

Correlation between the STOP-Bang Score and the Severity of Obstructive Sleep Apnea

To the Editor:

In the September 2014 letter to the editor, Corso *et al.*¹ commented on preoperative screening for perioperative management of patients with obstructive sleep apnea (OSA) in the recently published Practice Guidelines.² They stated that, "The STOP-Bang questionnaire has been shown to identify patients at risk with moderate-to-severe OSA, with reasonable certainty and can be easily implemented in the clinical setting."¹ In the reply by Gross *et al.*,³ the authors indicated that, "While the STOP-Bang scores were shown to correlate with the probability of sleep apnea, it was not established that they correlate with its severity." This statement is not accurate based on recently published studies supporting a correlation between the STOP-Bang score and the severity of OSA.

In 2012, we demonstrated that as the STOP-Bang score increased, the probability of having more severe OSA also increased. When the score rose from 0 to 2 till 7 to 8, the probability of having moderate-to-severe OSA (apnea-hypopnea index [AHI] > 15 event/h) increased from 18% (95% confidence interval [CI], 13 to 24%) to 60% (95% CI, 44 to 73%). The probability of severe OSA (AHI > 30 event/h) increased from 4% (95% CI, 2 to 8%) to 38% (95% CI, 29 to 53%).⁴ This indicates that the patients who have a higher score in the STOP-Bang questionnaire would have a greater probability of severe OSA.

In 2011, Farney *et al.*⁵ evaluated the STOP-Bang score in patients referred to a sleep clinic and who underwent polysomnography. Although the predominant reason for referral was for suspected OSA, the study population consisted of patients with a variety of conditions, including insomnia, narcolepsy, and behavioral disorders. As the STOP-Bang score increased from 0 to 8, the probability of severe OSA increased from 4.4 to 81.9%. With any score greater than 4, the probability of severe OSA continuously increased with the increase of STOP-Bang score, whereas the probability having non-OSA, mild

OSA, or moderate OSA decreased (fig. 1).⁵ A similar relation between the STOP-Bang score and the severity of OSA was also found in the Chinese patients referred to sleep clinics.⁶

In summary, the currently available data in the literature support that a correlation exists between a higher STOP-Bang score and the severity of OSA. Accordingly, the STOP-Bang score can be used to not only identify cases with any degree of OSA but also prioritize those who are more likely to have moderate-to-severe disease. To the extent that the severity of sleep apnea characterized by the AHI is useful in clinical management, we would argue that the STOP-Bang questionnaire should be considered the optimal screening tool at the present time and that the score can be used for making more reasoned clinical decisions.

Competing Interests

The authors declare no competing interests.

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References

1. Corso RM, Gregoretti C, Braghiroli A, Fanfulla F, Insalaco G: Practice guidelines for the perioperative management of patients with obstructive sleep apnea: Navigating through uncertainty. *ANESTHESIOLOGY* 2014; 121:664–5
2. Practice guidelines for the perioperative management of patients with obstructive sleep apnea: An updated report by the American Society of Anesthesiologists Task Force on the Perioperative Management of Patients with Obstructive Sleep Apnea. *ANESTHESIOLOGY* 2014; 120:268–86
3. Gross JB, Apfelbaum JL, Connis RT, Nickinovich DG: In reply. *ANESTHESIOLOGY* 2014; 121:667–8
4. Chung F, Subramanyam R, Liao P, Sasaki E, Shapiro C, Sun Y: High STOP-Bang score indicates a high probability of obstructive sleep apnoea. *Br J Anaesth* 2012; 108:768–75
5. Farney RJ, Walker BS, Farney RM, Snow GL, Walker JM: The STOP-Bang equivalent model and prediction of severity of obstructive sleep apnea: Relation to polysomnographic measurements of the apnea/hypopnea index. *J Clin Sleep Med* 2011; 7:459–65B
6. Luo J, Huang R, Zhong X, Xiao Y, Zhou J: Value of STOP-Bang questionnaire in screening patients with obstructive sleep apnea hypopnea syndrome in sleep disordered breathing clinic. *Chin Med J (Engl)* 2014; 127:1843–8

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This letter was sent to the author of the original Reply referenced above, who declined to respond.

