Practice Guidelines for Moderate Procedural Sedation and Analgesia 2018

*A Report by the American Society of Anesthesiologists Task Force on Moderate Procedural Sedation and Analgesia, the American Association of Oral and Maxillofacial Surgeons, American College of Radiology, American Dental Association, American Society of Dentist Anesthesiologists, and Society of Interventional Radiology**

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, these practice guidelines 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.

This document replaces the "Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists: An Updated Report by the American Society of Anesthesiologists (ASA) Task Force on Sedation and Analgesia by Non-Anesthesiologists," adopted in 2001 and published in 2002.[1]

Update Highlights

In October 2014, the American Society of Anesthesiologists Committee on Standards and Practice Parameters recommended that new practice guidelines addressing moderate procedural sedation and analgesia be developed.

These new guidelines:

- Replace the "Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists: An Updated Report by the American Society of Anesthesiologists Task Force on Sedation and Analgesia by Non-Anesthesiologists," published in 2002.[1]
- Specifically address moderate sedation. They do not address mild or deep sedation and do not address the educational, training, or certification requirements for providers of moderate procedural sedation. (Separate Practice Guidelines are under development that will address deep procedural sedation.)
- Differ from previous guidelines in that they were developed by a multidisciplinary task force of physicians from several medical and dental specialty organizations with the intent of specifically addressing moderate procedural sedation provided by any medical specialty in any location.

New recommendations include:

- Patient evaluation and preparation.
- Continual monitoring of ventilatory function with capnography to supplement standard monitoring by observation and pulse oximetry.
- The presence of an individual in the procedure room with the knowledge and skills to recognize and treat airway complications.
- Sedatives and analgesics not intended for general anesthesia (*e.g.,* benzodiazepines and dexmedetomidine).
- Sedatives and analgesics intended for general anesthesia (*e.g.,* propofol, ketamine, and etomidate).
- Recovery care.
- Creation and implementation of quality improvement processes.

Methodology

Definition of Procedural Moderate Sedation and Analgesia

These guidelines apply to moderate sedation and analgesia before, during, and after procedures. Sedation and analgesia comprises a continuum of states ranging from minimal sedation (anxiolysis) through general anesthesia, as defined by the American Society of Anesthesiologists and accepted by the Joint Commission (table 1).[2,3] Level of sedation is entirely independent of the route of administration. Moderate and deep sedation or general anesthesia may be achieved *via* any route of administration.

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These guidelines specifically apply to the level of sedation corresponding to moderate sedation/analgesia (previously called conscious sedation), which is defined as a drug-induced depression of consciousness during which patients respond purposefully† to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway when spontaneous ventilation is adequate.‡ Cardiovascular function is usually maintained. For these guidelines, analgesia refers to the management of patient pain or discomfort during and after procedures requiring moderate sedation.

Purposes of the Guidelines

The purposes of these guidelines are to allow clinicians to optimize the benefits of moderate procedural sedation regardless of site of service; to guide practitioners in appropriate patient selection; to decrease the risk of adverse patient outcomes (*e.g.*, apnea, airway obstruction, respiratory arrest, cardiac arrest, death); to encourage sedation education, training, and research; and to offer evidence-based data to promote cross-specialty consistency for moderate sedation practice.

Moderate sedation/analgesia provides patient tolerance of unpleasant or prolonged procedures through relief of anxiety, discomfort, and/or pain. If the patient response results in deeper sedation than intended, these sedation practices can be associated with cardiac or respiratory depression that must be rapidly recognized and appropriately managed to avoid the risk of hypoxic brain damage, cardiac arrest, or death. Conversely, inadequate sedation or analgesia can result in undue patient discomfort or patient injury, lack of cooperation, or adverse physiological or psychological responses to stress.

The appropriate choice of agents and techniques for moderate sedation/analgesia is dependent upon the experience, training, and preference of the individual practitioner, requirements or constraints imposed by associated medical issues of the patient or type of procedure, and the risk of producing a deeper level of sedation than anticipated. In some cases, the choice of agents or techniques are limited by federal, state, or municipal regulations or statutes. Because it is not always possible to predict how a specific patient will respond to sedative and analgesic medications, practitioners intending to produce a given level of sedation should be able to rescue patients whose level of sedation becomes deeper than initially intended. For moderate sedation, this implies the ability to manage a compromised airway or hypoventilation, and support cardiovascular function in patients who become hypotensive, hypertensive, bradycardic, or tachycardic.

Focus

These guidelines focus specifically on the administration of moderate sedation and analgesia for adults and children. The guidelines exclude patients who are not undergoing a diagnostic or therapeutic procedure (*e.g.*, postoperative analgesia). Because minimal sedation (anxiolysis) may entail minimal risk, the guidelines specifically exclude it. Examples of minimal sedation are (1) less than 50% nitrous oxide in oxygen with no other sedative or analgesic medications by any route and (2) a single, oral sedative or analgesic medication administered in doses appropriate for the unsupervised treatment of anxiety or pain. The guidelines do not apply to patients receiving deep sedation, general anesthesia, or major conduction (*i.e.*, neuraxial) anesthesia. Additional interventions excluded from these guidelines include but are not limited to patient-controlled sedation/analgesia, sedatives administered before or during regional and central neuraxis anesthesia, premedication for general anesthesia, interventions without sedatives (*e.g.*, hypnosis, acupuncture), new or rarely administered sedative/analgesics, new or rarely used monitoring or delivery devices, and automated sedative delivery systems. These guidelines do not address education, training, or certification requirements for practitioners who provide moderate procedural sedation.

Application

These guidelines are intended for use by all providers who perform moderate procedural sedation and analgesia in any inpatient or outpatient setting including but not limited to hospitals, ambulatory procedural centers, hospital-connected or freestanding office practices (*e.g.*, dental, urology, or ophthalmology offices), endoscopy suites, plastic surgery suites, radiology suites (magnetic resonance imaging, computed tomography), oral and maxillofacial surgery suites, cardiac catheterization laboratories, oncology clinics, electrophysiology laboratories, interventional radiology laboratories, neurointerventional laboratories, echocardiography laboratories, and evoked auditory testing laboratories. They are intended to serve as a resource for other physicians and patient care personnel who are involved in the care of these patients, including those involved in local policy development.

This article is featured in "This Month in Anesthesiology," page 1A. Supplemental Digital Content is available for this article. Direct URL citations appear in the printed text and are available in both the HTML and PDF versions of this article. Links to the digital files are provided in the HTML text of this article on the Journal's Web site (www.anesthesiology.org). A complete bibliography used to develop these guidelines, arranged alphabetically by author, is available as Supplemental Digital Content 1, http://links.lww.com/ALN/B594.

†Reflex withdrawal from a painful stimulus is NOT considered a purposeful response.

‡However, as stated in the American Academy of Pediatrics–American Academy of Pediatric Dentistry guidelines on the monitoring and management of pediatric patients during sedation (2016), "in the case of procedures that may themselves cause airway obstruction (*e.g.*, dental or endoscopic), the practitioner must recognize an obstruction and assist the patient in opening the airway."[4]

Task Force Members and Consultants

These guidelines were developed by an ASA–appointed task force of 13 members, consisting of physician anesthesiologists in both private and academic practices from various geographic areas of the United States, a cardiologist, a dentist anesthesiologist, an oral/maxillofacial surgeon, a radiologist, an ASA staff methodologist, and two consulting methodologists for the ASA Committee on Standards and Practice Parameters. Conflict of interest documentation regarding current or potential financial and other interests pertinent to the practice guideline were disclosed by all task force members and managed.

The task force developed these guidelines by means of a seven-step process. First, criteria for evidence associated with moderate sedation and analgesia techniques were established. Second, original published research studies relevant to the guidelines were reviewed and analyzed; only articles relevant to the administration of moderate sedation were evaluated. Third, a panel of expert consultants was asked to (1) participate in opinion surveys on the effectiveness and safety of various methods and interventions that might be used during sedation/analgesia and (2) review and comment on a draft of the guidelines developed by the task force. Fourth, survey opinions about the guideline recommendations were solicited from a random sample of active members of the ASA and participating medical specialty societies. Fifth, the task force held open forums at major national meetings to solicit input on its draft recommendations.§ National organizations representing specialties whose members typically provide moderate sedation were invited to participate in the open forums. Sixth, the consultants were surveyed to assess their opinions on the feasibility of implementing the guidelines. Seventh, all available information was used to build consensus within the task force to finalize the guidelines.

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

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

Findings from the aggregated literature are reported in the text of these 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 nonrandomized study designs or RCTs without pertinent comparison groups. When available, category A evidence is given precedence over category B evidence for any particular outcome. 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). In this document, only the highest level of evidence is included in the summary report for each intervention–outcome pair, including a directional designation of benefit, harm, or equivocality.

Category A. 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 nonsignificant 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 separately 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 clinical 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 nonrandomized comparisons (*e.g.*, quasiexperimental, cohort [prospective or retrospective], or case-control research designs) with comparative statistics between clinical interventions for a specified clinical outcome.

§American Dental Association Council on Dental Education and Licensure: Anesthesia Committee Meeting, April 20, 2017; 2017 Combined Annual Meeting of the Southwest Society of Oral and Maxillofacial Surgeons, the Texas Society of Oral and Maxillofacial Surgeons, the Midwestern Chapter of Oral and Maxillofacial Surgeons, and the Oklahoma Society of Oral and Maxillofacial Surgeons, April 21, 2017, Scottsdale, Arizona; the Society for Ambulatory Anesthesia 32nd Annual Meeting, May 5, 2017, Scottsdale, Arizona; International Anesthesia Research Society 2017 Annual Meeting; and the International Science Symposium, Washington, D.C., May 8, 2017.

‖All meta-analyses are conducted by the ASA methodology group. Meta-analyses from other sources are reviewed but not included as evidence in this document. A minimum of five independent RCTs are required for meta-analysis.

Level 2: The literature contains noncomparative observational studies with associative statistics (*e.g.*, relative risk, correlation, sensitivity, and specificity).
Level 3: The literature contains noncomparative observational studies with descriptive statistics (*e.g.*, frequencies, percentages).
Level 4: The literature contains case reports.

Insufficient Literature. 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 because a clear interpretation of findings is not obtained due to methodological concerns (*e.g.*, confounding of study design or implementation) or the study 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 guidelines. However, only the findings obtained from formal surveys are reported in the document.

Opinion surveys were developed 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 members of the participating organizations.

Expert and Participating Membership Opinion Surveys. Survey findings from task force–appointed expert consultants, a random sample of the ASA membership, and membership samples from the American Association of Oral and Maxillofacial Surgeons (AAOMS) and the American Society of Dentist Anesthesiologists (ASDA) are fully reported in this document. Survey responses were recorded using a 5-point scale and summarized based on median values.

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)

Informal Opinion. Open forum testimony obtained during development of these 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

Patient Evaluation

Preprocedure *patient evaluation* consists of the following strategies for reducing sedation-related adverse outcomes: (1) reviewing previous medical records for underlying medical problems (*e.g.*, abnormalities of major organ systems, obesity, obstructive sleep apnea, anatomical airway problems, congenital syndromes with associated medical/surgical issues, respiratory disease, allergies, intestinal inflammation); sedation, anesthesia, and surgery history; history of or current problems pertaining to cooperation, pain tolerance, or sensitivity to anesthesia or sedation; current medications; extremes of age; psychotropic drug use; use of nonpharmaceuticals (*e.g.*, nutraceuticals); and family history; (2) a focused physical examination; and (3) preprocedure laboratory testing (where indicated).

Literature Findings. Although it is well accepted clinical practice to review medical records, conduct a physical examination, and review laboratory test results, comparative studies are insufficient to evaluate the periprocedural impact of these activities. Observational studies indicate that some adverse outcomes (*e.g.*, unintended deep sedation, hypoxemia,#** or hypotension) may occur in patients with preexisting medical conditions when moderate sedation/analgesia is administered. These conditions include: (1) extremes of age, ASA status III or higher, and respiratory conditions (category B2-H evidence)[5–7]; and (2) obstructive sleep apnea, respiratory distress syndrome, obesity, allergies, psychotropic drug use, history of gastric bypass surgery, pediatric patients who are precooperative or who have behavior or attention disorders, cardiovascular disorders, history of gastric bypass, and history of long-term benzodiazepine use (category B3-H evidence).[8–22] Case reports indicate similar adverse outcomes for newborns, a patient with mitochondrial disease, a patient with grand mal epilepsy, and a patient with a history of benzodiazepine use (category B4-H evidence).[23–26]

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendations to (1) review previous medical records and interview the patient or family, (2) conduct a focused physical examination of the patient, and (3) review available laboratory test results. The consultants and ASA members agree with the recommendation to, if possible, perform the preprocedure evaluation well enough in advance (*e.g.*, several days to weeks) to allow for optimal patient preparation; the AAOMS members and ASDA members strongly agree with this recommendation. Finally, consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendation to reevaluate the patient immediately before the procedure.

#Unless otherwise noted in this document, hypoxemia is reported in the literature to be oxygen desaturation to at most 90%.
**This may not be feasible for urgent or emergency procedures, interventional radiology, or other radiology settings.

Recommendations for Patient Evaluation

- Review previous medical records and interview the patient or family to identify:
  - Abnormalities of the major organ systems (*e.g.*, cardiac, renal, pulmonary, neurologic, sleep apnea, metabolic, endocrine)
  - Adverse experience with sedation/analgesia, as well as regional and general anesthesia
  - History of a difficult airway
  - Current medications, potential drug interactions, drug allergies, and nutraceuticals
  - History of tobacco, alcohol or substance use or abuse
  - Frequent or repeated exposure to sedation/analgesic agents
- Conduct a focused physical examination of the patient (*e.g.*, vital signs, auscultation of the heart and lungs, evaluation of the airway,†† and, when appropriate to sedation, other organ systems where major abnormalities have been identified)
- Review available laboratory test results
  - Order additional laboratory tests guided by a patient's medical condition, physical examination, and the likelihood that the results will affect the management of moderate sedation/analgesia
  - Evaluate results of these tests before sedation is initiated
- If possible, perform the preprocedure evaluation well enough in advance (*e.g.*, several days to weeks) to allow for optimal patient preparation.**
- Reevaluate the patient immediately before the procedure.

Preprocedure Patient Preparation

Preprocedure *patient preparation* consists of (1) consultation with a medical specialist when needed; (2) patient preparation for the procedure (*e.g.*, informing patients of the benefits and risks of sedatives and analgesics, preprocedure instruction, medication usage, counseling); and (3) preprocedure fasting from solids and liquids.

Literature Findings. The literature is insufficient regarding the benefits of consultation with a medical specialist or providing the patient (or legal guardian, in the case of a child or impaired adult) with preprocedure information about sedation and analgesia. A nonrandomized comparative study reported equivocal outcomes (*e.g.*, emesis, apnea, oxygen levels) when preprocedure fasting (*i.e.*, liquids or solids) is compared to no fasting (category B1-E evidence).[27] Another nonrandomized comparison of fasting for less than 2 h *versus* fasting for greater than 2 h reported equivocal findings for emesis, oxygen saturation levels, and arrhythmia for infants (category B1-E evidence).[28] Finally, a third nonrandomized comparison reported equivocal findings for gastric volume and pH when fasting of liquids for 0.5 to 3 h is compared with fasting times of greater than 3 h (category B1-E evidence).[29]

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendations to (1) consult with a medical specialist, when appropriate, before administration of moderate procedural sedation to patients with significant underlying conditions; (2) when feasible before the procedure, inform patients or legal guardians of the benefits, risks, and limitations of moderate sedation/analgesia and possible alternatives, and elicit their preferences; (3) before the day of the procedure, inform patients or legal guardians that they should not drink fluids or eat solid foods for a sufficient period of time to allow for gastric emptying; and (4) on the day of the procedure, assess the time and nature of the last oral intake. All four groups of survey respondents agreed with the recommendation that in urgent or emergent situations where complete gastric emptying is not possible, do not delay moderate procedural sedation based on fasting time alone.

Recommendations for Preprocedure Patient Preparation

- Consult with a medical specialist (*e.g.*, physician anesthesiologist, cardiologist, endocrinologist, pulmonologist, nephrologist, pediatrician, obstetrician, or otolaryngologist), when appropriate before administration of moderate procedural sedation to patients with significant underlying conditions
  - If a specialist is needed, select a specialist based on the nature of the underlying condition and the urgency of the situation
  - For severely compromised or medically unstable patients (*e.g.*, ASA status IV, anticipated difficult airway, severe obstructive pulmonary disease, coronary artery disease, or congestive heart failure) or if it is likely that sedation to the point of unresponsiveness will be necessary to obtain adequate conditions, consult with a physician anesthesiologist
- Before the procedure, inform patients or legal guardians of the benefits, risks, and limitations of moderate sedation/analgesia and possible alternatives and elicit their preferences‡‡
- Inform patients or legal guardians before the day of the procedure that they should not drink fluids or eat solid foods for a sufficient period of time to allow for gastric emptying before the procedure§§

††See table 2 for additional information related to airway assessment.

‡‡This may not be feasible for urgent or emergency procedures.

§§See table 3 and/or refer to: American Society of Anesthesiologists: Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: Application to healthy patients undergoing elective procedures: An updated report. Anesthesiology 2017; 126:376–93.

