

## Suboptimal Diagnostic Accuracy of Obstructive Sleep Apnea in One Database Does Not Invalidate Previous Observational Studies

### To the Editor:

We read with interest the article published by McIsaac *et al.*<sup>1</sup> entitled “Identifying Obstructive Sleep Apnea in Administrative Data: A Study of Diagnostic Accuracy.”

The authors utilized data collected by a Canadian academic health sciences network within a universal health insurance plan to study the validity of using diagnosis codes to reliably identify patients with obstructive sleep apnea (OSA) within administrative databases. The presence of any registered diagnostic code, procedure, or therapeutic intervention consistent with the presence of sleep apnea within 2 yr before surgery was used as a benchmark.

The authors should be commended for their thoughtful undertaking and their contribution toward improving methodology in the field of population-based sleep apnea research.

Moreover, the presented findings are convincing; insofar as various diagnosis and billing codes are not reliable in identifying patients with OSA. However, their interpretation as it extends to the value of database studies that have used these codes to determine OSA cohorts may not be valid.

First and foremost, the analysis uses specific data to test the authors’ hypothesis, which located in Canada may be substantially different than those including information from US hospitals utilized in the majority of OSA observational studies published to date.<sup>2,3</sup> Indeed, next to such important differences such as a single-payer system *versus* a multipayer system, billing and coding practices have also been shown to be influenced by type of hospital, most importantly among for-profit *versus* non-for-profit hospitals.<sup>4</sup> The difference in *International Classification of Diseases*, Ninth Revision (ICD-9) validity between datasets is also demonstrated in the results presented by authors as they show varying sensitivities and specificities for ICD-9 code 780.5 (“unspecified sleep apnea”) in the Ontario Health Insurance Plan *versus* the Discharge Abstract Database. Thus, the results presented in the study by McIsaac *et al.* may not be applicable to other databases, and each data source would require separate validation studies to determine its ability to reliably identify those with OSA.

Although it is likely that because of the deficiencies of current coding systems to identify OSA patients, only a fraction of those affected are detected; the biggest effect of this deficiency would be on the determination of the true prevalence of the problem. However, outcome analyses utilizing a cohort of OSA patients (representing all such patients or

not) should be less affected by this problem, thus rendering results establishing OSA as a perioperative risk factor for adverse outcomes valid.

The authors’ statement that “researchers and knowledge consumers should approach such studies cautiously” is put into perspective by their finding that those patients labeled as “true positives” for OSA appeared to have the highest disease burden putting them at highest risks for adverse perioperative outcomes. However, patients labeled as having OSA in observational studies (using ICD-9 codes) will be a mixture of true and false OSA diagnoses. Therefore, we would expect this misclassification to bias the results of an observational study to the null, as the authors rightfully point out. Therefore, it is very well possible that any association found in observational studies will be an underestimation of the true effects. This would not only mean that the findings reported by McIsaac *et al.* do not necessarily invalidate previous observational studies in respect to OSA and perioperative outcomes but also mean that their effects may be even larger than suggested.

Finally, the authors extracted their reference standard from a cohort of patients who actually underwent a polysomnogram based on unspecified criteria and met diagnostic criteria based on the apnea hypopnea index. Although this makes sense as it is vital in OSA ascertainment, the authors fail to mention and discuss the limitation of undiagnosed OSA, a more crucial and overarching issue as it has been demonstrated that a significant part of surgical OSA patients is missed by surgeons and anesthesiologists.<sup>5</sup> Next to the study by McIsaac *et al.*, this limitation also affects all other (observational) studies in which OSA is diagnosed based on a previous decision to perform a polysomnogram. This limitation is also expected to bias results of previous studies to the null and further highlights the need for reliable data, *e.g.*, in the form of a registry.

In conclusion, although the study by McIsaac *et al.* points toward considerable limitations associated with the use of diagnosis codes to identify OSA patients in a Canadian universal health insurance database, these findings neither negate results from previous database studies identifying OSA as a risk factor for adverse outcomes nor can they be extrapolated to other datasets without further testing. We, therefore, suggest that the more important implications of the study by McIsaac *et al.* are the call for more validation studies and the generation of more reliable data such as a national registry.

### Competing Interests

The authors declare no competing interests.

**Jashvant Poeran, M.D., Ph.D., Crispiana Cozowicz, M.D., Frances Chung, M.B.B.S., F.R.C.P.C., Babak Mokhlesi, M.D., M.Sc., Satya-Krishna Ramachandran, M.D., Stavros G. Memtsoudis, M.D., Ph.D., F.C.C.P.** Hospital for Special Surgery, New York, New York; Weill Cornell Medical College, New York, New York; Paracelsus Medical University, Salzburg, Austria (S.G.M.). memtsoudiss@hss.edu

