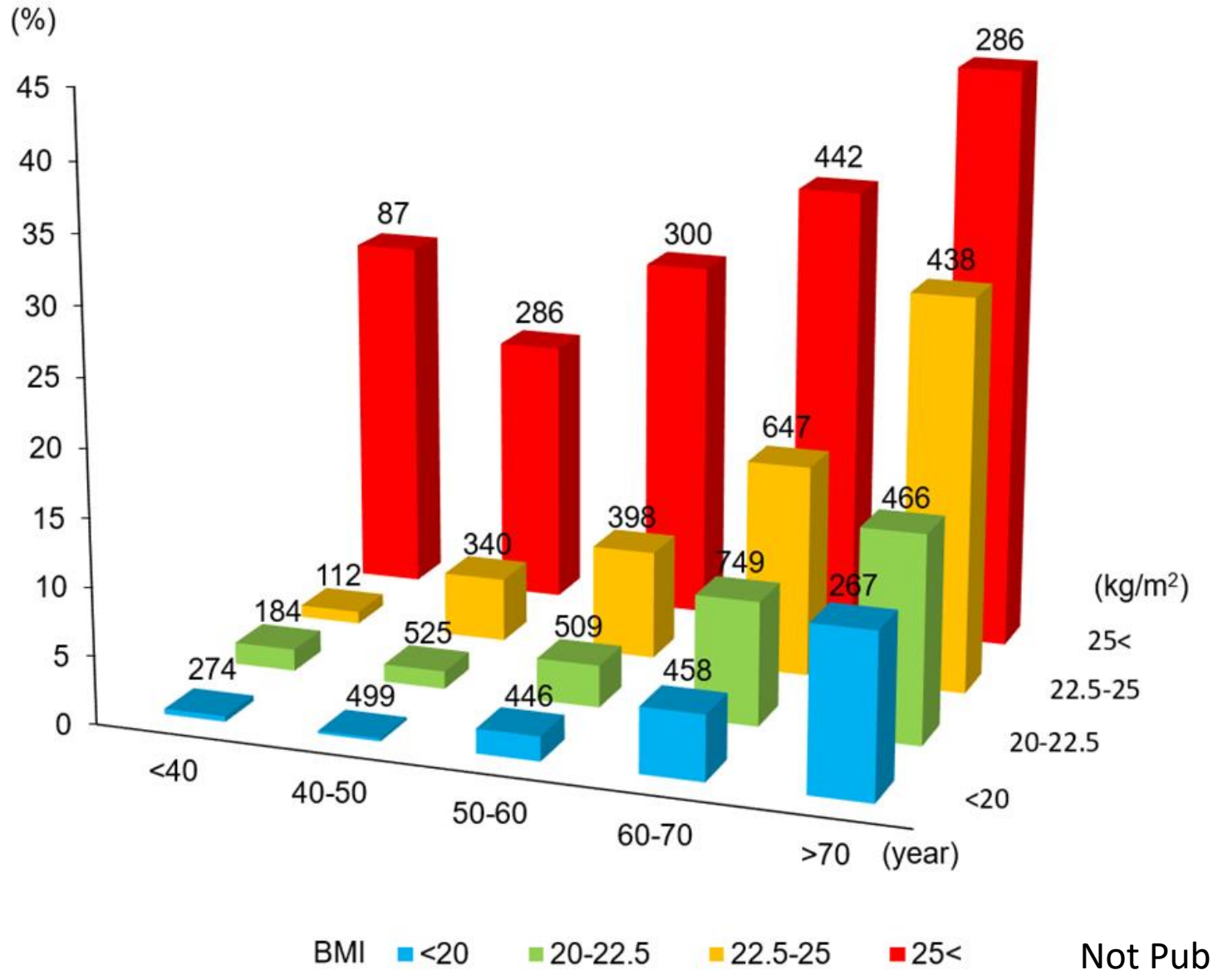

(A) Diabetes (all)
P <0.001
P <0.001
P = 0.030
Adjusted odds ratio according to SDB category
Normal
Mild
Moderate to severe
(B) Diabetes (men)
P = 0.119
P = 0.182
P = 0.571
(C) Diabetes (post-menopausal women)
P <0.001
P = 0.002
P = 0.012
(D) Diabetes (pre-menopausal women)
P <0.001
P = 0.028
P = 0.002
124.6
12.0
(E) Systemic Hypertension (all)
P <0.001
P <0.001
P <0.001
(F) Systemic Hypertension (men)
P <0.001
P = 0.001
P <0.001
(G) Systemic Hypertension (post-menopausal women)
P <0.001
P <0.001
P = 0.008
(H) Systemic Hypertension (pre-menopausal women)
P = 0.008
P = 0.025
P = 0.088
10.6



Mediation analyses for sleep-disordered breathing as a mediator of obesity and diabetes or systemic hypertension. (A) The scheme of the mediation analysis.
(B) The direct and indirect effects of obesity to diabetes. (C) The direct and indirect effects of obesity to systemic hypertension.