- On the day of the procedure, assess the time and nature of last oral intake
  - Evaluate the risk of pulmonary aspiration of gastric contents when determining (1) the target level of sedation and (2) whether the procedure should be delayed
- In urgent or emergent situations where complete gastric emptying is not possible, do not delay moderate procedural sedation based on fasting time alone

Patient Monitoring

Many of the complications associated with moderate sedation and analgesia may be avoided if adverse drug responses are detected and treated in a timely manner (*i.e.*, before the development of cardiovascular decompensation or cerebral hypoxia). Patients given sedatives or analgesics in unmonitored settings may be at increased risk of these complications. Patient monitoring includes strategies for the following: (1) monitoring patient level of consciousness assessed by the response of patients, including spoken responses to commands or other forms of bidirectional communication during procedures performed with moderate sedation/analgesia‖‖; (2) monitoring patient ventilation and oxygenation, including ventilatory function, by observation of qualitative clinical signs, capnography, and pulse oximetry; (3) hemodynamic monitoring, including blood pressure, heart rate, and electrocardiography; (4) contemporaneous recording of monitored parameters; and (5) availability/presence of an individual responsible for patient monitoring.

Literature Findings. The literature is insufficient to determine whether monitoring patients' level of consciousness improves patient outcomes or decreases risks. Also, the literature is insufficient to evaluate whether observation of the patient, auscultation, chest excursion, or plethysmography are associated with reduced sedation-related risks.

Meta-analysis of RCTs indicate that the use of continuous end-tidal carbon dioxide monitoring (*i.e.*, capnography) is associated with a reduced frequency of hypoxemic events (*i.e.*, oxygen saturation less than 90%) when compared to monitoring without capnography (*e.g.*, practitioners were blinded to capnography results) during procedures with moderate sedation (category A1-B evidence).[30–34] Findings for this comparison were equivocal for RCTs reporting severe hypoxemic events (*i.e.*, oxygen saturation less than 85%)[30,32,33] and for oxygen saturation levels of 92, 93, and 95% (category A2-E evidence).[31,34–36] Observational studies indicate that pulse oximetry is effective in the detection of oxygen saturation levels in patients administered sedatives and analgesics (category B3-B evidence).[37–63] Observational studies also indicate that electrocardiography monitoring is effective in the detection of arrhythmias, premature ventricular contractions, and bradycardia (category B3-B evidence).[46,49,64]

The literature is insufficient to determine the benefits of contemporaneous recording of patients' level of consciousness, respiratory function, or hemodynamics. In addition, the literature is insufficient to evaluate whether the presence of an individual dedicated to patient monitoring will reduce adverse outcomes related to moderate sedation/analgesia.

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members agree with the recommendations to (1) periodically monitor a patient's response to verbal commands during moderate sedation, except in patients who are unable to respond appropriately or during procedures where movement could detrimental clinically; and (2) during procedures where a verbal response is not possible, check the patient's ability to give a "thumbs up" or other indication of consciousness in response to verbal or tactile (light tap) stimulation. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendations to (1) continually monitor ventilatory function by observation of qualitative clinical signs; (2) continually monitor ventilatory function with capnography unless precluded or invalidated by the nature of the patient, procedure, or equipment; (3) monitor all patients by pulse oximetry with appropriate alarms; (4) determine blood pressure before sedation/analgesia is initiated unless precluded by lack of patient cooperation; (5) once moderate sedation/analgesia is established, continually monitor blood pressure and heart rate during the procedure unless such monitoring interferes with the procedure; (6) use electrocardiographic monitoring during moderate sedation in patients with clinically significant cardiovascular disease or those who are undergoing procedures where dysrhythmias are anticipated; (7) record patients' level of consciousness, ventilatory and oxygenation status, and hemodynamic variables at a frequency that depends on the type and amount of medication administered, the length of the procedure, and the general condition of the patient; (8) set device alarms to alert the care team to critical changes in patient; (9) assure that a designated individual other than the practitioner performing the procedure is present to monitor the patient throughout the procedure; and (10) the individual responsible for monitoring the patient should be trained in the recognition of apnea and airway obstruction and be authorized to seek additional help. The consultants, ASA members, and ASDA members agree that the designated individual may assist with minor, interruptible tasks once the patient's level of sedation/analgesia and vital signs have stabilized, provided that adequate monitoring for the patient's level of sedation is maintained; the AAOMS members strongly agree with this recommendation.

‖‖Patients whose only response is reflex withdrawal from painful stimuli are deeply sedated, approaching a state of general anesthesia, and should be treated accordingly.

Recommendations for Patient Monitoring

Monitoring Patient Level of Consciousness

- Periodically (*e.g.*, at 5-min intervals) monitor a patient's response to verbal commands during moderate sedation, except in patients who are unable to respond appropriately (*e.g.*, patients where age or development may impair bidirectional communication) or during procedures where movement could be detrimental
- During procedures where a verbal response is not possible (*e.g.*, oral surgery, restorative dentistry, upper endoscopy), check the patient's ability to give a "thumbs up" or other indication of consciousness in response to verbal or tactile (light tap) stimulation; this suggests that the patient will be able to control his airway and take deep breaths if necessary##

Monitoring Patient Ventilation and Oxygenation

- Continually*** monitor ventilatory function by observation of qualitative clinical signs
- Continually monitor ventilatory function with capnography unless precluded or invalidated by the nature of the patient, procedure, or equipment
  - For uncooperative patients, institute capnography after moderate sedation has been achieved
- Continuously monitor all patients by pulse oximetry with appropriate alarms

Monitoring Hemodynamics

- Determine blood pressure before sedation/analgesia is initiated unless precluded by lack of patient cooperation
- Once moderate sedation/analgesia is established, continually monitor blood pressure (*e.g.*, at 5-min intervals) and heart rate during the procedure unless such monitoring interferes with the procedure (*e.g.*, magnetic resonance imaging where stimulation from the blood pressure cuff could arouse an appropriately sedated patient)
- Use electrocardiographic monitoring during moderate sedation in patients with clinically significant cardiovascular disease or those who are undergoing procedures where dysrhythmias are anticipated

Contemporaneous Recording of Monitored Parameters

- Record patients' level of consciousness, ventilatory and oxygenation status, and hemodynamic variables at a frequency that depends on the type and amount of medication administered, the length of the procedure, and the general condition of the patient
  - At a minimum, this should occur (1) before the administration of sedative/analgesic agents†††; (2) after administration of sedative/analgesic agents; (3) at regular intervals during the procedure; (4) during initial recovery; and (5) just before discharge
- Set device alarms to alert the care team to critical changes in patient status

Availability of an Individual Responsible for Patient Monitoring

- Assure that a designated individual other than the practitioner performing the procedure is present to monitor the patient throughout the procedure
  - The individual responsible for monitoring the patient should be trained in the recognition of apnea and airway obstruction and be authorized to seek additional help
  - The designated individual should not be a member of the procedural team but may assist with minor, interruptible tasks once the patient's level of sedation/analgesia and vital signs have stabilized, provided that adequate monitoring for the patient's level of sedation is maintained

Supplemental Oxygen

Literature Findings. Meta-analysis of RCTs indicate that the use of supplemental oxygen *versus* no supplemental oxygen is associated with a reduced frequency of hypoxemia‡‡‡ during procedures with moderate sedation (category A1-B evidence).[65–71] The literature is insufficient to examine which methods of supplemental oxygen administration (*e.g.*, nasal cannula, face mask, or specialized devices) are more effective in reducing hypoxemia.

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendation to use supplemental oxygen during moderate procedural sedation/analgesia unless specifically contraindicated for a particular patient or procedure.

##A response limited to reflex withdrawal from a painful stimulus is not considered a purposeful response and thus represents a state of general anesthesia.

***The term *continual* is defined as "repeated regularly and frequently in steady rapid succession," whereas *continuous* means "prolonged without any interruption at any time" (see Standards for Basic Anesthetic Monitoring, American Society of Anesthesiologists. Approved by the ASA House of Delegates October 21, 1986, and last amended October 28, 2015. Available at: http://www.asahq.org/quality-and-practice-management/practice-guidance-resource-documents/standards-for-basic-anesthetic-monitoring. Accessed on August 21, 2017).

†††For rare uncooperative patients (*e.g.*, children with autism spectrum disorder or attention deficit disorder), recording oxygenation status or blood pressure may not be possible until after sedation.

‡‡‡Reported by authors as oxygen desaturation to at most 95% or oxygen desaturation more than 5 or 10% below baseline.

Recommendations for Supplemental Oxygen

- Use supplemental oxygen during moderate procedural sedation/analgesia unless specifically contraindicated for a particular patient or procedure

Emergency Support

Emergency support strategies include (1) the presence of pharmacologic antagonists; (2) the presence of age and weight appropriate emergency airway equipment (*e.g.*, different types of airway devices, supraglottic airway devices); (3) the presence of an individual capable of establishing a patent airway and providing positive pressure ventilation and resuscitation; (4) the presence of an individual to establish intravenous access; and (5) the availability of rescue support.

Literature Findings. Although it is established clinical practice to provide access to emergency support, the literature is insufficient to assess the benefits or harms of keeping pharmacologic antagonists or emergency airway equipment available during procedures with moderate sedation and analgesia. The literature is insufficient to assess whether the presence of an individual capable of establishing a patent airway, positive pressure ventilation, and resuscitation will improve outcomes. In addition, the literature is insufficient to determine the benefits of keeping an individual present to establish intravenous access during procedures with moderate sedation/analgesia. Finally, the literature is insufficient to determine the benefits of rescue support availability during moderate procedural sedation/analgesia.

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendation to assure that (1) pharmacologic antagonists for benzodiazepines and opioids are immediately available in the procedure suite or procedure room; (2) an individual is present in the room who understands the pharmacology of the sedative/analgesics administered and potential interactions with other medications and nutraceuticals the patient may be taking; (3) appropriately sized equipment for establishing a patent airway is available; (4) at least one individual capable of establishing a patent airway and providing positive pressure ventilation is present in the procedure room; (5) suction, advanced airway equipment, positive pressure ventilation, and supplemental oxygen are immediately available in the procedure room and in good working order; (6) a member of the procedural team is trained in the recognition and treatment of airway complications, opening the airway, suctioning secretions, and performing bag-valve-mask ventilation; (7) a member of the procedural team has the skills to establish intravascular access; (8) a member of the procedural team has the skills to provide chest compressions; (9) a functional defibrillator or automatic external defibrillator is immediately available in the procedure area; (10) an individual or service is immediately available with advanced life support skills; and (11) members of the procedural team are able to recognize the need for additional support and know how to access emergency services from the procedure room.

Recommendations for Emergency Support§§§

- Assure that pharmacologic antagonists for benzodiazepines and opioids are immediately available in the procedure suite or procedure room‖‖‖
- Assure that an individual is present in the room who understands the pharmacology of the sedative/analgesics administered (*e.g.*, opioids and benzodiazepines) and potential interactions with other medications and nutraceuticals the patient may be taking
- Assure that appropriately sized equipment for establishing a patent airway is available
- Assure that at least one individual capable of establishing a patent airway and providing positive pressure ventilation is present in the procedure room
- Assure that suction, advanced airway equipment, a positive pressure ventilation device, and supplemental oxygen are immediately available in the procedure room and in good working order
    - Assure that a member of the procedural team is trained in the recognition and treatment of airway complications (*e.g.*, apnea, laryngospasm, airway obstruction), opening the airway, suctioning secretions, and performing bag-valve-mask ventilation
- Assure that a member of the procedural team has the skills to establish intravascular access
- Assure that a member of the procedural team has the skills to provide chest compressions
- Assure that a functional defibrillator or automatic external defibrillator is immediately available in the procedure area
- Assure that an individual or service (*e.g.*, code blue team, paramedic-staffed ambulance service) with advanced life support skills (*e.g.*, tracheal intubation, defibrillation, resuscitation medications) is immediately available
- Assure that members of the procedural team are able to recognize the need for additional support and know how to access emergency services from the procedure room (*e.g.*, telephone, call button)

Sedative/Analgesic Medications Not Intended for General Anesthesia

For these guidelines, sedatives not intended for general anesthesia include benzodiazepines (*e.g.*, midazolam, diazepam,

§§§Refer to table 4 for examples of emergency support equipment and pharmaceuticals.

‖‖‖"Immediately available in the procedure room" refers to easily accessible shelving, cabinetry, and other measures to assure that there is no delay in accessing medications and equipment during the procedure.

flunitrazepam, lorazepam, or temazapam) and dexmedetomidine. Analgesics administered with sedatives include opioids such as fentanyl, alfentanil, remifentanil, meperidine, morphine, and nalbuphine. This section of the guidelines addresses the following topics: (1) benzodiazepines and dexmedetomidine, (2) sedative/opioid combinations, (3) intravenous *versus* nonintravenous sedatives/analgesics not intended for general anesthesia,### and (4) titration of sedatives/analgesics not intended for general anesthesia.

Literature Findings. Meta-analysis of RCTs comparing midazolam combined with opioids *versus* midazolam alone report equivocal findings for pain and discomfort,[72–77] hypoxemia,****[74,75,77–80] and patient recall of the procedure.[72–74,77,80–83] (category A1-E evidence). When midazolam combined with opioids are compared with opioids alone, RCTs report equivocal findings for patient recall, pain during the procedure, frequency of hypoxemia,### hypercarbia and respiratory depression (category A2-E evidence).[75,78,83–85]

One RCT comparing dexmedetomidine with midazolam reports equivocal outcomes for recovery time, oxygen saturation levels, apnea, and bradycardia (category A3-E evidence).[86] Another RCT reports a longer recovery time for dexmedetomidine compared with midazolam (category A3-H evidence), with equivocal findings for analgesia scores, oxygen saturation levels, respiratory rate, blood pressure, and pulse rate (category A3-E evidence).[87] One RCT reports a lower frequency of hypoxemia when dexmedetomidine is combined with an opioid analgesic compared with midazolam combined with an opioid analgesic (category A3-B evidence).[88] One RCT reports deeper sedation (*i.e.*, higher sedation scores) and a lower frequency of hypoxemia when dexmedetomidine combined with midazolam and meperidine is compared with midazolam combined with meperidine (category A3-B evidence).[89]

One RCT comparing intravenous midazolam with intramuscular midazolam reports equivocal findings for oxygen saturation levels, respiratory rate, and heart rate (category A3-E evidence).[90] One RCT comparing intravenous midazolam with intranasal midazolam reports equivocal findings for sedation efficacy (category A3-E evidence), but discomfort from the nasal administration was reported for all intranasal patients with no nasal discomfort from the intravenous patients (category A3-B evidence).[91] One RCT comparing intravenous diazepam with rectal diazepam reports lower recall for the intravenous method (category A3-B evidence); findings were equivocal for sedative effect, anxiety, and crying (category A3-E evidence).[92] One RCT comparing intravenous with intranasal dexmedetomidine reported equivocal findings for sedation time, duration of the procedure, and the frequency of rescue doses of midazolam administered (category A3-E evidence).[93]

One RCT comparing titration (*i.e.*, administration of small, incremental doses of intravenous midazolam combined with meperidine until the desired level of sedation and/or analgesia is achieved) of midazolam combined with an opioid compared with a single, rapid bolus reports higher total physician times, medication dosages, frequencies of hypoxemia, and somnolence scores for titration (category A3-H evidence).[94]

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendation that combinations of sedative and analgesic agents may be administered as appropriate for the procedure and the condition of the patient. The consultants, ASA members, and ASDA members agree that dexmedetomidine may be administered as an alternative to benzodiazepine sedatives on a case-by-case basis; the AAOMS members are equivocal regarding this recommendation. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendation that in patients receiving intravenous medications for sedation/analgesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression. The consultants agree and the ASA members, AAOMS members, and ASDA members strongly agree that in patients who have received sedation/analgesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of reestablishing intravenous access on a case-by-case basis. Finally, the consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendation to administer intravenous sedative/analgesic drugs in small, incremental doses, or by infusion, titrating to the desired endpoints.

Recommendations for Sedative or Analgesic Medications Not Intended for General Anesthesia

- Combinations of sedative and analgesic agents may be administered as appropriate for the procedure and the condition of the patient††††
  - Administer each component individually to achieve the desired effect (*e.g.*, additional analgesic medication to relieve pain; additional sedative medication to decrease awareness or anxiety)
- Dexmedetomidine may be administered as an alternative to benzodiazepine sedatives on a case-by-case basis

###All routes of administration were considered, including oral, nasal, intramuscular, rectal, transdermal, sublingual, iontophoresis, and nebulization.

****Reported by authors as oxygen desaturation to less than 94, 93, or 90%.

††††The propensity for combinations of sedative and analgesic agents to cause respiratory depression and airway obstruction emphasizes the need to appropriately reduce the dose of each component, as well as the need to continually monitor respiratory function. Knowledge of each drug's time of onset, peak response, and duration of action is important. Titration of drug to effect is an important concept; one must know whether the previous dose has taken full effect before administering additional drug.

- In patients receiving intravenous medications for sedation/analgesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression
- In patients who have received sedation/analgesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of reestablishing intravenous access on a case-by-case basis
- Administer intravenous sedative/analgesic drugs in small, incremental doses, or by infusion, titrating to the desired endpoints
    - Allow sufficient time to elapse between doses so the peak effect of each dose can be assessed before subsequent drug administration
- When drugs are administered by nonintravenous routes (*e.g.*, oral, rectal, intramuscular, transmucosal), allow sufficient time for absorption and peak effect of the previous dose to occur before supplementation is considered

Sedative/Analgesic Medications Intended for General Anesthesia

For these guidelines, sedatives intended for general anesthesia include propofol, ketamine and etomidate.‡‡‡‡ Sedatives not intended for general anesthesia (*e.g.*, benzodiazepines, nitrous oxide, chloral hydrate, barbiturates, and antihistamines) are included either as comparison groups or in combination with sedatives intended for general anesthesia. Analgesics (*e.g.*, opioids, nonsteroidal antiinflammatory drugs, and local anesthetics) are included either in comparison groups or in combination with sedatives intended for general anesthesia. This section of the guidelines addresses the following topics: (1) propofol *versus* other sedative/analgesics, (2) ketamine *versus* other sedative/analgesics, (3) etomidate *versus* other sedative/analgesics, (4) combinations of sedatives intended for general anesthesia *versus* other sedatives/analgesics, alone or in combination, (5) intravenous *versus* nonintravenous sedatives/analgesics intended for general anesthesia,‖‖‖ and (6) titration of intravenous sedatives/analgesics intended for general anesthesia.

