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*

PRACTICE guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints, and are not intended to replace local institutional policies. In addition, practice guidelines developed by the American Society of Anesthesiologists (ASA) are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome. Practice guidelines are subject to revision as warranted by the evolution of medical knowledge, technology, and practice. They provide basic recommendations that are supported by a synthesis and analysis of the current literature, expert and practitioner opinion, open forum commentary, and clinical feasibility data.


Received from American Society of Anesthesiologists, Park Ridge, Illinois. Submitted for publication ____. Accepted for publication ____. Supported by the American Society of Anesthesiologists and developed under the direction of the Committee on Standards and Practice Parameters, Jeffrey L. Apfelbaum, M.D. (Chair). Approved by the ASA House of Delegates on, _____. A complete bibliography used to develop these updated Guidelines, arranged alphabetically by author, is available as Supplemental Digital Content 1, http://links.lww.com/__

Address correspondence to the American Society of Anesthesiologists: 520 N. Northwest Highway, Park Ridge, Illinois 60068-2573. These Practice Guidelines, as well as all ASA Practice Parameters, may be obtained at no cost
Methodology

A. Definition of Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) is a syndrome characterized by periodic, partial, or complete obstruction of the upper airway during sleep. This, in turn, causes repetitive arousal from sleep to restore airway patency, which may result in daytime hypersomnolence or other daytime manifestations of disrupted sleep such as aggressive or distractible behavior in children. The airway obstruction may also cause episodic sleep-associated oxygen desaturation, episodic hypercarbia, and cardiovascular dysfunction. In the perioperative period, both pediatric and adult patients with OSA, even if asymptomatic, present special challenges that must be addressed to minimize the risk of perioperative morbidity or mortality.

Because procedures differ among laboratories, it is not possible to use specific values of indices such as the apnea-hypopnea index (AHI) to define the severity of sleep apnea. Therefore, for the purposes of these Guidelines, patients will be stratified using the terms mild, moderate, and severe as defined by the laboratory where the sleep study was performed.

B. Purposes of the Guidelines

The purposes of these Guidelines are to improve the perioperative care and reduce the risk of adverse outcomes in patients with confirmed or suspected OSA who receive sedation, analgesia, or anesthesia for diagnostic or therapeutic procedures under the care of an anesthesiologist.

C. Focus

These Guidelines focus on the perioperative management of patients with confirmed or suspected OSA who may be at increased risk for perioperative morbidity and mortality because of potential difficulty in maintaining a patent airway. This population includes but is not limited to patients who have sleep apnea resulting from obesity, pregnancy, and other skeletal, cartilaginous, or
soft tissue abnormalities causing upper airway obstruction. These Guidelines do not focus on patients with the following conditions: (1) pure central sleep apnea, (2) abnormalities of the upper or lower airway not associated with sleep apnea (e.g., deviated nasal septum), (3) daytime hypersomnolence from other causes, (4) patients younger than 1 yr, and (5) obesity in the absence of sleep apnea.

D. Application

These Guidelines apply to both inpatient and outpatient settings, and to procedures performed in an operating room as well as in other locations where sedation or anesthesia is administered. They are directly applicable to care administered by anesthesiologists and individuals who deliver care under the medical direction or supervision of an anesthesiologist. They are also intended to serve as a resource for other physicians and patient care personnel who are involved in the care of these patients. In addition, these Guidelines may serve as a resource to provide an environment for safe patient care.

E. Task Force Members and Consultants

The original Guidelines were developed by an ASA appointed Task Force of 12 members, consisting of anesthesiologists in both private and academic practices from various geographic areas of the United States, a bariatric surgeon, an otolaryngologist, and two methodologists from the ASA Committee on Standards and Practice Parameters.

The original Task Force developed the Guidelines by means of a six-step process. First, they reached consensus on the criteria for evidence of effective perioperative management of patients with OSA. Second, original published research studies from peer-reviewed journals relevant to the perioperative management of patients with OSA were evaluated. Third, the panel of expert consultants was asked to (1) participate in opinion surveys on the effectiveness of various

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† American Society of Anesthesiologists: Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea. ANESTHESIOLOGY 2006;104:1081-1093
perioperative management strategies for patients with OSA and (2) review and comment on a draft of the Guidelines developed by the Task Force. Fourth, the Task Force held open forums at two major national meetings to solicit input on its draft recommendations. National organizations representing most of the specialties whose members typically care for patients with OSA were invited to participate in the open forums. Fifth, the consultants were surveyed to assess their opinions on the feasibility and financial implications of implementing the Guidelines. Sixth, all available information was used to build consensus within the Task Force to finalize the Guidelines.

In 2012, the ASA Committee on Standards and Practice Parameters requested that the updated Guidelines published in 2006 be re-evaluated. This update consists of an evaluation of literature published since completion of the original Guidelines, and an evaluation of new survey findings of expert consultants and ASA members. A summary of recommendations is found in Appendix 1.

F. Availability and Strength of Evidence

Preparation of these updated Guidelines followed a rigorous methodological process. Evidence was obtained from two principal sources: scientific evidence and opinion-based evidence (appendix 2).

Scientific Evidence:

Scientific evidence used in the development of these Guidelines is based on findings from literature published in peer-reviewed journals. Literature citations are obtained from PubMed and other healthcare databases, direct internet searches, task force members, liaisons with other organizations, and from hand searches of references located in reviewed articles.

Findings from the aggregated literature are reported in the text of the Guidelines by evidence category, level, and direction. Evidence categories refer specifically to the strength and quality of the research design of the studies. Category A evidence represents results obtained from randomized controlled trials (RCTs), and Category B evidence represents observational results obtained from non-randomized study designs or RCTs without pertinent controls. When available,
Category A evidence is given precedence over Category B evidence in the reporting of results. These evidence categories are further divided into evidence levels. Evidence levels refer specifically to the strength and quality of the summarized study findings (i.e., statistical findings, type of data, and the number of studies reporting/replicating the findings) within the two evidence categories. For this document, only the highest level of evidence is included in the summary report for each intervention, including a directional designation of benefit, harm, or equivocality for each outcome.

**Category A:** Randomized controlled trials (RCTs) report comparative findings between clinical interventions for specified outcomes. Statistically significant (p < 0.01) outcomes are designated as either beneficial (B) or harmful (H) for the patient; statistically non-significant findings are designated as equivocal (E).

