MEDICAL UNIVERSITY OF SOUTH CAROLINA
VALUE INSTITUTE
Evidence-Based Practice Brief
Obstructive Sleep Apnea Assessment in Inpatients

Author(s): Amanda Davis, MPH, RD, CHES; Emily Brennan, MLIS

ASK THE QUESTION

Question(s): Is Obstructive Sleep Apnea (OSA) assessment effective in identifying hospitalized patients with untreated OSA and what criteria indicate that OSA assessment should occur?

SEARCH FOR EVIDENCE

Databases: PubMed, CINAHL, Scopus

PubMed search strategy: obstructive sleep apnea AND (inpatients OR hospitalized OR hospitalization) AND (assessment OR evaluation OR screening OR diagnosis OR “STOP-BANG” OR “Sleep Apnea Clinical Score”)

Keywords: “obstructive sleep apnea”, inpatients, hospitalized, hospitalization, assessment, evaluation, screening, diagnosis, “Sleep Apnea Clinical Score”, “STOP-BANG”

CRITICALLY ANALYZE THE EVIDENCE

There were 9 studies found addressing the effectiveness of obstructive sleep apnea (OSA) assessment in hospitalized patients. These studies addressed OSA assessment in two distinct categories: 1) preoperative surgical patients and 2) patients with identified comorbidities (i.e., age, obesity, cardiopulmonary, stroke). Multiple, validated screening tools were used in these studies, including the Berlin questionnaire, STOP questionnaire, STOP-BANG questionnaire and Flemons’ Index.

Preoperative surgical patients:
Three studies focused on the use of validated screening tools to assess for OSA in preoperative surgical patients (Cordovani et al., 2016; Lockhart et al., 2013; Vasu et al., 2010). Vasu et al. (2010) retrospectively reviewed the STOP-BANG assessment results in 135 adult patients undergoing elective surgery, and found that 41.5% were screened at high risk for OSA. Further analysis of these patients indicated that patients at high risk for
OSA had a higher rate of postoperative complications (19.6% vs 1.3%; p<0.001), and that the odds of postoperative complications was 11 times higher in patients with a high risk for OSA (OR 11.40, 95% CI 1.18-110.47, p=0.03).

Lockhart et al. (2013) prospectively compared the results of four OSA screening tools (Berlin, Flemons’, STOP, STOP-BANG) in almost 15,000 adult surgical patients following implementation of routine preoperative screening for OSA and perioperative precautions for patients screened at high risk. They found that while four screening tools did not significantly differ in the demographics and health information of patients, a high risk score on the STOP (5.57%; p = 0.004) and STOP-BANG (5.2%; p < 0.001) assessments was significantly associated with ICU admission, and that there were 1-year mortality differences between the low and high-risk groups as identified by the Flemons’ (4.96% vs 6.91%; p < 0.0001), STOP (5.28% vs 7.57%; p < 0.0001) and STOP-BANG (4.13% vs 7.45%; p < 0.0001) tools.

Cordovani et al. (2016) was a survey of Canadian Anesthesiologist that assessed for the tools used to manage surgical patients diagnosed or suspected OSA. This survey of approximately 1,400 anesthesiologist found that only 30% were using a screening questionnaire if they clinically suspected OSA, and even fewer (18%) used an OSA questionnaire in all patients.

Hospitalized patients with identified comorbidities:
Seven studies assessed specific groups of hospitalized patients at risk for OSA based on comorbidities previously identified in the literature.

Three studies addressed the use of OSA assessment in hospitalized cardiopulmonary patients (Kauta et al., 2014; Konikkara et al., 2016; Loo et al., 2013). Loo et al. (2013) investigated the prevalence of high risk OSA using the Berlin questionnaire and neck-to-height ratio in 513 patients hospitalized under general cardiology service. They found that 44.1% of patients were at high risk for OSA, and that high BMI (OR 1.21, 95% CI 1.15-12.7, p<0.001) and high neck/height ratio (OR 1.32, 95% CI 1.21-1.44, p<0.001) were significant predictors of being high risk.

