

# Approach To The Cost Of Polysomnography In A Spanish Hospital

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## Abstract

**AIMS:** Overnight polysomnography (PSG) constitutes the gold standard in the diagnosis of sleep disorders. PSG requires technology, personnel, dedication and experience. Mainly due to high personnel costs, PSG is considered expensive and exposed to monetary restrictions, making it not accessible to every hospital, especially in countries with universal health coverage. The aims of our study were to know the cost of PSG in our clinical setting, and to evaluate the way to reduce it.

**METHOD:** The cost of a single PSG was calculated from the price of 220 conventional PSG carried out by our Sleep Respiratory Disorders Unit during 1999. The imputable costs were obtained by the economic services from hospital stays, sleep technician salary and proportional part of medical attendance, annual paying-off for equipment investment, consumable material and repairs. The total cost was divided by the number of annual PSG to obtain the final price in Euros (€) (1 € = 1.17 \$). The price of PSG was again calculated, considering hiring a second technician to duplicate the number of annual studies, and including the forthcoming proportional increase of the global costs generated.

**RESULTS:** The total cost of 220 PSG was 74920 € (88141 \$) that is distributed as: 23800 € from hospital stays (108,2 € per stay), 22537 € from full-time technician work, 18030 € from part-time Respiratory physician work, 9015 € from annual equipment paying-off and 1502 € from consumable material and repairs. The final price of PSG in 1999 was 340 € (400 \$). The calculated cost of 440 annual PSG, hiring a second technician and with a full-time Respiratory physician would amount 141355 € (166300 \$), being the final cost of PSG 321 € (378 \$).

**CONCLUSIONS:** We conclude that an increase in personnel costs (medical and technician) may paradoxically reduce the cost of PSG since it allows to use the technical resources in a cost-effective way.

## INTRODUCTION

Sleep apnea syndrome (SAS) constitutes a public health problem in developed countries due to its high prevalence<sup>(1,2,3)</sup> and to its consequences over mortality<sup>(4,5,6)</sup>, morbidity<sup>(7,8,9)</sup>, spending of health resources<sup>(10)</sup> and impairing work, driving and social interaction<sup>(11,12,13)</sup>. Overnight polysomnography (PSG) is considered the gold standard diagnostic tool to approach sleep disorders<sup>(14,15)</sup>. PSG requires technology, experience, personnel and it is time-consuming, for all of these it has been considered expensive and very often it has suffered monetary restrictions especially in countries with universal health coverage. Those limitations have restricted its accessibility to all hospitals claiming for its high costs, not only in equipment but also in personnel.

The first step to diminish the price of a test is the cost

analysis, only after that approach we would be able to get more efficient and money-saving systems. These lines of arguments could be used for the clinician, not only for the diagnostic work-up of patients but also for his relationship with the hospital executive office, in these times of managed care medicine.

The objective of our study was to know the price of a PSG in our place and to study the way to reduce it.

## METHODS

Our Sleep Unit is part of the Respiratory Department located in a 450-beds University Hospital in Alicante (Spain). The unit has assigned two beds for PSG, which are managed by the Central Admission Unit, in charge of all clerical work related to program any admission. The equipment of the Unit consists of a level I system (Somnostar-alfa, Sensor Medics)

and a level II system (Sleep-IT, Jaeger) which are run by direct supervision of a nurse. Her daily schedule (from nine p.m. until nine a.m.) and labor restrictions limit the total number of nights to 110 per year. A part-time (20 hours/week) pulmonary physician belongs to the Sleep Unit, being responsible for the scoring of sleep studies, the reviewing of CPAP titration and the outpatients' management.

