

## Resources and Delays in the Diagnosis of Sleep Apnea-Hypopnea Syndrome

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**OBJECTIVE:** The demand for consultations and diagnostic studies for sleep apnea-hypopnea syndrome (SAHS) has increased, and this has led to considerable delays. We therefore need an updated evaluation of the diagnostic situation to serve as a management tool for specialists and health care administrations responsible for solving the problem. The objective of the present study was to carry out a descriptive analysis of the situation regarding the diagnosis of SAHS in Spanish hospitals.

**METHODS:** We undertook a descriptive cross-sectional observational study. Public and private hospitals listed in the Ministry of Health's 2005 catalog of health care institutions were contacted, and those that routinely evaluate patients for SAHS were included in the study. The person in charge of each hospital filled in a questionnaire concerning the availability of resources and waiting periods for diagnosis.

**RESULTS:** Of the 741 hospitals we contacted, 217 routinely evaluated patients for SAHS. In 88% of these, respiratory polygraphy (RP) (n=168) or polysomnography (PSG) (n=97) was available. The mean waiting period was 61 days for consultation and 224 days for RP. The mean number of RP devices was 0.99 per 100 000 inhabitants, while the recommended number is 3 per 100 000 inhabitants. The mean waiting period for PSG was 166 days. The mean number of PSG beds was 0.49 per 100 000 inhabitants, while the recommended number is 1 per 100 000.

**CONCLUSIONS:** We observed a marked inadequacy of resources that has led to unacceptable waiting periods. While there has been a favorable change in the situation regarding SAHS diagnosis compared to previous studies, there is still room for improvement and it is urgent that health care

authorities allocate more resources to this public health problem.

**Key words:** Sleep apnea. Respiratory Polygraphy. Polysomnography. Delays. Waiting lists.

Recursos y demoras en el diagnóstico del síndrome de apneas-hipopneas durante el sueño (SAHS)

**OBJETIVO:** La demanda de consultas y estudios diagnósticos del síndrome de apneas-hipopneas durante el sueño (SAHS) se ha incrementado, lo que ha llevado a importantes demoras. Por tanto, es precisa una evaluación actualizada de la situación del diagnóstico que sirva como herramienta de gestión a especialistas y las administraciones sanitarias que tienen la responsabilidad de solventar el problema. El objetivo del presente estudio ha sido realizar un análisis descriptivo de la situación del diagnóstico del SAHS en los hospitales españoles.

**MÉTODOS:** Se ha realizado un estudio descriptivo, observacional y transversal. Se estableció contacto con los centros públicos y privados incluidos en el catálogo de instituciones sanitarias del Ministerio de Sanidad de 2005. Se incluyeron aquellos que evaluaban habitualmente a pacientes con SAHS. El responsable de cada centro rellenó un cuestionario sobre disponibilidad de recursos y demoras para el diagnóstico.

**RESULTADOS:** De los 741 centros con los que se estableció contacto, 217 evaluaban habitualmente a pacientes con SAHS. El 88% disponía de poligrafía respiratoria (PR) (n = 168) o polisomnografía (PSG) (n = 97). La demora media en consulta fue de 61 días, y la demora media para realizar PR, de 224 días. La media de equipos de PR fue de 0,99/100.000 habitantes, cuando lo recomendable es 3/100.000. La demora media para PSG fue de 166 días. La media de camas de PSG fue de 0,49/100.000 habitantes y lo recomendable es 1/100.000.

**CONCLUSIONES:** Se observa una notable deficiencia de recursos que lleva a inaceptables listas de espera. Aunque la

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**situación del diagnóstico de SAHS ha cambiado favorablemente con respecto a estudios previos, sigue siendo mejorable y es imprescindible que las autoridades sanitarias dediquen más recursos a este problema de salud pública.**

**Palabras clave:** *Apneas del sueño. Poligrafía respiratoria. Polisomnografía. Demoras. Lista de espera.*

## Introduction

Sleep apnea-hypopnea syndrome (SAHS) is characterized by repeated episodes of upper airway obstruction which may be total (apnea) or partial (hypopnea). The direct consequences of such episodes are decreases in oxygen saturation and arousals, which are in turn responsible for a clinical picture characterized by excessive daytime sleepiness as well as neurological and psychiatric disorders.<sup>1,2</sup> The prevalence of SAHS has been estimated at about 2% to 4% of the adult population.<sup>3,4</sup> Several studies have shown an association between sleep apneas and high blood pressure,<sup>4-9</sup> cardiovascular and cerebrovascular disease,<sup>10-13</sup> and traffic accidents.<sup>14-17</sup>

SAHS is usually diagnosed by polysomnography (PSG), although in selected patients respiratory polygraphy (RP) may be used.<sup>18-20</sup> Continuous positive airway pressure (CPAP) is considered the treatment of choice in cases with the most pronounced symptoms,<sup>21,22</sup> as it has been shown to improve clinical symptoms (especially daytime sleepiness), quality of life, and apnea-hypopnea indices.<sup>23-27</sup>

As the scientific community has come to understand SAHS better and the general public has become more aware of the disease and its symptoms in recent years, consultations and the demand for diagnostic studies have increased. An estimated 7 million people in Spain experience apneas during sleep. Of these, 2 million have significant symptoms, and it is estimated that about 10% of these have been evaluated and treated.<sup>28</sup>

Several studies carried out in Spain in 1994,<sup>29</sup> 1997,<sup>30</sup> and 2003<sup>28</sup> have evaluated the availability of diagnostic and therapeutic resources, and a study carried out in 2002 analyzed delays.<sup>31</sup> In the 1994 study, only 24% of the health care facilities contacted performed some type of sleep study (including oximetry) and PSG was available in 11%. In the 1997 study, 68% of the health care facilities performed some type of diagnostic study (including oximetry), and PSG was available in 7.5%. In the 2003 study, 47% performed some type of sleep study and PSG was available in 25%. The mean waiting period at the end of 2002 was 208 days for RP and 261 days for PSG.