Matsumoto T, Chin K et al. ***Sleep*** 2018

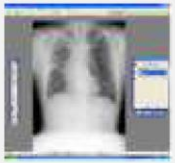
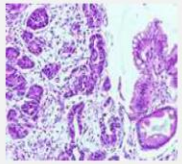
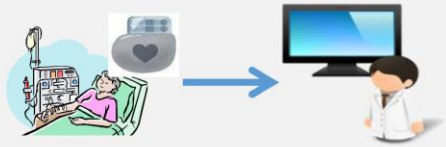
BMI, Age, and the Prevalence of Moderate to Severe SDB



Not Published Yet.

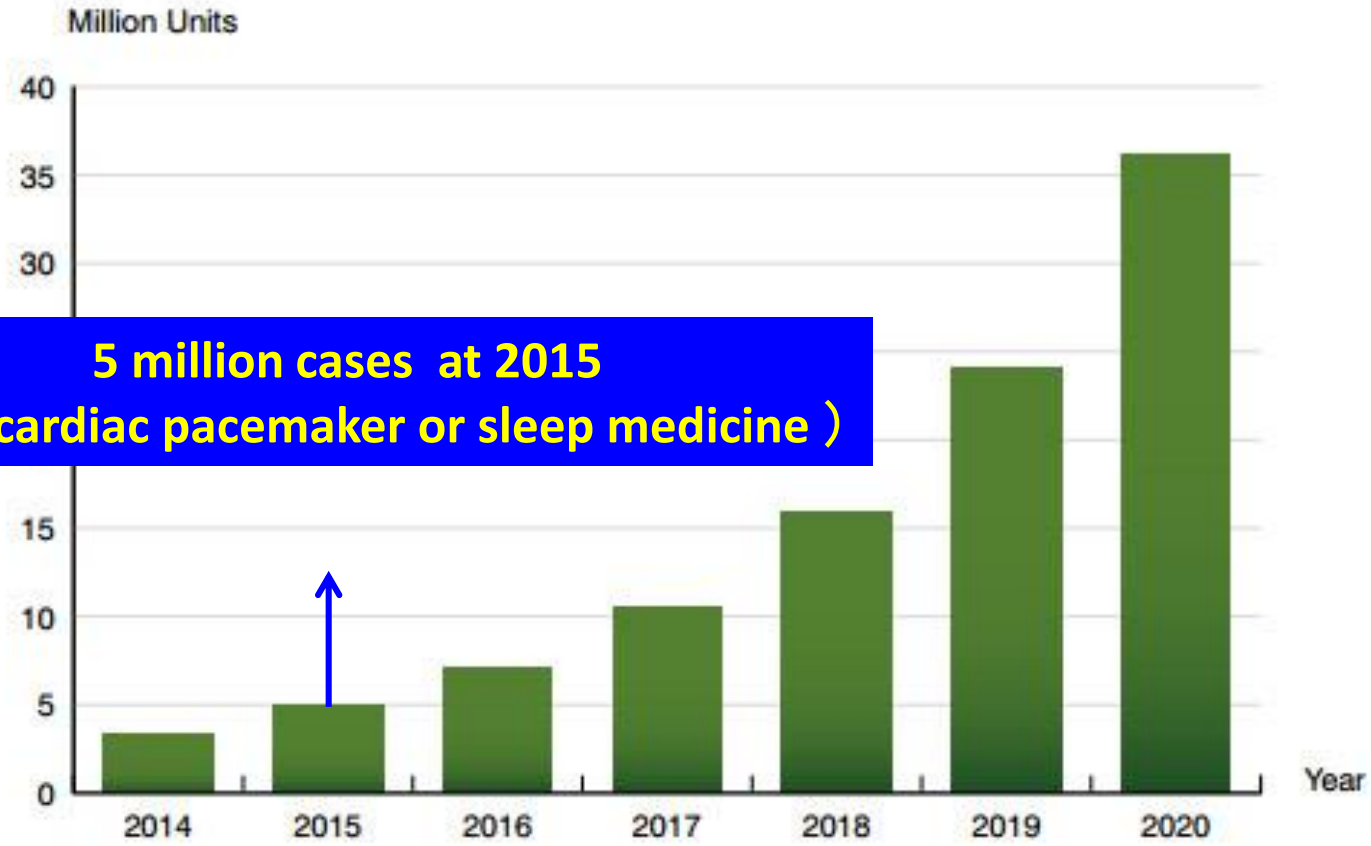
Control of Body Weight in Middle Age People is Very Important.

