Published in final edited form as:

Med Care. 2018 November ; 56(11): 899–900. doi:10.1097/MLR.0000000000000995.

Failure of PAP therapy to alter the trajectory of healthcare utilization among patients with OSA: a wake-up call for the field of sleep medicine or just a bad dream?

Karin G Johnson, MD^{1,2} and Peter K Lindenauer, MD, MSc^{2,3,4}

¹Department of Neurology, University of Massachusetts Medical School- Baystate

²Institute of Health Care Delivery and Population Science, University of Massachusetts Medical School- Baystate

³Department of Medicine, University of Massachusetts Medical School- Baystate

⁴Department of Quantitative Health Sciences, University of Massachusetts Medical School

Obstructive sleep apnea (OSA), which affects as many as 30 million individuals in the US, is characterized by recurrent blockages of the upper airway that cause hypoxia and night-time arousals. In clinical practice OSA is a primary cause of excessive daytime sleepiness. Epidemiologic studies have found associations between moderate-severe OSA and increased risk of a number of chronic diseases, including diabetes, asthma, cardio- and cerebrovascular diseases, behavioral health problems and mortality. These findings have sparked interest and hope that, beyond improving sleepiness, treatment of OSA might have salutary effects on these other conditions. Although the last several decades have witnessed dramatic growth in prescriptions of Positive Airway Pressure (PAP) therapy, questions remain about the impact of treatment on this broader set of outcomes. In this issue of *Medical Care*, Deroose et al. report on the association between PAP therapy and health care utilization within a large population of patients with OSA.¹

For a condition as common as OSA, evidence supporting the role of PAP therapy is surprisingly limited. Randomized trials and meta-analyses have demonstrated improvements in daytime sleepiness, blood pressure control, and quality of life.^{2,3} Although prospective cohort studies have suggested that PAP therapy may have favorable effects on major cardiovascular complications, large randomized trials, which have been limited by low levels of adherence to treatment, have failed to corroborate these findings. Even less is known about the impact of PAP therapy on healthcare utilization. Small observational studies from Canada have found that adherence to PAP therapy was associated with reductions in physician claims and hospitalizations. In the US, a study conducted in the Veteran's Affairs system found that, compared to individuals who were non-adherent with PAP therapy, adherent patients had a lower risk of readmission within 30 days of hospital discharge; another small, before-after study, found approximately 20% lower healthcare utilization (a

Corresponding Author: Peter K Lindenauer MD MSc, 3601 Main Street, Springfield, MA 01199, Peter.Lindenauer@baystatehealth.org.

Conflict of interest: None

composite score comprised of non-sleep outpatient visits, laboratory studies and medication prescriptions) in the year after PAP therapy among adherent patients.^{4,5} Although a strength of these studies is that they incorporated information about adherence to PAP, because treatment was not assigned randomly it is possible that the associations may reflect confounding by other behaviors associated with adherence and not by the effects of PAP itself.

In this issue of Medical Care, the study by Derose et al. represents the first large population based analysis of the effect of PAP therapy on health care utilization, set within the Kaiser system. Analyzing the outcomes of over 13,000 patients with OSA who were dispensed CPAP as well as matched individuals without diagnosed OSA or without CPAP dispensation, they found no differences in the change in number of hospitalization and emergency room visit days or medication utilization after PAP was dispensed compared to the matched non-cases. Higher medication use was found in the cases both before and after PAP dispensation, which is consistent with other studies showing higher medication utilization in OSA patients.⁶ Although an observational study, the large size and population based nature maximizes power and generalizability; the results reflect the experience of a diverse cohort of patients under routine care, not trial conditions.

If individuals with OSA incur higher health care costs than those without OSA, why didn't prescriptions of CPAP lead to improvements in acute care utilization and medication costs? One explanation is simply that improvements in sleepiness and quality of life do not translate into lower health care utilization. If true, this result would be a wake-up call for the field of Sleep Medicine. Another possibility is that CPAP therapy does reduce healthcare utilization and costs, but that the measures used in this study were insensitive to these effects. For example, it is possible that treatment of OSA leads to less visits to primary care and behavioral health providers, but does not prevent hospitalizations or change medication spending. Further, Derose's decision to exclude acute care utilization in the 180 days prior to PAP dispensation (which was 1.9% higher in the cases), may have led the study to underestimate the benefits of treatment. An even more likely explanation of the study findings is that the benefits of CPAP may be limited to selected high-risk groups (such as those with the most severe apneas and hypoxia or older age or certain comorbidities), and that these effects were diluted in the study sample. Finally, the most obvious explanation for the negative results seen in DeRose et al is that adherence to PAP therapy was too low to make a difference. Thus, before abandoning the notion that PAP therapy can reduce health care costs in OSA, additional studies, using more contemporary data are needed.

