ramr
American Review of Respiratory Medicine
Revista Americana de Medicina Respiratoria

ORIGINAL ARTICLE

ISSN 1852-236X

Delays and Adherence to the Treatment of Sleep Apnea within a Universal Provision System in a Public Hospital

Demoras y adherencia al tratamiento de las apneas del sueño dentro de un sistema de provisión universal en un hospital público

Rojas Mendiola, Ramiro Horacio[1]; Smurra, Marcela Viviana[1]

Received: 11/08/2022
Accepted: 11/24/2023

Correspondence
Ramiro H. Rojas Mendiola, email: rhrojasmd@gmail.com

ABSTRACT

Introduction: Treatment with positive airway pressure is one of the cornerstones in managing obstructive sleep apnea (OSA). However, access to the equipment and adherence to their use are not easy to achieve. Objective: to evaluate the adherence of patients from the public health system who receive continuous pressure devices free of charge for the treatment of OSA.

Materials and methods: Patients diagnosed with OSA who received continuous positive airway pressure (CPAP) devices between 2013 and 2018 through PAMI (Programa de Atención Médica Integral, Medical Services Program) , Incluir Salud, and Cobertura Porteña de Salud were retrospectively evaluated.

Results: Patients from PAMI were older and had a lower score in the Epworth scale. The delay between the consultation and the diagnosis was 1.4 ± 2.4 months. The time from the diagnosis until the equipment was provided was 10.2 ± 9.9 months. Patients from PAMI received the equipment faster (2.7 ± 2.5 months) and were more adherent to follow-up visits. Adherence to clinical follow-up visits in the first year was 46 %. Older patients with a lower Epworth score and those using AutoCPAP had a non-significant trend favoring this adherence. The objective adherence measured by memory card or telemonitoring was 40 %. The higher body mass index (BMI) was the only factor favoring objective adherence.

Conclusions: Overcoming the economic limitation to access the equipment does not change the attitude towards adherence and follow-up.

Key words: Sleep Apnea; Obstructive; Continuous Positive Airway Pressure; Patient Compliance

RESUMEN

Introducción: El tratamiento con presión positiva es uno de los pilares del manejo de las apneas obstructivas del sueño, sin embargo, el acceso a los equipos y la adherencia a su uso no son fáciles de lograr.

Rev Am Med Resp 2023;23:217-224
https://doi.org./10.56538/ramr.XREG8277

[1]Center for Respiratory Failure and Sleep Laboratory, Pulmonology Division, Hospital General de Agudos Enrique Tornú, Buenos Aires, Argentina

Objetivo: Evaluar la adherencia de los pacientes del sistema público de salud que reciben equipos de presión continua de forma gratuita para el tratamiento de las apneas obstructivas del sueño.
Material y métodos: Se evaluó retrospectivamente a los pacientes con diagnóstico de apnea obstructiva del sueño que recibieron equipos de CPAP entre 2013 y 2018 a través de PAMI, Incluir Salud y Cobertura Porteña de Salud.
Resultados: Los pacientes de PAMI fueron de mayor edad y tenían un Epworth más bajo. La demora entre consulta y diagnóstico fue de 1,4 ± 2,4 meses. El tiempo de diagnóstico a provisión del equipo fue de 10,2 ± 9,9 meses. Los pacientes de PAMI recibieron los equipos más rápido (2,7 ± 2,5 meses) y fueron más adherentes a las visitas de control. La adherencia a los controles clínicos el primer año fue del 46 %. Los pacientes de mayor edad, con Epworth más bajo y que usan auto-CPAP tenían una tendencia no significativa a favorecer esta adherencia. La adherencia objetiva medida por tarjeta de memoria o telemonitoreo fue del 40 %. El mayor IMC fue el único factor que la favorecía.
Conclusiones: Superando la limitación económica al acceso a los equipos, no cambia la actitud hacia la adherencia y control.

