SASM Consensus Statement:

Preoperative Screening for Obstructive Sleep Apnea

Satya Krishna Ramachandran et al ☺

Committee Members

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1.1 Should adult patients at risk for OSA be identified before surgery?

- **Considerations**
  - The prevalence of **diagnosed OSA** in surgical patients
    - Self-report or ICD9 codes
    - 7-10% for specific surgical populations[1-3]
    - May be as high as 70% in bariatric surgical patients.[4, 5]
  - The majority of OSA patients are undiagnosed at the time of surgery[9] (estimate 40-80% undiagnosed)
  - 2-3 fold increased risk of postoperative cardiopulmonary adverse events.[1, 10-13]
- Important caveat
  - These screening tests identify patients at high risk for OSA
  - Mere use of preoperative OSA screening alone may not impact patient complications.[7]

1.1 Should adult patients at risk for OSA be identified before surgery?

In the absence of high quality published evidence:
- This expert recommendation reflects a growing consensus to identify patients at high risk of OSA
- Targeted perioperative interventions*
  - May help to reduce surgical complications
  - May improve long-term health management

***Recommendation*:** *Adult patients at risk for OSA should be identified before surgery*
- *Grade of Evidence:*
  - *Moderate – High for OSA screening test accuracy*
  - *Low for clinical value of preoperative screening*
- *Grade of Recommendation:*
  - *Strong (Evidence-based and Expert opinion)*

1.2 Which tools can be used to identify surgical patients with suspected OSA in the preoperative period?

Considerations:
- The majority of OSA patients presenting for surgery are undiagnosed without the option of formal preoperative PSG testing.
- Previous systematic review, meta-analysis[17, 18] and guidelines[19, 20] do not provide recommendations for specific screening tests.
- Choices: questionnaires, clinical models +/- additional screening techniques
- The majority of screening tests are not validated in the surgical population

1.2 Which tools can be used to identify surgical patients with suspected OSA in the preoperative period?

Considerations:
- Feasibility/Usability
  - Questionnaires vs. clinical models
  - Perioperative validation vs. sleep clinic populations
- Reliability – how many studies have validated this?
  - Large heterogeneity
  - Comparative accuracy – for OSA diagnosis not outcome prediction
- Validated choices: The STOP-Bang tool, P-SAP score, Berlin questionnaire, ASA checklist

	STOP-Bang tool n=177	Berlin questionnaire n=177	ASA checklist n=177	P-SAP score n=511
Sensitivity	0.84	0.69	0.72	0.94
Specificity	0.56	0.56	0.38	0.32
PPV**	0.81	0.78	0.72	0.1
NPV**	0.61	0.45	0.38	0.99
LR+	1.9	1.57	1.16	1.38
LR-	0.29	NA	NA	0.18
DOR	6.58	2.85	1.59	7.40
ROC	0.80	0.69	0.78	0.82

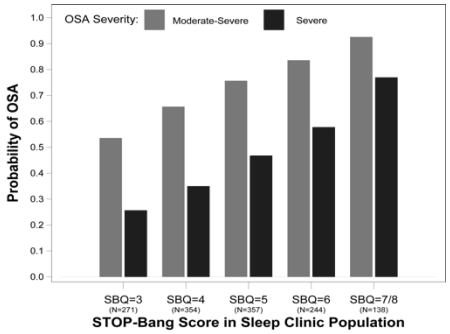
Pooled predictive parameters for STOP-Bang score ≥3
16 studies, n = 8991

Sleep Clinic population	**Surgical population**	**Others**
10 studies, n = 2960	3 studies, n = 1004	3 studies, n=5027
AHI ≥5	**AHI ≥5**	**General population**
10 studies, n = 2960	2 studies, n = 923	RDI ≥15 & ≥30, n=4770
AHI ≥15	**AHI ≥15**	
10 studies, n = 2960	3 studies, n = 1004	**Highway bus drivers** AHI >15, n=85
AHI ≥30	**AHI ≥30**	
8 studies, n = 2780	2 studies, n = 923	**Renal failure patients** RDI ≥15 & ≥30, n=172

