EDITORIAL

Preoperative Screening for Obstructive Sleep Apnea to Improve Long-term Outcomes

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IN this issue of ANESTHESIOLOGY, Sankar *et al.*[1] report the results of a Monte Carlo simulation comparing the cost-effectiveness of using sleep apnea screening for preventing perioperative complications and improving long-term outcomes in patients with obstructive sleep apnea (OSA). Cost-effectiveness analysis quantifies the incremental cost and benefit of selecting a more expensive and more effective healthcare intervention (OSA screening plus polysomnography) compared to a less costly and less effective intervention (no screening). The incremental cost-effectiveness ratio is the ratio of the difference in cost of two interventions divided by the difference in outcome (where outcome is measured in terms of quality-adjusted life-years). The cost-effectiveness ratio can be thought of as the additional cost of achieving 1 yr of perfect life (the quality-adjusted life-year)[2] using the more effective intervention. Historically, interventions have been considered cost-effective if the incremental cost-effectiveness ratio is less than $50,000, which is the threshold value that society assigns to 1 yr of "perfect" life.[3] Cost-effectiveness analysis can be limited to traditional healthcare-related costs (defined as the healthcare system perspective), or extended to also include costs outside of the healthcare system such as lost wages and the cost of family caregivers (societal perspective).[4]

"…should anesthesiologists take a leading role in the diagnostic workup of patients who screen positive for OSA?"

Sankar *et al.*[1] based their cost-effectiveness analysis on a cohort of 26,068 patients who underwent elective noncardiac surgery (total hip arthroplasty, total knee arthroplasty, prostatectomy, hysterectomy, thyroidectomy, or bowel resection) in a quaternary care hospital network in Canada. They compared the cost effectiveness of four approaches to OSA screening from the perspective of the healthcare system: (1) AQ4 no screening, (2) STOP-Bang alone, (3) STOP-Bang with portable monitoring, and (4) STOP-Bang with polysomnography. They evaluated the cost-effectiveness of these approaches across two different time frames: (1) the perioperative period and (2) a patient's lifetime. Although STOP-Bang with polysomnography was the most cost-effective strategy for the perioperative time period compared to no screening, the cost of one additional quality-adjusted life-year for STOP-Bang with polysomnography was $634,656—which is nearly 13 times higher than what might be considered acceptable. However, when the time frame was shifted to a patient's lifetime, the cost of one additional quality-adjusted life-year using STOP-Bang with polysomnography was only $2,044 compared to no screening.

The results of this analysis suggest that the cost of comprehensive OSA screening is too high if the goal is only to achieve better perioperative outcomes. Moreover, even if cost was not a consideration and patients with OSA could all be identified preoperatively, following "best practices" in managing OSA patients perioperatively may not yield better outcomes.[5] In their analysis, Sankar *et al.*[1] assumed that an enhanced monitoring protocol, which included a "12-h level 2 intensive care unit stay," was as equally effective as "long-term OSA treatment." However, since the most recent clinical practice guidelines from the American Society of Anesthesiologists state that the literature is insufficient to evaluate the benefits of using continuous monitoring with pulse oximetry postoperatively in patients with OSA,[5] it may not be reasonable to assume that the short-term effectiveness of perioperative interventions for OSA patients is equivalent to the effectiveness of long-term interventions.

In the absence of robust evidence-based practices to reduce short-term complications in patients diagnosed

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with OSA, should anesthesiologists take a leading role in the diagnostic workup of patients who screen positive for OSA? We believe that the absence of evidence should not lead us to discount the potential benefits of identifying and instituting targeted interventions in patients who present preoperatively with undiagnosed OSA, especially since the long-term OSA treatment may be cost-effective. As anesthesiologists continue to expand their role outside of the operating room as perioperative physicians, it seems reasonable to include the preoperative identification of OSA as part of our practice. The preoperative evaluation is an important opportunity to uncover diseases that, left untreated, may cause major complications over the lifetime of an individual. The evidence that treating OSA improves long-term outcomes is more robust for long-term compared to short-term outcomes, and randomized controlled trials have shown that the use of continuous positive airway pressure improves quality of life and blood pressure, and may reduce the risk of cardiovascular events.[6] But even with long-term outcomes, there remains uncertainty regarding the effectiveness of available treatments for preventing long-term cardiovascular complications. In particular, a recent large randomized trial of continuous positive airway pressure in patients with moderate-to-severe OSA with a mean follow-up of 3.7 yr did not show that continuous positive airway pressure prevents cardiovascular events.[7] The analysis by Sankar *et al.*[1] suggests that the "price" of improving long-term outcomes by screening patients for OSA is low—about $2,000 for each additional "perfect" year of healthy life. For some patients, their perioperative encounter is their first interaction with the healthcare system. Regardless of whether a diagnosis of OSA will impact their perioperative outcome, OSA is a disease that should be identified and treated.