Literature Findings. Literature comparing propofol with other sedative/analgesic medications, either alone or in combination, report the following findings: (1) Meta-analysis of RCTs report faster recovery times for propofol *versus* midazolam after procedures with moderate sedation (category A1-B evidence),[95–99] with equivocal findings for patient recall,[95,100–103] and frequency of hypoxemia (category A1-E evidence).[96,100,102,103] One RCT reports shorter sedation time, a lower frequency of recall and higher recovery scores for propofol *versus* diazepam (category A3-B evidence).[104] (2) RCTs comparing propofol *versus* benzodiazepines combined with opioid analgesics report shorter sedation and recovery times for propofol alone (category A2-B evidence),[105,106] with equivocal findings for pain, oxygen saturation levels, and blood pressure (category A2-E evidence).[107–109] (3) RCTs comparing propofol combined with benzodiazepines *versus* propofol alone report equivocal findings for recovery and procedure times, pain with injection, and restlessness (category A2-E evidence).[110–112] One RCT comparing propofol combined with midazolam *versus* propofol alone reports deeper sedation levels and more episodes of deep sedation for the combination group (category A3-H evidence).[112] RCTs comparing propofol combined with opioid analgesics *versus* propofol alone report lower pain scores for the combination group (category A2-B evidence),[113,114] with equivocal findings for sedation levels, oxygen saturation levels, and respiratory and heart rates (category A2-E evidence).[113–116] (4) One RCT comparing propofol combined with remifentanil *versus* remifentanil alone reports deeper sedation, less recall (category A3-B evidence), and more respiratory depression (category A3-H evidence) for the combination group.[117] (5) RCTs comparing propofol combined with sedatives/analgesics not intended for general anesthesia *versus* combinations of sedatives/analgesics not intended for general anesthesia report equivocal findings for outcomes including sedation time, patient recall, pain scores, recovery time, oxygen saturation levels, blood pressure, and heart rate (category A2-E evidence).[118–136] (6) RCTs comparing propofol with ketamine report equivocal findings for sedation scores, pain during the procedure, recovery, oxygen saturation levels, respiratory rate, blood pressure, and heart rate (category A2-E evidence).[137,138] (7) One RCT comparing propofol *versus* ketamine combined with midazolam reports equivocal findings for recovery agitation, oxygen saturation levels, respiratory rate, blood pressure, and heart rate (category A3-E evidence).[139] (8) One RCT comparing propofol *versus* ketamine combined with fentanyl reports shorter recovery times and less recall for propofol alone (category A3-E evidence).[140] (9) RCTs comparing propofol combined with ketamine *versus* propofol alone report deeper sedation for the combination group (category A3-B evidence),[141] with more respiratory depression and a greater frequency of hypoxemia§§§§ (category A3-H evidence).[142]

Literature comparing ketamine with other sedative/analgesic medications, either alone or in combination, report the following findings: (1) RCTs comparing ketamine with midazolam report equivocal findings for sedation scores, recovery time, and oxygen saturation levels (category A2-E evidence).[87,143,144] (2) One RCT comparing ketamine *versus* nitrous oxide reports longer sedation times and higher levels of sedation (*i.e.*, deeper sedation levels) for ketamine (category A3-H evidence).[145] (3) One RCT comparing ketamine with midazolam combined with fentanyl reports a lower

‡‡‡‡Note that these guidelines do not address education, training, or certification requirements for practitioners who provide moderate procedural sedation with these drugs.

§§§§Reported by author as oxygen desaturation to less than 94%.

depth of sedation for ketamine (category A3-B evidence), with equivocal findings for recall, pain scores and frequency of hypoxemia (category A3-E evidence).[146] (4) RCTs comparing ketamine combined with midazolam *versus* ketamine alone or midazolam alone report equivocal findings for sedation scores, sedation time, recovery, and recovery agitation (category A2-E evidence).[143,147,148] (5) One RCT comparing ketamine combined with midazolam *versus* midazolam combined with alfentanil reports a lower frequency of hypoxemia (category A3-B evidence) and increased disruptive movements, longer recovery times, and longer times to discharge for ketamine combined with midazolam (category A3-H evidence).[149] (6) RCTs comparing ketamine with propofol report equivocal findings for sedation scores, pain during the procedure, oxygen saturation levels, and recovery scores (category A2-E evidence).[137,138] RCTs comparing ketamine with etomidate report less airway assistance required and lower frequencies of myoclonus with ketamine (category A2-B evidence).[150,151] (7) RCTs comparing ketamine combined with propofol *versus* propofol combined with fentanyl report equivocal findings for recovery times, oxygen saturation levels, respiratory rate, and heart rate (category A3-H evidence).[152–154]

Literature comparing etomidate with other sedative/analgesic medications, either alone or in combination, report the following findings: (1) One RCT comparing etomidate with midazolam reports shorter sedation times for etomidate (category A3-B evidence), with equivocal findings for recovery agitation, oxygen saturation levels, and apnea (category A3-E evidence).[155] (2) One RCT comparing etomidate with pentobarbital reports shorter sedation times for etomidate (category A3-B evidence), with equivocal findings for recovery agitation and hypotension (category A3-B evidence).[156] (3) One RCT comparing etomidate combined with fentanyl *versus* midazolam combined with fentanyl reports deeper sedation (*i.e.*, higher sedation scores) for the combination group (category A3-B evidence), with equivocal findings for sedation times, recovery times, frequency of oversedation, and oxygen saturation levels (category A3-E evidence), and a higher frequency of myoclonus (category A3-H evidence).[157] (4) One RCT comparing etomidate combined with morphine and fentanyl *versus* midazolam combined with morphine and fentanyl reports shorter sedation times for the etomidate combination (category A3-B evidence), with equivocal findings for oxygen saturation levels, apnea, hypotension, and recovery agitation (category A3-E evidence), and a higher frequency of patient recall and myoclonus (category A3-H evidence).[158]

One RCT reports shorter sedation onset times, shorter recovery times, and fewer rescue doses administered for intravenous ketamine when compared with intramuscular ketamine (category A3-B evidence), with equivocal findings for sedation efficacy, respiratory depression, and time to discharge (category A3-E evidence).[159] One RCT comparing intravenous *versus* intramuscular ketamine with or without midazolam reports equivocal findings for sedation time, recovery agitation, and duration of the procedure (category A3-E evidence).[148]

Observational studies reporting titrated administration of sedatives intended for general anesthesia report the frequency of hypoxemia ranging from 1.7 to 4.7% of patients,[14,160–163] with oversedation occurring in 0.13%-0.2% of patients.[14,161]

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendations to (1) provide care consistent with that required for general anesthesia when moderate procedural sedation with sedative or analgesic medications intended for general anesthesia by any route is intended; (2) assure that practitioners administering these drugs are able to reliably rescue patients from unintended deep sedation or general anesthesia; (3) maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression for patients receiving intravenous sedatives intended for general anesthesia; (4) determine the advisability of reestablishing intravenous access on a case-by-case basis in patients who have received sedatives intended for general anesthesia by nonintravenous routes or whose intravenous line has become dislodged or blocked; and (5) administer intravenous sedative/analgesic drugs intended for general anesthesia in small, incremental doses, or by infusion, titrating to the desired endpoints.

Recommendations for Sedative/Analgesic Medications Intended for General Anesthesia

- When moderate procedural sedation with sedative/analgesic medications intended for general anesthesia by any route is intended, provide care consistent with that required for general anesthesia
- Assure that practitioners administering sedative/analgesic medications intended for general anesthesia are able to reliably identify and rescue patients from unintended deep sedation or general anesthesia
- For patients receiving intravenous sedative/analgesic medications intended for general anesthesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression
- In patients who have received sedative/analgesic medications intended for general anesthesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of reestablishing intravenous access on a case-by-case basis
- Administer intravenous sedative/analgesic medications intended for general anesthesia in small, incremental doses or by infusion, titrating to the desired endpoints
    - Allow sufficient time to elapse between doses so the peak effect of each dose can be assessed before subsequent drug administration

- When drugs intended for general anesthesia are administered by nonintravenous routes (*e.g.*, oral, rectal, intramuscular, transmucosal), allow sufficient time for absorption and peak effect of the previous dose to occur before supplementation is considered

Reversal Agents: Naloxone and Flumazenil

Literature Findings. One placebo-controlled RCT reports that naloxone effectively reverses the effects of meperidine as measured by increasing alertness scores and respiratory rate (category A3-B evidence).[164] Reversal of respiratory depression, apnea, and oxygen desaturation after naloxone administration in other practice settings is also reported by observational studies (category B3-B evidence)[165,166] and case reports (category B4-B evidence).[167–170]

Meta-analysis of double-blind placebo-controlled RCTs indicates that flumazenil effectively antagonizes the effects of sedation within 15 min for patients who have been administered benzodiazepines (category A1-B evidence).[171–178] Placebo-controlled RCTs also indicate that flumazenil administration is associated with shorter recovery times for benzodiazepine sedation (category A2-B evidence).[176,179–181] Meta-analysis of placebo-controlled RCTs indicate that flumazenil effectively antagonizes the effects of benzodiazepines when combined with opioids (category A1-B evidence).[182–186]

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendations to (1) assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia, regardless of route of administration; (2) encourage or physically stimulate patients to breathe deeply if patients become hypoxemic or apneic during sedation/analgesia; (3) administer supplemental oxygen if patients become hypoxemic or apneic during sedation/analgesia; (4) provide positive pressure ventilation if spontaneous ventilation is inadequate when patients become hypoxemic or apneic during sedation/analgesia; (5) use reversal agents in cases where airway control, spontaneous ventilation, or positive pressure ventilation is inadequate; (6) administer naloxone to reverse opioid-induced sedation and respiratory depression; (7) administer flumazenil to reverse benzodiazepine-induced sedation and respiratory depression; (8) after pharmacologic reversal, observe and monitor patients for a sufficient time to ensure that sedation and cardiorespiratory depression does not recur once the effect of the antagonist dissipates; and (9) not use sedation regimens that include routine reversal of sedative or analgesic agents.

Recommendations for Reversal Agents

- Assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia, regardless of route of administration
- If patients develop hypoxemia, significant hypoventilation or apnea during sedation/analgesia: (1) encourage or physically stimulate patients to breathe deeply, (2) administer supplemental oxygen, and (3) provide positive pressure ventilation if spontaneous ventilation is inadequate
- Use reversal agents in cases where airway control, spontaneous ventilation or positive pressure ventilation are inadequate
  - Administer naloxone to reverse opioid-induced sedation and respiratory depression‖‖‖‖
  - Administer flumazenil to reverse benzodiazepine-induced sedation and respiratory depression
- After pharmacologic reversal, observe and monitor patients for a sufficient time to ensure that sedation and cardiorespiratory depression does not recur once the effect of the antagonist dissipates
- Do not use sedation regimens that are intended to include routine reversal of sedative or analgesic agents

Recovery Care

Patients receiving moderate procedural sedation may continue to be at risk for developing complications after their procedure is completed. Decreased stimulation from the proceduralist delayed drug absorption after nonintravenous administration, and slow drug elimination may contribute to residual sedation and cardiorespiratory depression during the recovery period. When sedation/analgesia is administered to outpatients, medical supervision may not be available once the patient leaves the medical facility. This section of the guidelines addresses the following recovery care topics: (1) continued observation and monitoring until discharge and (2) predetermined discharge criteria.

Literature Findings. Although it is well accepted clinical practice to continue patient observation until discharge, the literature is insufficient to evaluate the impact of postprocedural observation and monitoring. The literature is also insufficient to evaluate the effects of using predetermined discharge criteria on patient outcomes.

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendations to (1) observe and monitor patients in an appropriately staffed and equipped area until they are near their baseline level of consciousness and are no longer at increased risk for cardiorespiratory depression, (2) monitor oxygenation continuously until patients are no longer at risk for hypoxemia, (3) monitor ventilation and circulation at regular intervals until patients are suitable for discharge, and (4) design discharge criteria to minimize the risk of central

‖‖‖‖Practitioners are cautioned that acute reversal of opioid-induced analgesia may result in pain, hypertension, tachycardia, or pulmonary edema.

nervous system or cardiorespiratory depression after discharge from observation by trained personnel.

Recommendations for Recovery Care

- After sedation/analgesia, observe and monitor patients in an appropriately staffed and equipped area until they are near their baseline level of consciousness and are no longer at increased risk for cardiorespiratory depression
- Monitor oxygenation continuously until patients are no longer at risk for hypoxemia
- Monitor ventilation and circulation at regular intervals (*e.g.*, every 5 to 15 min) until patients are suitable for discharge
- Design discharge criteria to minimize the risk of central nervous system or cardiorespiratory depression after discharge from observation by trained personnel####

Creation and Implementation of Patient Safety Processes

Patient safety processes include quality improvement and preparation for rare events.

Literature Findings. Regarding quality improvement, one observational study reported that use of a presedation checklist compared to no checklist use may improve safety documentation in emergency department sedations (category B1-B evidence).[187]

Survey Findings. The consultants, ASA members, AAOMS members, and ASDA members strongly agree with the recommendations to (1) create and implement a quality improvement process based upon established national, regional, or institutional reporting protocols; (2) strengthen patient safety culture through collaborative practices; and (3) create an emergency response plan.

Recommendations

- Create and implement a quality improvement process based upon established national, regional, or institutional reporting protocols, (*e.g.*, adverse events, unsatisfactory sedation)
  - Periodically update the quality improvement process to keep up with new technology, equipment or other advances in moderate procedural sedation/analgesia
- Strengthen patient safety culture through collaborative practices (*e.g.*, team training, simulation drills, development and implementation of checklists)
- Create an emergency response plan (*e.g.*, activating "code blue" team or activating the emergency medical response system: 911 or equivalent)

####Discharge criteria examples are noted in table 5.

Appendix I: Summary of Recommendations

Patient Evaluation

- Review previous medical records and interview the patient or family to identify:
  - Abnormalities of the major organ systems (*e.g.*, cardiac, renal, pulmonary, neurologic, sleep apnea, metabolic, endocrine)
  - Adverse experience with sedation/analgesia, as well as regional and general anesthesia
  - History of a difficult airway
  - Current medications, potential drug interactions, drug allergies, and nutraceuticals
  - History of tobacco, alcohol or substance use or abuse
  - Frequent or repeated exposure to sedation/analgesic agents
- Conduct a focused physical examination of the patient (*e.g.*, vital signs, auscultation of the heart and lungs, evaluation of the airway,* and when appropriate to sedation, other organ systems where major abnormalities have been identified)
- Review available laboratory test results
  - Order additional laboratory tests guided by a patient's medical condition, physical examination, and the likelihood that the results will affect the management of moderate sedation/analgesia
  - Evaluate results of these tests before sedation is initiated
- If possible, perform the preprocedure evaluation well enough in advance (*e.g.*, several days to weeks) to allow for optimal patient preparation†
- Reevaluate the patient immediately before the procedure.

Preprocedure Patient Preparation

- Consult with a medical specialist (*e.g.*, physician anesthesiologist, cardiologist, endocrinologist, pulmonologist, nephrologist, pediatrician, obstetrician, or otolaryngologist), when appropriate before administration of moderate procedural sedation to patients with significant underlying conditions
  - If a specialist is needed, select a specialist based on the nature of the underlying condition and the urgency of the situation
  - For severely compromised or medically unstable patients (*e.g.*, ASA status IV, anticipated difficult airway, severe obstructive pulmonary disease, coronary artery disease, or congestive heart failure) or if it is likely that sedation to the point of unresponsiveness will be necessary to obtain adequate conditions, consult with a physician anesthesiologist

*See table 2 for additional information related to airway assessment.

†This may not be feasible for urgent or emergency procedures, interventional radiology or other radiology settings.