In the light of these findings and of the magnitude of the public health problem SAHS represents,<sup>19,32</sup> it seems clear that we need an updated evaluation of the diagnostic situation that will provide us with an understanding of how it has evolved over time and will serve as a management tool for specialists and health care administrations responsible for solving the problem. The objective of the present study was to carry out a descriptive

analysis of SAHS diagnosis in Spanish hospitals. The main variables of this analysis were the resources available and delays in diagnosis.

## Methods

### Design

Between November 2005 and February 2006 we carried out a descriptive cross-sectional observational study that included public and private Spanish hospitals that routinely evaluated patients for SAHS. Hospitals that did not answer the questionnaire were excluded.

### Protocol

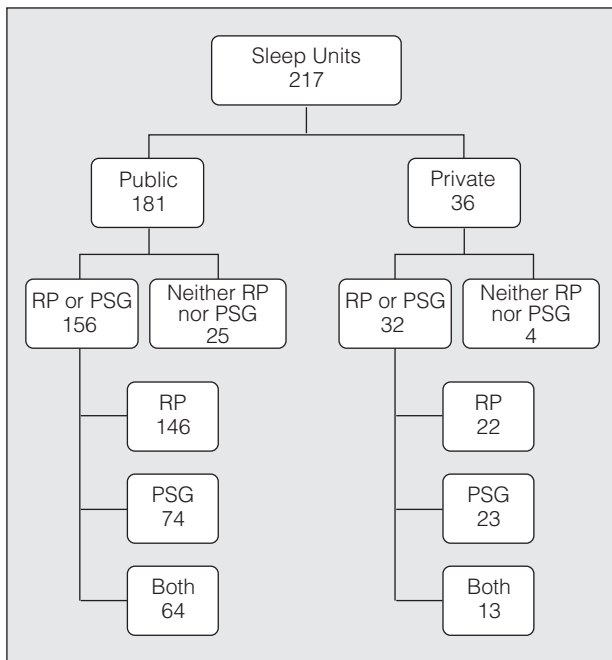
Our target population consisted of all 780 hospitals listed in the Ministry of Health's 2005 catalog of health care institutions (<http://www.msc.es/ciudadanos/prestaciones/centrosServiciosSNS/hospitales/busquedaCA/frmBusquedaCA.jsp>). The fieldwork was organized by a central committee composed of the people in charge of 11 subcommittees (North: Basque Country, Cantabria, Asturias, and Navarre; East: Autonomous Community of Valencia, Murcia, and the eastern part of Castile-La Mancha [Cuenca and Albacete]; Center: Madrid and part of Castile-La Mancha [Toledo and Guadalajara]; West: Extremadura and Ciudad Real; Islands: Balearic Islands and Canary Islands; Southwest: Western Andalusia, Ceuta and Melilla; Eastern Andalusia; Aragon: Aragon and La Rioja; Galicia, Catalonia, and Castile-León). There were a total of 59 researchers on these subcommittees, with at least 1 researcher from each province. All the hospitals included in the catalog were contacted by phone in order to find out whether they routinely evaluated patients for SAHS. If the answer was affirmative, we contacted the person in charge to request collaboration in filling in a questionnaire (Appendix) that was sent by post or e-mail (first option), or administered directly on the telephone by the researcher. We excluded those hospitals that we could not contact after 5 attempts on different days and at different times.

The questionnaire consisted of 3 parts (Appendix). In the first, which was to be filled in by all hospitals that routinely evaluated patients for SAHS, details of the hospital and contact person as well as information regarding the evaluation of patients for SAHS (in the pneumology or any other department) were recorded. The second part included questions regarding RP and was directed exclusively to those hospitals in which RP was available (in the pneumology or any other department). This second part also included questions on auto-titrating CPAP devices. The third part was directed to hospitals that performed PSG (in the pneumology or any other department).

The coordinating center in Cáceres created an Excel database with the study variables. The person in charge of each of the 11 subcommittees entered the data from each hospital into the database and carried out a preliminary check for accuracy. These databases were sent to the coordinating center for unification, a second check for errors, and analysis.

### Statistical Analysis

Among the continuous variables, the results for Spanish autonomous communities were expressed as means and the results on the national level as the means of values for all hospitals. The results for certain continuous variables were expressed per 100 000 inhabitants, however. For these, the values for the various hospitals were added up to give the global values for the autonomous communities. In this case, the value used for results on the national level was the average value of the data for the



**Figure 1.** Total number of sleep units and those with respiratory polygraphy (RP) or polysomnography (PSG) available in Spain, and by public or private hospital status

various autonomous communities. The range of values were given based on results for autonomous communities. Categorical variables were expressed as a percentage for each autonomous community and for all the hospitals taken together for the national value. In each table there is mention of the number of hospitals in each autonomous community that failed to provide data for specific variables.

## Results

### Results for the First Part of the Questionnaire

Of the 780 hospitals listed in the 2005 catalog, we contacted 741 (95%). Of these, 217 (29%)—181 public and 36 private—routinely evaluated patients for SAHS. Either RP (n=168) or PSG systems (n=97) were available in 188 (88%) hospitals. Of these 188 hospitals, 20 (11%)—10 public (6%) and 10 private (31%)—had PSG but not RP systems. Of the 29 hospitals that evaluated patients but did not have RP or PSG equipment, 25 were public (Figure 1).

The mean (SD) number of hospitals per 100 000 inhabitants that evaluated patients with SAHS in Spain was 0.69 (0.34) (range, 0.19-1.51) (Table 1 and Figure 2). The mean waiting period for a consultation for suspected SAHS was 61 (130) days (range, 9-161 days) and 60 (66) days (range, 5-114) days for a first examination. The mean waiting period was 69 (138) days for the first consultation and 67 (68) days for the first examination in public hospitals and 13 (18) days for the first consultation and 17 (24) days for the first examination in private hospitals.