診療報酬における遠隔診療（情報通信機器を用いた診療）への対応

	診療形態		診療報酬での対応
医師対医師（D to D）	情報通信機器を用いて画像等の送受信を行い特定領域の専門的な知識を持っている医師と連携して診療を行うもの  		**[遠隔画像診断]** ・　画像を他医療機関の専門的な知識を持っている医師に送信し、その読影・診断結果を受信した場合 **[遠隔病理診断]** ・　術中迅速病理検査において、標本画像等を他医療機関の専門的な知識を持っている医師に送信し、診断結果を受信した場合（その後、顕微鏡による観察を行う。） ・（新）生検検体等については、連携先の病理医が標本画像の観察のみによって病理診断を行った場合も病理診断料等を算定可能
医師対患者（D to P）	情報通信機器を用いた診察	医師が情報通信機器を用いて患者と離れた場所から診療を行うもの 	**[オンライン診療]** ・（新）オンライン診療料 ・（新）オンライン医学管理料 ・（新）オンライン在宅管理料・精神科オンライン在宅管理料 対面診療の原則の上で、有効性や安全性等への配慮を含む一定の要件を満たすことを前提に、情報通信機器を用いた診察や、外来・在宅での医学管理を行った場合 **※電話等による再診** （新）患者等から電話等によって治療上の意見を求められて指示をした場合に算定が可能であるとの取扱いがより明確になるよう要件の見直し （定期的な医学管理を前提とした遠隔での診察は、オンライン診療料に整理。）
	情報通信機器を用いた遠隔モニタリング	情報通信機能を備えた機器を用いて患者情報の遠隔モニタリングを行うもの 	**[遠隔モニタリング]** **・心臓ペースメーカー指導管理料（遠隔モニタリング加算）** 体内植込式心臓ペースメーカー等を使用している患者に対して、医師が遠隔モニタリングを用いて療養上必要な指導を行った場合 ・（新）在宅患者酸素療法指導料（遠隔モニタリング加算） ・（新）在宅患者持続陽圧呼吸療法（遠隔モニタリング加算） 在宅酸素療法、在宅CPAP療法を行っている患者に対して、情報通信機器を備えた機器を活用したモニタリングを行い、療養上必要な指導管理を行った場合

(厚生労働省Webサイトより引用)

The number of cases of telemedicine in the world



5 million cases at 2015
（80%: cardiac pacemaker or sleep medicine ）

（Market research by BERG Insight）

From 2016, the number of sleep telemedicine cases would become the largest number