- Before the procedure, inform patients or legal guardians of the benefits, risks, and limitations of moderate sedation/analgesia and possible alternatives, and elicit their preferences‡
- Inform patients or legal guardians before the day of the procedure that they should not drink fluids or eat solid foods for a sufficient period of time to allow for gastric emptying before the procedure§
- On the day of the procedure, assess the time and nature of last oral intake
    - Evaluate the risk of pulmonary aspiration of gastric contents when determining (1) the target level of sedation and (2) whether the procedure should be delayed
- In urgent or emergent situations where complete gastric emptying is not possible, do not delay moderate procedural sedation based on fasting time alone

Patient Monitoring

Monitoring Patient Level of Consciousness

- Periodically (*e.g.*, at 5-min intervals) monitor a patient's response to verbal commands during moderate sedation, except in patients who are unable to respond appropriately (*e.g.*, patients where age or development may impair bidirectional communication) or during procedures where movement could be detrimental
- During procedures where a verbal response is not possible (*e.g.*, oral surgery, restorative dentistry, upper endoscopy), check the patient's ability to give a "thumbs up" or other indication of consciousness in response to verbal or tactile (light tap) stimulation; this suggests that the patient will be able to control his airway and take deep breaths if necessary‖

Monitoring Patient Ventilation and Oxygenation

- Continually# monitor ventilatory function by observation of qualitative clinical signs
- Continually monitor ventilatory function with capnography unless precluded or invalidated by the nature of the patient, procedure, or equipment
    - For uncooperative patients, institute capnography after moderate sedation has been achieved
- Continuously monitor all patients by pulse oximetry with appropriate alarms

Monitoring Hemodynamics

- Determine blood pressure before sedation/analgesia is initiated unless precluded by lack of patient cooperation
- Once moderate sedation/analgesia is established, continually monitor blood pressure (*e.g.*, at 5-min intervals) and heart rate during the procedure unless such monitoring interferes with the procedure (*e.g.*, magnetic resonance imaging where stimulation from the blood pressure cuff could arouse an appropriately sedated patient)
- Use electrocardiographic monitoring during moderate sedation in patients with clinically significant cardiovascular disease or those who are undergoing procedures where dysrhythmias are anticipated

Contemporaneous Recording of Monitored Parameters

- Record patients' level of consciousness, ventilatory and oxygenation status, and hemodynamic variables at a frequency that depends on the type and amount of medication administered, the length of the procedure, and the general condition of the patient
    - At a minimum, this should occur: (1) before the administration of sedative/analgesic agents,** (2) after administration of sedative/analgesic agents, (3) at regular intervals during the procedure, (4) during initial recovery, and (5) just before discharge
- Set device alarms to alert the care team to critical changes in patient status

Availability of an Individual Responsible for Patient Monitoring

- Assure that a designated individual other than the practitioner performing the procedure is present to monitor the patient throughout the procedure
    - The individual responsible for monitoring the patient should be trained in the recognition of apnea and airway obstruction and be authorized to seek additional help

‡This may not be feasible for urgent or emergency procedures.

§See table 3 and/or refer to: American Society of Anesthesiologists: Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: Application to healthy patients undergoing elective procedures: An updated report. Anesthesiology 2017; 126:376–93

‖A response limited to reflex withdrawal from a painful stimulus is not considered a purposeful response and thus represents a state of general anesthesia.

#The term "continual" is defined as "repeated regularly and frequently in steady rapid succession" whereas "continuous" means "prolonged without any interruption at any time" (see Standards for Basic Anesthetic Monitoring, American Society of Anesthesiologists. Approved by the ASA House of Delegates October 21, 1986, and last amended October 28, 2015. Retrieved May 9, 2017, from http://www.asahq.org/quality-and-practice-management/standards-and-guidelines/search?q=basic anesthesia monitoring).

**For rare uncooperative patients (*e.g.*, children with autism spectrum disorder or attention deficit disorder) recording oxygenation status or blood pressure may not be possible until after sedation.

- The designated individual may assist with minor, interruptible tasks once the patient's level of sedation/analgesia and vital signs have stabilized, provided that adequate monitoring for the patient's level of sedation is maintained

Supplemental Oxygen

- Use supplemental oxygen during moderate procedural sedation/analgesia unless specifically contraindicated for a particular patient or procedure

Emergency Support

- Assure that pharmacologic antagonists for benzodiazepines and opioids are immediately available in the procedure suite or procedure room††
- Assure that an individual is present in the room who understands the pharmacology of the sedative/analgesics administered (*e.g.*, opioids and benzodiazepines) and potential interactions with other medications and nutraceuticals the patient may be taking
- Assure that appropriately sized equipment for establishing a patent airway is available
- Assure that at least one individual capable of establishing a patent airway and providing positive pressure ventilation is present in the procedure room
- Assure that suction, advanced airway equipment, a positive pressure ventilation device, and supplemental oxygen are immediately available in the procedure room and in good working order
  - Assure that a member of the procedural team is trained in the recognition and treatment of airway complications (*e.g.*, apnea, laryngospasm, airway obstruction), opening the airway, suctioning secretions, and performing bag-valve-mask ventilation
- Assure that a member of the procedural team has the skills to establish intravascular access
- Assure that a member of the procedural team has the skills to provide chest compressions
- Assure that a functional defibrillator or automatic external defibrillator is immediately available in the procedure area
- Assure that an individual or service (*e.g.*, code blue team, paramedic-staffed ambulance service) with advanced life support skills (*e.g.*, tracheal intubation, defibrillation, resuscitation medications) is immediately available
- Assure that members of the procedural team are able to recognize the need for additional support and know how to access emergency services from the procedure room (*e.g.*, telephone, call button)

††"Immediately available in the procedure room" refers to accessible shelving, unlocked cabinetry, and other measures to assure that there is no delay in accessing medications and equipment during the procedure.

Sedative or Analgesic Medications Not Intended for General Anesthesia

- Combinations of sedative and analgesic agents may be administered as appropriate for the procedure and the condition of the patient‡‡
  - Administer each component individually to achieve the desired effect (*e.g.*, additional analgesic medication to relieve pain; additional sedative medication to decrease awareness or anxiety)
- Dexmedetomidine may be administered as an alternative to benzodiazepine sedatives on a case-by-case basis
- In patients receiving intravenous medications for sedation/analgesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression
- In patients who have received sedation/analgesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of reestablishing intravenous access on a case-by-case basis
- Administer intravenous sedative/analgesic drugs in small, incremental doses, or by infusion, titrating to the desired endpoints
  - Allow sufficient time to elapse between doses so the peak effect of each dose can be assessed before subsequent drug administration
- When drugs are administered by nonintravenous routes (*e.g.*, oral, rectal, intramuscular, transmucosal), allow sufficient time for absorption and peak effect of the previous dose to occur before supplementation is considered

Sedative/Analgesic Medications Intended for General Anesthesia

- When moderate procedural sedation with sedative/analgesic medications intended for general anesthesia by any route is intended, provide care consistent with that required for general anesthesia
- Assure that practitioners administering sedative/analgesic medications intended for general anesthesia are able to reliably identify and rescue patients from unintended deep sedation or general anesthesia
- For patients receiving intravenous sedative/analgesics intended for general anesthesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression

‡‡The propensity for combinations of sedative and analgesic agents to cause respiratory depression and airway obstruction emphasizes the need to appropriately reduce the dose of each component as well as the need to continually monitor respiratory function. Knowledge of each drug's time of onset, peak response, and duration of action is important. Titration of drug to effect is an important concept; one must know whether the previous dose has taken full effect before administering additional drug.

- In patients who have received sedative/analgesic medications intended for general anesthesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of reestablishing intravenous access on a case-by-case basis
- Administer intravenous sedative/analgesic medications intended for general anesthesia in small, incremental doses, or by infusion, titrating to the desired endpoints
  - Allow sufficient time to elapse between doses so the peak effect of each dose can be assessed before subsequent drug administration
- When drugs intended for general anesthesia are administered by nonintravenous routes (*e.g.*, oral, rectal, intramuscular, transmucosal), allow sufficient time for absorption and peak effect of the previous dose to occur before supplementation is considered

Reversal Agents

- Assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia, regardless of route of administration
- If patients develop hypoxemia, significant hypoventilation or apnea during sedation/analgesia: (1) encourage or physically stimulate patients to breathe deeply, (2) administer supplemental oxygen, and (3) provide positive pressure ventilation if spontaneous ventilation is inadequate
- Use reversal agents in cases where airway control, spontaneous ventilation, or positive pressure ventilation is inadequate
  - Administer naloxone to reverse opioid-induced sedation and respiratory depression§§
  - Administer flumazenil to reverse benzodiazepine-induced sedation and respiratory depression
- After pharmacologic reversal, observe and monitor patients for a sufficient time to ensure that sedation and cardiorespiratory depression does not recur once the effect of the antagonist dissipates
- Do not use sedation regimens that are intended to include routine reversal of sedative or analgesic agents

Recovery Care

- After sedation/analgesia, observe and monitor patients in an appropriately staffed and equipped area until they are near their baseline level of consciousness and are no longer at increased risk for cardiorespiratory depression
- Monitor oxygenation continuously until patients are no longer at risk for hypoxemia
- Monitor ventilation and circulation at regular intervals (*e.g.*, every 5 to 15 min) until patients are suitable for discharge
- Design discharge criteria to minimize the risk of central nervous system or cardiorespiratory depression after discharge from observation by trained personnel‖‖

Creation and Implementation of Patient Safety Processes

- Create and implement a quality improvement process based upon established national, regional, or institutional reporting protocols (*e.g.*, adverse events, unsatisfactory sedation)
  - Periodically update the quality improvement process to keep up with new technology, equipment or other advances in moderate procedural sedation/analgesia
- Strengthen patient safety culture through collaborative practices (*e.g.*, team training, simulation drills, development and implementation of checklists)
- Create an emergency response plan (*e.g.*, activating "code blue" team or activating the emergency medical response system: 911 or equivalent)

Appendix 2: Methods and Analyses

For these guidelines, a systematic search and review of peer-reviewed published literature was conducted, with scientific findings summarized and reported below and in the document. Assessment of conceptual issues, practicality and feasibility of the guideline recommendations was also evaluated, with opinion data collected from surveys and other sources. Both the systematic literature review and the opinion data are based on *evidence linkages*, or statements regarding potential relationships between interventions and outcomes associated with moderate procedural sedation. The evidence model below guided the search, providing inclusion and exclusion information regarding patients, procedures, practice settings, providers, clinical interventions, and outcomes. After review of all evidentiary information, the task force placed each recommendation into one of three categories: (1) provide this intervention or treatment, (2) this intervention or treatment may be provided to the patient based on circumstances of the case and the practitioner's clinical judgment, or (3) do not provide this intervention or treatment. The policy of the ASA Committee on Standards and Practice Parameters is to update practice guidelines every 5 yr. The ASA Committee on Standards and Practice Parameters reviews all practice guidelines at the ASA annual meeting and determines update and revision timelines.

Evidence Model

Patients

- Inclusion criteria:
  - Any patient having a diagnostic or therapeutic procedure for which moderate sedation is planned
- Exclusion criteria:
  - Patients in whom the level of sedation cannot reliably be established

§§Practitioners are cautioned that acute reversal of opioid-induced analgesia may result in pain, hypertension, tachycardia, or pulmonary edema.

‖‖Discharge criteria examples are noted in table 5.

- Patients who do not respond purposefully to verbal or tactile stimulation (*e.g.*, stroke victims, neonates)
- Patients in whom determining the level of sedation interferes with the procedure

Procedures

- Inclusion criteria:
  - Elective and urgent/emergent procedures
  - Diagnostic and therapeutic procedures
    - Principal procedures (*e.g.*, upper endoscopy, colonoscopy, radiology, ophthalmology, cardiology, dentistry, plastics, orthopedic, urology, podiatry)
    - Diagnostic imaging (radiological scans, endoscopy)
    - Minor surgical procedures in all care areas (*e.g.*, cardioversion)
    - Pediatric procedures (*e.g.*, suture of laceration, setting of simple fracture, lumbar puncture, bone marrow with local, magnetic resonance imaging or computed tomography scan, routine dental procedures)
    - Pediatric cardiac catheterization (*e.g.*, cardiac biopsy after transplantation)
    - Obstetric procedures (*e.g.*, labor and delivery)
- Exclusion criteria:
  - Procedures using minimal sedation (*e.g.*, anxiolysis for insertion of peripheral nerve blocks, local or topical anesthesia)
  - Procedures where deep sedation is intended
  - Procedures where general anesthesia is intended
  - Procedures using major conduction anesthesia (*i.e.*, neuraxial anesthesia)
  - Procedures using sedatives in combination with regional anesthesia
  - Nondiagnostic or nontherapeutic procedures (*e.g.*, postoperative analgesia, pain management/chronic pain, critical care, palliative care)

Practice Settings

- Inclusion criteria:
  - Settings where procedural moderate sedation may be administered
    - Hospitals
    - Ambulatory procedural centers
    - Office practices
      - Hospital connected
      - Free-standing
      - Dental office
      - Urology office
      - Ophthalmology office
    - Emergency settings
    - Endoscopy suite
    - Plastic surgery suite
    - Radiology suite (magnetic resonance imaging, computed tomography, invasive)
    - Oral and maxillofacial surgery suite
    - Cardiac catheterization laboratory
    - Oncology clinics
    - Electrophysiology laboratory
    - Interventional radiology laboratory
    - Neurointerventional laboratory
    - Echocardiology laboratory
    - Evoked auditory testing laboratory
- Exclusion criteria: (none indicated)

Providers

- Inclusion criteria:
  - All providers who deliver moderate procedural sedation in any practice setting
    - Physician anesthesiologists and anesthetists
    - Cardiologists
    - Dentists
    - Dentist anesthesiologists
    - Emergency physicians
    - Gastroenterologists
    - Hospitalists
    - Nurse anesthetists
    - Nursing personnel who perform monitoring tasks
    - Oncologists
    - Oral/maxillofacial surgeons
    - Pulmonologists
    - Radiologists
    - Sedation nurses
    - Supervised physicians and dentists in training
    - Surgeons
- Exclusion criteria: (none indicated)

Interventions

- Inclusion criteria:
  - Preprocedure patient evaluation and preparation
    - Medical records review (patient history/condition)
      - Underlying medical problems
        - Abnormalities of major organ systems
        - Obstructive sleep apnea
        - Respiratory distress syndrome
        - Allergies
        - Intestinal inflammation
        - Obesity
      - Sedation history
      - Anesthesia history
      - Surgical history
      - Problems pertaining to cooperation
      - Current medications
      - Extremes of age
      - Psychotropic drug use
      - Nonpharmaceutical (*e.g.*, nutraceutical) use
      - Family history

- Focused physical examination (*e.g.*, heart, lungs, airway)
- Consultation with a medical specialist (*e.g.*, physician anesthesiologist, cardiologist, endocrinologist, pulmonologist, nephrologist, obstetrician)
- Preparation of the patient (*e.g.*, preprocedure instruction, medication usage, counseling, fasting)

◦ Patient monitoring
- Level of consciousness (*e.g.*, responsiveness)
- Breathing/ventilation
  - Observation (color when the procedure allows)
  - Auscultation, chest excursion
  - Continual end tidal carbon dioxide monitoring (*e.g.*, capnography, capnometry) *versus* observation or auscultation
  - Plethysmography
    - Plethysmography *versus* observation or auscultation
    - Plethysmography *versus* capnography
- Oxygenation
  - Pulse oximetry
- Hemodynamic monitoring
  - Blood pressure
  - Heart rate
  - Electrocardiography
- Contemporaneous recording of monitored parameters
- Presence of an individual dedicated to patient monitoring
- Creation and implementation of quality improvement processes

◦ Supplemental oxygen
- Supplemental oxygen *versus* room air or no supplemental oxygen
  - Method of oxygen administration (*e.g.*, nasal cannula, face masks, specialized devices (*e.g.*, high-flow cannula)

◦ Emergency support
- Presence of individual(s) capable of establishing a patent airway, positive pressure ventilation and resuscitation (*i.e.*, advanced life-support skills)
- Presence of emergency and airway equipment
  - Types of airway devices (*e.g.*, nasal cannula, face masks, specialized devices (*e.g.*, high-flow cannula)
  - Supraglottic airway (*e.g.*, laryngeal mask airway)
- Presence of an individual to establish intravenous access
- Intravenous access *versus* no intravenous access

◦ Sedative or analgesic medications not intended for general anesthesia
- Sedatives (all routes of administration)
  - Benzodiazepines
  - Dexmedetomidine *versus* other sedatives or analgesics
- Sedative/opioid combinations (all routes of administration)
  - Benzodiazepines combined with opioids *versus* benzodiazepines
  - Benzodiazepines combined with opioids *versus* opioids
  - Dexmedetomidine combined with other sedatives or analgesics *versus* dexmedetomidine
  - Dexmedetomidine combined with other sedatives or analgesics *versus* other sedatives or analgesics (alone or in combination)

• Intravenous *versus* nonintravenous sedative/analgesics not intended for general anesthesia (all non-IV routes of administration, including oral, nasal, intramuscular, rectal, transdermal, sublingual, iontophoresis, nebulized)
- Titration *versus* single dose, repeat bolus, continuous infusion

◦ Sedative/analgesic medications intended for general anesthesia
- Propofol
  - Propofol alone *versus* non–general anesthesia sedative/analgesics alone
  - Propofol alone *versus* non–general anesthesia sedative/analgesic combinations
  - Propofol combined with non–general anesthesia sedative/analgesics *versus* propofol alone
  - Propofol combined with non–general anesthesia sedative/analgesics *versus* non–general anesthesia sedative/analgesics (alone or in combination)
  - Propofol alone *versus* other general anesthesia sedatives (alone or in combination)
  - Propofol combined with sedatives intended for general anesthesia *versus* other sedatives intended for general anesthesia (alone or in combination)
  - Propofol combined with other sedatives intended for general anesthesia *versus* propofol (alone or in combination)
- Ketamine
  - Ketamine alone *versus* non–general anesthesia sedative/analgesics alone
  - Ketamine alone *versus* non–general anesthesia sedative/analgesic combinations
  - Ketamine combined with non–general anesthesia sedative/analgesics *versus* ketamine alone

- Ketamine combined with non–general anesthesia sedative/analgesics *versus* non–general anesthesia sedative/analgesics (alone or in combination)
- Ketamine alone *versus* other general anesthesia sedatives (alone or in combination)
- Ketamine combined with sedatives intended for general anesthesia *versus* other sedatives intended for general anesthesia (alone or in combination)
- Ketamine combined with other sedatives intended for general anesthesia *versus* ketamine (alone or in combination)

- Etomidate
  - Etomidate alone *versus* non–general anesthesia sedative/analgesics alone
  - Etomidate alone *versus* non–general anesthesia sedative/analgesic combinations
  - Etomidate combined with non–general anesthesia sedative/analgesics *versus* etomidate alone
  - Etomidate combined with non–general anesthesia sedative/analgesics *versus* non–general anesthesia sedative/analgesics (alone or in combination)
  - Etomidate alone *versus* other general anesthesia sedatives (alone or in combination)
  - Etomidate combined with sedatives intended for general anesthesia *versus* other sedatives intended for general anesthesia (alone or in combination)
  - Etomidate combined with other sedatives intended for general anesthesia *versus* etomidate (alone or in combination)
- Intravenous *versus* nonintravenous sedatives intended for general anesthesia
- Titration of sedatives intended for general anesthesia