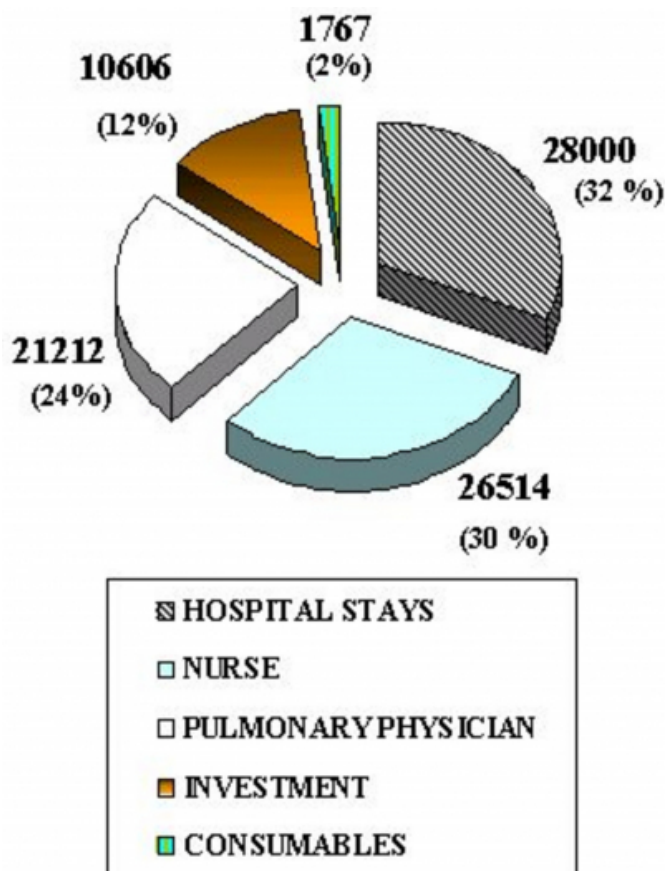
The cost of one PSG has been calculated from 220 PSG performed in our Unit during 1999. The economical department has provided us with the costs, which include hospital stays, structural costs, salaries (clerical, nurse, and physician), annual paying-off for investment, one-use material and repairs. The final cost has been divided by the number of PSG performed in one year in order to know the price of any PSG. Subsequently we have recalculated the cost of one PSG, if we would have duplicated the sleep studies in one year providing we would hire a second nurse and a full-time pulmonary physician, plus the increase in one-use materials. The prices have been calculated in Euros (€) and US dollars (\$) (1 dollar = 0.85 €) (rates of October 2000).

**RESULTS**

The total price of 220 PSG in 1999, in our institution, was 74920 € (88141 \$). This amount is divided in the following sections: Hospital stays 23800 € (28000 \$) (one day 108.2 €), nurse salary 22537 € (26514 \$), part-time pulmonary physician salary 18030 € (21212 \$), annual paying-off for investment 9015 € (10606 \$) and one-use material and repairs 1502 € (1767 \$). Finally, the price for one PSG in 1999 was 340 € (400 \$). Total amounts of any section and percentages of individual contribution to the whole cost of PSG are shown in Figure 1.

**Figure 1**

Figure 1: Individual contribution (US dollars) of any section to total cost of polysomnography



The cost of 440 PSG in one year after hiring a second nurse and a full-time pulmonary physician would be 141355 € (166300 \$). The sections are divided as follows: Hospital stays 47599 € (55999 \$), two-nurse salary 45075 € (53029 \$), full-time pulmonary physician salary 36060 € (42424 \$), paying-off for investment 9015 € (10606 \$) and materials and repairs 3005 € (3535 \$). The final price of one PSG with our approach would be 321 € (378 \$).

**DISCUSSION**

Our knowledge about sleep disorders has increased steeply during the last decade. PSG remains as the gold standard diagnostic tool for SAS patients and the number of such patients referred to sleep units is also growing very fast generating enormous waiting lists. This phenomenon is not limited to our country and it seems to be a universal problem (16,17,18).

Limited resources and waiting lists in sleep units (18,19) lead to search for other diagnostic tools besides 'traditional' PSG as hospital or home respiratory polygraphy (20,21), diagnostic or therapeutic mode auto-CPAP (22,23) or nocturnal oximetry

(<sub>24</sub>). When patients have a high suspicion of SAS they may be studied with these simplified techniques, nevertheless PSG remains as confirmatory diagnostic procedure not only for SAS, but also for other sleep disorders as the upper airway resistance syndrome, primary parasomnias, etc., or as a research tool (14,15). In any sleep unit diagnostic methods are used in a prioritized way based in their human or technical resources.

The situation in Spain as in some parts of Europe shows differences about the diagnostic work-up and the therapeutic approach to sleep disorders. Those differences are mainly due to technical and human availability of sleep units (18,19). This provokes waiting time to undergo PSG, which could be considered in some instances inadmissible (<sub>25</sub>). In a general way, it can be said that the resources are under-used, so increasing the costs of PSG. This provokes a vicious circle that is argued against new sleep units by the economic departments of hospitals.

Our study shows that the cost of PSG may be lowered, paradoxically, after increasing investment in personnel (nurse and physician), due to a better use of technical resources.