Palabras clave: Apneas del sueño; Presión positiva continua en la vía aérea; Adherencia

INTRODUCTION

Obstructive sleep apnea (OSA) is defined by the presence of recurrent episodes of apneas or hypopneas secondary to pharyngeal collapse during sleep, leading to desaturations and micro-arousals. When these events are associated with a set of signs and symptoms, they constitute the obstructive sleep apnea-hypopnea syndrome (OSAHS). The traditionally accepted prevalence of OSAHS in the general population is 3.1 to 7.5 % in men and 1.2 to 4.5 % in pre-menopausal women. However, recent epidemiological studies describe an even higher prevalence. [1]

Taking into account the population data in Argentina, in 2010, there were 40,117,096 inhabitants, 91 % of whom lived in urban areas, with a male/female ratio of 0.95/1. Approximately 65 % of the population is concentrated in the Central region, especially in the province of Buenos Aires, which accounts for 38.9 % of the country's population, particularly in the Autonomous City of Buenos Aires (CABA) and its surroundings.

The Argentinian Healthcare System is made up of national and provincial ministries, as well as a network of public hospitals and health centers that provide free care to anyone in need, particularly those in the lowest income quintiles, without social security or without the capacity to pay for health services. In the city of Buenos Aires, the population that has public health coverage, without resources or through the *Cobertura Porteña de Salud* (CPS, Buenos Aires Health Coverage) provided by the Government of CABA, represented 18.7 % during the year 2017. The population with social health insurance (*Obra Social*) was 46.1 %, prepaid health care plan, 28 %, and coverage from other systems 7.2 %.[3] Additionally, the National Institute of Social Services for Retirees and Pensioners (INSSJP), through the Medical Services Program (PAMI), provides coverage to retirees of the national welfare system and their families, reaching 20 % of the population, with an expenditure that accounts for 0.75 % of the GDP.[4]

Individuals with pension benefits or disability pension receive coverage from the National Government (formerly PRO.FE, currently *Incluir Salud*) and also seek diagnosis and follow-up care at hospitals in CABA.

At the Hospital Enrique Tornú, an average of 235,500 patients consulted the Diagnostic Services per year, from 2013 to 2018. The Sleep and Respiratory Failure Laboratory receives 600 annual consultations from patients without coverage, members of PAMI, and those with social health insurance coverage.

Our objective is to describe the hospital's situation regarding patients with state coverage that addresses economic limitations, a key aspect of access to treatment.

MATERIALS AND METHODS

This is a descriptive retrospective study of patients with coverage from PAMI, *Incluir Salud*, and CPS who were diagnosed with OSAHS between 2013 and 2018 and were able to access treatment with continuous airway pressure (CAP) devices, either CPAP, Auto CPAP, or BiPAP (bilevel positive airway pressure). Patients who purchased their own devices and those with social health insurance were excluded.

Data were obtained from the medical records of patients older than 18 years who first consulted during this period and were diagnosed with OSA either through polygraphy or polysomnography, and initiated treatment with PAP devices. As it is a referral center, some patients come to the consultation with the study already performed. Data were collected on sex, age, Body Mass Index (BMI), neck circumference (NC), and daytime sleepiness using the Epworth Sleepiness Scale (ESS).

Polygraphy studies were conducted using two different devices. The first is a Resmed Apnea Link® device that records airflow signals through a nasal pressure cannula, snoring derived from a nasal cannula, oximetry, and pulse frequency. The signal analysis is performed using ApneaLink software version 8 with automatic analysis and subsequent manual review. The second device is an Embla Embletta Gold® model that records airflow signals through a nasal pressure cannula, snoring derived from a nasal cannula, thoracic and abdominal movement using XactTrace® RIP (Respiratory Inductance Plethysmography) belts, pulse oximetry, and body position. The signals are evaluated using RemLogic-E software version 1.3 with automatic analysis and manual review of events. For polysomnography studies, an ATI Praxis18 AMP18P - Lermed S.R.L. device is used. In each study, three EEG (electroencephalogram) channels were recorded: 3, C4, and O1 with references on the mastoids (A1 and A2), two EOG (electrooculogram) channels (right and left), three EMG (electromyogram) channels, ECG (electrocardiogram), airflow measurement through thermistor and nasal pressure cannula, piezoelectric thoracic and abdominal bands for effort, body position sensor, pulse oximetry, and a microphone. The records are manually analyzed using DelphosDB software version 1.75.32.4 (Lermed S.R.L.) according to the standards of the American Association of Sleep Medicine (AASM).[7]

The calibration procedure is performed with polysomnographic control or during 3 nights at home in order to reduce equipment ordering times. The devices used for calibration are: REMstar auto with Aflex (Philips-Respironics) and S9 (Resmed). Once the calibrations are completed, an effective treatment pressure is established by the device's software, as effective pressure (P) during 90 or 95 % of the appropriate device usage time, with system leaks of less than 24 liters/minute. Finally, the type of device is noted, whether it has fixed pressure (CPAP), automatic variable pressure (AutoCPAP), or bilevel pressure (BiPAP).

