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Scientific letter

Apnea Virtual Lab: A Community-Based Sleep Apnoea Management Programme

Apnea Virtual Lab, un programa comunitario de gestión de la apnea del sueño

Dear Editor,

Obstructive sleep apnoea (OSA) is a chronic sleep disorder, with a 12% prevalence of treatable OSA in middle-aged adults[1,2] and 80% of cases going undiagnosed.[3] It is associated with an increased risk of motor vehicle accidents and life-threatening cardiovascular and metabolic comorbidities. It may be considered a hidden pandemic with a high economic impact, estimated at $150 billion in the US.[4]

In our health area, upwards of 25,000 people are unaware that they suffer from treatable OSA. If all of them were diagnosed and treated, savings could amount to around €96 million.

Apnea Virtual Lab (AVL) is a community-based OSA management programme in adults. It was developed at Araba University Hospital Sleep Unit in Vitoria, Spain, serving a population of 340,000 people.

This programme seeks to reduce undiagnosed OSA, improve quality of life among patients and contribute to the sustainability of the public health system.

We have developed an ongoing, simplified, outpatient and virtual healthcare process which improves efficiency without losing quality. It is based on four criteria: lean methodology for continuous improvement to obtain maximum operational efficiency; learning-by-doing methodology in a real and specific context; eHealth, with a commitment to virtual processes, the use of information and communication technologies (ICTs) as well as telemedicine tools; networking with physicians in our health area to coordinate screening and referral protocols.

Raising sleep awareness and OSA training is the first step of our process followed by screening, diagnosis and therapy decision. The final part is monitoring adherence and effectiveness of these treatments.

We use quality indicators to measure and track the efficiency of each stage of the process.

We present this observational study based on real world data from our clinical practice. With these data, we test the effectiveness of the programme in reducing undiagnosed OSA and the potential savings for the healthcare system over the last three years (2019–2021). Data collection follows the established ethical and legal considerations, with the informed consent from patients.

The diagnostic process begins with a screening in adults suspected of having OSA due to related symptoms or physical examination findings and the active search for cases in persons with OSA-associated comorbidities, obesity or high-risk jobs. The screening follows a protocol agreed with primary care and specialist doctors in our health area, based on the STOP-Bang questionnaire (SB).[5] Patients are referred through electronic health record (EHR).

Once we assess this information, cases with a medium-high pre-test probability (SB score ≥ 3) are included in the AVL programme and a home sleep apnoea test (HSAT) is ordered. Cases with a low pre-test probability, previous OSA diagnosis or with indication for polysomnography study due to severe and/or unstable cardio-respiratory pathology or suspicion of comorbid sleep disorder are excluded from this programme.

With this first virtual improvement solution, we avoid the first face-to-face sleep consultation and reduce the diagnostic cycle time per patient.

We perform HSATs with validated respiratory polygraphs.[6,7] Sleep technicians prepare the devices, show patients how to put them on and score the records according to AASM criteria[8] (v. 2.4, 2017). On the day of the test, we ask patients to fill a clinical questionnaire with PROM scales (patient-reported outcome measure) and the Epworth sleepiness scale to assess sleep quality, symptoms, and daytime sleepiness.

Once the study is completed, a doctor reviews the HSAT scoring, validates the test and prepares an interim diagnostic report. The OSA classification and indication for treatment follows the recommendations of the recently published international consensus document.[9] We schedule a medical visit (face-to-face or online) to confirm clinical data, answer questions and make a shared decision about the best treatment for OSA.

This programme is managed by a full-time pulmonologist and sleep physician (MAB), with part-time participation of the Sleep Unit (physicians, nurses, and administrative staff) and technicians of the respiratory therapy company.

Between 2019 and 2021, we evaluated 4128 patients for a sleep breathing disorder, including 2608 (63.2%) in AVL programme: 63% male, 43% obese, 44% with excessive sleepiness, 44% with high pre-test probability. Primary care referred 73% of the patients.

We diagnosed OSA (AHI ≥ 5 events/h) in 92% (mean AHI 27.6) and treatable OSA (AHI ≥ 15 events/h) in 1542 patients (62%), with positive airway pressure therapy indication in 59%.

It took an average of 25.4 weeks to complete the process of patient diagnosis (lead time) with an estimated cycle time of 113 min. The potential economic savings of diagnosing and treating these patients would amount to €5.7 million. Table 1 shows data disaggregated by year.

The two pandemic years (2020 and 2021) have had an impact on the annual trend in patient inclusion. Broadly, our data show no annual differences. However, a progressive reduction in lead time is observed, suggesting a satisfactory management of the AVL programme.

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Table 1
Clinical and demographic data of the population included in AVL programme.

Variable	2019–2021	2019	2020	2021
Patients in AVL programme	2608	902	620	1086
Men (%)	63	65	64	61
BMI (kg/m^2)	29.8	28.2	29.9	30.8
Obese (%)	43	34	42	49
EHR (%)	78	77	76	79
Primary health care (%)	73	73	73	72
SB avg	4.3	4.4	4.3	4.3
SB $\geq$ 5 (%)	44	46	44	42
ESS avg	10.1	10.3	10.4	9.3
ESS $\geq$ 11 (%)	44	46	47	38
AHI avg	27.6	29.4	27.1	26.1
AHI $\geq$ 30 (%)	34	37	33	32
OSA AHI $\geq$ 5 (%)	92	93	88	92
Treatable OSA AHI $\geq$ 15 (%)	62	66	60	60
Virtual visit (%)	54	0	0	54
PAP therapy (%)	59	61	58	58
Lead time (weeks)	25.4	34.7	28.1	14.5
Economic savings (€M)	5.7	2.2	1.4	2.1

BMI: body mass index, EHR: electronic health record, SB: STOP-Bang scoring, ESS: Epworth sleepiness scale, AHI: apnoea–hypopnea index, OSA: obstructive sleep apnoea, PAP: positive airway pressure, €M: million €.

For 2022, we plan two actions: an increase in OSA screenings and streamlining the diagnostic process to speed up access to treatment. We have requested the voluntary cooperation of other non-medical healthcare professionals (pharmacists,[10] dentists, nutritionists) to screen for OSA via an electronic form (Google Forms) accessed with a QR link. This allows for automatic screening and instant data submission.

We are considering the use of validated sleep wearable devices (SW).[11,12] They do not require training, provide automatic OSA diagnosis and offer the possibility of multi-night sleep testing.

We are working on a predictive model which estimates 60% prevalence of treatable OSA, an indication for a SW test in 85% of the patients included in the programme, and HSAT confirmation in 15% of SW test. With these data, we hope to achieve a 40% cycle time reduction allowing us to double the number of diagnostic processes in a calendar year without increasing human resources.

Once these data are analysed, we will be able to focus on new goals: assess the impact of new technologies, facilitate real-time decision making, establish new diagnostic strategies, explore opportunities to integrate artificial intelligence and machine learning or improve patient-centred sleep care.

Authors' contribution

All authors have contributed to, reviewed, and approved this manuscript to be submitted.

Informed consent

The authors confirm that written consent has been obtained from all patients.

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Conflicts of interest

The authors of this manuscript declare no relationships with any companies whose products or services may be related to the subject matter of the article.

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