Referrals from primary care facilities for the country as a whole were considered appropriate in 63% of the hospitals and inappropriate in 31%. In 11% it was considered very appropriate and in 4%, not at all appropriate.

### Results for the Second Part of the Questionnaire

All the autonomous communities had hospitals that performed RP except for the autonomous city of Melilla. The national mean number of RP devices per 100 000

**TABLE 1**  
**Distribution of Hospitals Evaluating Sleep Apnea-Hypopnea Syndrome and Delays for First Consultation and First Examination\***

	Population	No. of Hospitals	No. of Hospitals/ Inhabitants	Delays, d	
				First Consultation†	First Examination
Andalusia	7 357 558	41	0.56	26 (24)	51 (55)
Aragon	1 204 215	12	1	10 (4.8)	18 (27)
Asturias	1 062 998	10	0.94	161 (211)	64 (66)
Autonomous Community of Valencia	4 162 776	24	0.58	49 (47)	71 (72)
Canary Islands	1 694 477	8	0.47	55 (89)	32 (47)
Cantabria	535 131	1	0.19	30	60
Castile-La Mancha	1 760 516	13	0.74	18 (10)	105 (109)
Castile-León	2 456 474	14	0.57	19 (13)	70 (108)
Catalonia	6 343 110	33	0.52	144 (270)	48 (49)
Ceuta	71 505	1	1.40	15	30
Extremadura	1 058 503	8	0.76	33 (16)	98 (68)
Galicia	2 695 880	7	0.26	83 (60)	114 (75)
Balearic Islands	841 669	8	0.95	61 (63)	61 (73)
La Rioja	276 702	2	0.72	9 (6)	5 (2)
Madrid	5 423 384	12	0.22	74 (63)	59 (33)
Melilla	70 000	1	1.51	60	90
Murcia	1 197 646	8	0.67	46 (38)	43 (25)
Navarre	555 829	3	0.54	11 (6)	15 (21)
Basque Country	2 082 587	11	0.53	50 (52)	67 (60)
Spain	40 504 258	217	0.69 (0.34)†	61 (30)	60 (66)

\*One hospital in Andalusia, 1 in the Autonomous Community of Valencia, 1 in the Balearic Islands, 2 in Aragon, 2 in Castile-León, and 2 in Madrid did not answer the questions regarding delays. †Data are expressed as mean (SD).

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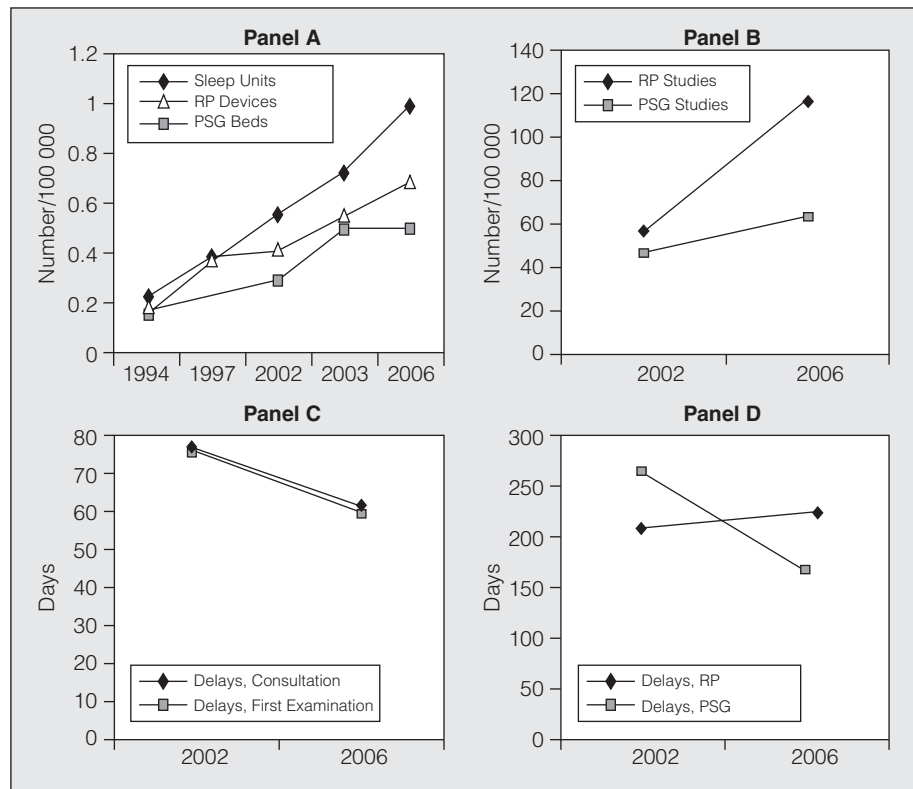


Figure 2. Panel A: number of sleep units, respiratory polygraphy (RP) systems, and polysomnography (PSG) beds per 100 000 inhabitants in previous studies and the present one. Panel B: national mean number of RP and PSG performed annually in a previous study and in the present one. Panel C: national mean delay (in days) for a first consultation and for examination in a previous study and in the present one. Panel D: national mean delay (in days) for a first consultation and for RP and PSG in a previous study and in the present one. (Data for the years 1994, 1997, 2002, and 2003 correspond to those provided in the studies of Durán et al.,<sup>29</sup> Terán et al.,<sup>30</sup> Masa et al.,<sup>31</sup> and Durán et al.<sup>28</sup>)

inhabitants was 0.99 (0.43) (range, 0.33-1.90) (Table 2 and Figures 2 and 3). The waiting period for diagnostic RP was 224 (290) days (range, 45-547 days). The waiting period in public hospitals was 257 (298) days and in private hospitals, 10 (10) days.