Sleep Apnea in the Telemedicine System

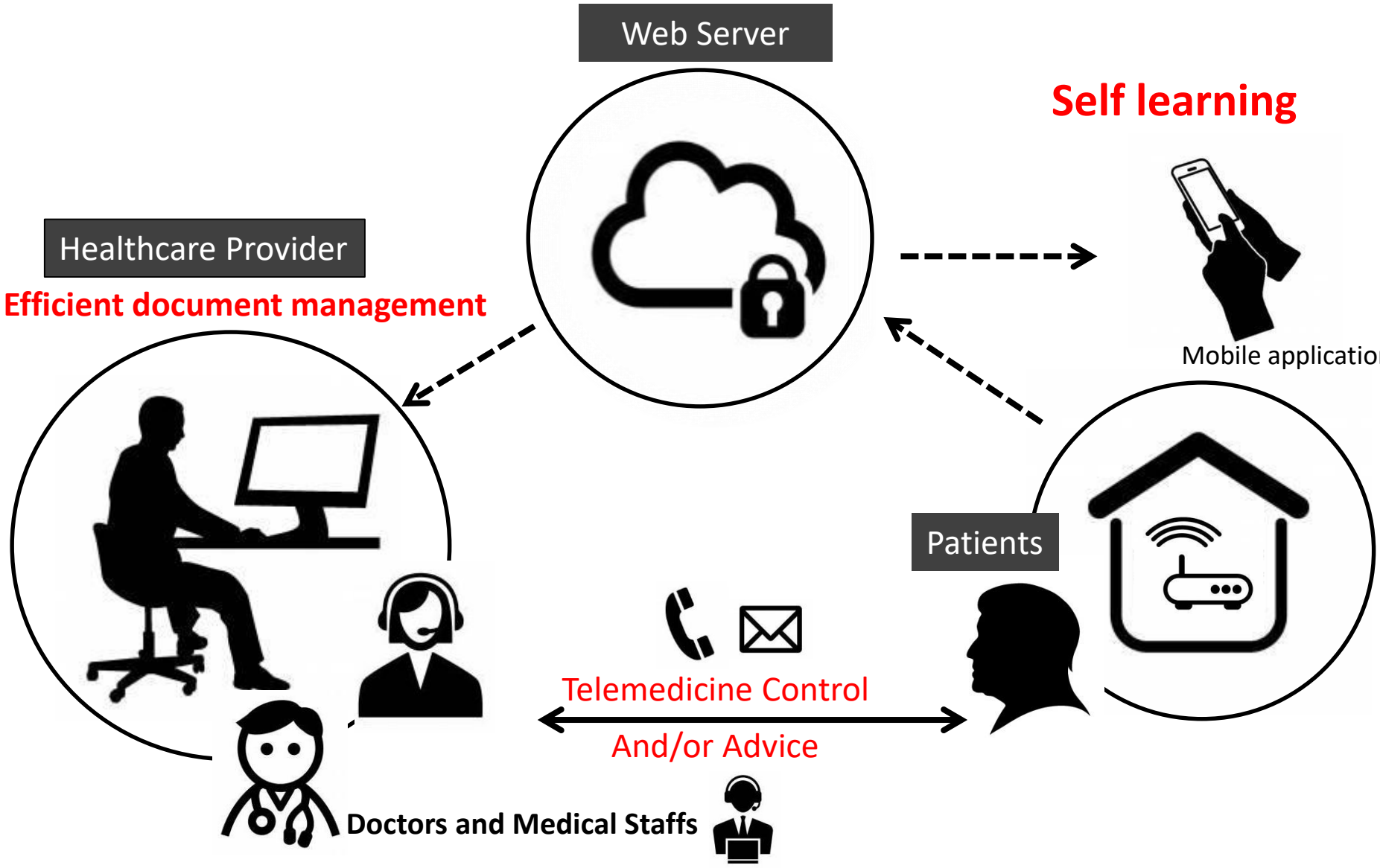
Telehealth/telemedicine

＝ Telehealth is the distribution of health-related services and information via electronic information and telecommunication technologies.

1. Telemedicine with real-time
   - PSG with telemedicine：
   - CPAP titration with telemedicine：
   - Medical examination with online

2. Telemedicine that does not require real-time
   - CPAP data monitoring and feed back to patients
   - Troubleshooting、self-learning、coaching
   - Changes for CPAP setting

Telemedicine in CPAP Therapy



The Results of Clinical Trials in CPAP Treatment with Telemedicine

Key 7 RCT Trials

Author		Time of intervention	介入方法	Adhe-rance	Cost	labor
Turino	2017	At Start of CPAP	遠隔モニタ＋早期介入	→	↓	N.A.
Munafo	2016	At Start	遠隔モニタ＋自動コーチング	→	N.A.	↓
Fields	2016	At Start	遠隔診断＋モニタ＋診察	→	N.A.	N.A.
Isetta	2015	At Start	遠隔診察＋自己管理・サポート	→	↓	N.A.
Kuna	2015	At Start	遠隔モニタ＋ウェブアクセス	↑	N.A.	N.A.
Fox	2012	At Start	遠隔モニタ＋早期介入	↑	N.A.	↑
Sparrow	2010	At Start	自己管理・遠隔サポート	↑	N.A.	N.A.

Overall, adherence increased and costs decreased.