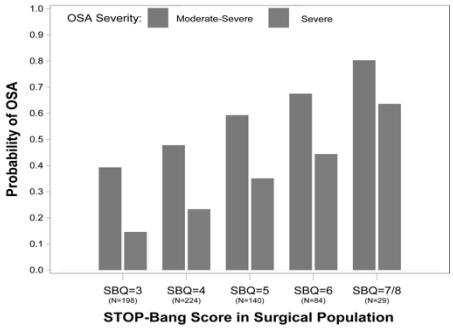
Surgical population

Predictive parameters	Mild OSA **AHI ≥5** (2 studies, n = 923)	Moderate-to-Severe OSA **AHI ≥15** (3 studies, n = 1002)	Severe OSA **AHI ≥30** (2 studies, n = 923)
Prevalence	**68.0**	**39.0**	**19.0**
Sensitivity	**84.0**	**91.0**	**96.0**
Specificity	**43.0**	**32.0**	**29.0**
Positive predictive value	**76.0**	**46.0**	**23.0**
Negative predictive value	**55.0**	**84.0**	**97.0**
Diagnostic odds' ratio	**4.46**	**4.08**	**11.31**
SROC	**0.64**	**0.68**	**0.63**

Sleep clinic population



Surgical population



1.2 Which tools can be used to identify surgical patients with suspected OSA in the preoperative period?

- STOP-Bang tool is the most validated screening test
- Sensitivity and specificity inter-dependence
  - At higher thresholds
    - Sensitivity decreases = missed diagnoses
    - Specificity increases = resource utilization improves
  - Local practices should decide threshold for high-risk
    - Relative rates of missed diagnoses and wasted resource utilization
    - Expect lower PPV perioperatively
- More advanced tools:
  - Complexity, applicability? needs perioperative validation

1.2 Which tools can be used to identify surgical patients with suspected OSA in the preoperative period?

Recommendation:

Screening tools such as STOP-Bang,[6] P-SAP,[3] Berlin[16] and ASA check list[16] can be used as preoperative screening tools to identify patients with suspected OSA.

- *Grade of Evidence*
  - *Moderate to High for perioperative use of screening tools*
- *Grade of Recommendation*
  - *Strong (evidence-based)*

1.3 What is the clinical value for performing additional preoperative screening tests?

Considerations:

- Screening tests perform better with increasing OSA severity
- Screen positive patients should be assumed to have moderate to severe OSA in the absence of diagnostic polysomnography
- Preoperative serum bicarbonate level may improve the prediction accuracy of STOP-Bang.[34]
- This recommendation does not relate to procedures where polysomnography is performed as part of the accepted preoperative management
  - Bariatric surgery
  - Airway surgery for OSA

1.3 What is the clinical value for performing additional preoperative screening tests?

Recommendation

There is insufficient evidence to support cancelling or delaying surgery in order to perform more advanced screening techniques or to formally diagnose OSA in those patients identified as being at high risk of OSA preoperatively, unless there is evidence of significant or uncontrolled systemic disease.

- *Grade of Evidence*
  - *Low to Moderate*
- *Grade of Recommendation*
  - *Strong (Expert Opinion)*

META-ANALYSIS OF SCREENING TESTS FOR OSA

Key Steps

- Search strategy
- Inclusion criteria
- Exclusion criteria
- Quality metrics: RevMan
- Quantitative analysis
  - Summary measures of accuracy
  - Definition of ideal screening test?
  - Fixed or random effects model
  - Measures of heterogeneity: Indications for metaregression
  - Variables that influence test accuracy

Inclusion Criteria

- Published between 1966 to date
- Index test: questionnaires, clinical scales, or prediction equations (advanced clinical models)
- Gold Standard: Standard overnight polysomnography, AHI threshold for diagnosis of OSA, severe OSA
- Provided prevalence of OSA and raw data as 2x2 tables or sensitivity and specificity, or positive and negative likelihood ratios