References about costs of PSG are scarce in the scientific literature. Durán et al (<sub>26</sub>) presented in 1994 the cost of one PSG in 415 € (488 \$), which was calculated after 150 studies. Parra et al (<sub>27</sub>) showed a cost of 315 € (371 \$) for one PSG based in 200 studies in one year, and 108 € (127 \$) for simplified home-based studies. They conclude that the first approach in the study of sleep disorders should be those home-based tests, mainly due to its cost-effectiveness. In the UK, according to Bradley et al (22) the cost of one PSG (also based in 200 studies in one year) was 210 € (247 \$) without including the expenses of one night of hospitalization. The investment was calculated in 36740 € (43224 \$) with a paying-off in 5 years. In their study about the efficacy, from the economical view, of home oximetry as diagnostic tool for SAS patients, Epstein and Dorlac (<sub>28</sub>) presented the total cost of one patient in 1123 € (955 \$), which includes one night for diagnosis and a second night for titration of CPAP. Calculated from that the price of one PSG in their institution is 478 €, which is higher than european prices. Chervin et al (<sub>29</sub>) found the price of one PSG between 1000 and 1400 \$ (850 and 1190 €), mean 1190 \$ (1012 €) for diagnostic PSG or for titration. Their study was designed to evaluate the utility in diagnosing SAS

expressed as quality-adjusted life-years. The authors concluded that PSG is superior in terms of cost-utility compared to home based studies or not testing.

As it happens in our environment, since 1991 to 1994 the number of patients referred to sleep units from primary care has increased around 30% in USA, which has elevated the total cost of sleep disorders, in spite of strategies to control expenses as study of only respiratory parameters or home CPAP titration (<sub>30</sub>). Nevertheless, as it has been demonstrated (29), PSG is cost-effective in comparison to any other diagnostic tests due to differences in specificity and sensibility of the techniques, based in the differences in prevalence of sleep disorders in the studied population. The authors suggest that the more precise and more expensive test as PSG provide better outcomes from the patient's perspective, but also represents a cost-effective option.

We conclude that PSG is an important technique in a hospital and it justifies the investment in human and technical resources in order to improve its efficiency and to decrease the final price.

### CORRESPONDENCE TO

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### References

1. Phillipson AE. Sleep apnea. A major public health problem. *N Eng J Med* 1993;328:1271-1273.
2. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *N Eng J Med* 1993;328:1230-1235.
3. Marin JM, Gascon JM, Carrizo S, Gispert J. Prevalence of sleep apnoea syndrome in the Spanish adult population. *Int J Epidemiol* 1997;26:2:381-386.
4. He J, Kryger Mh, Zorick Fj, Conway W, Roth T. Mortality and Apnea Index in Obstructive Sleep Apnea. Experience in 385 Male Patients. *Chest* 1988;94:9-14.
5. Partinen M, Jamieson A, Guilleminault C. Long-term Outcome for Obstructive Sleep Apnea Syndrome Patients. Mortality. *Chest* 1988;94:1200-1204.
6. Lindberg E, Janson C, Svärdsudd K, Gislason T, Hetta J, Boman G. Increased mortality among sleepy snorers: a prospective population based study. *Thorax* 1998;53:631-637.
7. Gottlieb DJ, Whitney CW, Bonekat WH, Iber C et al. Relation of Sleepiness to Respiratory Disturbance Index. The sleep Heart Health Study. *Am J Crit Care Med* 1999;159:502-507.
8. D'Ambrosio C, Bowman T, Mohsenin V. Quality of life in patients with obstructive sleep apnea: effect of nasal continuous positive airway pressure: a prospective study. *Chest* 1999;115:123-129.
9. Peker Y, Kariczi H, Hedner J, Loth S, Johansson A,