The national mean number of RP studies was 280 (258) (range, 75-640). Of these, 51% (45%) (range, 20%-100%) were performed in the patient's home. The annual number of RP studies performed per RP device was 127 (82) (range, 75-187) (Table 2).

TABLE 2  
Results for Respiratory Polygraphy (RP)\*

	No. of Hospitals With RP	Total No. of RP Devices	RP Devices/Hospital†	RP Devices/100 000 Inhabitants	Delays for RP, d†	RP Studies/Hospital/Year†	RP Studies/Year/100 000 Inhabitants	RP Studies/Year/Hospital/ RP Device†	Home RP Studies/Year, %†
Andalusia	28	71	2.5 (1.6)	0.96	184 (246)	350 (316)	124	133 (85)	57 (45)
Aragon	6	7	1.2 (0.4)	0.58	219 (295)	233 (287)	116	167 (136)	40 (49)
Asturias	10	14	1.4 (0.8)	1.32	231 (214)	133 (131)	125	83 (44)	89 (33)
Autonomous Community of Valencia	20	37	1.8 (1.1)	0.89	106 (241)	303 (284)	146	158 (132)	71 (42)
Canary Islands	5	8	1.6 (0.5)	0.47	404 (429)	153 (93)	36	89 (43)	75 (50)
Cantabria	1	6	6	1.12	45	640	120	107	58
Castile-La Mancha	12	24	2 (1.2)	1.36	245 (197)	255 (162)	174	142 (76)	53 (47)
Castile-León	12	19	1.6 (0.9)	0.77	249 (269)	149 (94)	73	100 (57)	38 (49)
Catalonia	28	49	1.7 (0.7)	0.77	365 (411)	227 (191)	97	124 (77)	20 (36)
Ceuta	1	1	1	1.40	45	75	105	75	100
Extremadura	5	16	3.2 (1.1)	1.51	318 (440)	366 (243)	173	109 (39)	96 (6)
Galicia	7	16	2.3 (0.5)	0.59	170 (252)	346 (147)	90	150 (54)	50 (36)
Balearic Islands	8	16	2 (1.9)	1.90	74 (123)	248 (250)	177	103 (60)	43 (53)
La Rioja	1	1	1	0.36	60	160	58	160	100
Madrid	9	19	2.1 (1.5)	0.33	232 (217)	318 (283)	41	116 (54)	21 (37)
Murcia	5	12	2.4 (1.7)	1	89 (94)	266 (170)	111	112 (36)	89 (22)
Navarre	2	4	2	0.72	547 (258)	373 (108)	133	187 (54)	56 (1)
Basque Country	8	31	3.9 (2.9)	1.49	189 (186)	543 (507)	209	128 (83)	23 (28)
Spain	168	351	2.1 (1.4)	0.99 (0.43)†	224 (290)	280 (258)	(116)†	127 (82)	51 (45)

\*One hospital in Madrid and 2 in Andalusia did not answer questions regarding delays, number of RP studies performed per year, or percentage of those performed at home. †Data are expressed as mean (SD).

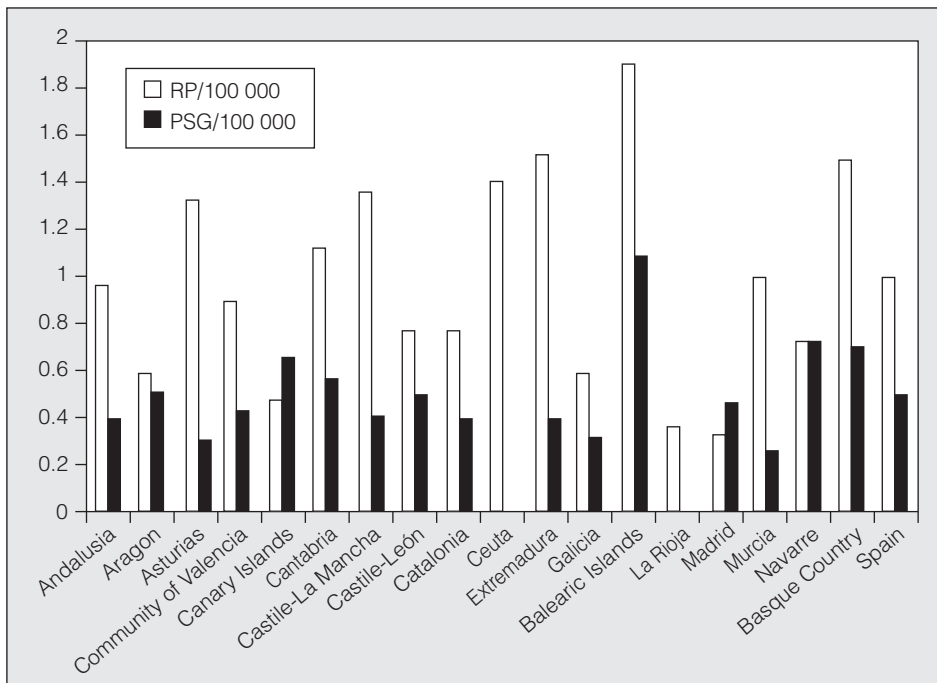


Figure 3. Number of respiratory polygraphy (RP) and polysomnography (PSG) systems per 100 000 inhabitants in each autonomous community and in Spain as a whole.

The logistics systems most frequently used throughout Spain for home RP were patients collecting and returning devices to the hospital (in 48% of cases) and obtaining them through suppliers of CPAP systems for RP (in 47% of cases). About 2% of patients obtained RP studies through hospital staff, while 3% used other means.