Kauta et al. (2014) did not use a screening questionnaire, but instead used visualization of sleep disordered breathing (SDB) by nursing staff as a trigger for unattended sleep studies and PAP initiation during inpatient admission for specific cardiac conditions (heart failure, arrhythmia, MI) in a cohort of 106 patients. This nursing trigger resulted in 61.3% of cardiac patients with no previous SDB being diagnosed with OSA. Konikkara et al. (2016) retrospectively reviewed the charts of 24 obese patients with COPD identified at high risk for OSA using the STOP questionnaire. They found that the mean number of clinical events (ED visits, hospitalizations) was significantly reduced at 6 months (-2.1±0.3 vs -0.8±0.5, p=0.01) and 12 months (-2.7±0.5 vs -0.8±0.6, p=0.03) in patients that were compliant with PAP therapy.

Sharma et al. (2015) addressed the use of OSA assessment in approximately 750 obese hospitalized patients under the care of cardiology, internal medicine, family practice services. Use of the STOP assessment in resulted in: 1) 84.4% being identified as high risk for OSA, 2) 184 formal sleep consults, 3) 232 overnight pulse oximetry tests for diagnostic purposes, and 4) 149 in-laboratory polysomnography within 4 weeks of discharge. Of these 149, 87% were positive for OSA and 65% of them had moderate to severe OSA.

Shear et al. (2014) looked specifically at the use of OSA assessment in over 400 hospitalized adults ≥ 50 years old. Approximately 40% of patients were screened as high risk for OSA using the Berlin questionnaire, and these patients had lower sleep efficiency (-5.50%, 95% CI -9.96 to -1.05, p = 0.015), slept approximately 40 min less each night per actigraphy (-39.6 min, 95% CI -66.5, to -12.8, p = 0.004), self-reported lower sleep quality (-0.101, 95% CI -0.164 to -0.037, p = 0.002) and were 3 times more likely to receive pharmacologic sleep aids while in the hospital (15.5% high vs. 5.1% low, p < 0.001).
Severine et al. (2016) prospectively evaluated the use of the Berlin questionnaire for OSA assessment in 291 patients in the comprehensive stroke unit post-TIA/stroke. Based on STOP-BANG questionnaire results, 88% were at risk for OSA with 74.2% at mild to moderate risk and 14% at a high risk. While they did find that 32.2% of these patients had an OSA screening before the TIA/stroke occurred, it was not possible to determine pre-TIA/stroke OSA risk in this population.

The effectiveness of using an OSA screening tool is supported by the literature for patients undergoing surgery and hospitalized patients with obesity, cardiopulmonary comorbidities, or that are post-TIA/stroke. Since four different tools (Berlin, Flemons’, STOP, STOP-BANG) are referenced in this body of literature, and only one study (Lockhart et al., 2013) compared the results of different tools with the same cohort of patients, there is not enough evidence to support the use of any one tool in particular.

PICO Question: Is Obstructive Sleep Apnea (OSA) assessment effective in identifying hospitalized patients at risk for OSA and what criteria indicate that OSA assessment should occur?