- **Level 1:** The literature contains a sufficient number of RCTs to conduct meta-analysis,‡ and meta-analytic findings from these aggregated studies are reported as evidence.
- **Level 2:** The literature contains multiple RCTs, but the number of RCTs is not sufficient to conduct a viable meta-analysis for the purpose of these Guidelines. Findings from these RCTs are reported as evidence.
- **Level 3:** The literature contains a single RCT, and findings from this study are reported as evidence.

**Category B:** Observational studies or RCTs without pertinent comparison groups may permit inference of beneficial or harmful relationships among clinical interventions and outcomes. Inferred findings are given a directional designation of beneficial (B), harmful (H) or equivocal (E). For studies that report statistical findings, the threshold for significance is p < 0.01.

- **Level 1:** The literature contains observational comparisons (e.g., cohort, case-control research designs) between clinical interventions for a specified outcome.
- **Level 2:** The literature contains observational studies with associative statistics (e.g., relative

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‡ All meta-analyses are conducted by the ASA methodology group. Meta-analyses from other sources are reviewed
risk, correlation, sensitivity/specificity).

but not included as evidence in this document.
Level 3: The literature contains non-comparative observational studies with descriptive statistics (e.g., frequencies, percentages).

Level 4: The literature contains case reports.

**Insufficient Evidence:** The lack of sufficient scientific evidence in the literature may occur when the evidence is either unavailable (i.e., no pertinent studies found) or inadequate. Inadequate literature cannot be used to assess relationships among clinical interventions and outcomes, since such literature does not permit a clear interpretation of findings due to methodological concerns (e.g., confounding in study design or implementation) or does not meet the criteria for content as defined in the “Focus” of the Guidelines.

**Opinion-Based Evidence:**

All opinion-based evidence (e.g., survey data, open-forum testimony, internet-based comments, letters, and editorials) relevant to each topic was considered in the development of these updated Guidelines. However, only the findings obtained from formal surveys are reported. Opinion surveys were developed for this update by the Task Force to address each clinical intervention identified in the document. Identical surveys were distributed to expert consultants and a random sample of ASA members.

**Category A: Expert Opinion.** Survey responses from Task Force-appointed expert consultants are reported in summary form in the text, with a complete listing of consultant survey responses reported in Appendix 2.

**Category B: Membership Opinion.** Survey responses from active ASA members are reported in summary form in the text, with a complete listing of ASA member survey responses reported in Appendix 2.
Survey responses from expert and membership sources are recorded using a 5-point scale and summarized based on median values.\(^8\)

**Strongly Agree:** Median score of 5 (At least 50% of the responses are 5)

**Agree:** Median score of 4 (At least 50% of the responses are 4 or 4 and 5)

**Equivocal:** Median score of 3 (At least 50% of the responses are 3, or no other response category or combination of similar categories contain at least 50% of the responses)

**Disagree:** Median score of 2 (At least 50% of responses are 2 or 1 and 2)

**Strongly Disagree:** Median score of 1 (At least 50% of responses are 1)

### Category C: Informal Opinion
Open-forum testimony obtained during development of the original Guidelines, Internet-based comments, letters and editorials are all informally evaluated and discussed during the formulation of Guideline recommendations. When warranted, the Task Force may add educational information or cautionary notes based on this information.

### Guidelines

#### I. Preoperative Evaluation

Preoperative evaluation of a patient for potential identification of OSA includes: (1) medical record review, (2) patient/family interview and screening protocol, and (3) physical examination.

**Medical record review:** The literature is insufficient to evaluate the efficacy of conducting a directed medical history or reviewing prior medical records to identify the presence of OSA. Observational studies comparing OSA with non-OSA patients report higher body mass index (BMI) values for OSA patients,\(^1\)-\(^{11}\) similarly, when obese patients are compared with non-obese patients, higher frequencies of OSA are reported\(^{12}\)-\(^{13}\) (Category B1-H evidence). Comparative observational studies report other pertinent patient characteristics associated with OSA that may be available in medical records, such as hypertension,\(^{14}\)-\(^{18}\) history of stroke,\(^{19}\),\(^{20}\) history of myocardial infarction,\(^{21}\) diabetes mellitus,\(^{18}\) or abnormal cephalometric measurements.\(^{22}\)-\(^{48}\) (Category B1-H evidence). Non-comparative observational studies and case reports indicate that certain congenital conditions (e.g.,

\(^8\) When an equal number of categorically distinct responses are obtained, the median value is determined by calculating the arithmetic mean of the two middle values. Ties are calculated by a predetermined formula.
Down’s syndrome, acromegaly, and disease states (e.g., neuromuscular disease, cerebral palsy) may also be associated with OSA (Category B3-H evidence).

**Patient/family interview and screening protocol:** The literature is insufficient to evaluate the efficacy of conducting a patient or family interview to identify the presence of OSA. Observational studies evaluating screening protocols or questionnaires to identify adult OSA patients report sensitivity values ranging from 36%-86%, specificity values ranging from 31%-95%, positive predictive values ranging from 72%-96%, and negative predictive values ranging from 30%-82%, based on Apnea-Hypopnea Index (AHI) or Respiratory Depression Index (RDI) scores ≥ 5 (Category B2-B evidence).

**Physical examination:**

The literature is insufficient to evaluate the efficacy of conducting a directed physical or airway examination to identify the presence of OSA. Comparative observational studies report differences in neck circumference, tongue size, and nasal and oropharyngeal airway structures when comparing OSA with non-OSA patients (Category B1-H evidence). Observational studies also report associations between tonsil size and AHI or RDI scores in adult OSA patients (Category B2-H evidence).

The consultants and ASA members strongly agree that anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management plan. They also both strongly agree that preoperative evaluation should include: (1) a comprehensive review of previous medical records (if available), (2) an interview with the patient and/or family and (3) conducting a physical examination. The consultants and ASA members both agree that if any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to: (1) manage the patient perioperatively based on clinical criteria alone, or (2) obtain sleep studies, conduct a more
extensive airway examination, and initiate indicated OSA treatment in advance of surgery. The
consultants agree and the ASA members strongly agree that if the preoperative evaluation does not
occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive
management based on clinical criteria or a last-minute delay of surgery. Both the consultants and
ASA members strongly agree that the severity of the patient’s OSA, the invasiveness of the
diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be
taken into account in determining whether a patient is at increased perioperative risk from OSA.
Finally, both the consultants and ASA members strongly agree the patient and his or her family as
well as the surgeon should be informed of the potential implications of OSA on the patient’s
perioperative course.