The next step is the equipment request. For patients without coverage, a form is completed that evaluates the clinical and social situation to qualify for a request as Medical aid. Under this designation, a request number is generated, categorized as "Hospital Supply" in the Financial Management and Administration Integrated System of the Ministry of Health of the Government of CABA, where the resource provided by the Ministry is directly available. Based on the availability of funds, a bidding process is initiated with the submission of proposals from equipment suppliers. Technical support is provided by the sleep laboratory doctors according to each patient's requirements. Upon confirmation of the final amount, the equipment purchase is made, and the device is delivered to the patient from 2 months on. In cases of urgent equipment provision, the administrative resource of Emergency Purchase can be used, resulting in equipment acquisition within one month. This administrative model has been in operation since 2016. Between 2013 and 2016, a similar procedure was followed, but there were some variations in supply times due to administrative issues beyond our control.

For PAMI patients, a specific supply form is completed; it must then be renewed every 6 months. The bidding process of the equipment is carried out for each patient, in every INSSJP agency, depending on the patient's address.

After the equipment is delivered, a sleep laboratory doctor explains the basic care aspects of the equipment, he/she tests the mask, and checks the proper functioning of the equipment. Follow-up visits are scheduled according to national guidelines, one month after the beginning of treatment, at 3 months, and then every 6 months. A contact phone number is provided for difficulties that could arise between scheduled consultations.

The mean times that were evaluated include: from consultation to diagnosis, from previous studies until consultation, from equipment request until provision, from equipment provision until the first follow-up visit, and follow-up in the last 12 months. Adherence to treatment was also evaluated basing on the presence or absence of a follow-up visit one year after equipment delivery, the subjective use of devices without memory, the objective use of devices with compliance memory card, and the use in patients undergoing telemedicine.

Differences were analyzed between adherents and non-adherents to follow-up visits, regardless of their equipment provision method. In the subgroup of patients monitored with memory card or telemedicine, differences were sought between those with more than 70 % adherence and those without.

Patients who do not attend scheduled follow-up visits during the last year are contacted to assess the use of their equipment.

Statistical analysis

The data were collected in Excel spreadsheets and processed using the EPI Info 7 program. The data are described with measures of central tendency and dispersion according to the type of variable. Differences between categorical variables were compared using the chi-square test,[2] and continuous variables were analyzed using the Student's t-test. A p-value of less than 0.05 was considered significant.

RESULTS

The data of 148 patients were evaluated. A first group of 84 patients received the equipment from the Government of the City of Buenos Aires and the National Government, referred to as the Hospital Group (HG); and a second group of 64 patients with health coverage received the equipment through the Social Services System for Retirees and Pensioners and were called the PAMI group.

The characteristics of the patients are presented in **Table 1**. The waiting times for diagnosis, treatment, and follow-up are presented in **Table 2**.

Values expressed in months as mean ± SD or number and percentage according to the variable

In a sub-analysis, patients who had not yet completed 1 year of treatment by the statistical cutoff date were excluded. Those who attended follow-up visits during the first year were grouped as adherents. This group was compared with the remaining patients in order to identify factors favoring adherence. Results are presented in **Table 3**.

The objective adherence in patients who had memory cards or were monitored through the cloud, defined as more than 70 % of use for more than 4 nights per week, was only 40 %, with no statistically significant differences between adherent and non-adherent patients in the analyzed variables. **Table 4.**

91 patients who hadn't attended any follow-up visit in the last year were contacted: 51.6 % reported that they were still using the CPAP; 6.6 % had returned the device due to intolerance; 3.3 % had the device but weren't using it; and 38.5 % of patients couldn't be located.