<table>
<thead>
<tr>
<th>Author/Dates/Journal</th>
<th>Purpose of Study</th>
<th>Study Design</th>
<th>Sample &amp; Setting</th>
<th>Outcomes</th>
<th>Design Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cordovani et al., 2016, Canadian Journal of Anesthesia</td>
<td>To evaluate the perspectives of Canadian anesthesiologists regarding the perioperative management of patients with diagnosed or suspected OSA</td>
<td>Survey</td>
<td>Scenario-based survey sent to 2734 certified anesthesiologists in Canada (1782 sent online survey) - initial -6 wk follow-up for non-responders - online version for active members of the Canadian Anesthesiologists’ Society</td>
<td>To identify patients who may have undiagnosed OSA preoperatively, 50% (385/772) of the respondents specified relying on clinical suspicion alone, 30% (231/772) specified using a screening questionnaire in cases where OSA is clinically suspected, 18% (139/772) specified using a screening questionnaire for all patients, and 2% (18/772) specified not screening for OSA at all.</td>
<td>Study Limitations = None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-65% response rate for mail &amp; 26% for online surveys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kauta et al., 2014, Journal of Clinical Sleep Medicine</td>
<td>To design a new paradigm to diagnose and manage OSA in cardiac inpatients by performing sleep studies and</td>
<td>Prospective and retrospective chart review</td>
<td>106 cardiac patients (heart failure, arrhythmia, MI only) admitted to a teaching hospital in Pennsylvania - 81 SDB (65 OSA) - 23 non-SDB - 2 inconclusive</td>
<td>76.4% of cardiac patients with no previous SDB diagnosis had OSA or CSA, with OSA being much more prevalent (61.3%). Patients with newly-diagnosed SDB who were adherent to</td>
<td>Study Limitations = None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Insufficient sample size</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sample not representative of patients in the population as a whole</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Variables (confounders, exposures, predictors) were not described</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Outcome criteria not objective or were not applied in blind fashion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For diagnostic study, sample not defined at common point in course of disease/condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For diagnostic study, gold standard not applied to all patients</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For diagnostic study, no independent, blind comparison between index test and gold standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Publication Bias (e.g., pharmaceutical company sponsors study on effectiveness of drug)</td>
</tr>
</tbody>
</table>

GRADE CRITERIA for rating a body of evidence (See Appendix A for more info)

Lower Quality Rating if:

- Studies inconsistent (When there are differences in the direction of the effect, populations, interventions or outcomes between studies)
- Studies are indirect (Your PICO question is quite different from the available evidence in regard to population, intervention, comparison, or outcome)
- Studies are imprecise (When studies include few patients and few events and thus have wide confidence intervals and the results are uncertain)

Increase Quality Rating
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Description</th>
<th>Study Design</th>
<th>Study Results</th>
<th>Limitations</th>
</tr>
</thead>
</table>
| Konikkara et al., 2016, Hospital Practice | To evaluate the use of an early detection and treatment protocol for patients with chronic obstructive pulmonary disease (COPD) at risk for OSA | Retrospective chart review (pre/post intervention) | 24 patients with COPD exacerbation and BMI of > 30kg/m² screened for OSA over 10 months at a hospital in Pennsylvania that began PAP therapy
- compared admissions/ER visits 12 months before/after intervention
- used STOP questionnaire (snoring, daytime tiredness, witnessed apnea, hypertension) with 2+ "yes" responses labeled high risk
- weekend/holiday and off-service admissions excluded
PAP compliance:
- 12 compliant
- 12 non-compliant
With similar pre-intervention admission/visit rates
There was a significant change in the mean # of clinical events between PAP compliant & PAP non-compliant patients at 6 months (-2.1±0.3 vs -0.8±0.5, p=0.01) and 12 months (-2.7±0.5 vs -0.8±0.6, p=0.03). | Study Limitations =
- None
Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)
- Insufficient sample size
- Sample not representative of patients in the population as a whole
- Variables (confounders, exposures, predictors) were not described
- Outcome criteria not objective or were not applied in blind fashion
- Insufficient follow-up, if applicable
- For prognostic study, sample not defined at common point in course of disease/condition
- For diagnostic study, gold standard not applied to all patients
- For diagnostic study, no independent, blind comparison between index test and gold standard |
| Lockhart et al., 2013, Sleep Medicine | To determine if a prior diagnosis of OSA or a positive screen for OSA was associated with | Prospective cohort | 14,962 adult surgical patients at 1 hospital following implementation of routine preoperative screening for OSA and perioperative precautions
The Berlin questionnaire identified 24.1% as high risk, STOP identified 16.7% as high risk, STOP-BANG identified 41.6% as high risk, and the Flemons’ Index | Study Limitations =
- None
Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)
Loo et al., 2013, International Journal of Cardiology

To investigate the prevalence of high risk OSA in patients hospitalized under general cardiology

Prospective observational study

513 patients admitted to general cardiology services over 4 months at a university hospital in Singapore

-Used Berlin questionnaire

44.1% of patients were at high risk of OSA

- High BMI (OR 1.21, 95% CI 1.15-1.27, p<0.001) and neck/height ratio (OR 1.32, 95% CI 1.21-1.44, p<0.001) significant predictors of high risk for OSA