Recommendations for preoperative evaluation: Anesthesiologists should work with surgeons to
develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds
are evaluated long enough before the day of surgery to allow preparation of a perioperative
management plan. This evaluation may be initiated in a preanesthesia clinic (if available) or by
direct consultation from the operating surgeon to the anesthesiologist. A preoperative evaluation
should include a comprehensive review of previous medical records (if available), an interview with
the patient and/or family, and conducting a physical examination. Medical records review should
include (but not be limited to) checking for a history of airway difficulty with previous anesthetics,
hypertension or other cardiovascular problems, and other congenital or acquired medical conditions.
Review of sleep studies is encouraged. The patient and family interview should include focused
questions related to snoring, apneic episodes, frequent arousals during sleep (e.g., vocalization,
shifting position, extremity movements), morning headaches, and daytime somnolence.** A physical
examination should include an evaluation of the airway, nasopharyngeal characteristics, neck
circumference, tonsil size, and tongue volume. If any characteristics noted during the preoperative

** Screening protocols or questionnaires may be useful for indentifying these clinical characteristics.
evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to (1) manage the patient perioperatively based on clinical criteria alone or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery. If this evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery. For safety, clinical criteria (table 1) should be designed to have a high degree of sensitivity (despite the resulting low specificity), meaning that some patients may be treated more aggressively than would be necessary if a sleep study were available.

The severity of the patient’s OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA (table 2). The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient’s perioperative course.

II. Preoperative Determination of Inpatient versus Outpatient Management

The literature is insufficient to offer guidance regarding which patients with OSA can be safely managed on an inpatient versus on an outpatient basis.

The consultants and ASA members strongly agree that before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis.

Recommendations for preoperative determination of inpatient versus outpatient management:

Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis. Factors to be considered in determining whether outpatient care is appropriate include (1) sleep apnea status, (2) anatomical and physiologic abnormalities, (3) status of coexisting diseases, (4) nature of surgery, (5) type of anesthesia, (6) need
for postoperative opioids, (7) patient age, (8) adequacy of postdischarge observation, and (9) capabilities of the outpatient facility. The availability of emergency difficult airway equipment, respiratory care equipment, radiology facilities, clinical laboratory facilities, and a transfer agreement with an inpatient facility should be considered in making this determination.

III. Preoperative Preparation

Preoperative preparation is intended to improve or optimize an OSA patient’s perioperative physical status and includes: (1) preoperative continuous positive airway pressure (CPAP), or bilevel positive airway pressure (BiPAP®; Respironics, Murrysville, PA) or non-invasive positive pressure ventilation (NIPPV), (2) preoperative use of mandibular advancement or oral appliances, and (3) preoperative weight loss.

**CPAP, BiPAP or NIPPV:** An observational study reports lower frequencies of serious postoperative complications (*i.e.*, cardiac events, complications needing ICU transfer or urgent respiratory support) when preoperative at-home CPAP is compared with no preoperative CPAP (*Category B1-B evidence*).\(^7\)

The literature is insufficient to evaluate the impact of the preoperative use of BiPAP\(^\dagger\dagger\) or NIPPV.

**Mandibular advancement or oral appliances:** The literature is insufficient to evaluate the efficacy of preoperative mandibular advancement devices on perioperative outcomes.\(^\dagger\dagger\)

**Preoperative weight loss:** There is insufficient literature to evaluate the efficacy of preoperative weight loss.

The consultants agree and the ASA members strongly agree that preoperative initiation of CPAP should be considered, particularly if OSA is severe. The ASA members agree and the consultants are equivocal that for patients who do not respond adequately to CPAP, NIPPV should be considered. Also, the ASA members agree and the consultants are equivocal that the preoperative

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\(^\dagger\dagger\) Observational studies of BiPaP in non-perioperative settings report reduced AHI scores.

\(^\dagger\dagger\) RCTs of mandibular advancement devices in non-perioperative settings indicate the efficacy of these devices in reducing AHI scores.
use of mandibular advancement devices or oral appliances and preoperative weight loss should be
considered when feasible. Finally, both the consultants and ASA members agree that patients with
known or suspected OSA may have difficult airways and therefore should be managed according to
the “Practice Guidelines for Management of the Difficult Airway: an Updated Report,
Anesthesiology 2013; 118:251-270”

**Recommendations for preoperative preparation:** Preoperative initiation of CPAP should be
considered, particularly if OSA is severe. For patients who do not respond adequately to CPAP,
NIPPV should be considered. In addition, the preoperative use of mandibular advancement devices
or oral appliances and preoperative weight loss should be considered when feasible. A patient who
has had corrective airway surgery (e.g., uvulopalatopharyngoplasty, surgical mandibular
advancement) should be assumed to remain at risk for OSA complications unless a normal sleep
study has been obtained and symptoms have not returned. Patients with known or suspected OSA
may have difficult airways and therefore should be managed according to the “Practice Guidelines
for Management of the Difficult Airway.”§§

**IV. Intraoperative Management**

Intraoperative concerns in patients at increased perioperative risk from OSA include (1)
choice of anesthetic technique, (2) airway management, and (3) patient monitoring. The literature is
insufficient to evaluate the effects of various anesthetic techniques as they specifically apply to
patients with OSA. Similarly, the literature is insufficient to evaluate the impact of intraoperative
airway management (e.g., awake extubation) or patient monitoring techniques as they specifically
apply to patients with OSA.

The consultants and ASA members strongly agree that the potential for postoperative respiratory
compromise should be considered in selecting intraoperative medications. They also strongly agree
that for superficial procedures consider the use of local anesthesia or peripheral nerve blocks, with or

without moderate sedation. The consultants and ASA members agree that, for patients previously treated with CPAP or an oral appliance, consider using these modalities during sedation. The consultants and ASA members strongly agree that general anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway. The consultants and ASA members agree that major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures. They both strongly agree that, unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake. They also both strongly agree that full reversal of neuromuscular block should be verified before extubation. Finally, the ASA members agree and the consultants strongly agree that when possible, extubation and recovery should be carried out in the lateral, semi-upright, or other non-supine position.