Historically, anesthesiologists, surgeons, internists, and cardiologists have tailored the preoperative evaluation of patients toward finding high-risk patients who might benefit from cardiac revascularization before undergoing major noncardiac surgery to help them "get through the surgery."[8] Today, the indications for noninvasive cardiac testing are similar in patients who are and who are not undergoing surgery.[9] The goal is now to identify patients who might benefit from cardiovascular interventions over the long term, and perform these before elective surgery to improve both short- and long-term outcomes. Similarly, work by Sankar *et al.*[1] suggests that OSA screening combined with polysomnography achieves favorable long-term outcomes at a low cost, while at the same time possibly improving short-term outcomes in patients undergoing noncardiac surgery.

Like cardiac testing, polysomnography is resource-intensive, and the screening process would need to begin in the surgeon's office. Patients with suspected OSA who screen positive could be directed toward additional testing, recognizing that while targeted interventions such as continuous postoperative pulse oximetry monitoring may not be cost-effective in the short term, identifying patients with undiagnosed OSA when they present for preoperative evaluation may be cost-effective over the long term. Testing results could then be used to guide perioperative management. For example, screening might inform the appropriate triaging of OSA patients to inpatient *versus* stand-alone ambulatory centers and the decision to escalate care with monitored beds and positive airway pressure treatment. However, it should be recognized that even without testing, the use of automated remote respiratory monitoring may eventually become standard for all patients, and not just patients with OSA, since postoperative hypoxemia is widespread—occurring in up to 37% of patients undergoing noncardiac surgery.[10]

We applaud Sankar *et al.*[1] for using cost-effectiveness analysis to uncover the hidden benefits of OSA testing by looking beyond the immediate perioperative window and extending their analysis to a patient's lifetime. As anesthesiologists, we should continue to expand our role and use the preoperative visit as an opportunity to identify and treat conditions that will improve the short- and long-term outcomes of our patients. Using cost-effectiveness analysis, we can help direct our finite healthcare resources toward those interventions that achieve the greatest good at the most reasonable cost.

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Competing Interests

The authors declare no competing interests. AQ5

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References

1. Sankar A, Dixon PR, Sivanathan L, Memtsoudis SG, de Almeida JR, Singh M: Cost-effectiveness analysis of preoperative screening strategies for obstructive sleep apnea among patients undergoing elective inpatient surgery. Anesthesiology 2020; 133:XXX–XXX
2. Neumann PJ, Cohen JT: QALYs in 2018-Advantages and concerns. JAMA 2018; 319:2473–4
3. Neumann PJ, Cohen JT, Weinstein MC: Updating cost-effectiveness–the curious resilience of the $50,000-per-QALY threshold. N Engl J Med 2014; 371:796–7

4. Brooke BS, Kaji AH, Itani KMF: Practical guide to cost-effectiveness analysis. JAMA Surg 2020
5. American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea: Practice guidelines for the perioperative management of patients with obstructive sleep apnea: An updated report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea. Anesthesiology 2014; 120: 268–86
6. Phillips CL, Grunstein RR, Darendeliler MA, Mihailidou AS, Srinivasan VK, Yee BJ, Marks GB, Cistulli PA: Health outcomes of continuous positive airway pressure *versus* oral appliance treatment for obstructive sleep apnea: A randomized controlled trial. Am J Respir Crit Care Med 2013; 187:879–87
7. McEvoy RD, Antic NA, Heeley E, Luo Y, Ou Q, Zhang X, Mediano O, Chen R, Drager LF, Liu Z, Chen G, Du B, McArdle N, Mukherjee S, Tripathi M, Billot L, Li Q, Lorenzi-Filho G, Barbe F, Redline S, Wang J, Arima H, Neal B, White DP, Grunstein RR, Zhong N, Anderson CS; SAVE Investigators and Coordinators: CPAP for prevention of cardiovascular events in obstructive sleep apnea. N Engl J Med 2016; 375:919–31
8. Eagle KA, Berger PB, Calkins H, Chaitman BR, Ewy GA, Fleischmann KE, Fleisher LA, Froehlich JB, Gusberg RJ, Leppo JA, Ryan T, Schlant RC, Winters WL Jr, Gibbons RJ, Antman EM, Alpert JS, Faxon DP, Fuster V, Gregoratos G, Jacobs AK, Hiratzka LF, Russell RO, Smith SC Jr; American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery): ACC/AHA guideline update for perioperative cardiovascular evaluation for noncardiac surgery—Executive summary: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). Circulation 2002; 105:1257–67
9. Cohn SL: Preoperative evaluation for noncardiac surgery. Ann Intern Med 2016; 165:ITC81–96
10. Sun Z, Sessler DI, Dalton JE, Devereaux PJ, Shahinyan A, Naylor AJ, Hutcherson MT, Finnegan PS, Tandon V, Darvish-Kazem S, Chugh S, Alzayer H, Kurz A: Postoperative hypoxemia is common and persistent: A prospective blinded observational study. Anesth Analg 2015; 121:709–15

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