Telemedicine in CPAP treatment

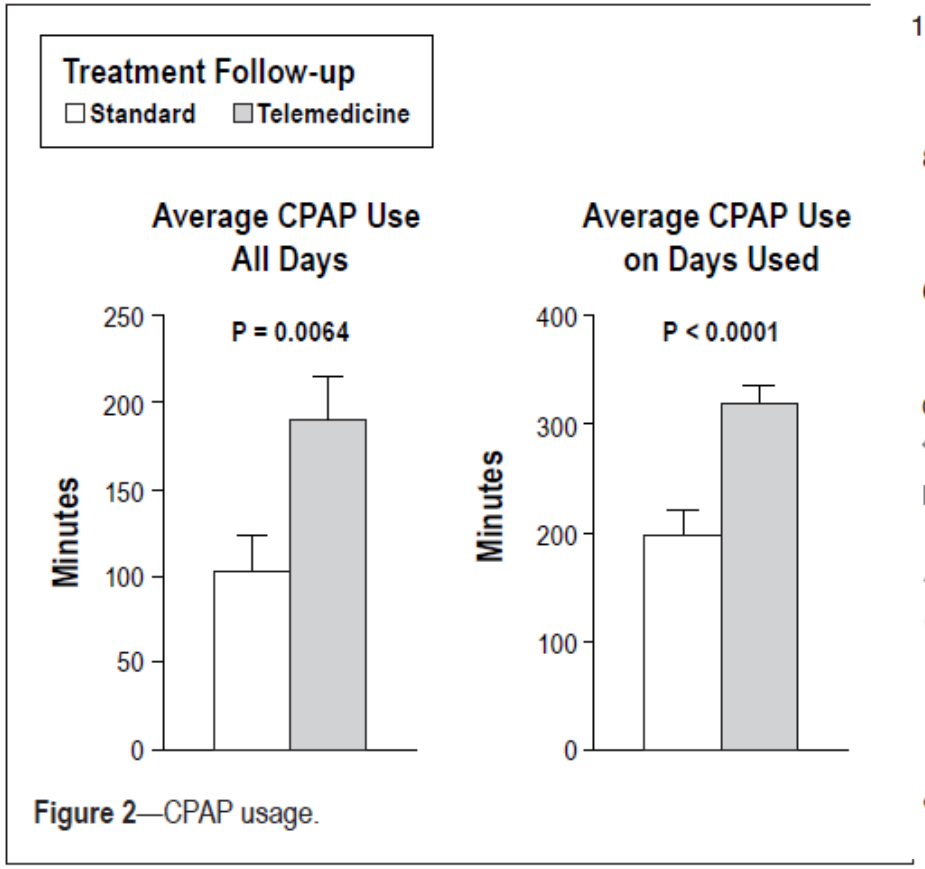
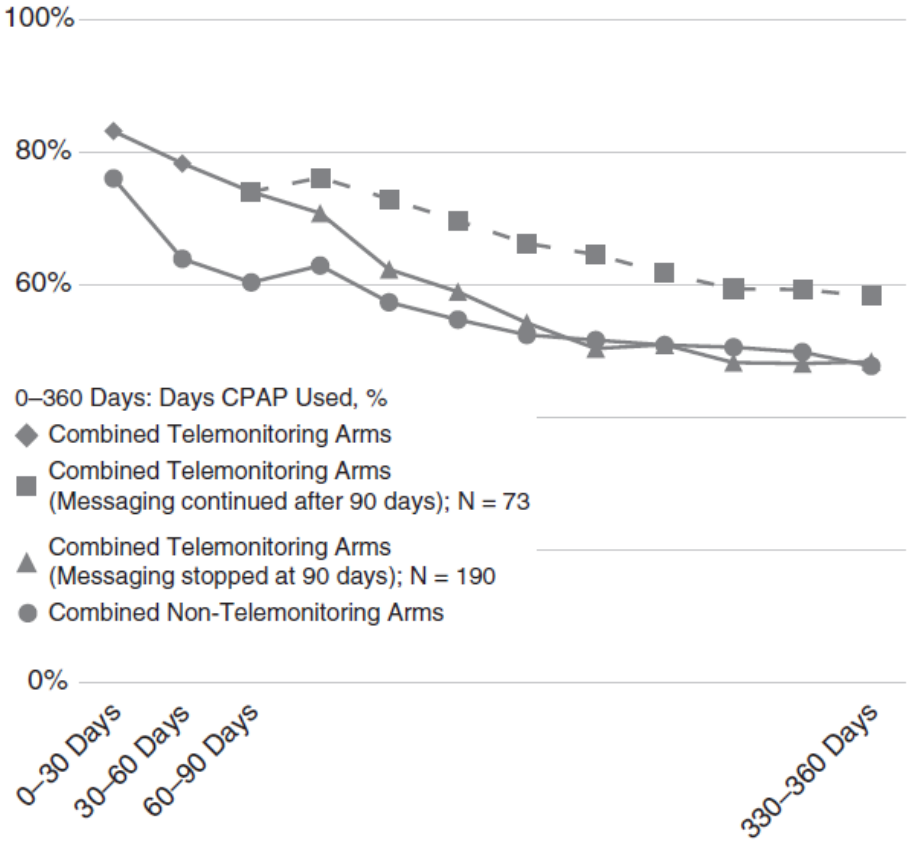


Figure 2—CPAP usage.