Study Limitations = None

Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)

- Insufficient sample size
- Sample not representative of patients in the population as a whole
- Variables (confounders, exposures, predictors) were not described
- Outcome criteria not objective or were not applied in blind fashion
- Insufficient follow-up, if applicable
- For prognostic study, sample not defined at common point in course of disease/condition
- For diagnostic study, gold standard not applied to all patients
- For diagnostic study, no independent, blind comparison between index test and gold standard
<table>
<thead>
<tr>
<th>Service</th>
<th>Risk</th>
<th>Study Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck circumference measured risk</td>
<td>30-day readmission (p=0.271) and mortality (p=0.702) rates were not significantly different between the high and low risk groups</td>
<td>Insufficient sample size&lt;br&gt;Sample not representative of patients in the population as a whole&lt;br&gt;Variables (confounders, exposures, predictors) were not described&lt;br&gt;Outcome criteria not objective or were not applied in blind fashion&lt;br&gt;Insufficient follow-up, if applicable&lt;br&gt;For prognostic study, sample not defined at common point in course of disease/condition&lt;br&gt;For diagnostic study, gold standard not applied to all patients&lt;br&gt;For diagnostic study, no independent, blind comparison between index test and gold standard</td>
</tr>
</tbody>
</table>

Severine et al., 2016, *Journal for Nurse Practitioners*<br>To examine OSA risk as measured by the STOP-BANG questionnaire among hospitalized adults diagnosed with transient ischemic attack (TIA) or stroke | Prospective observational | 291 comprehensive stroke unit patients admitted to a large Midwestern medical center<br>-excluded patients with poor comprehension/language barrier, global aphasia, or severely dysarthric<br>-See Appendix B for STOP-BANG questionnaire | 88% were at risk for OSA<br>- 74.2% had mild to moderate risk<br>- 14% subjects had a high risk<br>-All patients who were at risk for OSA were given results of the STOP-BANG questionnaire and a referral letter to be taken to their primary care physician for follow-up<br>32.2% of these patients had an OSA screening before the TIA/stroke occurred | Study Limitations = None<br>*Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)*<br>Insufficient sample size<br>Sample not representative of patients in the population as a whole<br>Variables (confounders, exposures, predictors) were not described<br>Outcome criteria not objective or were not applied in blind fashion<br>Insufficient follow-up, if applicable<br>For prognostic study, sample not defined at common point in course of disease/condition<br>For diagnostic study, gold standard not applied to all patients<br>For diagnostic study, no independent, blind comparison between index test and gold standard |

Sharma et al., 2015, *Journal of Clinical Sleep Medicine*<br>To conduct a clinical pathway evaluation for OSA screening in obese patients admitted to a hospital | Prospective observational | 754 consecutive obese (BMI ≥ 30) patients admitted to an medical services (cardiology, internal medicine, family practice) units of an academic medical center in Pennsylvania over 1 year<br>-149 patients underwent in-laboratory PSG within 4 wk of discharge | 636 patients were found to be high risk (84.4%)<br>-410 received formal sleep consult (184 occurred)<br>-232 had overnight pulse oximetry (for OSA diagnostic purposes)<br>-149 patients underwent in-laboratory PSG within 4 wk of discharge | Study Limitations = None<br>*Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)*<br>Insufficient sample size<br>Sample not representative of patients in the population as a whole
-used STOP questionnaire (snoring, daytime tiredness, witnessed apnea, hypertension) with 2+ “yes” responses labeled high risk
-used overnight pulse oximetry to detect sleep apnea in at risk patients during hospitalization
-polysomnography (PSG) recommended post-discharge
- 87% were positive for OSA and 65% of them had moderate to severe OSA
  There was a significant increase in referrals following introduction of the program (1 vs 410)
- 226 were not consulted for comprehensive sleep evaluation
  a significant number of patients refused consultation, suggesting poor awareness of potential effect of sleep disordered breathing at the community level
- BMI (30.9 vs 26.1, p=0.006) was significantly higher in high risk group
- High risk patients were less likely to be in the oldest age category (74-93 yr, p=0.006)
  Patients at high risk for OSA:
  -obtained approximately 40 min less sleep per night per actigraphy during hospitalization (-39.6 min [-66.5, -12.8], p = 0.004)
  -had lower inpatient sleep efficiency (-5.50% [-9.96, -1.05], p = 0.015)
  -self-reported lower sleep quality (-0.101 [-0.164, -0.037], p = 0.002)
  -were 3 times more likely to receive pharmacologic sleep aids while in the hospital (15.5% of high risk vs. 5.1% of low risk, p < 0.001)