- Reversal agents
  - Naloxone for reversal of opioids with or without benzodiazepines
    - Naloxone *versus* placebo
    - Intravenous *versus* nonintravenous naloxone
  - Flumazenil for reversal or benzodiazepines with or without opioids
    - Flumazenil *versus* placebo
    - Intravenous *versus* nonintravenous flumazenil
- Recovery care
  - Continued observation and monitoring until discharge
  - Predetermined discharge criteria

- Exclusion criteria:
  - Minimal sedation
  - Deep sedation
  - General anesthesia
  - Patient-controlled sedation/analgesia
  - Major conduction anesthetics (*i.e.*, neuraxial anesthesia)
  - Sedatives combined with regional anesthesia
  - Premedication administered before general anesthesia
  - Interventions without sedatives (*e.g.*, hypnosis, acupuncture)
  - New or rarely administered sedative/analgesics (*e.g.*, fospropofol)
  - Automated sedative delivery systems
  - New or rarely used monitoring or delivery devices
  - Bispectral index monitoring

Outcomes

- Expected benefits:
  - Sedation efficacy
    - Induction time
    - Duration of sedation
    - Successful procedure
    - Patient/family satisfaction
    - Proceduralist satisfaction
  - Improved pain management (*i.e.*, pain during a procedure)
  - Speed of recovery
    - Time to recovery
    - Time to discharge-ready
  - Reduced frequency/severity of sedation-related complications
    - Unintended deep sedation or general anesthesia
    - Conversion to deep sedation or general anesthesia
    - Undersedation
    - Unplanned hospitalization and/or intensive care unit admission
    - Unplanned emergency department visits
    - Unplanned use of rescue agents (naloxone, flumazenil)
    - Resedation after discharge criteria met
    - Postprocedure neurologic function
    - Need to change planned procedure or technique
    - Respiratory depression
    - Hypoxemia
    - Oxygen desaturation
    - Upper airway obstruction
    - Airway support required
    - Intubation required
    - Airway adjunct required
    - Pulmonary aspiration
    - Hypotension
    - Arrhythmias
    - Cardiac arrest
    - Bradycardia

- Hemodynamic support or rescue required
- Assistance request
- Neurologic injury
- Death

Evidence Collection

- Literature inclusion criteria:
  - Randomized controlled trials
  - Prospective nonrandomized comparative studies (*e.g.*, quasiexperimental, cohort)
  - Retrospective comparative studies (*e.g.*, case-control)
  - Observational studies (*e.g.*, correlational or descriptive statistics)
  - Case reports, case series
- Literature exclusion criteria (except to obtain new citations):
  - Editorials
  - Literature reviews
  - Meta-analyses
  - Abstracts greater than 5 yr old
  - Unpublished studies
  - Studies in non–peer-reviewed journals
  - Newspaper articles
- Survey evidence:
  - Expert consultant survey
  - ASA membership survey
  - Other participating organization surveys
  - Reliability survey
  - Feasibility survey

State of the Literature. For the systematic review, potentially relevant clinical studies were identified *via* electronic and manual searches. Healthcare database searches included PubMed, EMBASE, Web of Science, Google Books, and the Cochrane Central Register of Controlled Trials. The searches covered a 15.6-yr period from January 1, 2002, through July 31, 2017. Accepted studies from the previous guidelines were also rereviewed, covering the period of August 1, 1976, through December 31, 2002.[1] Only studies containing original findings from peer-reviewed journals were acceptable. Editorials, letters, and other articles without data were excluded. A literature search strategy and PRISMA* flow diagram are available as Supplemental Digital Content 2, http://links.lww.com/ALN/B597.

In total, 4,349 new citations were identified, with 1,428 articles assessed for eligibility. After review, 1,140 were excluded, with 288 new studies meeting the above stated criteria. These studies were combined with 209 pre-2002 articles used in the previous guidelines, resulting in a total of 497 articles accepted as evidence for these guidelines. In this document, 187 are referenced, with a complete bibliography of articles used to develop these guidelines, organized by section, available as Supplemental Digital Content 3, http://links.lww.com/ALN/B595.

*Preferred reporting items of systematic reviews and meta-analyses.

Results for each pertinent outcome were summarized, and when sufficient numbers of RCTs were found, study grading and meta-analyses were conducted. The literature relating to six evidence linkages contained enough studies with well defined experimental designs and statistical information to conduct formal meta-analyses. These seven evidence linkages are: (1) capnography *versus* blinded capnography, (2) supplemental oxygen *versus* no supplemental oxygen, (3) midazolam combined with opioids *versus* midazolam alone, (4) propofol *versus* midazolam, (5) flumazenil *versus* placebo for benzodiazepine reversal, and (6) flumazenil *versus* placebo for reversal of benzodiazepines combined with opioids (table 6). Fixed and random-effects odds ratios are reported for dichotomous outcomes, and raw and standardized mean differences are reported for findings with continuous data. An acceptable significance level was set at $P < 0.01$. No search for unpublished studies was conducted, and no reliability tests for locating research results were done.

Interobserver agreement among task force members and two methodologists was obtained by interrater reliability testing of 36 randomly selected studies. Agreement levels using a κ statistic for two-rater agreement pairs were as follows: (1) research design, $\kappa = 0.57$ to 0.92; (2) type of analysis, $\kappa = 0.60$ to 0.75; (3) evidence linkage assignment, $\kappa = 0.76$ to 0.85; and (4) literature inclusion for database, $\kappa = 0.28$ to 1.00. Three-rater κ values were: (1) research design, $\kappa = 0.70$; (2) type of analysis, $\kappa = 0.68$; (3) linkage assignment, $\kappa = 0.79$; and (4) literature database inclusion, $\kappa = 0.43$. These values represent moderate to high levels of agreement.

Consensus-based Evidence. Consensus was obtained from multiple sources, including: (1) survey opinion from consultants† who were selected based on their knowledge or expertise in moderate procedural sedation and analgesia; (2) survey opinions from a randomly selected sample of active members of the ASA, AAOMS, and ASDA‡; (3) testimony from attendees of publicly held open forums at national anesthesia meetings§§; (4) internet commentary; and (5) task force opinion and interpretation. The survey rate of return was 81% (n = 129 of 159) for consultants. For membership respondents, survey data were collected from 69 ASA members, 104 AAOMS members, and 104 ASDA members. The results of the surveys are reported in tables 7–10 and are summarized in the text of the guidelines.

†Consultants were drawn from the following specialties where moderate procedural sedation/analgesia are commonly administered: anesthesiology, cardiology, dentistry, emergency medicine, gastroenterology, oral and maxillofacial surgery, pediatrics, radiology, and surgery.

‡All participating organizations were invited to participate in this survey.

§American Dental Association Council on Dental Education and Licensure: Anesthesia Committee Meeting, April 20, 2017; 2017 Combined Annual Meeting of the Southwest Society of Oral and Maxillofacial Surgeons, the Texas Society of Oral and Maxillofacial Surgeons, the Midwestern Chapter of Oral and Maxillofacial Surgeons, and the Oklahoma Society of Oral and Maxillofacial Surgeons, April 21, 2017, Scottsdale, Arizona; the Society for Ambulatory Anesthesia 32nd Annual Meeting, May 5, 2017, Scottsdale, Arizona; International Anesthesia Research Society 2017 Annual Meeting; and the International Science Symposium, Washington, D.C., May 8, 2017.

Consultants were asked to indicate which, if any, of the evidence linkages would change their clinical practices if the guidelines were instituted. The rate of return was 34.6% (n = 55 of 159). The percent of responding consultants expecting *no change* associated with each linkage were as follows (preprocedure patient evaluation – %): preprocedure patient preparation – 93.75%; patient preparation – 87.5%; patient monitoring – 68.75%; supplemental oxygen – 93.75%; emergency support – 87.5%; sedative or analgesic medications not intended for general anesthesia – 87.5%; sedative or analgesic medications intended for general anesthesia – 75.0%%; availability/use of reversal agents – 87.5%; recovery care – 75%; and creation and implementation of patient safety processes – 56.25%. Forty-four respondents (84.62%) indicated that the guidelines would have *no effect* on the amount of time spent on a typical case with the implementation of these guidelines. Seven respondents (13.46%) indicated that there would be an increase in the amount of time, with four of these respondents estimating an increase ranging from 5 to 15 min. One respondent (1.92%) estimated a decrease in the amount of time they would spend on a typical case.

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Competing Interests

The authors declare no competing interests.

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References

1. American Society of Anesthesiologists: Practice guidelines for sedation and analgesia by non-anesthesiologists: An updated report. Anesthesiology 2002; 96:1004–17
2. American Society of Anesthesiologists: Continuum of depth of sedation: Definition of general anesthesia and levels of sedation/analgesia. Approved by ASA House of Delegates on October 13, 1999 and last amended on October 15, 2014. Available at: http://www.asahq.org/quality-and-practice-management/practice-guidance-resource-documents/continuum-of-depth-of-sedation-definition-of-general-anesthesia-and-levels-of-sedation-analgesia. Accessed August 21, 2017
3. Joint Commission: Speak up anesthesia infographic. Available at: http://www.jointcommision.org/assets/1/6/speak_up_anesthesia_infographic_final.pdf. Accessed December 20, 2017
4. Coté CJ, Wilson S; American Academy of Pediatrics; American Academy of Pediatric Dentistry: Guidelines for monitoring and management of pediatric patients before, during, and after sedation for diagnostic and therapeutic procedures: Update 2016. Pediatrics 2016; 138:e20161212
5. Müller S, Prolla JC, Maguilnik I, Breyer HP: Predictive factors of oxygen desaturation of patients submitted to endoscopic retrograde cholangiopancreatography under conscious sedation. Arq Gastroenterol 2004; 41:162–6
6. Omata F, Masuda K, Fujita Y, Fukui T: Risk factors of hypoxia during conscious sedation for colonoscopy: A prospective time-to-event analysis. Gastro Endosc 2014; 1:AB224
7. Papachristou GI, Gleeson FC, Papachristou DJ, Petersen BT, Baron TH: Endoscopist administered sedation during ERCP: Impact of chronic narcotic/benzodiazepine use and predictive risk of reversal agent utilization. Am J Gastroenterol 2007; 102:738–43
8. Andrade C, Gill J, Kulkarni P, Amodeo D, Goldsmith S, Boyd W, Anderson W, Klein M, Vidyarthi G: Evaluation of the safety of conscious sedation and gastrointestinal endoscopy in the veteran population with sleep apnea. Am J Gastroenterol 2013; 108:S480
9. Andrade CM, Patel B, Gill J, Amodeo D, Kulkarni P, Goldsmith S, Bachman B, Geerken R, Klein M, Anderson W, Miladinovic B, Fernandez I, Kumar A, Richter J, Vidyarthi G: Safety of gastrointestinal endoscopy with conscious sedation in patients with and without obstructive sleep apnea. J Clin Gastroenterol 2016; 50:198–201
10. Asserhøj LL, Mosbech H, Krøigaard M, Garvey LH: No evidence for contraindications to the use of propofol in adults allergic to egg, soy or peanut. Br J Anaesth 2016; 116:77–82
11. Bal BS, Crowell MD, Kohli DR, Menendez J, Rashti F, Kumar AS, Olden KW: What factors are associated with the difficult-to-sedate endoscopy patient? Dig Dis Sci 2012; 57:2527–34
12. Cha JM, Jeun JW, Pack KM, Lee JI, Joo KR, Shin HP, Shin WC: Risk of sedation for diagnostic esophagogastroduodenoscopy in obstructive sleep apnea patients. World J Gastroenterol 2013; 19:4745–51
13. Czwornog J, Austin GL: Body mass index, age, and gender affect prep quality, sedation use, and procedure time during screening colonoscopy. Dig Dis Sci 2013; 58:3127–33
14. Heuss LT, Schnieper P, Drewe J, Pflimlin E, Beglinger C: Safety of propofol for conscious sedation during endoscopic procedures in high-risk patients: A prospective, controlled study. Am J Gastroenterol 2003; 98:1751–7
15. Hsu AJ, Carson KA, Yung R, Pham PA: Severe prolonged sedation associated with coadministration of protease inhibitors and intravenous midazolam during bronchoscopy. Pharmacotherapy 2012; 32:538–45
16. Jirapinyo P, Kumar N, Thompson CC: Patients with Roux-en-Y gastric bypass require increased sedation during upper endoscopy. Clin Gastroenterol Hepatol 2015; 13:1432–6
17. Kinder KL, Lehman-Huskamp KL, Gerard JM: Do children with high body mass indices have a higher incidence of emesis when undergoing ketamine sedation? Pediatr Emerg Care 2012; 28:1203–5
18. Kitagawa E, Iida A, Kimura Y, Kumagai M, Nakamura M, Kamekura N, Fujisawa T, Fukushima K: Responses to intravenous sedation by elderly patients at the Hokkaido University Dental Hospital. Anesth Prog 1992; 39:73–8
19. Kotani J, Shimada M: A prospective, multicenter, observational study for the dosage and administration of Dormicum (generic name: midazolam) for the intravenous sedation in actual dental clinical settings. J Japanese Dental Soc Anesthes 2013; 41:160–170
20. Lubisch N, Roskos R, Berkenbosch JW: Dexmedetomidine for procedural sedation in children with autism and other behavior disorders. Pediatr Neurol 2009; 41:88–94
21. Mehta PP, Albeldawi M, Kochhar GS, Kalra SS, Maurer WG, Tetzlaff J, Lopez R, Sanaka MR, Vargo JJ: Body mass index (BMI) predicts the need for airway intervention and sedation related complications in anesthesiologist-directed propofol sedation for routine EGD and colonoscopy. Gastrointest Endosc 2013; 1:AB177