Fox N et al. *Sleep* 2012

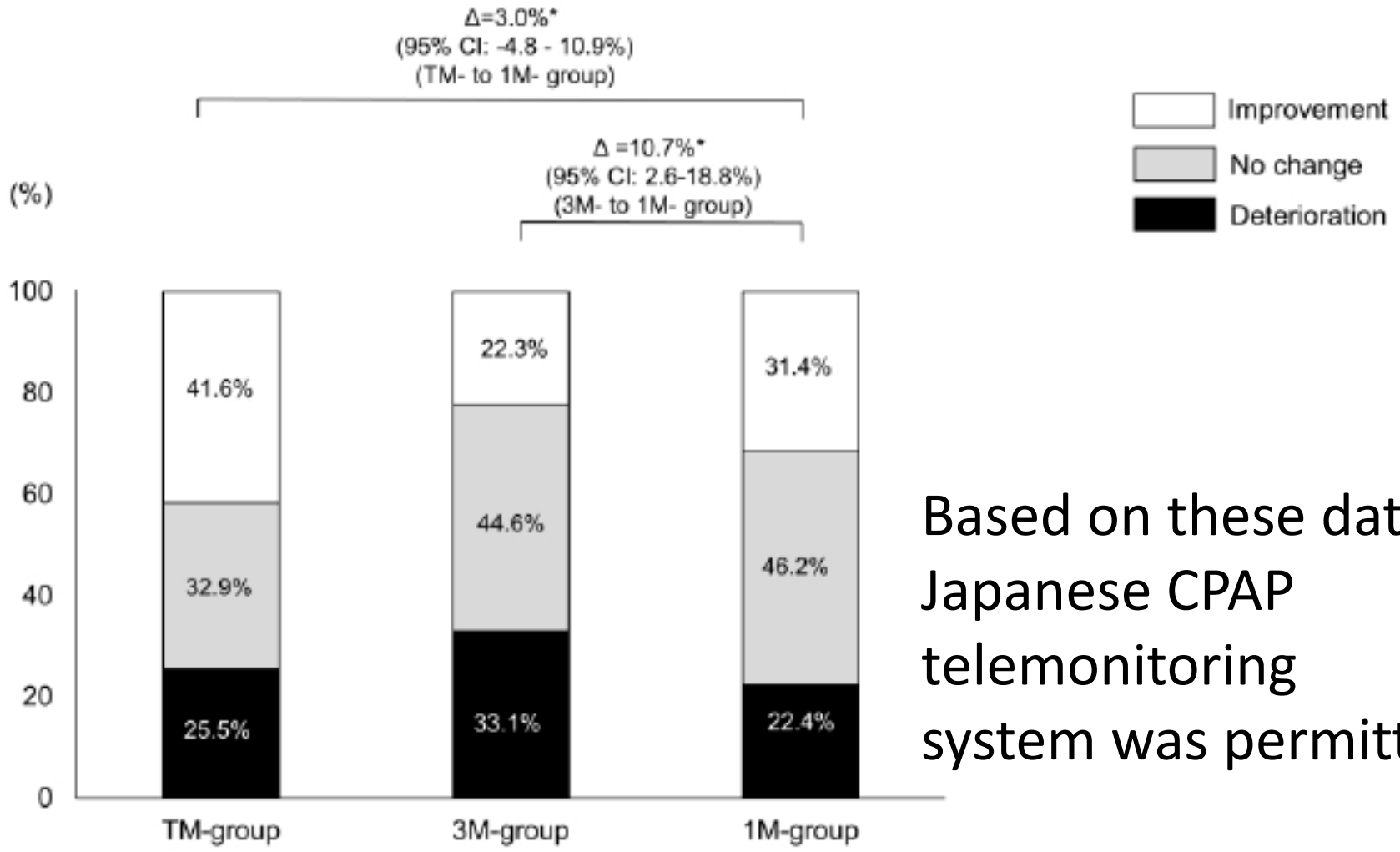


Hwang D et al. *Am J Respir Crit Care Med.* 2018

Most of reports of the telemedicine system in CPAP treatment were based on the data at the start of CPAP treatment.