**Recommendations for intraoperative management:** Because of their propensity for airway collapse and sleep deprivation, patients at increased perioperative risk from OSA are especially susceptible to the respiratory depressant and airway effects of sedatives, opioids, and inhaled anesthetics; therefore, the potential for postoperative respiratory compromise should be considered in selecting intraoperative medications. For superficial procedures, consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation. If moderate sedation is used, ventilation should be continuously monitored by capnography or another automated method if feasible because of the increased risk of undetected airway obstruction in these patients.*** Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities. General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway. Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures. Unless there
is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake. Full reversal of neuromuscular block should be verified before extubation. When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine position.

**V. Postoperative Management**

Risk factors for postoperative respiratory depression may include the underlying severity of the sleep apnea, systemic administration of opioids, use of sedatives, site and invasiveness of surgical procedure, and the potential for “REM rebound” on the third or fourth postoperative day as sleep patterns are reestablished. Postoperative interventions to manage OSA patients who may be susceptible to the above risks include (1) analgesia, (2) oxygenation, (3) patient positioning, and (4) monitoring.

**Postoperative analgesia:** The literature is insufficient to evaluate outcomes associated with postoperative peripheral regional *versus* systemic analgesic techniques on patients with OSA; similarly, the literature is insufficient to evaluate outcomes associated with postoperative central regional (*i.e.*, neuraxial) *versus* systemic techniques.††† The literature is insufficient to evaluate the effect of adding a basal infusion to systemic patient-controlled opioids on the oxygenation of patients with OSA.

**Oxygenation:** The literature is insufficient to evaluate the effects of postoperative supplemental oxygen administration in patients with OSA.‡‡‡ An RCT indicates improved ventilatory function for

*** ASA Standards now state “During moderate or deep sedation the adequacy of ventilation shall be evaluated by continual observation of qualitative clinical signs and monitoring for the presence of exhaled carbon dioxide unless precluded or invalidated by the nature of the patient, procedure, or equipment.” American Society of Anesthesiologists: Standards for Basic Anesthetic Monitoring, effective July, 2011.

††† For unselected surgical patients, RCTs indicate that neuraxial opioids are associated with lower frequencies of respiratory depression, somnolence and sedation compared to systemic opioids. (see “Practice Guidelines for the Prevention, Detection, and Management of Respiratory Depression Associated with Neuraxial Opioid Administration. ANESTHESIOLOGY 2009; 110:218-230.”)

‡‡‡ For unselected surgical patients, RCTs indicate that postoperative supplemental oxygen is associated with lower frequencies of hypoxemia. (see “Practice Guidelines for Management of the Difficult Airway: an Updated Report. ANESTHESIOLOGY 2013; 118:251-270.”)
OSA patients when postoperative CPAP is compared with no postoperative CPAP (Category A3-B evidence).  

**Patient Positioning:** Comparative observational studies indicate an improvement in AHI scores when adult non-surgical OSA patients sleep in the lateral, prone, or sitting positions rather than the supine (Category B1-B evidence); the literature is insufficient to evaluate the effects of positioning adult or pediatric OSA patients in the postoperative setting.  

**Monitoring:** Observational studies and case reports indicate that continuous postoperative monitoring with pulse oximetry is effective in detecting hypoxemic events (Category B3-B evidence). The literature is insufficient to examine the impact of monitored postoperative settings (e.g., stepdown or intensive care unit) versus routine hospital wards for patients with known or suspected OSA. The literature is insufficient to offer guidance regarding the appropriate duration of postoperative respiratory monitoring in patients with OSA.  

The consultants and ASA members strongly agree that regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA. They both agree that if neuraxial analgesia is planned; weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone. The consultants and ASA members strongly agree that if patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution. Additionally, they both strongly agree that to reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (e.g., ice, transcutaneous electrical nerve stimulation) should be considered if appropriate. The consultants agree and the ASA members strongly agree that supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air. They both strongly agree that when feasible, CPAP or NIPPV (with or without
supplemental oxygen) should be continuously administered postoperatively to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure. The consultants and ASA members agree that if possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process. The ASA members agree and the consultants strongly agree that hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room. Also, the ASA members agree and the consultants strongly agree that continuous monitoring should be maintained as long as patients remain at increased risk.

Finally, both the consultants and ASA members strongly agree that if frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered.

**Recommendations for postoperative management:**

Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA. If neuraxial analgesia is planned, weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone. If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution. To reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (e.g., ice, transcutaneous electrical nerve stimulation) should be considered if appropriate. Clinicians are cautioned that the

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§§§ Reduction or avoidance of systemic opioids is of particular concern for some high-risk OSA patient populations. In October, 2012 the U.S. Food and Drug Administration posted a Box Warning to be added to the drug labels of codeine-containing products about the risk of codeine in post-operative pain management in children following tonsillectomy and/or adenoidectomy. They note that “Health care professionals should prescribe an alternate analgesic for post-operative pain control in children who are undergoing tonsillectomy and/or adenoidectomy. Codeine should not be used for pain in children following these procedures. For management of other types of pain in children, codeine should only be used if the benefits are anticipated to outweigh the risks.” (Updated 2/20/2013). For more information, go to the following web address:
concurrent administration of sedative agents (e.g., benzodiazepines, barbiturates) increases the risk of respiratory depression and airway obstruction.

Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air.**** When feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure. Compliance with CPAP or NIPPV may be improved if patients bring their own equipment to the hospital.

If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process. Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room. Continuous monitoring may be provided in a critical care or stepdown unit, by telemetry on a hospital ward, or by a dedicated, appropriately trained professional observer in the patient’s room. Continuous monitoring should be maintained as long as patients remain at increased risk.†††† If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered.

VI. Criteria for Discharge to Unmonitored Settings

The literature is insufficient to offer guidance regarding the appropriate time for discharge of patients at increased perioperative risk from OSA from the surgical facility.

The consultants and ASA members strongly agree that patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (i.e., home or unmonitored hospital bed) until they are no longer at risk for postoperative respiratory depression. Moreover, they both agree that to establish that patients are able to maintain adequate oxygen

**** The Task Force cautions that supplemental oxygen may increase the duration of apneic episodes and may hinder detection of atelectasis, transient apnea, and hypoventilation by pulse oximetry.
†††† Intermittent pulse oximetry or continuous bedside oximetry without continuous observation does not provide the
saturation levels while breathing room air, respiratory function may be determined by observing
patients in an unstimulated environment, preferably while asleep.