Only 18% of the hospitals that performed RP had a technician to read recordings made by the device. The

mean percentage of RP recordings read by such in-hospital technicians was 83% (25%). Of the hospitals that had RP but not PSG systems, 74% had an established referral relationship with hospitals with PSG available. Sixty-eight percent of these hospitals were satisfied with the relationship.

In 80% of the 188 hospitals that performed either RP or PSG the supervisor of the sleep unit was a pneumologist.

TABLE 3  
Results for Auto-Titrating Continuous Positive Airway Pressure (CPAP) Devices\*

	No. of Hospitals	No. of Auto-Titrating CPAP Devices	Auto-Titrating CPAP Devices/Hospital†	Auto-Titrating CPAP Devices/100 000 Inhabitants	Delays for Automatic Titration Studies, d†	Automatic Titration Studies/Hospital/Year†	Automatic Titration Studies/Year/100 000 Inhabitants†	Automatic Titration Studies/Year/Auto-Titrating CPAP Device†	Home Automatic Titration Studies/Year, %†
Andalusia	12	29	2.4 (2.2)	0.37	67 (127)	99 (77)	9.4	48 (47)	100
Aragon	7	8	1.1 (0.4)	0.66	8.9 (10)	17 (16)	9.9	13 (7.5)	100
Asturias	1	1	1	0.09	0	20	1.9	20	100
Autonomous Community of Valencia	6	11	1.8 (1.2)	0.24	47 (42)	172 (80)	21	95 (34)	25 (50)
Canary Islands	3	3	1	0.18	50 (35)	81 (54)	14	81 (54)	75 (43)
Cantabria	1	4	4.3	0.75	0	82	15	20	100
Castile-La Mancha	6	6	1	0.34	243 (211)	56 (62)	16	56 (62)	40 (55)
Castile-León	5	12	2.4 (1.1)	0.77	36 (65)	110 (128)	18	39 (42)	61 (51)
Catalonia	27	38	1.4 (0.8)	0.60	44 (43)	114 (74)	43	85 (49)	47 (48)
Extremadura	1	4	4	0.38	14	320	30	80	100
Galicia	6	10	1.7 (1)	0.37	186 (309)	127 (81)	28	84 (64)	78 (40)
Balearic Islands	5	13	2.6 (1.7)	1.54	70 (96)	301 (388)	179	82 (110)	68 (53)
La Rioja	2	2	1	0.72	7.5 (3.5)	25 (7.1)	18	25 (7.1)	100
Madrid	4	10	2.5 (0.6)	0.18	9.3 (8.3)	125 (152)	6.9	44 (49)	68 (55)
Murcia	2	3	1.5 (0.7)	0.25	265 (332)	150 (71)	25	100	50 (71)
Navarre	2	3	1.5 (0.7)	0.54	365	87	16	44	75
Basque Country	4	9	2.3 (1.5)	0.43	12 (16)	139 (119)	20	41 (36)	24 (35)
Spain	94	166	1.8 (1.2)	0.55(0.33)†	63 (118)	116 (130)	28 (39)†	65 (54)	63 (46)

\*One hospital in the Autonomous Community of Valencia, 1 in Castile-La Mancha, 1 in Catalonia, 1 in Navarre, and 3 in Andalusia did not answer the questions regarding delays, number of automatic titration studies performed per year, or percentage of those performed at home. †Data are expressed as mean (SD).

TABLE 4  
Results for Polysomnography (PSG)\*

	No. of Hospitals with Conventional PSG Systems	PSG Beds/Hospital†	Total PSG Beds	PSG Beds‡/100 000 Inhabitants	Delay for Diagnostic PSG, d†	Delay for Titration PSG, d†	PSGs/Year†	PSGs/Year/100 000 Inhabitants	PSGs/Year/Hospital/PSG Bed†
Andalusia	13	2.2 (1)	29	0.39	250 (257)	107 (159)	402 (348)	66	174 (103)
Aragon	4	1.5 (0.6)	6	0.50	38 (44)	38 (44)	185 (201)	61	111 (94)
Asturias	2	1.5 (0.7)	3	0.28	250 (325)	0	287 (372)	54	149 (147)
Autonomous Community of Valencia	10	1.8 (1)	18	0.43	90 (88)	98 (118)	271 (207)	52	165 (97)
Canary Islands	7	1.6 (0.5)	11	0.65	188 (246)	19 (18)	166 (118)	69	109 (70)
Cantabria	1	3	3	0.56	60	45	300	56	150
Castile-La Mancha	5	1.4 (0.5)	7	0.40	541 (143)	47 (15)	155 (67)	35	109 (38)
Castile-León	7	1.7 (0.8)	12	0.49	134 (124)	25 (33)	259 (248)	74	133 (96)
Catalonia	15	1.7 (0.6)	25	0.39	164 (186)	54 (69)	228 (207)	54	122 (84)
Extremadura	2	2	4	0.38	183 (118)	100	460 (240)	87	230 (120)
Galicia	5	1.6 (0.5)	8	0.30	236 (166)	158 (228)	221 (191)	41	134 (87)
Balearic Islands	5	1.8 (0.5)	9	1.07	105 (122)	108 (166)	300 (181)	178	155 (82)
Madrid	11	2.2 (1.1)	24	0.44	107 (86)	60 (75)	304 (178)	56	148 (76)
Murcia	2	1	4	0.25	10	50	4.20	50	
Navarre	2	2	4	0.71					
Basque Country	6	2.3 (1.9)	14	0.67	82 (68)	93 (74)	276 (201)	79	141 (111)
Spain	97	1.9 (0.9)	180	0.49 (0.20)‡	166 (186)	72 (105)	279 (222)	64 (36)‡	140 (88)

\*One hospital in Andalusia, 1 in Castile-La Mancha, 1 in Madrid, 1 in Murcia, 2 in the Autonomous Community of Valencia, and 2 in Navarre did not answer the questions regarding delays or number of PSGs performed per year. †Data are expressed as mean (SD).