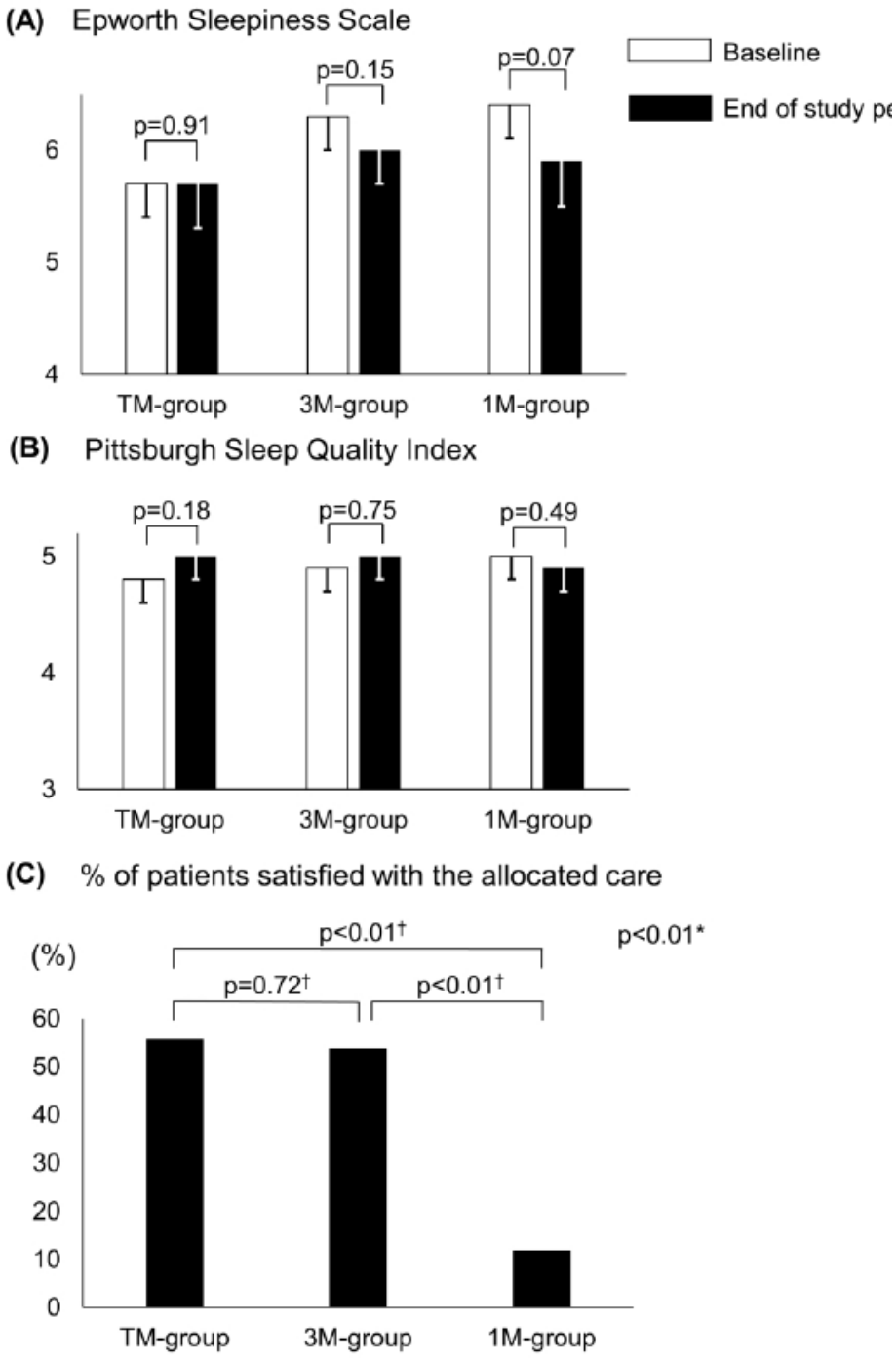
A Randomized Controlled Trial of Telemedicine for Long-Term Sleep Apnea CPAP Management. . *Ann Am Thorac Soc* in press

Results: Analyzed were 483 patients (median duration of CPAP use, 29 (interquartile range,12-71) months), and deterioration of adherence was found in 41/161 (25.5%), 55/166 (33.1%) and 35/156 (22.4%) patients in the TM-, 3M- and 1M-groups, respectively. The non-inferiority of the TM-group compared with the 1M-group was verified (difference in % of patients with adherence deterioration, 3.0%, 95% confidence interval (CI) -4.8 – 10.9%, $p<0.01$).



Based on these data, Japanese CPAP telemonitoring system was permitted.