**Recommendations for criteria for discharge to unmonitored settings:**

Patients at increased perioperative risk from OSA should not be discharged from the recovery
area to an unmonitored setting (i.e., home or unmonitored hospital bed) until they are no longer at
risk for postoperative respiratory depression. ‡‡‡‡ To establish that patients are able to maintain
adequate oxygen saturation levels while breathing room air, respiratory function may be determined
by observing patients in an unstimulated environment, preferably while asleep.

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‡‡‡‡ Because of their propensity to develop airway obstruction or central respiratory depression, this may require a longer
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Table 1: Identification and Assessment of Obstructive Sleep Apnea: Example

A. Clinical signs and symptoms suggesting the possibility of OSA

1. Predisposing physical characteristics
   - Adult patients: BMI 35 kg/m²
   - Pediatric patients: 95th percentile for age and gender
   - Neck circumference 17 inches (men) or 16 inches (women)
   - Craniofacial abnormalities affecting the airway
   - Anatomical nasal obstruction
   - Tonsils nearly touching or touching in the midline

2. History of apparent airway obstruction during sleep
   Two or more of the following are present: (if patient lives alone or sleep is not observed by another person then only one condition needs to be present)
   - Loud snoring (loud enough to be heard through closed door)
   - Frequent snoring
   - Observed pauses in breathing during sleep
   - Awakens from sleep with choking sensation
   - Frequent arousals from sleep
   - Pediatric patients:
     - Intermittent vocalization during sleep
     - Parental report of restless sleep, difficulty breathing or struggling respiratory efforts during sleep
     - Child with night terrors
     - Child sleeps in unusual positions
     - Child with new onset enuresis

3. Somnolence (one or more of the following is present)
   - Frequent daytime somnolence or fatigue despite adequate “sleep”
   - Falls asleep easily in a non-stimulating environment (e.g., watching television, reading, riding in or driving a car) despite adequate “sleep”
   - Pediatric patients: parent or teacher comments that child appears sleepy during the day, is easily distracted, is overly aggressive, is irritable or has difficulty concentrating
   - Pediatric patients: child often difficult to arouse at usual awakening time

If a patient has signs or symptoms in two or more of the above categories, there is a significant probability that he or she has OSA. The severity of OSA may be determined by sleep study (see below). If a sleep study is not available, such patients should be treated as though they have moderate sleep apnea unless one or more of the signs or symptoms above is severely abnormal (e.g., markedly increased BMI or neck circumference, respiratory pauses which are frightening to the observer, patient regularly falls asleep within minutes after being left unstimulated without another explanation) in which case they should be treated as though they have severe sleep apnea.

B. If a sleep study has been done, the results should be used to determine the perioperative anesthetic management of a patient. However, because sleep laboratories differ in their criteria for detecting episodes of apnea and hypopnea, the Task Force believes that the sleep laboratory’s

---

§§§§ OSA = obstructive sleep apnea.
***** BMI = body mass index.
assessment (none, mild, moderate, or severe) should take precedence over the actual AHI†††††. If the overall severity is not indicated, it may be determined by using the table below:

<table>
<thead>
<tr>
<th>Severity of OSA</th>
<th>Adult AHI</th>
<th>Pediatric AHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0 - 5</td>
<td>0</td>
</tr>
<tr>
<td>Mild OSA</td>
<td>6 - 20</td>
<td>1 - 5</td>
</tr>
<tr>
<td>Moderate OSA</td>
<td>21 - 40</td>
<td>6 - 10</td>
</tr>
<tr>
<td>Severe OSA</td>
<td>&gt; 40</td>
<td>&gt; 10</td>
</tr>
</tbody>
</table>

††††† AHI = apnea-hypopnea index: the number of episodes of sleep-disordered breathing per hour.
Table 2: Scoring System for Perioperative Risk from OSA: Example

A. Severity of sleep apnea based on sleep study (or clinical indicators if sleep study is not available).

Point Score: ___(0-3)$\text{§§§§§}$

<table>
<thead>
<tr>
<th>Severity of OSA (see Table 1)</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Mild</td>
<td>1</td>
</tr>
<tr>
<td>Moderate</td>
<td>2</td>
</tr>
<tr>
<td>Severe</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Invasiveness of surgery and anesthesia.

Point Score: ___(0-3)

<table>
<thead>
<tr>
<th>Type of Surgery and Anesthesia:</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial surgery under local or peripheral nerve block anesthesia without sedation</td>
<td>0</td>
</tr>
<tr>
<td>Superficial surgery with moderate sedation or general anesthesia</td>
<td>1</td>
</tr>
<tr>
<td>Peripheral surgery with spinal or epidural anesthesia (with no more than moderate sedation)</td>
<td>1</td>
</tr>
<tr>
<td>Peripheral surgery with general anesthesia</td>
<td>2</td>
</tr>
<tr>
<td>Airway surgery with moderate sedation</td>
<td>2</td>
</tr>
<tr>
<td>Major surgery, general anesthesia</td>
<td>3</td>
</tr>
<tr>
<td>Airway surgery, general anesthesia</td>
<td>3</td>
</tr>
</tbody>
</table>

C. Requirement for postoperative opioids.

Point Score: ___(0-3)

<table>
<thead>
<tr>
<th>Opioid requirement</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Low dose oral opioids</td>
<td>1</td>
</tr>
<tr>
<td>High dose oral opioids, parenteral or neuraxial opioids</td>
<td>3</td>
</tr>
</tbody>
</table>

D. Estimation of perioperative risk:

Overall Point Score: the score for A plus the greater of the score for either B or C: ___(0-6)$\text{†††††}$

$\text{§§§§§}$ A scoring system similar to the above may be used to estimate whether a patient is at increased perioperative risk of complications from obstructive sleep apnea. This example, which has not been clinically validated, is meant only as a guide and clinical judgment should be used to assess the risk of an individual patient.

$\text{******}$ One point should be added if a patient with mild or moderate OSA also has a resting PaCO$_2$ > 50mmHg.

