[Original Research]

CHEST

Patient Engagement Using New Technology to Improve Adherence to Positive Airway Pressure Therapy

A Retrospective Analysis

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BACKGROUND: Sleep apnea has major neurocognitive and cardiovascular and metabolic risks. Treatment of sleep apnea is suboptimal because of variable adherence to existing therapies.

METHODS: This trial compared positive airway pressure adherence among patients who were provided active patient engagement (APE) technology vs those who received usual care monitoring (UCM). The primary outcome was expressed by using the US Medicare definition of adherence. Adherence data from two cloud-based databases (AirView and myAir) were analyzed for patients with sleep apnea. Data were included if a patient's activation date in the APE tool was within 7 days of the therapy start date in the UCM database during a defined time window. Data were propensity matched in a 1:2 ratio (APE:UCM) based on baseline patient characteristics.

RESULTS: A total of 128,037 patients were analyzed. Baseline characteristics were typical of a sleep clinic cohort. APE was associated with more patients achieving adherence criteria (87.3%) compared with UCM patients (70.4%; $P < .0001$ for the difference). Average therapy usage was 5.9 h per night in the APE group vs 4.9 h per night in the matched UCM patients ($P < .00001$). Patients with sleep apnea "struggling" with therapy adherence had a 17.6% absolute improvement in adherence using APE compared with UCM.

CONCLUSIONS: Robust therapy adherence rates can be achieved by adding modern technology to usual care. Adopting advances in technology in care management may allow clinicians to more effectively and efficiently treat patients who have sleep apnea. Rigorous randomized controlled trials may be required before making strong clinical recommendations.

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KEY WORDS: CPAP; lung; OSA; sleep-disordered breathing; sleep medicine

ABBREVIATIONS: AHI = apnea-hypopnea index; APE = active patient engagement; PAP = positive airway pressure; UCM = usual care monitoring

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OSA is a serious condition with major cardiovascular, metabolic, and neurocognitive sequelae.[1-4] Treatment with positive airway pressure (PAP) is highly efficacious because it generally eliminates respiratory events in adherent patients.[5] However, the effectiveness of PAP is limited by varying adherence to treatment.[6,7] Although the data vary, they suggest that PAP adherence may be optimized by using labor-intensive approaches such as detailed support and education.[8,9] However, reported adherence rates fluctuate widely, ranging from 50% to 80% depending on the study. Many patients also refuse to undergo diagnostic testing or never agree to therapy, emphasizing the need for further education and research into new treatment approaches.[10,11]

Technological improvements continue to be made, both in the PAP devices themselves and in their implementation using remote monitoring, exception management, and patient engagement.[12-14] PAP devices have become small and quiet, with built-in humidifiers and comfort features such as inspiratory support, expiratory pressure modulation, and pressure-ramping features.[12,15,16] Improvements in adherence with these technological advances have been modest, leading investigators to pursue new ways to engage patients to use their PAP device. For example, adherence of patients can be improved by direct feedback and motivation for activity (in the case of Fitbit) or for diet (in the case of iPhone calorie counts).[17,18] In the PAP arena, several technologies have been developed that allow patients to engage in their own care by monitoring adherence (eg, the PAP device displays previous night's usage) and providing direct feedback and coaching messages in real time. This approach can be tailored to provide both positive and negative feedback to the individual based on objective data. Another technology-related approach is to use a cloud-based platform that receives regular data updates from PAP machines. Such an approach allows clinicians to monitor adherence to therapy of PAP patients, including hours of use, residual apnea-hypopnea index (AHI), and mask leak.[19] However, data are limited regarding the effectiveness of these new technological approaches regarding improving PAP adherence.[20]

Using this conceptual framework, the goal of the present article was to assess the impact of a real-time feedback patient engagement tool on PAP adherence compared with the usual standard of care (remote monitoring of PAP adherence). We tested the hypothesis that patient engagement would yield important improvements in PAP adherence vs usual care.

Patients and Methods

Study Design and Participants

We performed a retrospective analysis of the AirView (usual care monitoring [UCM]) and myAir (active patient engagement [APE]) databases (ResMed Corp). AirView is a Health Insurance Portability and Accountability Act–compliant, password-protected cloud-based technology. PAP device data are transferred automatically to AirView on a daily basis to help clinicians remotely manage compliance and therapy for patients with sleep-disordered breathing. myAir was developed to provide real-time feedback and coaching to patients based on their data within AirView. Patients sign up themselves, and the patient engagement platform is accessed via logging in on the myAir website. Interactions with the patient include: a myAir score, usage-based praise messages, usage-based exception messages, exception-based leak, exception-based AHI, and "badges." The daily myAir score consists of usage hours, mask seal (to indicate levels of leak), events per hour, and number of times for mask on/off. Personalized coaching and reinforcement messages are sent via e-mail and are designed to increase self-management skills, recognize success, and identify and resolve basic treatment issues. These messages generally provide tips on how to make PAP therapy more comfortable or be messages of encouragement when patients meet a certain milestone (eg, average hours of use $>$ 4 h). Patients in the APE group do not receive any additional materials. Patients in the UCM group did not use the patient engagement tool.

Data were included in the analysis if the database record met the following prespecified criteria: therapy set-up date between October 1, 2014, and July 31, 2015; activation date in the APE tool was within 7 days of therapy start date; and use of specified PAP devices (AirSense 10 or AirCurve 10; ResMed Corp). Data include PAP therapy in CPAP, automatic positive airway pressure, and bilevel modes. Patients in both groups represent patients being treated for Q9 their OSA from myriad locations, including private and academic sleep centers, HMEs, and primary care offices with locations across the United States and, therefore, a range of follow-up programs. Patients with multiple or inconsistent therapy start dates were excluded from analysis. All data were de-identified prior to analysis. This trial was reviewed by the Chesapeake Institutional Review Board and deemed exempt from institutional review board oversight per Department of Health and Human Services regulations 45 CFR 46.101(b)(4).

Outcomes

The primary outcome was the percentage of patients who satisfied the US Medicare criteria for adherence; that is, use of PAP for $\geq$ 4 h per night on at least 70% of nights during a consecutive 30-day period during the first 90 days of initial usage. Secondary outcomes included mean nightly PAP usage, median number of days to achieve US Medicare adherence, residual AHI, and mask leak.

Statistical Analyses

To minimize risks of potential bias due to differences between the UCM and APE groups, UCM and APE patients were matched on propensity scores. Propensity scores were calculated with a logistic regression model that predicted whether the patient used APE or not, using baseline patient characteristics. The propensity score modeling accounts for and controls for the following confounders:

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