22. Schmerler BL, Cohen DM, Leder MS, Bonsu BK: Procedural sedation for fracture reduction in children with hyperactivity. Am J Emerg Med 2008; 26:661–4
23. Burtin P, Daoud P, Jacqz-Aigrain E, Mussat P, Moriette G: Hypotension with midazolam and fentanyl in the newborn. Lancet 1991; 337:1545–6
24. Mtaweh H, Bayır H, Kochanek PM, Bell MJ: Effect of a single dose of propofol and lack of dextrose administration in a child with mitochondrial disease: A case report. J Child Neurol 2014; 29:NP40–6
25. Robb ND, Hargrave SA: Tolerance to intravenous midazolam as a result of oral benzodiazepine therapy: A potential problem for the provision of conscious sedation in dentistry. Anesth Pain Control Dent 1993; 2:94–7
26. Robb ND: Epileptic fits under intravenous midazolam sedation. Br Dent J 1996; 181:178–9
27. Bell A, Treston G, McNabb C, Monypenny K, Cardwell R: Profiling adverse respiratory events and vomiting when using propofol for emergency department procedural sedation. Emerg Med Australas 2007; 19:405–10
28. Ghaffar S, Haverland C, Ramaciotti C, Scott WA, Lemler MS: Sedation for pediatric echocardiography: Evaluation of preprocedure fasting guidelines. J Am Soc Echocardiogr 2002; 15:980–3
29. Ingebo KR, Rayhorn NJ, Hecht RM, Shelton MT, Silber GH, Shub MD: Sedation in children: Adequacy of two-hour fasting. J Pediatr 1997; 131:155–8
30. Beitz A, Riphaus A, Meining A, Kronshage T, Geist C, Wagenpfeil S, Weber A, Jung A, Bajbouj M, Pox C, Schneider G, Schmid RM, Wehrmann T, von Delius S: Capnographic monitoring reduces the incidence of arterial oxygen desaturation and hypoxemia during propofol sedation for colonoscopy: A randomized, controlled study (ColoCap Study). Am J Gastroenterol 2012; 107:1205–12
31. Langhan ML, Shabanova V, Li FY, Bernstein SL, Shapiro ED: A randomized controlled trial of capnography during sedation in a pediatric emergency setting. Am J Emerg Med 2015; 33:25–30
32. Mehta PP, Kochhar G, Albeldawi M, Kirsh B, Rizk M, Putka B, John B, Wang Y, Breslaw N, Lopez R, Vargo JJ: Capnographic monitoring in routine EGD and colonoscopy with moderate sedation: A prospective, randomized, controlled trial. Am J Gastroenterol 2016; 111:395–404
33. Qadeer MA, Vargo JJ, Dumot JA, Lopez R, Trolli PA, Stevens T, Parsi MA, Sanaka MR, Zuccaro G: Capnographic monitoring of respiratory activity improves safety of sedation for endoscopic cholangiopancreatography and ultrasonography. Gastroenterology 2009; 136:1568–76
34. Slagelse C, Vilmann P, Hornslet P, Jørgensen HL, Horsted TI: The role of capnography in endoscopy patients undergoing nurse-administered propofol sedation: A randomized study. Scand J Gastroenterol 2013; 48:1222–30
35. Deitch K, Miner J, Chudnofsky CR, Dominici P, Latta D: Does end tidal CO2 monitoring during emergency department procedural sedation and analgesia with propofol decrease the incidence of hypoxic events?: A randomized, controlled trial. Ann Emerg Med 2010; 55:258–64
36. Lightdale JR, Goldmann DA, Feldman HA, Newburg AR, DiNardo JA, Fox VL: Microstream capnography improves patient monitoring during moderate sedation: A randomized, controlled trial. Pediatrics 2006; 117:e1170–8
37. al-Hadeedi S, Leaper DJ: Falls in hemoglobin saturation during ERCP and upper gastrointestinal endoscopy. World J Surg 1991; 15:88–94
38. Bell GD, Reeve PA, Moshiri M, Morden A, Coady T, Stapleton PJ, Logan RF: Intravenous midazolam: A study of the degree of oxygen desaturation occurring during upper gastrointestinal endoscopy. Br J Clin Pharmacol 1987; 23:703–8
39. Bell GD, Morden A, Coady T, Lee J, Logan RF: A comparison of diazepam and midazolam as endoscopy premedication assessing changes in ventilation and oxygen saturation. Br J Clin Pharmacol 1988; 26:595–600
40. Bendig DW: Pulse oximetry and upper intestinal endoscopy in infants and children. J Pediatr Gastroenterol Nutr 1991; 12:39–43
41. Bilotta JJ, Floyd JL, Waye JD: Arterial oxygen desaturation during ambulatory colonoscopy: Predictability, incidence, and clinical insignificance. Gastrointest Endosc 1990; 36(suppl 3):S5–8
42. Cacho G, Pérez-Calle JL, Barbado A, Lledó JL, Ojea R, Fernández-Rodríguez CM: Capnography is superior to pulse oximetry for the detection of respiratory depression during colonoscopy. Rev Esp Enferm Dig 2010; 102:86–9
43. Casteel HB, Fiedorek SC, Kiel EA: Arterial blood oxygen desaturation in infants and children during upper gastrointestinal endoscopy. Gastrointest Endosc 1990; 36:489–93
44. Conlong P, Rees W: The use of hypnosis in gastroscopy: A comparison with intravenous sedation. Postgrad Med J 1999; 75:223–5
45. Froehlich F, Schwizer W, Thorens J, Köhler M, Gonvers JJ, Fried M: Conscious sedation for gastroscopy: Patient tolerance and cardiorespiratory parameters. Gastroenterology 1995; 108:697–704
46. Gilger MA, Jeiven SD, Barrish JO, McCarroll LR: Oxygen desaturation and cardiac arrhythmias in children during esophagogastroduodenoscopy using conscious sedation. Gastrointest Endosc 1993; 39:392–5
47. Gombar KK, Dhall JC, Suri RP, Singh B, Gombar S: Effect of diazepam sedation on arterial oxygen saturation during esophagogastroduodenoscopy: A placebo-controlled study. Indian J Gastroenterol 1996; 15:40–2
48. Gross JB, Long WB: Nasal oxygen alleviates hypoxemia in colonoscopy patients sedated with midazolam and meperidine. Gastrointest Endosc 1990; 36:26–9
49. Hartke RH Jr, Gonzalez-Rothi RJ, Abbey NC: Midazolam-associated alterations in cardiorespiratory function during colonoscopy. Gastrointest Endosc 1989; 35:232–8
50. Hinzmann CA, Budden PM, Olson J: Intravenous conscious sedation use in endoscopy: Does monitoring of oxygen saturation influence timing of nursing interventions? Gastroenterol Nurs 1992; 15:6–13
51. Iber FL, Sutberry M, Gupta R, Kruss D: Evaluation of complications during and after conscious sedation for endoscopy using pulse oximetry. Gastrointest Endosc 1993; 39:620–5
52. Kassimatis A, Tsoukas A, Ikonomidis I, Joshi J, Nihoyannopoulos P: Routine arterial oxygen saturation monitoring is not necessary during transesophageal echocardiography. Clin Cardiol 1997; 20:547–52
53. Lamireau T, Dubreuil M, Daconceicao M: Oxygen saturation during esophagogastroduodenoscopy in children: General anesthesia *versus* intravenous sedation. J Pediatr Gastroenterol Nutr 1998; 27:172–5
54. Matthews RW, Malkawi Z, Griffiths MJ, Scully C: Pulse oximetry during minor oral surgery with and without intravenous sedation. Oral Surg Oral Med Oral Pathol 1992; 74:537–43
55. Mennuni M, Bianconi L, Antonicoli S, Frongillo D, Molle G, Rossi P, Venturini E, Toscano S: Fast cardiologist-administered midazolam for electrical cardioversion of atrial fibrillation. J Cardiovasc Med (Hagerstown) 2007; 8:176–80
56. Newland CJ, Spiers SP, Finlay DB: Technical report: Oxygen saturation monitoring during sedation for chemonucleolysis. Clin Radiol 1991; 44:352–3
57. Putinati S, Ballerin L, Corbetta L, Trevisani L, Potena A: Patient satisfaction with conscious sedation for bronchoscopy. Chest 1999; 115:1437–40
58. Ristikankare M, Julkunen R, Heikkinen M, Mattila M, Laitinen T, Wang SX, Hartikainen J: Sedation, topical pharyngeal anesthesia and cardiorespiratory safety during gastroscopy. J Clin Gastroenterol 2006; 40:899–905

59. Runes J, Ström C: Midazolam intravenous conscious sedation in oral surgery: A retrospective study of 372 cases. Swed Dent J 1996; 20:29–33
60. Visco DM, Tolpin E, Straughn JC, Fagraeus L: Arterial oxygen saturation in sedated patients undergoing gastrointestinal endoscopy and a review of pulse oximetry. Del Med J 1989; 61:533–42
61. Wilson S: Conscious sedation and pulse oximetry: False alarms? Pediatr Dent 1990; 12:228–32
62. Woods SD, Chung SC, Leung JW, Chan AC, Li AK: Hypoxia and tachycardia during endoscopic retrograde cholangiopancreatography: Detection by pulse oximetry. Gastrointest Endosc 1989; 35:523–5
63. Wright SW: Conscious sedation in the emergency department: The value of capnography and pulse oximetry. Ann Emerg Med 1992; 21:551–5
64. Herman LL, Kurtz RC, McKee KJ, Sun M, Thaler HT, Winawer SJ: Risk factors associated with vasovagal reactions during colonoscopy. Gastrointest Endosc 1993; 39:388–91
65. Deitch K, Chudnofsky CR, Dominici P: The utility of supplemental oxygen during emergency department procedural sedation and analgesia with midazolam and fentanyl: A randomized, controlled trial. Ann Emerg Med 2007; 49:1–8
66. Deitch K, Chudnofsky CR, Dominici P, Latta D, Salamanca Y: The utility of high-flow oxygen during emergency department procedural sedation and analgesia with propofol: A randomized, controlled trial. Ann Emerg Med 2011; 58:360–364.e3
67. Haines DJ, Bibbey D, Green JR: Does nasal oxygen reduce the cardiorespiratory problems experienced by elderly patients undergoing endoscopic retrograde cholangiopancreatography? Gut 1992; 33:973–5
68. Reed MW, O'Leary DP, Duncan JL, Majeed AW, Wright B, Reilly CS: Effects of sedation and supplemental oxygen during upper alimentary tract endoscopy. Scand J Gastroenterol 1993; 28:319–22
69. Reshef R, Shiller M, Kinberg R, Rennert H, Rennert G, Herskovits M, Loberant N: A prospective study evaluating the usefulness of continuous supplemental oxygen in various endoscopic procedures. Isr J Med Sci 1996; 32:736–40
70. Rohlfing GK, Dilley DC, Lucas WJ, Vann WF Jr: The effect of supplemental oxygen on apnea and oxygen saturation during pediatric conscious sedation. Pediatr Dent 1998; 20:8–16
71. Rozario L, Sloper D, Sheridan MJ: Supplemental oxygen during moderate sedation and the occurrence of clinically significant desaturation during endoscopic procedures. Gastroenterol Nurs 2008; 31:281–5
72. Barclay JK, Hunter KM: A comparison of midazolam with and without nalbuphine for intravenous sedation. Oral Surg Oral Med Oral Pathol 1990; 70:137–40
73. Barriga J, Sachdev MS, Royall L, Brown G, Tombazzi CR: Sedation for upper endoscopy: Comparison of midazolam *versus* fentanyl plus midazolam. South Med J 2008; 101:362–6
74. Lee JJ, Lee JH: Middle-ear surgery under sedation: Comparison of midazolam alone or midazolam with remifentanil. J Laryngol Otol 2011; 125:561–6
75. Wong DH, Merrick PM: Intravenous sedation prior to peribulbar anaesthesia for cataract surgery in elderly patients. Can J Anaesth 1996; 43:1115–20
76. Cok OY, Ertan A, Bahadir M: Comparison of midazolam sedation with or without fentanyl in cataract surgery. Acta Anaesthesiol Belg 2008; 59:27–32
77. Yüksel O, Parlak E, Köklü S, Ertugrul I, Tunç B, Sahin B: Conscious sedation during endoscopic retrograde cholangiopancreatography: Midazolam or midazolam plus meperidine? Eur J Gastroenterol Hepatol 2007; 19:1002–6
78. Froehlich F, Thorens J, Schwizer W, Preisig M, Köhler M, Hays RD, Fried M, Gonvers JJ: Sedation and analgesia for colonoscopy: Patient tolerance, pain, and cardiorespiratory parameters. Gastrointest Endosc 1997; 45:1–9
79. Klein EJ, Diekema DS, Paris CA, Quan L, Cohen M, Seidel KD: A randomized, clinical trial of oral midazolam plus placebo *versus* oral midazolam plus oral transmucosal fentanyl for sedation during laceration repair. Pediatrics 2002; 109:894–7
80. Walton GM, Boyle CA, Thomson PJ: Changes in oxygen saturation using two different sedation techniques. Br J Oral Maxillofac Surg 1991; 29:87–9
81. Cragg AH, Smith TP, Berbaum KS, Nakagawa N: Randomized double-blind trial of midazolam/placebo and midazolam/fentanyl for sedation and analgesia in lower-extremity angiography. AJR Am J Roentgenol 1991; 157:173–6
82. Göktay O, Satilmiş T, Garip H, Gönül O, Göker K: A comparison of the effects of midazolam/fentanyl and midazolam/tramadol for conscious intravenous sedation during third molar extraction. J Oral Maxillofac Surg 2011; 69:1594–9
83. Milligan KR, Howe JP, McLoughlin J, Holmes W, Dundee JW: Midazolam sedation for outpatient fibreoptic endoscopy: Evaluation of alfentanil supplementation. Ann R Coll Surg Engl 1988; 70:304–6
84. DiPalma JA, Herrera JL, Weis FR, Dark-Mezick DL, Brown RS: Alfentanil for conscious sedation during colonoscopy. South Med J 1995; 88:630–4
85. Hart LS, Berns SD, Houck CS, Boenning DA: The value of end-tidal CO_2 monitoring when comparing three methods of conscious sedation for children undergoing painful procedures in the emergency department. Pediatr Emerg Care 1997; 13:189–93
86. Demiraran Y, Korkut E, Tamer A, Yorulmaz I, Kocaman B, Sezen G, Akcan Y: The comparison of dexmedetomidine and midazolam used for sedation of patients during upper endoscopy: A prospective, randomized study. Can J Gastroenterol 2007; 21:25–9
87. Surendar MN, Pandey RK, Saksena AK, Kumar R, Chandra G: A comparative evaluation of intranasal dexmedetomidine, midazolam and ketamine for their sedative and analgesic properties: A triple blind randomized study. J Clin Pediatr Dent 2014; 38:255–61
88. Cho JS, Shim JK, Na S, Park I, Kwak YL: Improved sedation with dexmedetomidine-remifentanil compared with midazolam-remifentanil during catheter ablation of atrial fibrillation: A randomized, controlled trial. Europace 2014; 16:1000–6
89. Lee BS, Ryu J, Lee SH, Lee MG, Jang SE, Hwang JH, Ryu JK, Do SH, Kim YT: Midazolam with meperidine and dexmedetomidine *vs.* midazolam with meperidine for sedation during ERCP: Prospective, randomized, double-blinded trial. Endoscopy 2014; 46:291–8
90. Ghane MR, Javadzadeh HR, Mahmoudi S, Najafian B, Saburi A: Intramuscular compared to intravenous midazolam for paediatric sedation: A study on cardiopulmonary safety and effectiveness. Afr J Paediatr Surg 2014; 11:219–24
91. Högberg L, Nordvall M, Tjellström B, Stenhammar L: Intranasal *versus* intravenous administration of midazolam to children undergoing small bowel biopsy. Acta Paediatr 1995; 84:1429–31
92. Lundgren S, Rosenquist JB: Comparison of sedation, amnesia, and patient comfort produced by intravenous and rectal diazepam. J Oral Maxillofac Surg 1984; 42:646–50
93. Zhang X, Bai X, Zhang Q, Wang X, Lu L: The safety and efficacy of intranasal dexmedetomidine during electrochemotherapy for facial vascular malformation: A double-blind, randomized clinical trial. J Oral Maxillofac Surg 2013; 71:1835–42
94. Morrow JB, Zuccaro G Jr, Conwell DL, Vargo JJ 2nd, Dumot JA, Karafa M, Shay SS: Sedation for colonoscopy using a single bolus is safe, effective, and efficient: A prospective, randomized, double-blind trial. Am J Gastroenterol 2000; 95:2242–7

95. Carlsson U, Grattidge P: Sedation for upper gastrointestinal endoscopy: A comparative study of propofol and midazolam. Endoscopy 1995; 27:240–3
96. Clark G, Licker M, Younossian AB, Soccal PM, Frey JG, Rochat T, Diaper J, Bridevaux PO, Tschopp JM: Titrated sedation with propofol or midazolam for flexible bronchoscopy: A randomised trial. Eur Respir J 2009; 34:1277–83
97. Hari Keerthy P, Balakrishna R, Srungeri KM, Singhvi N, John J, Islam M: Comparitive evaluation of propofol and midazolam as conscious sedatives in minor oral surgery. J Maxillofac Oral Surg 2015; 14:773–83
98. Riphaus A, Lechowicz I, Frenz MB, Wehrmann T: Propofol sedation for upper gastrointestinal endoscopy in patients with liver cirrhosis as an alternative to midazolam to avoid acute deterioration of minimal encephalopathy: A randomized, controlled study. Scand J Gastroenterol 2009; 44:1244–51
99. Wehrmann T, Kokabpick S, Lembcke B, Caspary WF, Seifert H: Efficacy and safety of intravenous propofol sedation during routine ERCP: A prospective, controlled study. Gastrointest Endosc 1999; 49:677–83
100. Guerra F, Pavoni I, Romandini A, Baldetti L, Matassini MV, Brambatti M, Luzi M, Pupita G, Capucci A: Feasibility of a cardiologist-only approach to sedation for electrical cardioversion of atrial fibrillation: A randomized, open-blinded, prospective study. Int J Cardiol 2014; 176:930–5
101. Patterson KW, Casey PB, Murray JP, O'Boyle CA, Cunningham AJ: Propofol sedation for outpatient upper gastrointestinal endoscopy: Comparison with midazolam. Br J Anaesth 1991; 67:108–11
102. Salmon JF, Mets B, James MF, Murray AD: Intravenous sedation for ocular surgery under local anaesthesia. Br J Ophthalmol 1992; 76:598–601
103. Wagner HJ, Nowacki J, Klose KJ: Propofol *versus* midazolam for sedation during percutaneous transluminal angioplasty. J Vasc Interv Radiol 1996; 7:673–80
104. Nirwan AS, Jain N, Pragasm M, Kamblimath D, Bhargava A, Tiwari S: Randomised comparative study on propofol and diazepam as a sedating agent in day care surgery. J Maxillofac Oral Surg 2014; 13:583–91
105. Ulmer BJ, Hansen JJ, Overley CA, Symms MR, Chadalawada V, Liangpunsakul S, Strahl E, Mendel AM, Rex DK: Propofol *versus* midazolam/fentanyl for outpatient colonoscopy: Administration by nurses supervised by endoscopists. Clin Gastroenterol Hepatol 2003; 1:425–32
106. Vargo JJ, Zuccaro G Jr, Dumot JA, Shermock KM, Morrow JB, Conwell DL, Trolli PA, Maurer WG: Gastroenterologist-administered propofol *versus* meperidine and midazolam for advanced upper endoscopy: A prospective, randomized trial. Gastroenterology 2002; 123:8–16
107. Zuo XL, Li Z, Liu XP, Li CQ, Ji R, Wang P, Zhou CJ, Liu H, Li YQ: Propofol *vs.* midazolam plus fentanyl for upper gastrointestinal endomicroscopy: A randomized trial. World J Gastroenterol 2012; 18:1814–21
108. Carmi U, Kramer MR, Zemtzov D, Rosengarten D, Fruchter O: Propofol safety in bronchoscopy: Prospective randomized trial using transcutaneous carbon dioxide tension monitoring. Respiration 2011; 82:515–21
109. Stolz D, Kurer G, Meyer A, Chhajed PN, Pflimlin E, Strobel W, Tamm M: Propofol *versus* combined sedation in flexible bronchoscopy: A randomised non-inferiority trial. Eur Respir J 2009; 34:1024–30
110. Hampl KF, Marsch SC, Erb T, Drewe J, Schneider MC: Intravenous sedation for retrobulbar injection and eye surgery: Diazepam and/or propofol? Acta Anaesthesiol Scand 1996; 40:53–8
111. Lee JE, Lee SK, Chung H, Park JC, Shin SK, Lee YC: Comparison of midazolam plus propofol with propofol alone for upper endoscopy: A prospective, single blind, randomized clinical trial. Gastrointest Endosc 2016; 1:AB222
112. Molina-Infante J, Dueñas-Sadornil C, Mateos-Rodriguez JM, Perez-Gallardo B, Vinagre-Rodríguez G, Hernandez-Alonso M, Fernandez-Bermejo M, Gonzalez-Huix F: Nonanesthesiologist-administered propofol *versus* midazolam and propofol, titrated to moderate sedation, for colonoscopy: A randomized controlled trial. Dig Dis Sci 2012; 57:2385–93
113. Holas A, Krafft P, Marcovic M, Quehenberger F: Remifentanil, propofol or both for conscious sedation during eye surgery under regional anaesthesia. Eur J Anaesthesiol 1999; 16:741–8
114. Mahfouz AK, Ghali AM: Combined use of remifentanil and propofol to limit patient movement during retinal detachment surgery under local anesthesia. Saudi J Anaesth 2010; 4:147–51
115. Keidan I, Berkenstadt H, Sidi A, Perel A: Propofol/remifentanil *versus* propofol alone for bone marrow aspiration in paediatric haemato-oncological patients. Paediatr Anaesth 2001; 11:297–301
116. Li S, Yu F, Zhu H, Yang Y, Yang L, Lian J: The median effective concentration (EC_{50}) of propofol with different doses of fentanyl during colonoscopy in elderly patients. BMC Anesthesiol 2016; 16:24
117. Rewari V, Madan R, Kaul HL, Kumar L: Remifentanil and propofol sedation for retrobulbar nerve block. Anaesth Intensive Care 2002; 30:433–7
118. Akarsu Ayazoğlu T, Polat E, Bolat C, Yasar NF, Duman U, Akbulut S, Yol S: Comparison of propofol-based sedation regimens administered during colonoscopy. Rev Med Chil 2013; 141:477–85
119. Ali AR, El Ghoneimy MN: Dexmedetomidine *versus* fentanyl as adjuvant to propofol: Comparative study in children undergoing extracorporeal shock wave lithotripsy. Eur J Anaesthesiol 2010; 27:1058–64
120. Cimilli Ozturk T, Guneysel O, Akoglu H: Anterior shoulder dislocation reduction managed either with midazolam or propofol in combination with fentanyl. Hong Kong J Emerg Med 2014; 21:346–353
121. Correia LM, Bonilha DQ, Gomes GF, Brito JR, Nakao FS, Lenz L, Rohr MR, Ferrari AP, Libera ED: Sedation during upper GI endoscopy in cirrhotic outpatients: A randomized, controlled trial comparing propofol and fentanyl with midazolam and fentanyl. Gastrointest Endosc 2011; 73:45–51
122. Dunn MJ, Mitchell R, DeSouza CI, Drummond GB, Waite A: Recovery from sedation with remifentanil and propofol, compared with morphine and midazolam, for reduction in anterior shoulder dislocation. Emerg Med J 2011; 28:6–10
123. Eberl S, Polderman JA, Preckel B, Kalkman CJ, Fockens P, Hollmann MW: Is "really conscious" sedation with solely an opioid an alternative to every day used sedation regimes for colonoscopies in a teaching hospital?: Midazolam/fentanyl, propofol/alfentanil, or alfentanil only for colonoscopy: A randomized trial. Tech Coloproctol 2014; 18:745–52
124. Holger JS, Satterlee PA, Haugen S: Nursing use between 2 methods of procedural sedation: Midazolam *versus* propofol. Am J Emerg Med 2005; 23:248–52
125. Kawaai H, Tomita S, Nakaike Y, Ganzberg S, Yamazaki S: Intravenous sedation for implant surgery: Midazolam, butorphanol, and dexmedetomidine *versus* midazolam, butorphanol, and propofol. J Oral Implantol 2014; 40:94–102
126. Khoshoo V, Thoppil D, Landry L, Brown S, Ross G: Propofol *versus* midazolam plus meperidine for sedation during ambulatory esophagogastroduodenoscopy. J Pediatr Gastroenterol Nutr 2003; 37:146–9
127. Kim N, Yoo YC, Lee SK, Kim H, Ju HM, Min KT: Comparison of the efficacy and safety of sedation between dexmedetomidine-remifentanil and propofol-remifentanil during endoscopic submucosal dissection. World J Gastroenterol 2015; 21:3671–8