TABLE 1. Características de los pacientes con SAHOS

	Total (n = 148)	Hospital Group (n = 84)	PAMI (n = 64)	*P* value
Males	99 (66.8 %)	63 (75 %)	36 (56.2 %)	0.01
Age	58.3 ± 13.4	50.3 ± 10.8	68.6 ±8.5	
BMI	34 ± 7.5	35.5 ± 8.2	32.1 ± 6.2	<0.0001
Neck circumference (females)	38.3 ± 3.8	39 ± 4.4	37.9 ± 3.3	0.004
Neck circumference (males)	45 ± 4.2	45.2 ± 4.5	44.6 ± 3.9	0.35
Epworth	10.8 ± 6.3	12.3 ± 6.8	9 ± 4.9	0.53
AHI	40.7 ± 24.8	42.1 ± 27	38.8 ± 21.6	0.0008
Effective pressure	11.1 ± 2.1	11.3 ± 2.2	10.9 ± 4.4	0.41
AutoCPAP	69 (46.6 %)	42 (50 %)	27 (42.2 %)	0.33
CPAP	78 (52.7 %)	41 (48.8 %)	37 (57.8 %)	0.35
BiPAP	1 (0.7 %)	1 (1.2 %)	0	

Values expressed as mean ± SD or number and percentage according to the variable.

TABLE 2. Demoras en diagnóstico, tratamiento y seguimiento de los pacientes con SAHOS

	Hospital Group (n = 84)	PAMI (n = 65)	*P* value
Time from consultation to diagnosis (n = 82)	1.3 ± 3.3	1.5 ± 3.4	0.7
Diagnosis prior to consultation (n = 66)	4.9 ± 6.6	10 ± 14.8	0.06
From equipment request to provision	5.6 ± 4.7	2.7 ± 2.5	<0.0001
From equipment provision to first follow-up visit	2.9 ± 4.9	4.5 ± 6.8	0.1
From diagnosis to equipment provision	9.7 ± 7.1	10.6 ± 12.9	0.6
Provision of equipment after more than 6 months	33 (39.3 %)	8 (12.5 %)	0.0002
Follow-up visit 12 months after provision	30 (35.7 %)	28 (43.7 %)	0.07
No control since provision	19 (22.6 %)	5 (7.7 %)	0.01
Control in the last 12 months	19 (22.6 %)	26 (40 %)	0.03

Values expressed in months as mean ± SD or number and percentage according to the variable.

TABLE 3. Adherence to follow-up during the first year of treatment

	Adherent patients (n = 58)	No adherents patients (n = 68)	*P* value
Females	22 (52.4 %)	20 (47.6 %)	0.34
Males	36 (42.8 %)	48 (57.1 %)	
Age	59.6 ± 11.6	55.9 ± 14.6	0.07
BMI	34.6 ± 7.3	33.7 ± 7.4	0.9
Epworth	10.7 ± 5.5	11.8 ± 6.9	0.07
AHI	42.9 ± 26.5	40.7 ± 24.5	0.52
AutoCPAP	29(56.9 %)	22 (43.1 %)	0.07
CPAP	29(39.2 %)	45 (60.8 %)	
Pressure	11.2 ± 1.9	11 ± 2.3	0.2

Values expressed as mean ± SD

TABLE 4. Objective adherence to treatment

	Adherent patients (n = 30)	No adherents patients (n = 45)	*P* value
Females	11 (47.8 %)	12 (52.2 %)	0.4
Males	19 (36.5 %)	33 (63.5 %)	
Age	60.3 ± 14.5	56.2 ± 12.8	0.2
BMI	34.9 ± 8.2	31.8 ± 6.9	0.08
Epworth	10.5 ±6.2	10.4 ± 6.7	0.9
AHI	41.6 ± 24.5	42.3 ± 24.6	0.9
AutoCPAP	19 (37.3 %)	32 (62.7 %)	0.6
CPAP	11 (45.8 %)	13 (54.2 %)	
Pressure	11 ± 2.1	11.4 ± 2.1	0.4

Values expressed as mean ± SD.

