

COMMENTARY**Greater health care utilization and cost associated with untreated sleep apnea**

Commentary on Wickwire EM, Tom SE, Vadlamani A, et al. Older adult US Medicare beneficiaries with untreated obstructive sleep apnea are heavier users of health care than matched control patients. *J Clin Sleep Med*. 2020;16(1):81–89.

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Wickwire and colleagues, using administrative data have shown the economic impact of obstructive sleep apnea (OSA) in older people.¹ Prior research has shown OSA confers an increased risk for cardiovascular and metabolic disease,^{2–5} stroke,⁶ psychiatric conditions⁷ and death.⁸ A growing literature has also documented greater economic burden for individuals with untreated OSA compared with matched controls without OSA.^{9–13} Several explanations have been offered. These differences may be associated with higher rates of comorbidities such as cardiovascular disease and obesity,^{9,11} increased health care resources used for psychotherapy or psychoactive drugs,¹² or a greater likelihood that patients with OSA report poor self-perceived health status.¹³ To date, much of the literature on the economic impact of OSA has been in predominantly middle-aged men and with relatively small sample sizes; only few prior trials assessed health care utilization (HCU) in older adults using population-based data.¹¹

Greater understanding of the economic importance of OSA among older adults is needed because OSA is highly prevalent in adults aged older than 65 years.^{14,15} Older adults with OSA also are more likely to have multiple chronic diseases than those without OSA, which likely increase the contact of patients with OSA with the health care system.¹⁰ Furthermore, despite evidence suggesting that untreated OSA is associated with early mortality,¹⁶ up to 80% of individuals with OSA have gone undiagnosed despite adequate access to health care.¹⁷

To build upon prior investigations that have found OSA to be associated with substantial economic burden, Wickwire et al has presented a rigorous analysis of the impact of untreated OSA on HCU among older adults in this issue of the *Journal of Clinical Sleep Medicine*.¹ Using data from a random sample of Medicare administrative claims for years 2006–2013, the authors demonstrated that untreated OSA in older adults was associated with increased HCU and higher costs across all points of service.¹ This study is notable for several reasons. First, it is the largest analysis to date of the economic impact of OSA, and its sophisticated analyses confirms prior research showing that untreated OSA is associated with increased HCU and costs. Second, while the analyses cannot determine causal

association between OSA and elevated HCU or costs, they prompt discussion of underlying mechanisms and highlight the need to focus clinical attention on older adults and early diagnosis and initiation of OSA treatment. Finally, the authors demonstrate the importance of simultaneously considering the confounding effect of comorbid conditions and the modification effect by sex in analyses. In this commentary, we examine and expand upon the above three points.

First, while the authors confirm the known economic importance of OSA, their work enhances prior analyses and adds a population health perspective to the literature. Wickwire et al identified patients with OSA not only by diagnosis but also by the initiation of treatment.¹ In order to ensure comprehensive assessment of HCU and costs from the payer perspective, the authors successfully captured a broad range of health expenditures spanning 8 years, providing sufficient statistical power to evaluate the association between OSA and HCU and cost.¹ The study results can be generalized to the majority of older adults in the US because of random sampling from Medicare administrative claims. Additionally, the authors conducted a series of sensitivity analyses to evaluate robustness of study results.

Despite these strengths, the authors noted several limitations, including bias results concerns due to possible inclusion of undiagnosed cases in the control group; lack of OSA-related characteristics such as severity and body mass index; the Centers for Medicare & Medicaid Services approved home sleep apnea testing during the period being studied; and that the authors are unable to assess HCU and costs from the patient, employer or societal perspectives.¹ Another unmentioned limitation was lack of data on socioeconomic status and patient-centered measures such as household income and self-perceived health status. Previous research showed higher proportion of OSA cases in those with lower socioeconomic status.¹⁸ Access to health care for older adults with OSA may also be influenced by socioeconomic status.

Furthermore, consistent findings of increased HCU among individuals with untreated OSA prompt several important questions regarding contributing factors. This work confirms that patients with OSA are heavy users of health care 5 to 10

years before diagnosis of OSA.⁹ Why does OSA often go undiagnosed and untreated? Previously described factors in the literature to explain the causes of undiagnosed and untreated OSA included little or no sleep disorders training among clinicians,⁹ lack of availability and access to sleep labs and sleep specialists,¹⁹ and a commonly held belief that OSA may not pose a serious health risk.²⁰ Because early diagnosis and treatment of OSA would improve quality of life and functional ability in older adults and should reduce HCU,⁹ policymakers and health care leaders should consider ways to improve OSA screening and treatment measures as well as education of clinicians in detection of OSA.

Finally, this study provides an opportunity to examine the role of sex in OSA research. Research has shown multiple differences between men and women with OSA, with apnea severity and self-perceived health status being lower, and HCU, age and body mass index higher in women than men.^{21,22} OSA is more common in men than women and is often underdiagnosed in adult women.²² Wickwire et al acknowledge sex differences in the number of OSA older adults in the study and accounted for sex differences by adding an interaction term in each model. No significant modification effect by sex was found. It is hoped that the study findings will stimulate further research on the role of sex between OSA and HCU in older adults, as well as understanding mechanisms underlying sex disparities in OSA, if significant disparities exist.