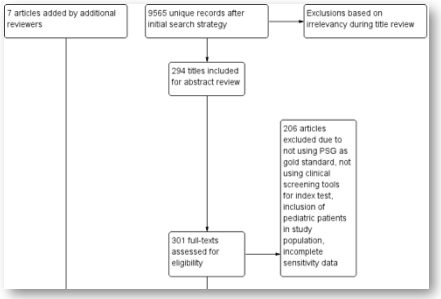
Exclusion Criteria

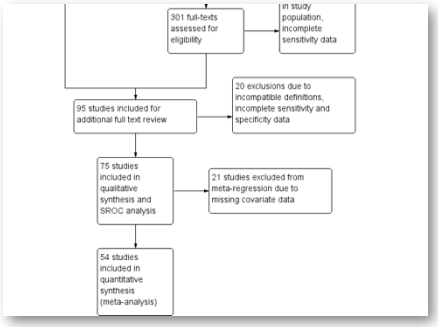
- Gold standard: portable monitoring (?split night study?)
- Other possible exclusions:
  - single validation study (in other words do we need >1 study evaluating the same tool to include in analysis),
  - ~~sample size <170 as this was identified as minimum sample size in Frances's STOP paper. Or use Carley's nomogram (see attachment) to come up with what we think is a minimum sample size for inclusion.~~
  - ~~Inadequate study quality as scored by QUADAS or PRISMA guidelines? We have to define this. It may strengthen our quantitative analysis~~

Search Strategy

- Through UHN Health Sciences Library
- OSA + Screening/Screening Tests + Diagnostic Accuracy/Predictive Value of Tests/Validity; limited to human, English, adults.
- >12,000 titles
  - 8 lonely team members -
  - 2 active team members plus two research assistant
  - De-duplication using Excel and EndNote
- Title search elimination through Dropbox

Study Flow





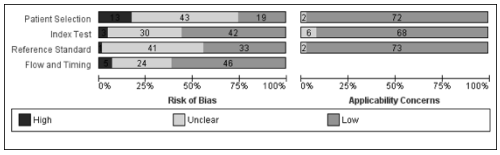
Data Extraction

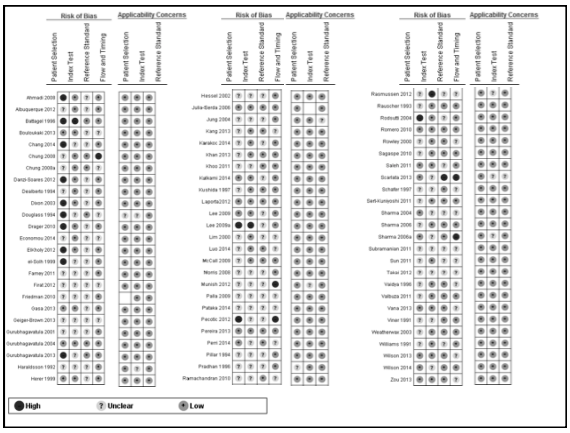
- Each study reported one or multiple index test and gold standard results
  - All were extracted
  - 2x2 data directly extracted
  - Bayesian back calculation performed using Excel tool if prevalence was provided along with sensitivity and specificity.
  - Cross validated the accuracy of output against known 2x2

Study	N	Prevalence	Sensitivity	Specificity	TP	FP	FN	TN
1	1000	0.1	0.9	0.9	90	10	90	810
2	354	0.6	0.9	0.3				

Qualitative Analysis

- Used RevMan latest version (5.3.4)
- Risk of bias and applicability concerns examined





Quantitative Analysis

- Primary principles:
  - Ideal: high sensitivity to reduce the false negative rates
    - Previously shown that FNR are wide across tests
  - Positive predictive value reflects wasted resources
    - Predictive values are directly affected by prevalence
    - Most studies in this analysis had very high (abnormal) prevalence compared to preoperative care
    - Unlikely to be useful statistic
  - More advanced methods:
    - Summary ROC curve comparison
    - HSROC
    - Mixed models

Meta-analysis Output

- Will be independent of the consensus statement
  - Alludes only to 1.2
  - Does not specifically look for preoperative screening
  - May require more rigorous exclusion criteria
  - Ongoing discussion with Mariska Leeflang
- Goal: manuscript by year end