DISCUSSION

Our study found that patients from the Hospital Group (HG) are younger but have a higher BMI and higher levels of daytime sleepiness according to the Epworth Sleepiness Scale. The age differences between groups are due to the fact that patients from the PAMI group are mostly retired individuals, while the HG group consists of middle-aged patients. Lee et al observed that the BMI does not correlate with the apnea/hypopnea index (AHI) in patients older than 70 years.[11] Additionally, the Sleep Health Heart Study showed that correlation and also demonstrated that sleepiness is less prevalent in elderly patients compared to middle-aged individuals.[12]

In our study, the delays in the access to the diagnostic study were 1.4 months. Access to diagnostic procedures is deficient worldwide. A review on this topic in 2004 found significant variability among the analyzed countries, with Belgium having the shortest waiting time, with average delays ranging from 2 weeks to 2 months. In the United States, significant differences are observed between centers and hospitals, with average waiting times ranging from 2 weeks to 9 months. In other countries, such as the United Kingdom, the average is 4 months; in Australia, 5 months, and in Canada, 24 months. It is important to note that there are differences within each country, with Ontario, for example, having a waiting time of only 2 months.[13]

The use of continuous airway pressure devices is considered the standard treatment for patients with moderate to severe OSAHS. Understanding the obstacles and difficulties in accepting and adhering to CPAP is crucial for an effective treatment and the development of an adherence protocol.

Access to the equipment is the first barrier to treatment. A recent study in six Latin American countries showed that 28.7 % of the patients who could not initiate CPAP treatment lacked economic resources to purchase the equipment.[14] In Mexico, Torre B. et al observed that 45 % of patients with a CPAP prescription failed to acquire the equipment, considering the economic aspect an essential causal factor.[15] Through economic incentives for patients with low socioeconomic status, CPAP acceptance rates of 70 % were achieved.[16] The Argentinian public healthcare system enables all patients diagnosed with OSAHS to access the equipment. However, in our study, treatment adherence during the first year was only 39 %, similar to the findings by Tarasiuk et al (35 to 39 %).[16] Another study in Belgium demonstrated that CPAP acceptance was higher when there was economic reimbursement from social security, but found no differences with regard to adherence and compliance after more than 2 years of follow-up.[17]

There are few studies about delays in treatment initiation. A cohort study in Ontario with 216,514 patients who started CPAP treatment between 2006 and 2013 showed a mean delay of 138 +/- 202 to 196 +/- 238 days since the diagnosis in hospital sleep laboratories versus 119 +/- 167 to 150 +/- 202 days in community sleep laboratories, with 33.6 % of patients taking more than 6 months to receive the equipment.[18] Our study has a much smaller sample size, but we obtained provision times of 130.4 +/- 130.9 days, with shorter times in the PAMI system and only 12.2 % of patients taking more than 6 months to receive the equipment.

In a systematic literature review from 1994 to 2015 about CPAP adherence, an average usage rate of 36.3 % was observed with a mean use of 4.6 hours per night that did not improve over time.[19] Baratta et al found that adherence to the use of CPAP for more than 4 hours per night and more than 5 days per week was 41.4 %, with an average follow-up of 74.8 months.[20] This value is similar to what was found in our group of patients with objective CPAP adherence. In contrast, a study conducted in Denmark with 695 patients who received a free AutoCPAP under a strict follow-up protocol achieved compliance rates of 77.7 %, with an average follow-up of 3 years, showing higher adherence in severe patients. Furthermore, they found that the severity of the OSAHS, daytime sleepiness, and smoking are independent factors for treatment adherence.[21] Kohler et al evaluated long-term follow-up at the Oxford Centre for Respiratory Medicine, and found 81 % adherence at 5 years, and 70 % at 10 years, with an mean use of 6.2 hours per night, with the desaturation index being the only factor favoring long-term adherence in the multivariate analysis.[22] In the study by Santin et al, it was observed that 60.5 % of patients continued using CPAP at an average of 12.3 months of follow-up, with age, Epworth Scale score, and AHI being the factors favoring long-term adherence.[23] Torre B. et al reported an 80 % adherence to CPAP at 34 months post-prescription, which was related to a higher respiratory distress index (RDI).[15] Our study found that age, the Epworth Scale score, and the use of AutoCPAP over the CPAP had a non-significant trend in favor of adherence to follow-ups, while the increased BMI was the only factor showing a non-significant trend toward improving objective adherence. These findings lack statistical significance, probably due to the smaller number of patients.