## References

1. McIsaac DI, Gershon A, Wijeyesundera D, Bryson GL, Badner N, van Walraven C: Identifying obstructive sleep apnea in administrative data: A study of diagnostic accuracy. *ANESTHESIOLOGY* 2015; 123:253–63
2. Memtsoudis SG, Stundner O, Rasul R, Chiu YL, Sun X, Ramachandran SK, Kaw R, Fleischut P, Mazumdar M: The impact of sleep apnea on postoperative utilization of resources and adverse outcomes. *Anesth Analg* 2014; 118:407–18
3. Mokhlesi B, Hovda MD, Vekhter B, Arora VM, Chung F, Meltzer DO: Sleep-disordered breathing and postoperative outcomes after elective surgery: Analysis of the nationwide inpatient sample. *Chest* 2013; 144:903–14
4. Pruitt Z, Pracht E: Upcoding emergency admissions for non-life-threatening injuries to children. *Am J Manag Care* 2013; 19:917–24
5. Singh M, Liao P, Kobah S, Wijeyesundera DN, Shapiro C, Chung F: Proportion of surgical patients with undiagnosed obstructive sleep apnoea. *Br J Anaesth* 2013; 110:629–36

(Accepted for publication November 11, 2015.)

### In Reply:

We thank Dr. Poeran and coworkers for their interest and commentary regarding our recent publication.<sup>1</sup> As is correctly identified, patients identified as having obstructive sleep apnea (OSA) in observational cohorts based on the diagnostic codes will often be misclassified. Therefore, some of these patients will truly have OSA, whereas others will not. Although we agree that health administrative data collected in different jurisdictions (in this case, Canada *vs.* the United States) may not be entirely equivalent, on the basis of our work and the validation studies of other diagnostic codes for other medical conditions,<sup>2,3</sup> we do feel that caution is rightly warranted when interpreting any study relying on exposures that have not been compared with a gold standard to determine their accuracy and reliability. Although Dr. Poeran and coworkers suggest that the bias inherent in such measurements is most likely directed toward the null (*i.e.*, decreasing the effect of OSA on adverse outcomes), our findings suggest that this may not always be the case. As described in our study, true positives (people correctly identified as having OSA by a diagnostic code) appeared to have a higher perioperative risk than false negatives (people who truly had OSA but who were not identified as having OSA by a diagnostic code), as evidenced by higher severity of OSA, higher prevalence of male gender, and higher prevalence of diabetes. Therefore, the people identified as having OSA by these diagnostic codes may be more likely to have adverse postoperative outcomes independent of their OSA status. This would bias the results of health administrative data studies away from the null (*i.e.*, increasing the effect of OSA on adverse outcomes).

Ultimately, without validation studies proving the accuracy and reliability of exposures and outcomes (the core components of observational research), significant uncertainty

exists in interpreting the results of any investigation using health administrative data. Indeed, as supported by our work, its accompanying editorial,<sup>4</sup> and the comments of Dr. Poeran and coworkers, more validation studies are needed to fully harness the potential of “big data.”

## Competing Interests

The authors declare no competing interests.

**Daniel I. McIsaac, M.D., M.P.H., F.R.C.P.C., Carl van Walraven, M.D., F.R.C.P.C., M.Sc.** University of Ottawa and The Ottawa Hospital, Ottawa, Ontario, Canada; Ottawa Hospital Research Institute, Ottawa, Ontario, Canada; Institute for Clinical Evaluative Sciences, Toronto, Ontario, Canada (D.I.M.). dmcisaac@toh.on.ca

## References

1. McIsaac DI, Gershon A, Wijeyesundera D, Bryson GL, Badner N, van Walraven C: Identifying obstructive sleep apnea in administrative data: A study of diagnostic accuracy. *ANESTHESIOLOGY* 2015; 123:253–63
2. Redelmeier DA, Thiruchelvam D, Daneman N: Delirium after elective surgery among elderly patients taking statins. *CMAJ* 2008; 179:645–52
3. Katznelson R, Djaiani GN, Borger MA, Friedman Z, Abbey SE, Fedorko L, Karski J, Mitsakakis N, Carroll J, Beattie WS: Preoperative use of statins is associated with reduced early delirium rates after cardiac surgery. *ANESTHESIOLOGY* 2009; 110:67–73
4. Neuman MD: The importance of validation studies in perioperative database research. *ANESTHESIOLOGY* 2015; 123:243–5

(Accepted for publication November 13, 2015.)

## Keeping It Clean: Appropriate Hospital Attire

### To the Editor:

While I have the utmost regard for my many friends and colleagues at the Brigham and Women's Hospital, I must point out that on the cover of the November 2015 issue of *ANESTHESIOLOGY*, there appear to be several dozen of them wearing their scrubs outside the operating room, in violation of the regulations of both The Joint Commission and, I am sure, the Massachusetts Department of Public Health. I will give all involved the benefit of the doubt and assume that they changed into new scrubs before returning to the operating room.

## Competing Interests

The author declares no competing interests.

**David Wlody, M.D.**, SUNY-Downstate Medical Center, Brooklyn, New York. david.wlody@downstate.edu

(Accepted for publication January 11, 2016.)