This figure reached 90% when both supervisors and cosupervisors were considered. Only 32% of these 188 hospitals took a multidisciplinary approach to sleep disorders. The supervisors or cosupervisors of the 97 sleep units that performed PSG were pneumologists in 82% of the cases. The approach was multidisciplinary in 53% of the 97 hospitals.

Not all the autonomous communities had hospitals with auto-titrating CPAP devices (Table 3). The national mean number of such devices per 100 000 inhabitants was 0.55 (0.33) (Table 3). The mean waiting period for an automatic titration study was 63 (118) days (range, 0-365 days) —68 (123) days in public hospitals and 17 (16) days in private hospitals.

The national mean number of automatic titration studies performed yearly per hospital was 116 (130) (range, 17-320). (Table 3). Of the total number—such studies performed, 63% (46%) (range, 24% to 100%) were performed in the patient's home. The mean number of automatic titration studies performed yearly per auto-titrating CPAP was 65 (54) (range, 13-100).

#### Results for the Third Part of the Questionnaire

There were hospitals offering PSG in all of the autonomous communities except La Rioja and the autonomous cities of Ceuta and Melilla. In the 97 hospitals with PSG available, the mean delay was 166 (186) days (range, 10-541 days) for diagnostic PSG, and 72 (105) (range, 0-158 days) for titration PSG (Table 4 and Figure 2). The mean delay was 205 (193) days for diagnostic PSG and 87 (114) days for titration PSG in public hospitals, and 42 (83) and 14 (14) days in private hospitals.

The national mean number of PSG beds per 100 000 inhabitants was 0.49 (0.20) (Table 4 and Figures 2 and 3). The mean annual number of PSG studies performed per hospital was 279 (222) (range, 50-460). Once the number of PSG studies was adjusted for the number of beds available, the annual yield was 140 (88) (range, 50-230) studies per PSG device.

Forty-five percent of the hospitals reported lacking some of the necessary resources in their sleep unit (Figure 4): nighttime technical staff was needed in 8%, daytime medical staff in 24%, temperature control in 24%, and monitoring control stations in 13%. Other useful resources were lacking: There was no day hospital for the administration of CPAP in 57% of the units. There was a shortage of administrative staff in 63% and of daytime technicians for the reading of PSG recordings in 67%. About 77% (28%) of the recordings were read by such technicians. The mean national ratio of technicians/PSG beds during the night was 0.58 (0.29).

Thirty percent of the hospitals offering PSG did not perform studies on patients with suspected nonrespiratory sleep disorders and 62% had no established referral relationship with hospitals that had only RP devices.

#### Discussion

The present study was the second to evaluate delays in diagnosis of SAHS in Spanish hospitals and the fifth to evaluate resources since 1994. As in the previous studies, we observed a considerable disparity between hospitals and between autonomous communities. While diagnostic resources have improved compared to previous studies (Figure 2), waiting periods are still longer than desirable.

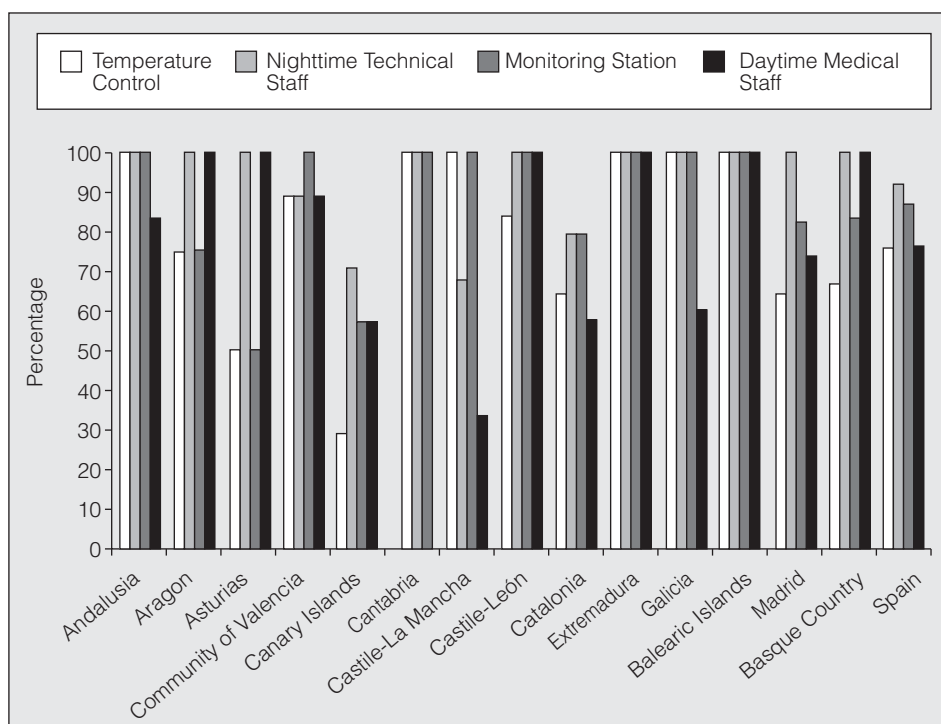


Figure 4. Resources needed by sleep units performing polysomnography, expressed as percentages of total for autonomous communities and for Spain as a whole. Data are not available for the communities of Navarre and Murcia.

As expected, delays were considerably longer in public hospitals than in private ones. Mean delays for the first consultation and examination were shorter than in 2002 (Figure 2), although the delays of 61 days for the first consultation and 60 days for successive consultations were longer than desirable. The number of days dedicated to consultations for evaluating SAHS should therefore be increased.