There should be an initial consultation with a specialist before the start of treatment, followed by frequent visits to a specialist nurse in the field of sleep disorders for adjustments in the CPAP combination, the mask type, and the use of humidification (if deemed necessary), until patient tolerance is achieved. Subsequently, there should be follow-up visits at least once a year.[21]

The decision of patients to sleep in another room has been shown to be a predictor CPAP treatment acceptance.[24] This suggests that educating the patient's partner and family environment is important to maintain good adherence. In a systematic review by Cochrane, low-quality evidence was found regarding individual support interventions (frequent consultations, phone calls, telemedicine, home visits, and group meetings for patients) and behavioral therapy (face-to-face or online motivational interviews) to improve the use of CPAP; and there is moderate-quality evidence for in-person or distance educational interventions.[25]

CPAP equipment providers can play a crucial role in the treatment of sleep apnea by helping patients to select the most suitable devices and masks and providing training on proper usage. In a study conducted in Germany, the equipment provider company evaluated the use of a patient support tool. This tool provided personalized edu-

cation on the use of the mask, the humidifier and overall device usage. Additionally, the company offered usage tips and encouraging messages, all tailored to the device usage data. These interventions resulted in improvements in the number of hours of use, reduced leakage, and lower rates of treatment withdrawal. [26]

CONCLUSIONS

With the data obtained in our analysis, we found significant delays in accessing the diagnosis of OSA and treatment with CPAP. These delays are longer in patients without medical coverage compared to those with PAMI coverage. Adherence to CPAP use is still low even after overcoming economic limitations in the access to treatment equipment. Age, the baseline Epworth score, and the use of auto-adjustable devices would favor treatment adherence. More interventions from various healthcare system stakeholders are needed to achieve optimal use of CPAP equipment and obtain all the benefits of treatment.

Conflict of interest

Authors have no conflict of interest to declare in relation to the topic of this manuscript. This work was carried out without funding.

REFERENCES

1. Nogueira FB, Cambursano H, Smurra M, et al. Guías prácticas de diagnóstico y tratamiento del síndrome de apneas e hipopneas obstructivas del sueño: Actualización 2019. Rev Am MedResp. 2019;19:31.
2. Jonas DE, Amick HR, Feltner C, et al. Screening for Obstructive Sleep Apnea in Adults: Evidence Report and Systematic Review for the US Preventive Services Task Force. JAMA. 2017;317:415-33. https://doi.org/10.1001/jama.2016.19635
3. Peppard PE, Young T, Barnet JH, et al. Increased prevalence of sleep-disordered breathing in adults. Am J Epidemiol. 2013;177:1006-14. https://doi.org/10.1093/aje/kws342
4. Redline S, Sotres-Álvarez D, Loredo J, et al. Sleep-disordered breathing in Hispanic/Latino individuals of diverse backgrounds. The Hispanic Community Health Study/Study of Latinos. Am J Respir Crit Care Med, 2014:189:335-644. https://doi.org/10.1164/rccm.201309-1735OC
5. Simpson L, Hillman DR, Cooper MN, et al. High prevalence of undiagnosed obstructive sleep apnoea in the general population and methods for screening for representative controls. Sleep Breath. 2013;17:967-73. https://doi.org/10.1007/s11325-012-0785-0
6. Arnardottir ES, Bjornsdottir E, Olafsdottir KA, et al. Obstructive sleep apnoea in the general population: highly prevalent but minimal symptoms. Eur Respir J. 2016;47:194-202. https://doi.org/10.1183/13993003.01148-2015
7. Shahar E, Redline S, Young T, et al. Hormone replacement therapy and sleep-disordered breathing. Am J Respir Crit Care Med. 2003;167:1186-92. https://doi.org/10.1164/rccm.200210-1238OC
8. Argentina, INdEyCR. Censo 2010. 2010; Available from: https://www.indec.gob.ar/nivel4_default.asp?id_tema_1=2&id_tema_2=41&id_tema_3=135.
9. Arce HE. Organización y financiamiento del sistema de salud en la Argentina [The Argentine Health System: organization and financial features]. Medicina (B Aires). 2012;72:414-8.
10. (Argentina), MdS. El acceso a la salud en Argentina: III encuesta de utilización y gasto en servicios de salud 2010. 2010; Available from: http://www.msal.gob.ar/fesp/images/stories/recursos-de-comunicacion/publicaciones/estudio_carga_enfermedad.pdf.
11. Lee YG, Lee YJ, Jeong DU. Differential Effects of Obesity on Obstructive Sleep Apnea Syndrome according to Age. Psychiatry Investig. 2017;14:656-61. https://doi.org/10.4306/pi.2017.14.5.656
12. Young T, Shahar E, Nieto FJ, et al. Predictors of sleep-disordered breathing in community-dwelling adults: the Sleep Heart Health Study. Arch Intern Med. 2002;162:893-900. https://doi.org/10.1001/archinte.162.8.893
13. Flemons WW, Douglas NJ, Kuna ST, et al. Access to diagnosis and treatment of patients with suspected sleep apnea. Am J Respir Crit Care Med. 2004;169:668-72. https://doi.org/10.1164/rccm.200308-1124PP
14. Nogueira JF, Poyares D, Simonelli G, et al., Accessibility and adherence to positive airway pressure treatment in patients with obstructive sleep apnea: a multicenter study in Latin America. Sleep Breath. 2020;24:455-64. https://doi.org/10.1007/s11325-019-01881-9
15. Torre Bouscoulet L, López Escárcega E, Castorena Maldonado A, Vázquez García JC, Meza Vargas MS, Pérez-Padilla R. Uso de CPAP en adultos con síndrome de apneas obstructivas durante el sueño después de prescripción en un hospital público de referencia de la Ciudad de México [Continuous positive airway pressure used by adults with obstructive sleep apneas after prescription in a public referral hospital in Mexico City]. Arch Bronconeumol. 2007;43:16-21. https://doi.org/10.1157/13096996
16. Torre Bouscoulet L, López Escárcega E, Castorena Maldonado A, Vázquez García JC, Meza Vargas MS, Pérez-Padilla R. Uso de CPAP en adultos con síndrome de apneas obstructivas durante el sueño después de prescripción en un hospital público de referencia de la Ciudad de México [Continuous positive airway pressure used by adults with obstructive sleep apneas after prescription in a public referral hospital in Mexico City]. Arch Bronconeumol. 2007;43:16-21. https://doi.org/10.1157/13096996
17. Leemans J, Rodenstein D, Bousata J, Mwenge GB. Impact of purchasing the CPAP device on acceptance and long-term adherence: a Belgian model. Acta Clin Belg. 2018;73:34-9. https://doi.org/10.1080/17843286.2017.1336294
18. Rotenberg B, George C, Sullivan K, Wong E. Wait times for sleep apnea care in Ontario: a multidisciplinary assessment. Can Respir J. 2010;17:170-4. https://doi.org/10.1155/2010/420275
19. Rotenberg BW, Murariu D, Pang KP. Trends in CPAP adherence over twenty years of data collection: a flattened curve. J Otolaryngol Head Neck Surg. 2016;45:43. https://doi.org/10.1186/s40463-016-0156-0
20. Baratta F, Pastori D, Bucci T, Fabiani M, Fabiani V, Brun-