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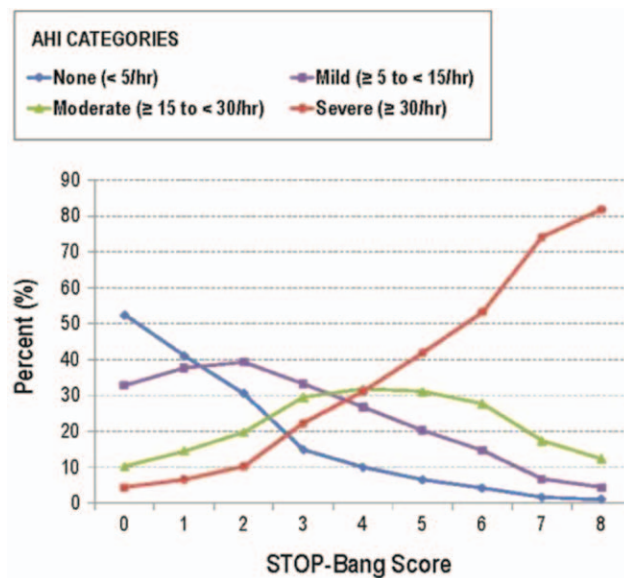


Fig. 1. STOP-Bang score and predicted probability of obstructive sleep apnea in different severity. AHI = apnea-hypopnea index. Adapted, with permission, from the article by Farney *et al.*⁵ Adaptations are themselves works protected by copyright. So to publish this adaptation, authorization must be obtained both from the owner of the copyright in the original work and from the owner of copyright in the translation or adaptation.

In Reply:

We appreciated the reply letter by Chung *et al.*, and we completely agree with their conclusions. As we underline in our former letter,¹ it is surprising and unjustified, on the basis of the evidence, that the authors of the Practice Guidelines did not recommend the use of the STOP-Bang questionnaire.^{2,3} In addition, stating that the STOP-Bang scores have been shown not to correlate with the severity of obstructive sleep apnea (OSA) is really surprising because robust data support that higher STOP-Bang scores significantly increase the probability of OSA.^{4,5} Since 2012, the Italian Society of Anesthesiology, Analgesia, Resuscitation and Intensive Care (SIAARTI) implemented the recommendation for perioperative management of OSA patients undergoing surgery, including the STOP-Bang questionnaire as cornerstone to rule in/rule out the disease in patients who never underwent an overnight monitoring.⁶ In this guideline, the allocation of the patient to a risk category drives the criteria for a safe OSA patient discharge from the postanesthesia care unit to unmonitored settings.⁷ Differently, the Task Force of the American Society states that, to decide whether the patient should be discharged to an unmonitored bed, it is necessary to observe “patients in an unstimulated environment, preferably while asleep,” an approach which cannot be considered a “reasoned clinical decision”² indeed.

In conclusion, the currently available data in the literature, as stressed by Chung *et al.*, support not only the correlation between a higher STOP-Bang score and the severity of OSA but also that at the present time it is imperative to adopt all the strategies to reduce perioperative risk.

Competing Interests

The authors declare no competing interests.

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References

- Corso RM, Gregoretti C, Braghiroli A, Fanfulla F, Insalaco G: Practice guidelines for the perioperative management of patients with obstructive sleep apnea: Navigating through uncertainty. *ANESTHESIOLOGY* 2014; 121:664–5
- Practice guidelines for the perioperative management of patients with obstructive sleep apnea: An updated report by the American Society of Anesthesiologists Task Force on the Perioperative Management of Patients with Obstructive Sleep Apnea. *ANESTHESIOLOGY* 2014; 120:268–86
- Gross JB, Apfelbaum JL, Connis RT, Nickinovich DG: In reply. *ANESTHESIOLOGY* 2014; 121:667–8
- Chung F, Subramanyam R, Liao P, Sasaki E, Shapiro C, Sun Y: High STOP-Bang score indicates a high probability of obstructive sleep apnoea. *Br J Anaesth* 2012; 108:768–75
- Farney RJ, Walker BS, Farney RM, Snow GL, Walker JM: The STOP-Bang equivalent model and prediction of severity of obstructive sleep apnea: Relation to polysomnographic measurements of the apnea/hypopnea index. *J Clin Sleep Med* 2011; 7:459–65B
- Petrini F, Vicini C, Gregoretti C, Corso RM: Raccomandazioni SIAARTI AIMS per la gestione perioperatoria del paziente affetto da Sindrome delle Apnee Ostruttive del Sonno. Prot. n. 454 SIAARTI 2009/2012, 15 maggio 2012. <http://www.siaarti.it>. Accessed March 27, 2015
- Gali B, Whalen FX, Schroeder DR, Gay PC, Plevak DJ: Identification of patients at risk for postoperative respiratory complications using a preoperative obstructive sleep

apnea screening tool and postanesthesia care assessment.
ANESTHESIOLOGY 2009; 110:869–77