$\text{†††††}$ Patients with score of 4 may be at increased perioperative risk from OSA; patients with a score of 5 or 6 may be at significantly increased perioperative risk from OSA.
Appendix I: Summary of Recommendations

I. Preoperative Evaluation

- Anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management plan.
  - This evaluation may be initiated in a preanesthesia clinic (if available) or by direct consultation from the operating surgeon to the anesthesiologist.
- A preoperative evaluation should include a comprehensive review of previous medical records (if available), an interview with the patient and/or family, and conducting a physical examination.
  - Medical records review should include (but not be limited to) checking for a history of airway difficulty with previous anesthetics, hypertension or other cardiovascular problems, and other congenital or acquired medical conditions.
    - Review of sleep studies is encouraged.
  - The patient and family interview should include focused questions related to snoring, apneic episodes, frequent arousals during sleep (e.g., vocalization, shifting position, extremity movements), morning headaches, and daytime somnolence.
  - A physical examination should include an evaluation of the airway, nasopharyngeal characteristics, neck circumference, tonsil size, and tongue volume.
- If any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to: (1) manage the patient perioperatively based on clinical criteria alone, or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery.
- If the preoperative evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery.
- For safety, clinical criteria should be designed to have a high degree of sensitivity (despite the resulting low specificity), meaning that some patients may be treated more aggressively than would be necessary if a sleep study were available.
- The severity of the patient’s OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA.
- The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient’s perioperative course.

II. Inpatient versus Outpatient Surgery

- Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis.
  - Factors to be considered in determining whether outpatient care is appropriate include (1) sleep apnea status, (2) anatomical and physiologic abnormalities, (3) status of coexisting diseases, (4) nature of surgery, (5) type of anesthesia, (6) need for postoperative opioids, (7) patient age, (8) adequacy of postdischarge observation, and (9) capabilities of the outpatient facility.

*** Screening protocols or questionnaires may be useful for indentifying these clinical characteristics.
The availability of emergency difficult airway equipment, respiratory care equipment, radiology facilities, clinical laboratory facilities, and a transfer agreement with an inpatient facility should be considered in making this determination.

III. Preoperative Preparation

- Preoperative initiation of CPAP should be considered, particularly if OSA is severe.
  - For patients who do not respond adequately to CPAP, NIPPV should be considered.
- The preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible.
  - A patient who has had corrective airway surgery (e.g., uvulopalatopharyngoplasty, surgical mandibular advancement) should be assumed to remain at risk for OSA complications unless a normal sleep study has been obtained and symptoms have not returned.
- Patients with known or suspected OSA may have difficult airways and therefore should be managed according to the “Practice Guidelines for Management of the Difficult Airway.”

IV. Intraoperative Management

- Because of their propensity for airway collapse and sleep deprivation, patients at increased perioperative risk from OSA are especially susceptible to the respiratory depressant and airway effects of sedatives, opioids, and inhaled anesthetics; therefore, the potential for postoperative respiratory compromise should be considered in selecting intraoperative medications.
- For superficial procedures, consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation.
- If moderate sedation is used, ventilation should be continuously monitored by capnography or another automated method if feasible because of the increased risk of undetected airway obstruction in these patients.
- Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities.
- General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway.
- Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures.
- Unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake.
- Full reversal of neuromuscular block should be verified before extubation.
- When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine position.

V. Postoperative Management

- Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA.
- If neuraxial analgesia is planned, weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone.

• If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution.
• To reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (e.g., ice, transcutaneous electrical nerve stimulation) should be considered if appropriate.
• Clinicians are cautioned that the concurrent administration of sedative agents (e.g., benzodiazepines, barbiturates) increases the risk of respiratory depression and airway obstruction.
• Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air.
  o The Task Force cautions that supplemental oxygen may increase the duration of apneic episodes and may hinder detection of atelectasis, transient apnea, and hypoventilation by pulse oximetry.
• When feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure.
  o Compliance with CPAP or NIPPV may be improved if patients bring their own equipment to the hospital.
• If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process.
• Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room.
  o Continuous monitoring may be provided in a critical care or stepdown unit, by telemetry on a hospital ward, or by a dedicated, appropriately trained professional observer in the patient’s room.
  o Continuous monitoring should be maintained as long as patients remain at increased risk.*******
• If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered.

VI. Criteria for Discharge to Unmonitored Settings

• Patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (i.e., home or unmonitored hospital bed) until they are no longer at risk for postoperative respiratory depression.
  o Because of their propensity to develop airway obstruction or central respiratory depression, this may require a longer stay as compared with non-OSA patients undergoing similar procedures.
• To establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep.

******* Intermittent pulse oximetry or continuous bedside oximetry without continuous observation does not provide the same level of safety.
Appendix 2: Methods and Analyses

A. State of the Literature.

For these updated Guidelines, a review of studies used in the development of the original Guidelines was combined with studies published subsequent to approval of the original Guidelines in 2005. The scientific assessment of these Guidelines was based on evidence linkages or statements regarding potential relationships between clinical interventions and outcomes. The interventions listed below were examined to assess their relationship to a variety of outcomes related to the perioperative management of patients with obstructive sleep apnea.

Preoperative Evaluation:
- Medical records review
- Patient/family interview and screening protocol
- Screening questionnaire
- Focused physical examination
- Sleep study

Preoperative Preparation:
- Preoperative treatment/optimization for OSA (e.g., CPAP, NIPPV, mandibular appliances, medical treatment)
- Consult the ASA “Practice Guidelines for Management of the Difficult Airway”
- Limit procedures to facilities with full hospital services

Intraoperative Management:
- Anesthetic technique
  - Local or regional anesthesia versus general anesthesia
  - Combined regional and general anesthesia versus general anesthesia
  - Sedation versus general anesthesia
- Monitoring
  - Continuously monitor the respiratory depressant effects of sedatives and/or opioids (e.g., level of consciousness, pulmonary ventilation, oxygenation, automated apnea monitoring)
  - Special intraoperative monitoring techniques (arterial line, pulmonary artery catheter)
  - Extubation:
    - Verify the full reversal of neuromuscular block before extubation
    - Extubate patients after they are fully awake (vs asleep or partially awake)
    - Extubate patients in the semi-upright, lateral or prone positions (vs supine)

Postoperative Management:
- Analgesic use
  - Regional analgesic techniques without neuraxial opioids versus systemic opioids
- Neuraxial opioids versus systemic opioids
- Oral analgesics versus parenteral opioids
- PCA without a background infusion versus PCA with a background infusion
- Titration or lower dosage levels of systemic opioids

- Oxygenation
  - Supplemental oxygen versus no supplemental oxygen
  - CPAP versus no CPAP (oxygen or room air)
  - CPAP for patients who had previously been on CPAP vs CPAP for patients not previously on CPAP
  - NIPPV versus no NIPPV (CPAP, oxygen or room air)

- Patient positioning
  - Lateral, prone, or tonsil position versus the supine position

- Monitoring
  - Telemetry monitoring systems versus no telemetry monitoring systems
  - Monitored settings versus routine hospital wards

- Length of stay
  - Extended stay in PACU versus no extended stay in PACU
  - Hospital admission versus discharge home

For the literature review, potentially relevant clinical studies were identified via electronic and manual searches of the literature. The electronic and manual searches covered a 61 yr period from 1953 through 2013. More than 2000 citations were initially identified, yielding a total of 831 non-overlapping articles that addressed topics related to the evidence linkages. After review of the articles, 473 studies did not provide direct evidence, and were subsequently eliminated. A total of 358 articles contained direct linkage-related evidence. A complete bibliography used to develop these Guidelines, organized by section, is available as Supplemental Digital Content 2, http://links.lww.com/ALN/A781.