We commend the authors for the rigorous and comprehensive way in which they tackled the dearth of research on the economic impact of OSA in older adults. Their study design and analytic approach serves as a reminder of the significant population-level economic burden associated with older men and women with OSA. We need to do a better job in early diagnosis and treatment of OSA, which may decrease morbidity and reduce HCU and cost in older adults.

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REFERENCES

1. Wickwire EM, Tom SE, Vadlamani A, et al. Older adult US Medicare beneficiaries with untreated obstructive sleep apnea are heavier users of health care than matched control patients. *J Clin Sleep Med*. 2020;16(1):81–89.
2. Konecny T, Kuniyoshi FH, Orban M, et al. Under-diagnosis of sleep apnea in patients after acute myocardial infarction. *J Am Coll Cardiol*. 2010;56(9):742–743.
3. Peppard PE, Young T, Palta M, Skatrud J. Prospective study of the association between sleep-disordered breathing and hypertension. *N Engl J Med*. 2000;342(19):1378–1384.
4. Punjabi NM, Shahar E, Redline S, Gottlieb DJ, Givelber R, Resnick HE. Sleep-disordered breathing, glucose intolerance, and insulin resistance: the Sleep Heart Health Study. *Am J Epidemiol*. 2004;160(6):521–530.
5. Botros N, Concato J, Mohsenin V, Selim B, Doctor K, Yaggi HK. Obstructive sleep apnea as a risk factor for type 2 diabetes. *Am J Med*. 2009;122(12):1122–1127.

6. Yaggi HK, Concato J, Kernan WN, Lichtman JH, Brass LM, Mohsenin V. Obstructive sleep apnea as a risk factor for stroke and death. *N Engl J Med*. 2005;353(19):2034–2041.
7. Peppard PE, Szklo-Coxe M, Hla KM, Young T. Longitudinal association of sleep-related breathing disorder and depression. *Arch Intern Med*. 2006;166(16):1709–1715.
8. Wang H, Parker JD, Newton GE, et al. Influence of obstructive sleep apnea on mortality in patients with heart failure. *J Am Coll Cardiol*. 2007;49(15):1625–1631.
9. Ronald J, Delaive K, Roos L, Manfreda J, Bahammam A, Kryger MH. Health care utilization in the 10 years prior to diagnosis in obstructive sleep apnea syndrome patients. *Sleep*. 1999;22(2):225–229.
10. Diaz K, Faverio P, Hospenthal A, Restrepo MI, Amuan ME, Pugh MJ. Obstructive sleep apnea is associated with higher healthcare utilization in elderly patients. *Ann Thorac Med*. 2014;9(2):92–98.
11. Kao LT, Lee HC, Lin HC, Tsai MC, Chung SD. Healthcare service utilization by patients with obstructive sleep apnea: a population-based study. *PLoS One*. 2015;10(9):e0137459.
12. Banno K, Ramsey C, Walld R, Kryger MH. Expenditure on health care in obese women with and without sleep apnea. *Sleep*. 2009;32(2):247–252.
13. Tarasiuk A, Greenberg-Dotan S, Simon-Tuval T, Oksenberg A, Reuveni H. The effect of obstructive sleep apnea on morbidity and health care utilization of middle-aged and older adults. *J Am Geriatr Soc*. 2008;56(2):247–254.
14. Ancoli-Israel S, Kripke DF, Klauber MR, Mason WJ, Fell R, Kaplan O. Sleep-disordered breathing in community-dwelling elderly. *Sleep*. 1991;14(6):486–495.
15. Bixler EO, Vgontzas AN, Ten Have T, Tyson K, Kales A. Effects of age on sleep apnea in men: I. Prevalence and severity. *Am J Respir Crit Care Med*. 1998;157(1):144–148.
16. Young T, Peppard PE, Gottlieb DJ. Epidemiology of obstructive sleep apnea: a population health perspective. *Am J Respir Crit Care Med*. 2002;165(9):1217–1239.
17. Lee W, Nagubadi S, Kryger MH, Mokhlesi B. Epidemiology of obstructive sleep apnea: a population-based perspective. *Expert Rev Respir Med*. 2008;2(3):349–364.
18. Guglielmi O, Lanteri P, Garbarino S. Association between socioeconomic status, belonging to an ethnic minority and obstructive sleep apnea: a systematic review of the literature. *Sleep Med*. 2019;57:100–106.
19. Leger D, Bayon V, Laaban JP, Philip P. Impact of sleep apnea on economics. *Sleep Med Rev*. 2012;16(5):455–462.
20. Tarasiuk A, Greenberg-Dotan S, Brin YS, Simon T, Tal A, Reuveni H. Determinants affecting health-care utilization in obstructive sleep apnea syndrome patients. *Chest*. 2005;128(3):1310–1314.
21. Otake K, Delaive K, Walld R, Manfreda J, Kryger MH. Cardiovascular medication use in patients with undiagnosed obstructive sleep apnoea. *Thorax*. 2002;57(5):417–422.
22. 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(9):1173–1180.

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