- Bende M. An independent association between obstructive sleep apnoea and coronary disease. *Eur Respir J* 1999;14:179-84.
10. Ronald J, Delaive K, Roos L, Manfreda J, Bahaammam A, Kryger MH. Health care utilization in the 10 years prior to diagnosis in obstructive sleep apnea syndrome patients. *Sleep* 1999;22:225-229.
11. Barbé F, Pericás J, Muñoz J, Findley L, Antó JM, Agustí AGN, de Lluç M. Automobile Accidents in Patients with Sleep Apnea Syndrome. An Epidemiological and Mechanistic Study. *Am J Respir Crit Care Med* 1998;158:18-22.
12. Cassel W, Ploch T, Becker C, Dugnus D, Peter JH, von Wichert P. Risk of traffic accidents in patients with sleep-disordered breathing: reduction with nasal CPAP. *Eur Respir J* 1996;9:2606-2611.
13. Teran-Santos J, Jimenez-Gómez A, Cordero-Guevara J. The association between sleep apnea and the risk of traffic accidents. Cooperative Group Burgos-Santander. *New Eng J Med* 1999;340:847-851
14. Chesson AL, Ferber RA, FRY JM, Grigg-Damberger M et al. An American Sleep Disorders Association Review. The Indications for polysomnography and Related Procedures. *Sleep* 1997;20:423-487
15. Barbé F, Amibilia J, Capote F, Durán J et al. Diagnóstico del síndrome de apneas obstructivas durante el sueño. Informe de Consenso del Area de Insuficiencia Respiratoria y Trastornos del Sueño. *Arch Bronconeumol* 1995;31:460-462
16. Teschler H, Berthon-Jones M. Full polysomnography versus home sleep study: searching for the optimal procedure. *Eur Respir J* 1997;10:1699-1700.
17. Pack AI, Gurubhagavatula I. Economic Implications of the Diagnosis of Obstructive Sleep Apnea. *Ann Intern Med* 1999;130:533-534.
18. Chiner E, Blanquer J, Arriero JM, Marco J. Síndrome de apnea de sueño en la Comunidad Valenciana: situación actual, estudio de necesidades y perspectivas de futuro. *Arch Bronconeumol* 1998;34:177-183
19. Duran J, Amibilia J, Barbe F, Capote F et al. Disponibilidad de recursos técnicos para el diagnóstico y tratamiento del síndrome de apnea obstructiva del sueño en los hospitales de la red pública del Estado. *Arch Bronconeumol* 1995;31:463-469.
20. Montserrat JM, Alarcon A, Lloberes P, Ballester E, Fornas C, Rodriguez-Roisin R. Adequacy of prescribing nasal continuous positive airway pressure therapy for the sleep apnoea/hypopnoea syndrome on the basis of night time respiratory recording variables. *Thorax* 1995;50:969-971.
21. Lloberes P, Montserrat JM, Ascaso O, Parra A et al. Comparison of partially attended night time respiratory recordings and full polysomnography in patients with suspected sleep apnea/hypopnea syndrome. *Thorax* 1996;51:1043-1047.
22. Bradley PA, Mortimore IL, Douglas NJ. Comparison of polysomnography with Res Care Autoset in the diagnosis of the sleep apnoea/hypopnoea syndrome. *Thorax* 1995;50:1201-1203.
23. Lloberes P, Ballester E, Montserrat JM, Botifoll et al. Comparison of manual and automatic CPAP titration in patients with sleep apnea syndrome. *Am J Respir Crit Care Med* 1996;154:1755-1758.
24. Chiner E, Signes-Costa J, Arriero JM, Marco J, Fuentes I, Sergado A. Nocturnal oximetry for the diagnosis of sleep apnoea-hypopnoea syndrome: a method to reduce the number of polysomnographies ?. *Thorax* 1999;54:968-971.
25. Chiner E. ¿Quién debe coordinar una unidad de patología del sueño?. *Rev Neurol (Barc)* 1996;24:111-114.
26. Durán J, Esnaola S, Rubio R, Betolaza J. Polisomnografía y/o poligrafía respiratoria (MESAM IV): análisis de costes. *Arch Bronconeumol* 1995; 31 (supl 1): 28.
27. Parra O, García.Esclasans N, Montserrat JM, García-Eroles L, Ruiz J, López JA, Guerra JM, Sopeña JJ. Should patients with sleep apnoea/hypopnoea syndrome be diagnosed and managed on the basis of home sleep studies. *Eur Respir J* 1997;110:1720-1724.
28. Epstein LJ, Dorlac GR. Cost-effectiveness Analysis of Nocturnal Oximetry as a Method of Screening for Sleep Apnea-Hypopnea Syndrome. *Chest* 1998;113:97:103.
29. Chervin RD, Murman DL, Malow BA, Totten V. Cost-Utility of Three Approaches to the Diagnosis of Sleep Apnea: Polysomnography, Home Testing, and Empirical Therapy. *Ann Intern Med* 1999;130:496-505.
30. American Thoracic Society/American Sleep Disorders Association. Statement on Health Outcomes Research in Sleep Apnea. *Am J Respir Crit Care Med* 1998;157:335-341.

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