128. Kuyrukluyıldız U, Binici O, Onk D, Ayhan Celik S, Torun MT, Unver E, Ozcicek A, Alagol A: Comparison of dexmedetomidine and propofol used for drug-induced sleep endoscopy in patients with obstructive sleep apnea syndrome. Int J Clin Exp Med 2015; 8:5691–8

129. Lee CK, Lee SH, Chung IK, Lee TH, Park SH, Kim EO, Lee SH, Kim HS, Kim SJ: Balanced propofol sedation for therapeutic GI endoscopic procedures: A prospective, randomized study. Gastrointest Endosc 2011; 73:206–14

130. Levitzky BE, Lopez R, Dumot JA, Vargo JJ: Moderate sedation for elective upper endoscopy with balanced propofol *versus* fentanyl and midazolam alone: A randomized clinical trial. Endoscopy 2012; 44:13–20

131. Manninen PH, Chan AS, Papworth D: Conscious sedation for interventional neuroradiology: A comparison of midazolam and propofol infusion. Can J Anaesth 1997; 44:26–30

132. Netinatsunton N, Attasaranya S, Sottisuporn J, Witeerungrot T, Piratvisuth T, Ovartlarnporn B: Efficacy and safety profiles of sedation with propofol combined with intravenous midazolam and pethidine versus intravenous midazolam and pethidine administered by trained nurses for ambulatory endoscopic retrograde cholangiopancreatography (ERCP). Gastrointest Endosc 2012; 1:AB291

133. Parworth LP, Frost DE, Zuniga JR, Bennett T: Propofol and fentanyl compared with midazolam and fentanyl during third molar surgery. J Oral Maxillofac Surg 1998; 56:447–53; discussion 453–4

134. Rahman NH, Hashim A: The use of propofol for procedural sedation and analgesia in the emergency department: A comparison with midazolam. Emerg Med J 2011; 28:861–5

135. Sajedi P, Yaraghi A, Niareisy L: A single dose of propofol can produce excellent sedation and comparable amnesia with midazolam in cystoscopic examination. J Research Med Sci 2006; 11:160–3

136. Sienkiewicz E, Albrecht P, Ziółkowski J, Dziechciarz P: Propofol-alfentanyl *versus* midazolam-alfentanyl in inducing procedural amnesia of upper gastrointestinal endoscopy in children: Blind randomised trial. Eur J Pediatr 2015; 174:1475–80

137. Miner JR, Gray RO, Bahr J, Patel R, McGill JW: Randomized clinical trial of propofol *versus* ketamine for procedural sedation in the emergency department. Acad Emerg Med 2010; 17:604–11

138. Rai K, Hegde AM, Goel K: Sedation in uncooperative children undergoing dental procedures: A comparative evaluation of midazolam, propofol and ketamine. J Clin Pediatr Dent 2007; 32:1–4

139. Baysal A, Polat TB, Yalcin Y, Celebi A: The use of basic parameters for monitoring the haemodynamic effects of midazolam and ketamine as opposed to propofol during cardiac catheterization. Cardiol Young 2014; 24:351–8

140. Uri O, Behrbalk E, Haim A, Kaufman E, Halpern P: Procedural sedation with propofol for painful orthopaedic manipulation in the emergency department expedites patient management compared with a midazolam/ketamine regimen: A randomized prospective study. J Bone Joint Surg Am 2011; 93:2255–62

141. Phillips W, Anderson A, Rosengreen M, Johnson J, Halpin J: Propofol *versus* propofol/ketamine for brief painful procedures in the emergency department: Clinical and bispectral index scale comparison. J Pain Palliat Care Pharmacother 2010; 24:349–55

142. Mittal N, Goyal A, Gauba K, Kapur A, Jain K: A double blind randomized trial of ketofol *versus* propofol for endodontic treatment of anxious pediatric patients. J Clin Pediatr Dent 2013; 37:415–20

143. Bahetwar SK, Pandey RK, Saksena AK, Chandra G: A comparative evaluation of intranasal midazolam, ketamine and their combination for sedation of young uncooperative pediatric dental patients: A triple blind randomized crossover trial. J Clin Pediatr Dent 2011; 35:415–20

144. Younge PA, Kendall JM: Sedation for children requiring wound repair: A randomised controlled double blind comparison of oral midazolam and oral ketamine. Emerg Med J 2001; 18:30–3

145. Lee JH, Kim K, Kim TY, Jo YH, Kim SH, Rhee JE, Heo CY, Eun SC: A randomized comparison of nitrous oxide *versus* intravenous ketamine for laceration repair in children. Pediatr Emerg Care 2012; 28:1297–301

146. Jamal SM, Fathil SM, Nidzwani MM, Ismail AK, Yatim FM: Intravenous ketamine is as effective as midazolam/fentanyl for procedural sedation and analgesia in the emergency department. Med J Malaysia 2011; 66:231–3

147. Barkan S, Breitbart R, Brenner-Zada G, Feldon M, Assa A, Toledano M, Berkovitch S, Shavit I, Kozer E: A double-blind, randomised, placebo-controlled trial of oral midazolam plus oral ketamine for sedation of children during laceration repair. Emerg Med J 2014; 31:649–53

148. Sener S, Eken C, Schultz CH, Serinken M, Ozsarac M: Ketamine with and without midazolam for emergency department sedation in adults: A randomized controlled trial. Ann Emerg Med 2011; 57:109–114.e2

149. Monk TG, Rater JM, White PF: Comparison of alfentanil and ketamine infusions in combination with midazolam for outpatient lithotripsy. Anesthesiology 1991; 74:1023–8

150. Genzlinger MA, Salen P, Grossman M, Stehly C, Stoltzfus J: "Put me out doc": Ketamine versus etomidate for the reduction of orthopedic dislocations. Ann Emerg Med 2012; 60:S52–3

151. Milazzo A, Villaneuve R, Salen P, Stoltzfus J, Grossman M: A comparison of ketamine versus etomidate for procedural sedation for the reduction of joint dislocations. Annals Emerg Med 2014; 1:S130

152. Akin A, Guler G, Esmaoglu A, Bedirli N, Boyaci A: A comparison of fentanyl-propofol with a ketamine-propofol combination for sedation during endometrial biopsy. J Clin Anesth 2005; 17:187–90

153. Chandar R, Jagadisan B, Vasudevan A: Propofol-ketamine and propofol-fentanyl combinations for nonanesthetist-administered sedation. J Pediatr Gastroenterol Nutr 2015; 60:762–8

154. Takzare A, Soltani AE, Maleki A, Nooralishahi B, Kaheh F, Arab S, Goudarzi M: Comparison of propofol-ketamine *vs.* propofol-fentanyl for pediatric sedation during upper gastroinestinal endoscopy. Arch Anesth Crit Care 2016; 2:216–25

155. Burton JH, Bock AJ, Strout TD, Marcolini EG: Etomidate and midazolam for reduction of anterior shoulder dislocation: A randomized, controlled trial. Ann Emerg Med 2002; 40:496–504

156. Kienstra AJ, Ward MA, Sasan F, Hunter J, Morriss MC, Macias CG: Etomidate *versus* pentobarbital for sedation of children for head and neck CT imaging. Pediatr Emerg Care 2004; 20:499–506

157. Di Liddo L, D'Angelo A, Nguyen B, Bailey B, Amre D, Stanciu C: Etomidate *versus* midazolam for procedural sedation in pediatric outpatients: A randomized controlled trial. Ann Emerg Med 2006; 48:433–40, 440.e1

158. Hunt GS, Spencer MT, Hays DP: Etomidate and midazolam for procedural sedation: Prospective, randomized trial. Am J Emerg Med 2005; 23:299–303

159. Gharavifard M, Boroumand Reza Zadeh B, Zamani Moghadam H: A Randomized clinical trial of intravenous and intramuscular ketamine for pediatric procedural sedation and analgesia. Emerg (Tehran) 2015; 3:59–63

160. Bell A, Treston G, Cardwell R, Schabort WJ, Chand D: Optimization of propofol dose shortens procedural sedation time, prevents resedation and removes the requirement

for post-procedure physiologic monitoring. Emerg Med Australas 2007; 19:411–7

161. Heuss LT, Schnieper P, Drewe J, Pflimlin E, Beglinger C: Conscious sedation with propofol in elderly patients: A prospective evaluation. Aliment Pharmacol Ther 2003; 17:1493–501
162. Heuss LT, Schnieper P, Drewe J, Pflimlin E, Beglinger C: Risk stratification and safe administration of propofol by registered nurses supervised by the gastroenterologist: A prospective observational study of more than 2000 cases. Gastrointest Endosc 2003; 57:664–71
163. Novak H, Karlsland Akeson P, Akeson J: Sedation with ketamine and low-dose midazolam for short-term procedures requiring pharyngeal manipulation in young children. Paediatr Anaesth 2008; 18:48–54
164. Barsan WG, Seger D, Danzl DF, Ling LJ, Bartlett R, Buncher R, Bryan C: Duration of antagonistic effects of nalmefene and naloxone in opiate-induced sedation for emergency department procedures. Am J Emerg Med 1989; 7:155–61
165. Balsells F, Wyllie R, Kay M, Steffen R: Use of conscious sedation for lower and upper gastrointestinal endoscopic examinations in children, adolescents, and young adults: A twelve-year review. Gastrointest Endosc 1997; 45:375–80
166. Jann MW, Fidone G, Gorday M, Rostedt RR: Butorphanol as a dental premedication in the mentally retarded. Oral Surg Oral Med Oral Pathol 1987; 63:403–7
167. Ackerman WE, Phero JC, Theodore GT: Ineffective ventilation during conscious sedation due to chest wall rigidity after intravenous midazolam and fentanyl. Anesth Prog 1990; 37:46–8
168. Greenwald B: Narcan use in the endoscopy lab: An important component of patient safety. Gastroenterol Nurs 2004; 27:20–1
169. Miller DL, Wall RT: Fentanyl and diazepam for analgesia and sedation during radiologic special procedures. Radiology 1987; 162:195–8
170. Yaster M, Nichols DG, Deshpande JK, Wetzel RC: Midazolam-fentanyl intravenous sedation in children: Case report of respiratory arrest. Pediatrics 1990; 86:463–7
171. Birch BR, Anson KM, Kalmanovitch DV, Cooper J, Miller RA: Sedation for day-case urology: An assessment of patient recovery profiles after midazolam and flumazenil. Ann R Coll Surg Engl 1991; 73:373–8
172. Birkenfeld S, Federico C, Dermansky-Avni Y, Bruck R, Melzer E, Bar-Meir S: Double-blind controlled trial of flumazenil in patients who underwent upper gastrointestinal endoscopy. Gastrointest Endosc 1989; 35:519–22
173. Clark MS, Lindenmuth JE, Jafek BW, Fryer GE Jr, Goldberg JR: Reversal of central benzodiazepine effects by intravenous flumazenil. Anesth Prog 1991; 38:12–6
174. Holloway AM, Logan DA: The use of flumazenil to reverse diazepam sedation after endoscopy. Eur J Anaesthesiol Suppl 1988; 2:191–8
175. Pearson RC, McCloy RF, Bardhan KD, Jackson V, Morris P: The use of flumazenil to reverse sedation induced by bolus low dose midazolam or diazepam in upper gastrointestinal endoscopy. Eur J Gastroent Hepatol 1991; 3:829–33
176. Rodrigo MR, Rosenquist JB: The effect of Ro15-1788 (Anexate) on conscious sedation produced with midazolam. Anaesth Intensive Care 1987; 15:185–92
177. Sanders LD, Piggott SE, Isaac PA, Okell RW, Roberts B, Rosen M, Robinson JO: Reversal of benzodiazepine sedation with the antagonist flumazenil. Br J Anaesth 1991; 66:445–53
178. Wille RT, Chaffee BW, Ryan ML, Elta GH, Walter V, Barnett JL: Pharmacoeconomic evaluation of flumazenil for routine outpatient EGD. Gastrointest Endosc 2000; 51:282–7
179. Chang AC, Solinger MA, Yang DT, Chen YK: Impact of flumazenil on recovery after outpatient endoscopy: A placebo-controlled trial. Gastrointest Endosc 1999; 49:573–9
180. Davies CA, Sealey CM, Lawson JI, Grant IS: Reversal of midazolam sedation with flumazenil following conservative dentistry. J Dent 1990; 18:113–8
181. Fennelly ME, Powell H, Galletly DC, Whitwam JG: Midazolam sedation reversed with flumazenil for cardioversion. Br J Anaesth 1992; 68:303–5
182. Reversal of central benzodiazepine effects by flumazenil after intravenous conscious sedation with diazepam and opioids: Report of a double-blind multicenter study. Clinical Ther 1992; 14:910–23
183. Reversal of central benzodiazepine effects by intravenous flumazenil after conscious sedation with midazolam and opioids: A multicenter clinical study. Clinical Ther 1992; 14:878–94
184. Cooper SA, Quinn PD, MacAfee K, McKenna D: Reversing intravenous sedation with flumazenil. Oral Surg Oral Med Oral Pathol 1991; 72:2–9
185. Peters JM, Tolia V, Simpson P, Aravind MK, Kauffman RE: Flumazenil in children after esophagogastroduodenoscopy. Am J Gastroenterol 1999; 94:1857–61
186. Roberts SP, Hargreaves J, Pollard BJ: The use of midazolam and flumazenil for invasive radiographic procedures. Postgrad Med J 1993; 69:922–6
187. Thurman RJ, Bryce S, Phillips L: Use of a novel electronic pre-sedation checklist improves safety documentation in emergency department sedations. Acad Emerg Med 2013; 20 (suppl 1):S65

Table 1. Continuum of Depth of Sedation, Definition of General Anesthesia, and Levels of Sedation/Analgesia

	Minimal Sedation (Anxiolysis)	Moderate Sedation/Analgesia (Conscious Sedation)	Deep Sedation/Analgesia	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful* response to verbal or tactile stimulation	Purposeful* response after repeated or painful stimulation	Unarousable, even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

Minimal Sedation (Anxiolysis) indicates a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected. Moderate Sedation/Analgesia (Conscious Sedation) indicates a drug-induced depression of consciousness during which patients respond purposefully* to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained. Deep Sedation/Analgesia is a drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully* after repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained. General Anesthesia is a drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired.