Referral from primary care facilities was considered appropriate or more than adequate by 74% of the hospitals. While this percentage might exceed a mere satisfactory grade and is better than the situation seen in previous studies,<sup>31</sup> action should be taken to improve referral processes through better coordination between primary and specialized care, with agreed-upon protocols.

The number of RP devices increased compared to previous studies (Figure 2), but the mean number of devices available is still low—0.99 instead of the recommended 3 per 100 000 inhabitants. As a consequence, the delay for RP was long and has increased slightly compared to 2002. (Figure 2). In order to reduce this delay from 224 to 30 days, resources would have to be multiplied by 7. However, the annual number of RP studies performed with each device was only 127. Bearing in mind that in practice these devices can work about 250 days a year (excluding weekends and vacation periods), the yield of the RP devices was probably about 51%. Therefore, if we made the most of the available RP devices, we would only need to increase their number by 3 rather than 7 in order to shorten the waiting period to 30 days. This would coincide with the above-mentioned recommendation of 3 systems per 100 000 inhabitants. One possible explanation for the low

yield of RP devices is that only 18% of hospitals had a specialized technician to read their outputs. This limited the number of studies that could be performed.

Almost half of the logistics systems used for home RP studies involved the use of commercial CPAP suppliers. This manner of distribution offers the advantage of not requiring that patients travel, but it is of the utmost importance that the hospitals choose the RP devices used, carry out the reading of RP recordings, and take the therapeutic decisions.

While PSG is the gold standard test, RP is currently an accepted method for the diagnosis of SAHS,<sup>18-20</sup> although we still need broad studies to determine the real cost-effectiveness of home RP for diagnosis.<sup>20</sup> However, 51% of RP studies were performed unattended in the home, doubtless due to the pressure of waiting lists, as occurs in other European countries where public health care is the rule.<sup>31,33</sup>

Today automatic titration is a standard procedure<sup>27</sup> and its use is increasing rapidly. The number of auto-titrating CPAP devices needed has not been established formally, but given that automatic titration is possible in 70% of patients who are candidates for CPAP<sup>27</sup> and that such patients represent about 50% to 60% of those referred for suspected SAHS, the number of such devices needed could be estimated to be about 1.5 per 100 000 inhabitants instead of the current 0.55.

As with RP, delays for PSG varied widely from one community to another. The mean delay in Spain (166 days) decreased compared to a previous study<sup>31</sup> (Figure 2), but was still longer than desirable. We would therefore need to multiply the number of PSG beds by 5 in order to shorten the waiting period to about 30 days. However, as with RP devices, the yield of a PSG bed was less than ideal. The

mean annual number of PSG studies per bed was 140, while the ideal number would be 250. If we could get maximum use from PSG equipment, we would have to more than double the number of PSG beds. This would coincide with the above-mentioned recommendation of at least 1 PSG bed per 100 000 inhabitants. There has been no increase in the number of PSG beds in the last few years (Figure 2), and we need to make this a priority.

The situation in hospitals offering PSG is far from ideal.<sup>19,34</sup> Forty-five percent of sleep laboratories lack some of the necessary resources. There is a shortage of daytime technicians for the reading of PSG recordings in 67% of them and a shortage of administrative personnel in 63%. Due to the staff shortfall, the functioning of some of these sleep units is not very cost-effective and on many occasions the physician takes on roles or functions that technical or auxiliary staff could handle. Such shortages can no doubt account at least partially for the low yield of PSG beds mentioned earlier.

The percentage of hospitals offering RP but not PSG that had established relations with referral hospitals where PSG was available increased compared to earlier studies. However, 26% of these had no established referral relationship. In turn, the majority (62%) of hospitals offering PSG had no such relationship with hospitals with only RP available. It is the responsibility of hospitals offering PSG to actively seek to coordinate their services with hospitals in their area that offer RP only.

SAHS and sleep disorders in general are by their very nature multidisciplinary, and it is therefore surprising that 47% of hospitals that offer PSG do not take a multidisciplinary approach. Improvement in this area should be one of our goals.

The results of this study showed a tendency towards a lower percentage of PSG availability in public hospitals than in private ones, where the percentage of RP availability was lower. Given that the recommendation is for 3 RP devices for each PSG bed, it would appear that public hospitals were more efficient. This can no doubt be explained in part by the delays.

Compared to other countries the number of PSG beds and studies performed annually per 100 000 inhabitants are probably similar to that of England; and less than that of Belgium, Australia, the United States of America, and Canada (Table 5).<sup>33</sup> With regard to delays for PSG, Spain

occupies an intermediate position, probably due to greater use of RP.<sup>31,33</sup>

In view of the fact that we were able to contact 95% of Spanish hospitals, we can affirm that our results are representative of the situation in the country. For some autonomous communities, however, some data were missing, or sample sizes were too small to allow us to affirm that the data are representative. This was the case for data on delays and automatic titration studies per year in the Spanish autonomous community of Navarre and on PSG in the communities of Murcia and Navarre. A common weakness in this type of study is the veracity of the responses given by each hospital. This limitation was minimized, in part, because the person in each subcommittee who was responsible for obtaining the completed survey was familiar with the situation in the area and provided, in fact, a way to check the information. Another factor that also mitigated the impact of possible erroneous data was the size of the study sample.

In summary, we observed considerable differences regarding the situation of SAHS diagnosis between the various hospitals in Spain and between autonomous communities. Considering the overall picture, it is clear that resources are inadequate, and this has led to low yield and unacceptable waiting lists. While there has been a favorable change in the situation regarding SAHS diagnosis compared to previous studies, there is still room for improvement and it is urgent that health care authorities allocate more resources to this important public health problem. First we need to optimize the use of existing sleep laboratories and equipment and then provide more equipment for the diagnosis of SAHS.