Murase K, Chin K et al. Ann Am Thorac Soc in press


(A) Epworth Sleepiness Scale
Baseline
End of study pe
p=0.91
p=0.15
p=0.07
6
5
4
TM-group
3M-group
1M-group
(B) Pittsburgh Sleep Quality Index
p=0.18
p=0.75
p=0.49
5
4
3
TM-group
3M-group
1M-group
(C) % of patients satisfied with the allocated care
p<0.01†
p<0.01*
(%)
p=0.72†
p<0.01†
60
50
40
30
20
10
0
TM-group
3M-group
1M-group

Does remote monitoring change OSA management and CPAP adherence? (Pepin JL, et al. *Respirology* (2017) 22, 1508–1517)

The evolution of sleep medicine care is full of incredible opportunities given its natural reliance of technology and relevance to so many medical specialties. The field has the potential to be a model to the greater healthcare community in transforming the cost-effective management of chronic disease conditions.

(Pepin JL, et al. Respirology (2017) 22, 1508–1517)

New Clinical Trail

体重体組成計
HBF-228T

体重
体脂肪率
内臓脂肪レベル
骨格筋率
体年齢
基礎代謝
BMI

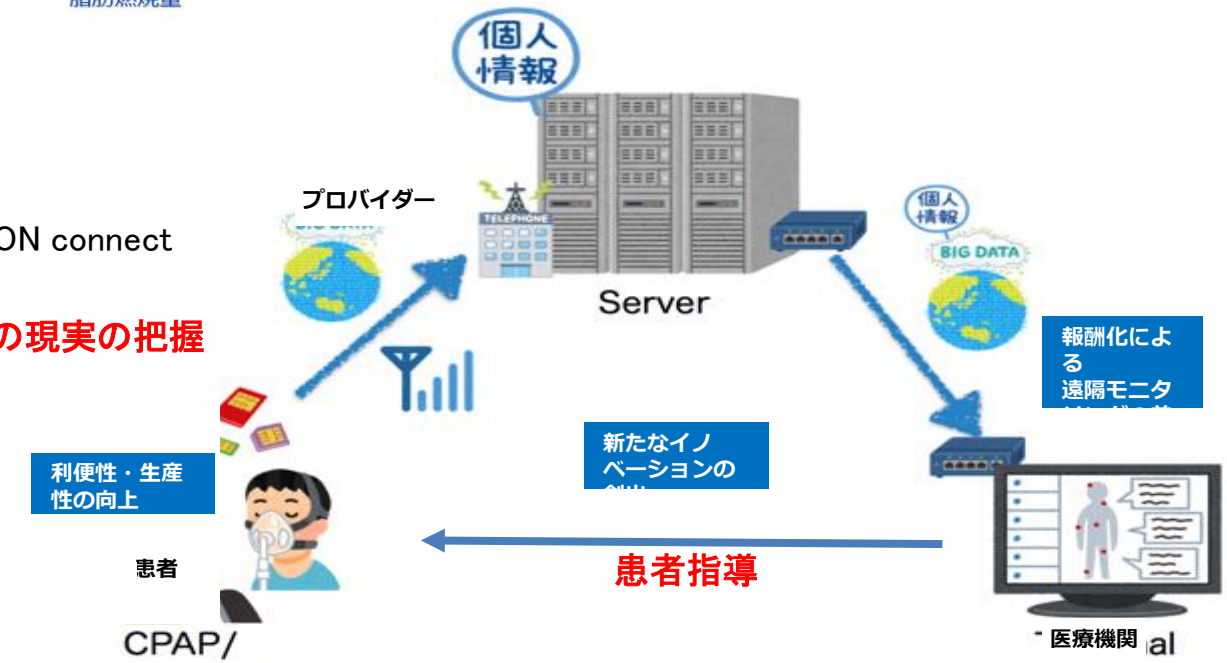
上腕式血圧計
HEM-7511T

血圧（最高/最低）
脈拍
※室温記録

活動量計
HJA-405T

歩数
距離
早歩き歩数
階段上がり歩数
活動消費カロリー
総消費カロリー
脂肪燃焼量

連携アプリ: OMRON connect



Conclusions

- **To understand the pathophysiology of sleep-disordered breathings is important to use the proper therapeutic instruments: oxygen, CPAP, NPPV, ASV and etc.**
- **Home respiratory care has developed in Japan following the health insurance system under the government**
- **Benefits of home respiratory care under the governmental health insurance system should be proven from the healthy (mortality) and economical points**

Acknowledgement

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