

Success Rates in a Patient-Applied Home Sleep Testing Program

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ABSTRACT

PURPOSE:

The Center for Medicare and Medicaid Services has recently approved the use of limited-channel home sleep testing (HST) for the diagnosis of obstructive sleep apnea. In some cases, patients may be unable or unwilling to travel to a lab for application of a home testing device.

METHODS:

A program was developed to send a HST device to the patient's home for self-application. Patients were screened for appropriateness for HST. Patients considered inappropriate for HST were referred for a facility-based study. Patients were sent the ABM 'ARES', a combined questionnaire and 6-channel testing device. The device provides audio/visual indicators when the device requires adjustment. The device was sent to the patient's home with instructions for self-application. The patient was phoned by a specially-trained Respiratory Therapist at the patient's bedtime to review the instructions and answer questions. Calls were placed after the 1st and 3rd nights of testing to assess success. The patient was instructed to perform 3 nights of testing and ship the device to a sleep center for scoring and interpretation. Studies were assessed for adequate signal quality. Periods with significant loss of signal were removed before the analysis. Successful testing was defined as at least 2 hours of quality recording (all data channels) on at least 2 nights.

RESULTS:

Overall, 310 (94.8%) of 327 patients were successful in testing. Patients averaged 2.86 nights of testing during the 3 nights and averaged 5.93 hours of testing per night.

CONCLUSIONS:

The vast majority of patients are able to successfully self-apply the ARES device. A direct ship, self-application program can be successful when patients are properly screened and supported.

CLINICAL IMPLICATIONS:

A model utilizing self-application of a home sleep testing device can be useful in providing testing to large populations of patients suspected of having sleep apnea that may be unable or unwilling to travel to a facility-based lab.

INTRODUCTION

Obstructive Sleep Apnea (OSA) is a significant healthcare problem that affects 15 million Americans.^{1,2} Currently, it is estimated that 80 – 90% of moderate to severe OSA is undiagnosed³ and in some areas diagnosis and treatment may be delayed due to limited access to testing.⁴

The standard of care for the diagnosis of OSA has been attended polysomnography (PSG), but recently non-attended Home Sleep Testing (HST) using a limited montage of recorded data has been suggested as an alternative method of diagnosis in selected patients. The Center for Medicare and Medicaid Services (CMS) recently approved HST as an acceptable method of testing for qualification of reimbursement for positive airway pressure therapy (e.g., CPAP, Bilevel PAP).⁵

Home Sleep Testing has potential advantages to facility-based PSG including:

- Improved access
- Less delay in performing testing
- Less patient inconvenience (traveling to facility, discomfort of test)
- Reduced cost of testing

Multiple devices are available for home sleep testing with varied methods of attaching the device and leads to the patient. This purpose of our study was to validate the patient's ability to self apply one such device while capturing a sufficient amount of quality signal data for diagnosis.

METHODS

A program was developed to ship a home sleep testing device to the homes of patients of a Veterans Administration health facility for self-application. Prior to admission to the program, the patient was assessed by a sleep physician and deemed appropriate for home testing. Patients that were considered inappropriate for home testing were referred to a facility-based sleep lab.

Because of the concern with the patient's ability to self-apply the device, a testing device was chosen based on ease of application, ability to provide required testing channels, validation data against traditional PSG, and the ability to store multiple nights of testing. Patients were sent an ARES (Apnea Risk Evaluation System) Device (Advanced Brain Monitoring, Carlsbad, CA) which is a combined Apnea Risk Questionnaire and 6-channel testing device. Testing channels include:

- Blood oxygen saturation (SpO2)
- Pulse rate (reflectance pulse oximetry)
- Airflow (by nasal cannula connected to a pressure transducer)
- Respiratory effort (pressure transducer sensing forehead venous pressure)
- Snoring levels (calibrated acoustic microphone)
- Head movement and head position (accelerometers)

The device is slides over the head much like a baseball cap (Figure 1) with the only adjustment being head strap circumference. The monitor, which records the signals, rests on the forehead and the only other point of attachment is a nasal cannula for monitoring airflow. Once the device is in place, a switch activates testing with audio / visual indicators when the device is recording correctly. The device also alarms when it requires adjustment (poor signal, cannula dislodged, etc.).

Patients were notified in advance by both the VA hospital and by a phone call from the testing center that the testing device was being sent to their home. The device was sent with step-by-step written and pictorial instructions on how to apply and activate the device.

When the device was received, the patient was phoned by a specially-trained Respiratory Therapist at the patient's scheduled bedtime to review the instructions, talk the patient through the set up, and answer any questions. Patients were instructed to perform the testing for 3 successive nights. A follow up call was placed after the 1st night of testing to determine whether the patient was able to complete the night of testing and a phone call was repeated after the 3rd night. After 3 successful nights of testing the patient was instructed to return the device to a centralized sleep center in a pre-posted mailer for scoring and interpretation.

Studies were assessed for adequate signal quality. Periods with significant loss of signal were removed before the analysis. In accordance with CMS standards, our definition of 'successful testing' was at least 2 hours of good quality testing on all data channels. In addition, we required at least 2 hours of testing on 2 or more testing nights.

Demographics	
Male	93.3%
Female	6.7%
Average Age	56.5 years

RESULTS

Overall, 327 patients received home testing devices and 310 (94.8%) were successful in obtaining test data for at least 2 hours on 2 or more nights of the study. Of the 327, 17 (5.2%) patients were not successful in obtaining adequate data per our definition. Patients averaged 2.86 nights of testing during the 3 nights and averaged 5.93 hours of testing on each night.

Successful Test Nights	≥ 4 Hours Per Night	≥ 3 Hours Per Night	≥ 2 Hours Per Night
One or more nights	287 (87.8%)	302 (92.4%)	310 (94.8%)
Two or more nights	306 (93.6%)	311 (95.1%)	312 (95.4%)

Of the 17 patients that did not complete testing:

- 2 patients had 2 or more hours of testing on at least one night of testing
- 6 patients had insufficient data after the device was shipped for a second attempt
- 1 patient had insufficient data and refused a second attempt
- 3 patients had insufficient data but had previous illness or problems that hindered study (senility, facial injury)
- 5 patients could not tolerate wearing the device for testing

Of the 310 patients that were successful in testing, 75.6% were confirmed to have obstructive sleep apnea.

Patient satisfaction with home testing was high. A random sample of 73 patients tested revealed that 97.2% of patients rated their experience with home testing as "Very Satisfied" or "Extremely Satisfied". Details of the patients' satisfaction are being published in a separate abstract.



Figure 1. ARES Unicorder Sleep Testing Device

SUMMARY

- Of the 327 patients tested, 310 (94.8%) were able to successfully self-apply the device and obtain at least 2 hours of testing on 2 nights
- An additional 2 patients were able to obtain at least 1 night of testing for 2 hours
- Of those tested 75.6% were confirmed to have a diagnosis of obstructive sleep apnea
- Patient satisfaction with testing was high during random satisfaction surveys

CONCLUSIONS

The vast majority of patients in this study were able to successfully self-apply the ARES device and obtain adequate data for diagnosis. A direct ship, patient-applied home sleep testing program with an easy to apply testing device can be successful when patients are properly screened and supported.

CLINICAL IMPLICATIONS

A model utilizing self-application of a home sleep testing device can be useful in providing testing to large populations of patients suspected of having sleep apnea that may be unable or unwilling to travel to a facility-based lab.

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