Specifically, future studies should determine whether better adherence to PAP can yield different results. DeRose's study was done using data from 1999–2014 with PAP device dispensed between 2002–2012. During this period rates of short term PAP adherence hovered around 50%, and in this cohort evidence of further mask dispensation (a crude marker of adherence) was observed in only 35% of patients, suggesting even poorer adherence. Significant improvements in PAP technology have occurred since 2012, especially with advances in AutoCPAP and mask technology as well as the development of remote monitoring and tele-sleep technology, which have been shown to improve adherence with therapy.^{7,8} Nevertheless, large population-based studies are needed to determine

whether these technical advances have translated into improved patient outcomes. We are optimistic that future research in this area will be facilitated by the integration of home adherence data into electronic health records.

Whether or not PAP therapy is ultimately shown to reduce health care costs for individuals with OSA, it is important to remember that PAP improves quality of life, productivity, and reduces motor vehicle and workplace accidents.^{9,10} Thus, rather than removing PAP devices from the homes of non-adherent patients (a common approach among many payors), we urge greater investment and research in efforts to improve PAP adherence.

Acknowledgments

Funding: Dr. Lindenauer was supported by grant K24HL132008 from the National Heart, Lung, and Blood Institute

References

1. Derose SF, Zhou H, Huang BZ, Manthena P, Hwang D, Shi JM. Does Providing Positive Airway Pressure (PAP) for Sleep Apnea Change Health Care Utilization? *Medical Care*. 2018; Publish Ahead of Print. doi:10.1097/MLR.0000000000000963
2. Kapur VK, Auckley DH, Chowdhuri S, et al. Clinical Practice Guideline for Diagnostic Testing for Adult Obstructive Sleep Apnea: An American Academy of Sleep Medicine Clinical Practice Guideline. *J Clin Sleep Med* 2017;13:479–504. [PubMed: 28162150]
3. Montesi SB, Edwards BA, Malhotra A, Bakker JP. The effect of continuous positive airway pressure treatment on blood pressure: a systematic review and meta-analysis of randomized controlled trials. *J Clin Sleep Med* 2012;8:587–96. [PubMed: 23066375]
4. Walter RJ, Hagedorn SI, Lettieri CJ. Impact of diagnosing and treating obstructive sleep apnea on healthcare utilization. *Sleep Med* 2017;38:73–7. [PubMed: 29031760]
5. Truong KK, De Jardin R, Massoudi N, Hashemzadeh M, Jafari B. Nonadherence to CPAP Associated With Increased 30-Day Hospital Readmissions. *J Clin Sleep Med* 2018;14:183–9. [PubMed: 29351826]
6. Greenberg-Dotan S, Reuveni H, Simon-Tuval T, Oksenberg A, Tarasiuk A. Gender differences in morbidity and health care utilization among adult obstructive sleep apnea patients. *Sleep* 2007;30:1173–80. [PubMed: 17910389]
7. Munafo D, Hevener W, Crocker M, Willes L, Sridasome S, Muhsin M. A telehealth program for CPAP adherence reduces labor and yields similar adherence and efficacy when compared to standard of care. *Sleep Breath* 2016;20:777–85. [PubMed: 26754933]
8. Fox N, Hirsch-Allen AJ, Goodfellow E, et al. The impact of a telemedicine monitoring system on positive airway pressure adherence in patients with obstructive sleep apnea: a randomized controlled trial. *Sleep* 2012;35:477–81. [PubMed: 22467985]
9. Hoffman B, Wingenbach DD, Kagey AN, Schaneman JL, Kasper D. The long-term health plan and disability cost benefit of obstructive sleep apnea treatment in a commercial motor vehicle driver population. *J Occup Environ Med* 2010;52:473–7. [PubMed: 20431410]
10. Berger MB SW, Owen R. A Corporate-Driven Sleep Apnea Detection and Treatment Program. *Chest* 2006;130(4_Meeting Abstracts).