ori M, et al. Long-term prediction of adherence to continuous positive air pressure therapy for the treatment of moderate/severe obstructive sleep apnea syndrome. Sleep Med. 2018;43:66-70. https://doi.org/10.1016/j.sleep.2017.09.032
21. Jacobsen AR, Eriksen F, Hansen RW, et al. Determinants for adherence to continuous positive airway pressure therapy in obstructive sleep apnea. PLoS One. 2017;12:e0189614. https://doi.org/10.1371/journal.pone.0189614
22. Kohler M, Smith D, Tippett V, Stradling JR. Predictors of long-term compliance with continuous positive airway pressure. Thorax. 2010;65:829-32. https://doi.org/10.1136/thx.2010.135848
23. Santín M J, Jorquera A J, Jordán J, et al. Uso de CPAP nasal en el largo plazo en síndrome de apnea-hipopnea del sueño [Long-term continuous positive airway pressure (CPAP) use in obstructive sleep apnea]. Rev Med Chil. 2007;135:855-61. https://doi.org/10.4067/S0034-98872007000700005
24. Kiely JL, McNicholas WT. Bed partners'assessment of nasal continuous positive airway pressure therapy in obstructive sleep apnea. Chest. 1997;111:1261-5. https://doi.org/10.1378/chest.111.5.1261
25. Wozniak DR, Lasserson TJ, Smith I. Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea. Cochrane Database Syst Rev. 2014:CD007736. https://doi.org/10.1002/14651858.CD007736.pub2
26. Woehrle H, Arzt M, Graml A, et al. Effect of a patient engagement tool on positive airway pressure adherence: analysis of a German healthcare provider database. Sleep Med. 2018;41:20-6. https://doi.org/10.1016/j.sleep.2017.07.026