No evidence linkage contained sufficient literature with well-defined experimental designs and statistical information to conduct an analysis of aggregated RCTs (i.e., meta-analysis). A complete bibliography used to develop these updated Guidelines, organized by section, is available as Supplemental Digital Content 2, http://links.lww.com____.

Interobserver agreement among Task Force members and two methodologists was established by interrater reliability testing. Agreement levels using a kappa (\( \kappa \)) statistic for two-rater agreement pairs were as follows: (1) type of study design, \( \kappa = 0.50–0.69 \); (2) type of analysis, \( \kappa = 0.43–0.60 \); (3) evidence linkage assignment, \( \kappa = 0.88–1.00 \); and (4) literature inclusion for database, \( \kappa = 0.44–0.87 \). Three-rater chance-corrected agreement values were (1) study design, \( \text{Sav} = 0.56, \text{Var (Sav)} = 0.009;\)
(2) type of analysis, $\text{Sav} = 0.54$, $\text{Var (Sav)} = 0.011$; (3) linkage assignment, $\text{Sav} = 0.87$, $\text{Var (Sav)} = 0.003$; and (4) literature database inclusion, $\text{Sav} = 0.58$, $\text{Var (Sav)} = 0.030$. These values represent moderate to high levels of agreement.

B. Consensus-Based Evidence.

Consensus was obtained from multiple sources, including: (1) updated surveys sent to consultants who were selected based on their knowledge or expertise in perioperative management of patients with OSA and a random sample of ASA members, (2) testimony from attendees of two publicly-held open forums at two national anesthesia meetings, and (3) Task Force opinion and interpretation. An updated opinion survey of consultant and ASA members regarding the management of patients with known or suspected OSA was conducted. The survey rate of return for the consultants was 53% ($N = 54/102$) and 267 responses were obtained from the random sample of ASA members. Summary results of these surveys are reported in the text of these updated Guidelines, with a complete and full reporting of all questionnaire item responses in Tables 3 and 4.

### Table 3: Consultant Survey Responses

<table>
<thead>
<tr>
<th>Percent Responding to Each Item</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>I. Preoperative Evaluation:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management</td>
<td>54</td>
<td>64.8*</td>
<td>27.8</td>
<td>3.7</td>
<td>3.7</td>
</tr>
<tr>
<td>2. A preoperative evaluation should include: (1) a comprehensive review of previous medical records (if available), (2) an interview with the patient and/or family, and (3) conducting a physical examination</td>
<td>54</td>
<td>74.1*</td>
<td>20.4</td>
<td>3.7</td>
<td>0.0</td>
</tr>
<tr>
<td>3. If any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to: (1) manage the patient perioperatively based on clinical criteria alone, or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery</td>
<td>54</td>
<td>48.1</td>
<td>35.2*</td>
<td>14.8</td>
<td>1.9</td>
</tr>
<tr>
<td>4. If the preoperative evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery</td>
<td>54</td>
<td>29.6</td>
<td>48.1*</td>
<td>13.0</td>
<td>9.3</td>
</tr>
<tr>
<td>5. The severity of the patient’s OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA</td>
<td>54</td>
<td>87.0*</td>
<td>13.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>6. The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient’s perioperative course</td>
<td>54</td>
<td>77.8*</td>
<td>16.7</td>
<td>5.6</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*§§§§§§§ N = number of consultants who responded to each item. An asterisk beside a percentage score indicates the median.*
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>54</td>
<td>59.3*</td>
<td>27.8</td>
<td>9.3</td>
</tr>
</tbody>
</table>

II. **Inpatient vs. Outpatient Surgery:**

7. Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis

III. **Preoperative Preparation:**

8. Preoperative initiation of CPAP should be considered, particularly if OSA is severe

9. For patients who do not respond adequately to CPAP, NIPPV should be considered

10. The preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible

11. Patients with known or suspected OSA may have difficult airways and therefore should be managed according to the “Practice Guidelines for Management of the Difficult Airway: an Updated Report, Anesthesiology 2013; 118:251-270”

IV. **Intraoperative Management:**

12. The potential for postoperative respiratory compromise should be considered in selecting intraoperative medications

13. For superficial procedures, consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation

14. Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities

15. General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway

16. Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures
17. Unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>54</td>
<td>55.6*</td>
<td>25.9</td>
<td>16.7</td>
<td>1.9</td>
<td>0.0</td>
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</table>

18. Full reversal of neuromuscular block should be verified before extubation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>54</td>
<td>70.4*</td>
<td>24.1</td>
<td>3.7</td>
<td>1.9</td>
<td>0.0</td>
</tr>
</tbody>
</table>

19. When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine position

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>54</td>
<td>50.0*</td>
<td>33.3</td>
<td>9.3</td>
<td>7.4</td>
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</tr>
</tbody>
</table>

V. Postoperative Management:

20. Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>54</td>
<td>50.0*</td>
<td>40.7</td>
<td>5.6</td>
<td>3.7</td>
<td>0.0</td>
</tr>
</tbody>
</table>

21. If neuraxial analgesia is planned, weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>54</td>
<td>40.7</td>
<td>37.0*</td>
<td>20.4</td>
<td>1.9</td>
<td>0.0</td>
</tr>
</tbody>
</table>

22. If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
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<tbody>
<tr>
<td></td>
<td>54</td>
<td>59.3*</td>
<td>31.5</td>
<td>5.6</td>
<td>3.7</td>
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</table>

23. To reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (e.g., ice, transcutaneous electrical nerve stimulation) should be considered if appropriate

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<tr>
<td></td>
<td>54</td>
<td>57.4*</td>
<td>37.0</td>
<td>5.6</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

24. Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Strongly</th>
<th>Agree</th>
<th>Equivocal</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>54</td>
<td>31.5</td>
<td>33.3*</td>
<td>16.7</td>
<td>14.8</td>
<td>3.7</td>
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</tbody>
</table>

25. When feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered postoperatively to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure

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<thead>
<tr>
<th></th>
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26. If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process

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</table>
27. Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room

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<tr>
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28. Continuous monitoring should be maintained as long as patients remain at increased risk

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29. If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered

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VI. Criteria for Discharge to Unmonitored Settings:

30. Patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (i.e., home or unmonitored hospital bed) until they are no longer at risk for postoperative respiratory depression

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<thead>
<tr>
<th>N</th>
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</table>

31. To establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep

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<tr>
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Table 4: ASA Members Survey Responses

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<tbody>
<tr>
<td>I. Preoperative Evaluation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Anesthesiologists should work with surgeons to develop a protocol whereby patients in whom the possibility of OSA is suspected on clinical grounds are evaluated long enough before the day of surgery to allow preparation of a perioperative management</td>
<td>267</td>
<td>55.4*</td>
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<tr>
<td>2. A preoperative evaluation should include:</td>
<td></td>
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</tr>
<tr>
<td>(1) a comprehensive review of previous medical records (if available), (2) an interview with the patient and/or family, and (3) conducting a physical examination</td>
<td>267</td>
<td>71.2*</td>
<td>22.1</td>
<td>5.6</td>
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</tr>
<tr>
<td>3. If any characteristics noted during the preoperative evaluation suggest that the patient has OSA, the anesthesiologist and surgeon should jointly decide whether to:</td>
<td></td>
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</tr>
<tr>
<td>(1) manage the patient perioperatively based on clinical criteria alone, or (2) obtain sleep studies, conduct a more extensive airway examination, and initiate indicated OSA treatment in advance of surgery</td>
<td>267</td>
<td>43.1</td>
<td>33.7*</td>
<td>18.0</td>
<td>4.5</td>
<td>0.7</td>
</tr>
<tr>
<td>4. If the preoperative evaluation does not occur until the day of surgery, the surgeon and anesthesiologist together may elect for presumptive management based on clinical criteria or a last-minute delay of surgery</td>
<td>267</td>
<td>50.9*</td>
<td>37.1</td>
<td>9.4</td>
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<tr>
<td>5. The severity of the patient’s OSA, the invasiveness of the diagnostic or therapeutic procedure, and the requirement for postoperative analgesics should be taken into account in determining whether a patient is at increased perioperative risk from OSA</td>
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<td>81.3*</td>
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<tr>
<td>6. The patient and his or her family as well as the surgeon should be informed of the potential implications of OSA on the patient’s perioperative course</td>
<td>267</td>
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</tbody>
</table>

******** N = number of ASA members who responded to each item. An asterisk beside a percentage score indicates the median.
II. Inpatient vs. Outpatient Surgery:

7. Before patients at increased perioperative risk from OSA are scheduled to undergo surgery, a determination should be made regarding whether a surgical procedure is most appropriately performed on an inpatient or outpatient basis

<table>
<thead>
<tr>
<th></th>
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</table>

III. Preoperative Preparation:

8. Preoperative initiation of CPAP should be considered, particularly if OSA is severe

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<tr>
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9. For patients who do not respond adequately to CPAP, NIPPV should be considered

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<tr>
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10. The preoperative use of mandibular advancement devices or oral appliances and preoperative weight loss should be considered when feasible

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</table>

11. Patients with known or suspected OSA may have difficult airways and therefore should be managed according to the “Practice Guidelines for Management of the Difficult Airway: an Updated Report, Anesthesiology 2013; 118:251-270”

<table>
<thead>
<tr>
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IV. Intraoperative Management:

12. The potential for postoperative respiratory compromise should be considered in selecting intraoperative medications

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13. For superficial procedures, consider the use of local anesthesia or peripheral nerve blocks, with or without moderate sedation

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</table>

14. Consider administering CPAP or using an oral appliance during sedation to patients previously treated with these modalities

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15. General anesthesia with a secure airway is preferable to deep sedation without a secure airway, particularly for procedures that may mechanically compromise the airway

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16. Major conduction anesthesia (spinal/epidural) should be considered for peripheral procedures

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17. Unless there is a medical or surgical contraindication, patients at increased perioperative risk from OSA should be extubated while awake

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18. Full reversal of neuromuscular block should be verified before extubation

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19. When possible, extubation and recovery should be carried out in the lateral, semiupright, or other nonsupine position

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V. Postoperative Management:

20. Regional analgesic techniques should be considered to reduce or eliminate the requirement for systemic opioids in patients at increased perioperative risk from OSA

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21. If neuraxial analgesia is planned, weigh the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid–local anesthetic mixture rather than a local anesthetic alone

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22. If patient-controlled systemic opioids are used, continuous background infusions should be avoided or used with extreme caution

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23. To reduce opioid requirements, nonsteroidal antiinflammatory agents and other modalities (e.g., ice, transcutaneous electrical nerve stimulation) should be considered if appropriate

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24. Supplemental oxygen should be administered continuously to all patients who are at increased perioperative risk from OSA until they are able to maintain their baseline oxygen saturation while breathing room air

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25. When feasible, CPAP or NIPPV (with or without supplemental oxygen) should be continuously administered postoperatively to patients who were using these modalities preoperatively, unless contraindicated by the surgical procedure

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26. If possible, patients at increased perioperative risk from OSA should be placed in nonsupine positions throughout the recovery process

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27. Hospitalized patients who are at increased risk of respiratory compromise from OSA should have continuous pulse oximetry monitoring after discharge from the recovery room.  
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28. Continuous monitoring should be maintained as long as patients remain at increased risk.  
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29. If frequent or severe airway obstruction or hypoxemia occurs during postoperative monitoring, initiation of nasal CPAP or NIPPV should be considered.  
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VI. Criteria for Discharge to Unmonitored Settings:

30. Patients at increased perioperative risk from OSA should not be discharged from the recovery area to an unmonitored setting (i.e., home or unmonitored hospital bed) until they are no longer at risk for postoperative respiratory depression.  
<table>
<thead>
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31. To establish that patients are able to maintain adequate oxygen saturation levels while breathing room air, respiratory function may be determined by observing patients in an unstimulated environment, preferably while asleep.  
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