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TABLE 5  
Polysomnography (PSG) in Spain Compared With Other Developed Countries\*

	No. of Hospitals Offering PSG/ 100 000 Inhabitants	No. of PSG Beds/ 100 000 Inhabitants	No. of PSGs/Year/ 100 000 Inhabitants	Delays for PSG, mo
United Kingdom	0.14	0.3	42	7-60
Belgium	0.5	1.5	177	2
Australia	0.34	1.3	288	3-16
USA	0.46		427	2-10
Canada	0.32	1.4	370	4-36
Spain	0.24	0.5	64	1-18

Taken from Flemons et al.<sup>33</sup>



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APPENDIX  
Survey

**1.1. Part 1 (to be completed by all public or private hospitals or health care facilities that evaluate for suspected sleep apnea)**

- 1.1. Details of hospital or health care facility surveyed
- 1.1.1. Name of person supplying data
- 1.1.2. Name of hospital or health care facility:
- 1.1.3. Type of entity:  Public  Private
- 1.1.4. City: .....
- 1.1.5. Province: .....
- 1.1.6. Region: .....
- 1.2. Population served by your hospital or health care facility with regard to sleep apnea-hypopnea syndrome (SAHS)
- 1.2.1. Number: .....
- 1.3. How appropriate do you consider referral by primary care physicians of patients with suspected SAHS to be?
- 1.3.1. Very appropriate
- 1.3.2. Appropriate
- 1.3.3. Not very appropriate
- 1.3.4. Not at all appropriate
- 1.4. Delay (in days) for a first consultation for a patient with SAHS.
- 1.4.1 .....
- 1.5. Delay (in days) for a first examination for a patient with SAHS.
- 1.5.1 .....
- 1.6. Is respiratory polygraphy (RP) available?
- 1.6.1. Yes
- 1.6.2. No
- 1.7. Is polysomnography (PSG) available?
- 1.7.1. Yes
- 1.7.2. No

**2. Part 2 (to be completed if RP is available)**

- 2.1. Number of patients pending RP:
- 2.1.1.1.....
- 2.2. Delay (in days) for diagnostic RP:
- 2.2.1 .....
- 2.3. How many RP devices do you have?
- 2.3.1.1.....
- 2.4. How many RP studies do you perform per year?
- 2.4.1.1 .....
- 2.5. How many of these RPs are performed in the patient's home?
- 2.5.1.1.....

- 2.6. Which of the following logistics systems do you use for carrying out home RP?
- 2.6.1.1. Patients collect and return devices
- 2.6.1.2. Through suppliers of continuous positive airway pressure (CPAP) devices
- 2.6.1.3. Through hospital staff
- 2.6.1.4. Through transport service providers
- 2.6.1.5. Others
- 2.7. Do you have a technician for the reading of RP recordings?
- 2.7.1.1. Yes
- 2.7.1.2. No
- 2.8. If so, state the percentage of readings carried out by the technician
- 2.8.1.1. 100%
- 2.8.1.2. 75%
- 2.8.1.3. 50%
- 2.8.1.4. 25%
- 2.9. If you do not perform PSG, do you have an established referral relationship with a hospital that does?
- 2.9.1.1. Yes
- 2.9.1.2. No
- 2.10. If so, are you satisfied with the referral relationship?
- 2.10.1.1. Yes
- 2.10.1.2. No
- 2.11. Do you have auto-titrating CPAP devices?
- 2.11.1.1. Yes
- 2.11.1.2. No
- 2.12. If so,
- 2.12.1.1. How many such devices do you have? .....
- 2.12.1.2. How many automatic titration studies do you perform per year? .....
- 2.12.1.3. Delay (in days): .....
- 2.12.1.4. Percentage of home titration studies: .....
- 2.13. Is a multidisciplinary (teamwork) approach to sleep disorders available?
- 2.13.1.1. Yes
- 2.13.1.2. No
- 2.14. Your laboratory (or unit) is
- 2.14.1.1. supervised by a pneumologist
- 2.14.1.2. cosupervised by a pneumologist
- 2.14.1.3. supervised by another specialist
- 2.15. If you chose the third option for the above question, indicate what type of specialist other than a pneumologist supervises or cosupervises your laboratory or unit:
- 2.15.1 .....

APPENDIX  
Survey (continuation)

<b>3. Part 3 (to be completed if PSG is available)</b>	
3.1. Number of patients pending PSG: 3.2.1.1.....	3.9. Does your sleep laboratory or unit have rooms in which temperature can be controlled individually, a control station, specific daytime and nighttime staff (both medical and technical)? 3.9.1.1. Yes 3.9.1.2. No
3.2. Delay (in days) for diagnostic PSG: 3.2.1.1.....	
3.3. Delay (in days) for titration PSG: 3.3.1.1.....	3.10. If not, specify which of the above you do not have: 3.10.1.1. ....
3.4. How many PSG beds do you have? 3.4.1.1.....	3.11. Do you have a full- or part-time secretary for the sleep laboratory or unit? 3.11.1.1. Yes 3.11.1.2. No
3.5. How many PSG per year do you perform? 3.5.1.1.....	
3.6. Indicate the ratio of technicians to beds for nighttime studies: 3.6.1.1...../.....	3.12. Do you have a day hospital to administer (or handle problems with) CPAP? 3.12.1.1. Yes 3.12.1.2. No
3.7. Do you have a daytime technician to read PSG recordings? 3.7.1.1. Yes 3.7.1.2. No	3.13. Do you perform PSG to evaluate nonrespiratory sleep disorders? 3.13.1.1. Yes 3.13.1.2. No
3.8. If so, state the percentage of readings carried out by the technician 3.8.1.1. 100% 3.8.1.1. 75% 3.8.1.1. 50% 3.8.1.1. 25%	3.14. Do you have an established referral relationship with sleep laboratories or units that only have RP? 3.14.1.1. Yes 3.14.1.2. No