**Study Limitations** =
- None

**Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)**
- Insufficient sample size
- Sample not representative of patients in the population as a whole
- Variables (confounders, exposures, predictors) were not described
- Outcome criteria not objective or were not applied in blind fashion
- Insufficient follow-up, if applicable
- For prognostic study, sample not defined at common point in course of disease/condition
- For diagnostic study, gold standard not applied to all patients
- For diagnostic study, no independent, blind comparison between index test and gold standard
<table>
<thead>
<tr>
<th>Otolaryngology-Head &amp; Neck Surgery</th>
<th>preoperative STOP-BANG questionnaire correlated with a higher rate of OSA complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>center in Pennsylvania over 3 consecutive days -renal failure &amp; low albumin excluded</td>
<td></td>
</tr>
</tbody>
</table>

Patients at high risk for OSA had a higher rate of postoperative complications compared with patients at low risk (19.6% vs 1.3%; p<0.001).
- area under curve for predicting postoperative complications for STOP-BANG was 0.82 (high)
- Odds of postoperative complications was 11 times higher in patients with a high risk for OSA (OR 11.40, 95% CI 1.18-110.47, p<0.001)

Mean length of stay in the hospital was 2.7 (2.6) days and was significantly longer for patients at high risk for OSA compared with patients at low risk (3.6 [3.6] days vs 2.1 [1.4] days; p=0.003)

sectional, longitudinal, descriptive, epidemiologic, case study/series, survey

- Insufficient sample size
- Sample not representative of patients in the population as a whole
- Variables (confounders, exposures, predictors) were not described
- Outcome criteria not objective or were not applied in blind fashion
- Insufficient follow-up, if applicable
- For prognostic study, sample not defined at common point in course of disease/condition
- For diagnostic study, gold standard not applied to all patients
- For diagnostic study, no independent, blind comparison between index test and gold standard

REFERENCES


Appendix A: GRADE criteria for rating a body of evidence on an intervention
Grades and interpretations:

High: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low: Any estimate of effect is very uncertain.

Type of evidence and starting level

Randomized trial–high
Observational study–low
Any other evidence–very low

Criteria for increasing or decreasing level

Reductions
Study quality has serious (−1) or very serious (−2) problems
Important inconsistency in evidence (−1)
Directness is somewhat (−1) or seriously (−2) uncertain
Sparse or imprecise data (−1)
Reporting bias highly probable (−1)

Increases
Evidence of association† strong (+1) or very strong (+2)
Dose-response gradient evident (+1)
All plausible confounders would reduce the effect (+1)

†Strong association defined as significant relative risk (factor of 2) based on consistent evidence from two or more studies with no plausible confounders. Very strong association defined as significant relative risk (factor of 5) based on direct evidence with no threats to validity.

Appendix B: STOP-BANG Questionnaire
### STOP-Bang questionnaire

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you snore loudly? (loud enough to be heard through closed door)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>2. Do you often feel tired, fatigued, or sleepy during daytime?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>3. Has anyone observed you stop breathing during your sleep?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>4. Do you have or are you being treated for high blood pressure?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>5. BMI ≥35 kg/m² ?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>6. Age ≥50 y old?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>7. Neck Circumference ≥40 cm</td>
<td>Yes/No</td>
</tr>
<tr>
<td>8. Gender Male?</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

High Risk of OSA: answering yes to three or more items.

Low Risk of OSA: answering yes to less than three items.