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Prehabilitation versus Rehabilitation

To the Editor:

We read with a great interest the article of Gillis *et al.*¹ In this study, 77 patients undergoing colorectal resection for cancer were randomized to receive either prehabilitation or rehabilitation. Prehabilitation group was able to walk significantly further in 6 min, showing that a prehabilitation program could improve postoperative functional exercise capacity.

Rigorously, the authors scheduled in the study design to measure patients' compliance to the postoperative rehabilitation program. This program was based on exercise, nutrition, and psychological interventions. It was reported in the study that the compliance to this trimodal rehabilitation program from surgery to 4-week period was significantly higher in the prehabilitation group than in the rehabilitation group (53 *vs.* 31%, respectively, $P < 0.001$). As a result, we could hypothesize that the enhance in exercise capacity observed in the prehabilitation group could be the result of a greater compliance to the postoperative program rather than the usefulness of a prehabilitation program.

We would like to know how the authors dealt with this problem.

Competing Interests

The authors declare no competing interests.

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Reference

1. Gillis C, Li C, Lee L, Awasthi R, Augustin B, Gamsa A, Liberman AS, Stein B, Charlebois P, Feldman LS, Carli F: Prehabilitation versus rehabilitation: A randomized control trial in patients undergoing colorectal resection for cancer. ANESTHESIOLOGY 2014; 121:937–47

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In Reply:

We thank Bordes *et al.* for the opportunity to clarify this point. Our results¹ indicate that the compliance to the trimodal program in the first 4 weeks postsurgery was significantly higher in the prehabilitation group than in the

rehabilitation group (53 *vs.* 31% respectively, $P < 0.001$). Bordes *et al.* thus hypothesized that the observed improvement in functional walking capacity in the prehabilitation group could be the result of a greater compliance to the postoperative program rather than the usefulness of a prehabilitation program.

We would argue that the usefulness of the prehabilitation program is directly linked to the ability to maintain compliance postoperatively. Our argument is based on two main points: (1) Prehabilitation maintains functional integrity so that patients are physically capable of complying with the trimodal program postoperatively; and (2) Prehabilitation is rooted in the belief that the preoperative period is an opportune time to encourage compliance by educating and preparing patients for the tasks that need to be completed in the postoperative period.

The prehabilitated patients gained, on average, +25.2 m (50.2 m) in functional walking distance before surgery; a mean difference of distance walked of approximately 40 m between groups. This preoperative difference was considered clinically and statistically significant ($P < 0.001$) and substantiates the impact of prehabilitation. The finding attests to successful attainment of a “buffer” (*i.e.*, reserve) against the expected decline in physical function and overall well-being that is typically observed postoperatively. Moreover, a number of investigations have identified preoperative physical fitness as a predictor of surgical complications and early convalescence.^{2–6}

Compliance was tabulated subjectively, based on adherence to the *entire* trimodal program. The value reported is an equally weighted average among all three interventions, as prehabilitation is believed to be a work of synergy. It should be noted that the self-reported physical activity, as measured using the validated CHAMPS questionnaire, 4 weeks after surgery was not significantly different between the two groups. This implies that prehabilitated patients were more compliant with the nutrition and psychological component, rather than the exercise component, of the trimodal intervention after surgery. Although anxiety reduction strategies likely contributed to overall well-being, there is no direct link between these techniques and improvement in functional capacity. Similarly, maintenance of adequate dietary protein is essential to preserve lean body mass and therefore skeletal muscle function; however, it is generally accepted that exercise is the main anabolic stimulus and that adequate nutrition augments the effect.^{7–9} Adherence to the nutrition intervention after surgery may have been useful in sustaining the functional gain achieved in the preoperative period, yet unlikely to stimulate anabolic gains independent of increased exercise.

Finally, the use of preoperative counseling to provide information on the expectations of surgical procedures is believed to reduce fear and anxiety and enhance postoperative recovery.^{10,11} It is a fundamental component of Enhanced Recovery Programs.¹¹ Preoperative instruction