Because sedation is a continuum, it is not always possible to predict how an individual patient will respond. Hence, practitioners intending to produce a given level of sedation should be able to rescue patients whose level of sedation becomes deeper than initially intended. Individuals administering Moderate Sedation/Analgesia (Conscious Sedation) should be able to rescue patients who enter a state of Deep Sedation/Analgesia, whereas those administering Deep Sedation/Analgesia should be able to rescue patients who enter a state of General Anesthesia. (Developed by the American Society of Anesthesiologists: Approved by ASA House of Delegates on October 13, 1999 and last amended on October 15, 2014. Available at: http://www.asahq.org/quality-and-practice-management/practice-guidance-resource-documents/continuum-of-depth-of-sedation-definition-of-general-anesthesia-and-levels-of-sedation-analgesia. Accessed on August 21, 2017.)

*Reflex withdrawal from a painful stimulus is NOT considered a purposeful response.

Table 2. Airway Assessment Procedures for Sedation and Analgesia

Positive pressure ventilation, with or without tracheal intubation, may be necessary if respiratory compromise develops during sedation/analgesia. This may be more difficult in patients with atypical airway anatomy. Also, some airway abnormalities may increase the likelihood of airway obstruction during spontaneous ventilation. Some factors that may be associated with difficulty in airway management are listed below.

History
- Previous problems with anesthesia or sedation
- Stridor, snoring, or sleep apnea
- Advanced rheumatoid arthritis
- Chromosomal abnormality (*e.g.,* trisomy 21)

Physical examination
- Habitus: significant obesity (especially involving the neck and facial structures)
- Head and neck: short neck, limited neck extension, decreased hyoid-mental distance (< 3 cm in an adult), neck mass, cervical spine disease or trauma, tracheal deviation, dysmorphic facial features (*e.g.*, Pierre–Robin syndrome)
- Mouth: small opening (< 3 cm in an adult); edentulous; protruding incisors; loose or capped teeth; dental appliances; high, arched palate; macroglossia; tonsillar hypertrophy; nonvisible uvula
- Jaw: micrognathia, retrognathia, trismus, significant malocclusion

Table 3. Summary of American Society of Anesthesiologists Recommendations for Preoperative Fasting and Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures

	Recommendation
Ingested material	
Clear liquids†	2-h minimum fasting period*
Breast milk	4-h minimum fasting period*
Infant formula	6-h minimum fasting period*
Nonhuman milk‡	6-h minimum fasting period*
Light meal§	6-h minimum fasting period*
Fried foods, fatty foods, or meat	Additional fasting time (*e.g.*, 8 h or more) may be needed
Pharmacologic recommendations (medication type and common examples)	
Gastrointestinal stimulants	
Metoclopramide	May be used/no routine use
Gastric acid secretion blockers	
Cimetidine	May be used/no routine use
Famotidine	May be used/no routine use
Ranitidine	May be used/no routine use
Omeprazole	May be used/no routine use
Lansoprazole	May be used/no routine use
Antacids	
Sodium citrate	May be used/no routine use
Sodium bicarbonate	May be used/no routine use
Magnesium trisilicate	May be used/no routine use
Antiemetics	
Ondansetron	May be used/no routine use
Anticholinergics	
Atropine	No use
Scopolamine	No use
Glycopyrrolate	No use
Combinations of the medications above	No routine use

These recommendations apply to healthy patients who are undergoing elective procedures. They are not intended for women in labor. Following the guidelines does not guarantee complete gastric emptying.

*The fasting periods noted above apply to all ages. †Examples of clear liquids include water, fruit juices without pulp, carbonated beverages, clear tea, and black coffee. ‡Because nonhuman milk is similar to solids in gastric emptying time, the amount ingested must be considered when determining an appropriate fasting period. §A light meal typically consists of toast and clear liquids. Meals that include fried or fatty foods or meat may prolong gastric emptying time. Additional fasting time (*e.g.*, 8 h or more) may be needed in these cases. Both the amount and type of foods ingested must be considered when determining an appropriate fasting period.

Table 4. Emergency Equipment for Sedation and Analgesia

Intravenous equipment (age- and size-appropriate)
- Gloves
- Tourniquets
- Alcohol wipes
- Sterile gauze pads
- Intravenous catheters
- Intravenous tubing
- Intravenous fluid
- Assorted needles for drug aspiration, intramuscular injection
- Intraosseous access kit
- Appropriately sized syringes
- Tape

Basic airway management equipment (age- and size-appropriate)
- Source of compressed O_2 (tank with regulator or pipeline supply with flowmeter)
- Source of suction
- Suction catheters
- Yankauer-type suction
- Face masks
- Self-inflating breathing bag-valve set
- Oral and nasal airways
- Lubricant

Advanced airway management equipment (age- and size-appropriate)
- Supraglottic airway devices
- Laryngoscope handles (tested)
- Laryngoscope blades
- Endotracheal tubes
- Stylet

Pharmacologic antagonists
- Naloxone
- Flumazenil

Emergency medications
- Epinephrine
- Ephedrine
- Vasopressin
- Atropine
- Nitroglycerin (tablets or spray)
- Amiodarone
- Lidocaine
- Glucose (IV or oral)
- Diphenhydramine
- Hydrocortisone, methylprednisolone, or dexamethasone
- Benzodiazepines
- β blocker
- Adenosine

Appropriate emergency equipment should be available whenever sedative or analgesic drugs capable of causing cardiorespiratory depression are administered. This table should be used as a guide, which should be modified depending upon the individual practice circumstances.

IV = intravenous.

Table 5. Recovery and Discharge Criteria after Sedation and Analgesia

General principles

- Medical supervision of recovery and discharge after moderate sedation is the responsibility of the operating practitioner or a licensed physician.
- The recovery area should be equipped with or have direct access to age and size appropriate monitoring and resuscitation equipment.
- Patients receiving moderate sedation should be monitored until appropriate discharge criteria are satisfied. The duration and frequency of monitoring should be individualized depending upon the level of sedation achieved, the overall condition of the patient, and the nature of the intervention for which sedation/analgesia was administered. Oxygenation should be monitored until patients are no longer at risk for respiratory depression.
- Level of consciousness, vital signs, and oxygenation (when indicated) should be recorded at regular intervals.
- A nurse or other individual trained to monitor patients and recognize complications should be in attendance until discharge criteria are fulfilled.
- An individual capable of managing complications (*e.g.*, establishing a patent airway, administering a reversal medication when appropriate, and providing positive pressure ventilation) should be immediately available until discharge criteria are fulfilled.

Guidelines for discharge

- Patients should be alert and oriented; infants and patients whose mental or physical status was initially abnormal should have returned to their baseline status.
- Patients should be advised to avoid making life-changing decisions and activities that may impact their safety (*e.g.*, operate a vehicle or heavy equipment) until the effects of the sedatives have worn off.
- Cardiovascular function, airway patency, and protective airway reflexes are satisfactory.
- Practitioners and parents must be aware that pediatric patients are at risk for airway obstruction should the head fall forward while the child is secured in a child safety seat.*
- Vital signs should be stable and within acceptable limits.
- Use of scoring systems may assist in documentation of fitness for discharge.
- Sufficient time (up to 2 h) should have elapsed after the last administration of reversal agents (naloxone, flumazenil) to ensure that patients do not become resedated after reversal effects have worn off.
- Outpatients should be discharged in the presence of a responsible adult who will accompany them home or to a care facility and be able to report any postprocedure complications.
- Outpatients and their escorts should be provided with written instructions regarding postprocedure diet, medications, activities, and a phone number to be called in case of emergency.

Each patient-care facility in which sedation/analgesia is administered should develop recovery and discharge criteria that are suitable for its specific patients and procedures. Some of the basic principles that might be incorporated in these criteria are enumerated in the table.

*Drugs with long durations of action (*e.g.*, chloral hydrate, intramuscular pentobarbital, phenothiazines) will require longer periods of observation even after the child achieves currently used recovery and discharge criteria. This concept is particularly important for infants and toddlers transported in car safety seats who are at risk of resedation after discharge because of residual prolonged drug effects with the potential for airway obstruction.

Table 6. Meta-analysis Summary

Evidence Linkages*	*N*†	Odds Ratio (CI)‡	*Z* Value	*P* Value	Odds Ratio (CI)§	*Z* Value	*P* Value	Heterogeneity‖
Patient monitoring (capnography versus blinded capnography)								
Hypoxemia (O_2 < 90%)[30–34]	6	0.68 (0.51–0.90)	–3.53	< 0.001	0.70 (0.47–1.02)	–2.44	0.015	0.110
Supplemental oxygen (supplemental oxygen *vs.* placebo)								
Hypoxemia (O_2 < 95%)[65–71]	7	0.15 (0.09–0.24)	–10.49	< 0.001	0.24 (0.07–0.81)	–3.01	< 0.001	< 0.001
Sedative/analgesics *not* intended for general anesthesia (midazolam combined with opioids *vs.* midazolam)								
Pain/discomfort during procedure[72–77]	6	0.57 (0.33–1.00)	–2.57	0.010	0.48 (0.16–1.43)	–1.73	0.084	0.061
Hypoxemia (O_2 < 95%)[74,75,77–80]	6	1.97 (1.00–3.90)	2.57	0.010	2.21 (0.80–6.12)	2.01	0.044	0.111
Recall (no recall during procedure)[72–74,77,80–83]	8	1.07 (0.62–1.84)	0.31	0.759	1.09 (0.58–2.06)	0.35	0.726	0.268
Sedative/analgesics intended for general anesthesia (propofol *vs.* midazolam)								
Recall[95,99–102]	5	0.49 (0.25–0.97)	–2.67	0.008	0.40 (0.07–2.21)	–1.38	0.168	0.002
Hypoxemia (O_2 < 95%) [95,96,98-100]	7	0.90 (0.47–1.70)	–0.431	0.666	0.92 (0.48–1.78)	–0.32	0.752	0.638
Sedation recovery (awakening time)[95–99]	5		–11.87	< 0.001		–4.55	< 0.001	< 0.001
Raw mean difference = –10.01 (CI = –11.63 to –8.39)								
Standard mean difference (fixed effects) = –1.23 (CI = –1.49 to –0.96)								
Standard mean difference (random effects) = –1.57 (CI = –2.46 to –0.68)								
Reversal agents (flumazenil *vs.* placebo [reversal of benzodiazepines])								
Recovery within 15 min[171–178]	8#	11.67 (6.47–21.05)	10.72	< 0.001	14.07 (5.59–35.45)	7.37	< 0.001	0.064
Reversal agents (flumazenil *vs.* placebo [reversal of benzodiazepines combined with opioids])								
Recovery within 30 min[182–186]	5	7.13 (4.49–11.32)	10.94	< 0.001	7.13 (4.49–11.32)	10.94	< 0.001	0.538

Statistics for individual studies and forest plots are available as supplemental digital content 4, http://links.lww.com/ALN/B596.

*Evidence linkage with references for included studies.

†Number of studies included in the meta-analysis.

‡Mantel–Haenszel or Peto fixed-effects analysis (99% CI); using Comprehensive Meta-analysis software, version 3.3.070, November 20, 2014. Licensed to Richard T. Connis, Ph.D., March 20, 2017.

§DerSimonian–Laird random-effects analysis (99% CI), using Comprehensive Meta-analysis software version 3.3.070, November 20, 2014. Licensed to Richard T. Connis, Ph.D., March 20, 2017.

‖Statistical significance values for homogeneity/heterogeneity of effect size; a *P* value of < 0.01 indicates that the studies are significantly heterogeneous.

#Double-blind studies only.

Table 7. Consultant Survey Responses

		Percent Responding to Each Item				
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
Patient evaluation						
1. Review previous medical records and interview the patient or family	129	87.6*	10.1	2.3	0.0	0.0
2. Conduct a focused physical examination of the patient	129	86.0*	13.2	0.8	0.0	0.0
3. Review available laboratory test results and order additional laboratory tests when needed	129	71.3*	21.7	6.2	0.8	0.0
4. *If possible*, perform the preprocedure evaluation well enough in advance (*e.g.*, several days to weeks) to allow for proper patient preparation	129	35.7	35.7*	19.4	4.7	4.7
5. Reevaluate the patient immediately before the procedure	127	80.3*	18.1	0.8	0.0	0.8
Preprocedure patient preparation						
6. Consult with a medical specialist, when appropriate, before administration of moderate procedural sedation to patients with significant underlying conditions	127	51.2*	22.8	15.7	5.5	4.7
7. When feasible before the procedure, inform patients or legal guardians of the benefits, risks, and limitations of moderate sedation/analgesia and possible alternatives and elicit their preferences	129	75.2*	20.2	1.6	2.3	0.8
8. Before the day of the procedure, inform patients or legal guardians that they should not drink fluids or eat solid foods for a sufficient period of time to allow for gastric emptying	128	71.9*	14.1	4.7	4.7	4.7
9. On the day of the procedure, assess the time and nature of last oral intake	128	82.0*	13.3	2.3	1.6	0.8
10. In urgent or emergent situations where complete gastric emptying is not possible, do not delay moderate procedural sedation based on fasting time alone	128	38.3	25.0*	17.2	10.2	9.4
Monitoring patient level of consciousness						
11. Periodically monitor a patient's response to verbal commands during moderate sedation, except in patients who are unable to respond appropriately or during procedures where movement could be detrimental clinically	129	46.5	37.2*	9.3	4.7	2.3
12. During procedures where a verbal response is not possible, check the patient's ability to give a "thumbs up" or other indication of consciousness in response to verbal or tactile stimulation	128	39.1	38.3*	16.4	4.7	1.6
Monitoring patient ventilation and oxygenation						
13. Continually monitor ventilatory function by observation of qualitative clinical signs	126	76.2*	19.8	2.4	1.6	0.0
14. Continually monitor ventilatory function by capnography unless precluded or invalidated by the nature of the patient, procedure, or equipment	127	67.7*	14.2	10.2	4.7	3.1
15. Monitor all patients by pulse oximetry with appropriate alarms	127	85.8*	14.2	0.0	0.0	0.0
Monitoring hemodynamics						
16. Determine blood pressure before sedation/analgesia is initiated unless precluded by lack of patient cooperation	127	74.8*	22.0	0.0	2.4	0.8
17. Once moderate sedation/analgesia is established, continually monitor blood pressure and heart rate during the procedure unless such monitoring interferes with the procedure	127	69.3*	23.6	1.6	2.4	3.1
18. Use electrocardiographic monitoring during moderate sedation in patients with clinically significant cardiovascular disease or those who are undergoing procedures where dysrhythmias are anticipated	127	76.4*	15.7	3.1	0.8	3.9
Contemporaneous recording of monitored parameters						
19. Record level of consciousness, ventilatory and oxygenation status, and hemodynamic variables at a frequency that depends on the type and amount of medication administered, the length of the procedure, and the general condition of the patient	126	60.3*	24.6	4.8	7.9	2.4
20. Set device alarms to alert the care team to critical changes in patient	126	75.4*	21.4	3.2	0.0	0.0
Availability of an individual responsible for patient monitoring						
21. Assure that a designated individual other than the practitioner performing the procedure is present to monitor the patient throughout the procedure	126	78.6*	18.3	0.8	0.8	1.6

(*Continued*)

Table 7. (Continued).

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
22. The individual responsible for monitoring the patient should be trained in the recognition of apnea and airway obstruction and be empowered to seek additional help	127	87.4*	11.8	0.0	0.8	0.0
23. The designated individual may assist with minor, interruptible tasks once the patient's level of sedation/ analgesia and vital signs have stabilized, provided that adequate monitoring for the patient's level of sedation is maintained	127	47.2	30.7*	10.2	9.4	2.4
Supplemental oxygen						
24. Use supplemental oxygen during moderate procedural sedation/ analgesia unless specifically contraindicated for a particular patient or procedure	126	54.0*	29.4	11.1	4.0	1.6
Emergency support						
25. Assure that pharmacologic antagonists for benzodiazepines and opioids are immediately available in the procedure room	127	68.5*	20.5	6.3	3.1	1.6
26. Assure that an individual is present in the room who understands the pharmacology of the sedative/analgesics administered and potential interactions with other medications and nutraceuticals the patient may be taking	127	78.0*	16.5	3.9	1.6	0.0
27. Assure that appropriately sized equipment for establishing a patent airway is available	124	88.7*	10.5	0.8	0.0	0.0
28. Assure that at least one individual capable of establishing a patent airway and providing positive pressure ventilation is present in the procedure room	126	84.9*	12.7	1.6	0.8	0.0
29. Assure that suction, advanced airway equipment, positive pressure ventilation, and supplemental oxygen are immediately available in the procedure room and in good working order	126	84.1*	11.9	3.2	0.8	0.0
30. Assure that a member of the procedural team is trained in the recognition and treatment of airway complications, opening the airway, suctioning secretions, and performing bag-valve-mask ventilation	127	87.4*	10.2	0.8	0.8	0.8
31. Assure that a member of the procedural team has the skills to establish intravenous access	127	80.3*	14.2	0.8	3.9	0.8
32. Assure that a member of the procedural team has the skills to provide chest compressions	127	84.3*	13.4	0.8	0.8	0.8
33. Assure that a functional defibrillator or automatic external defibrillator is immediately available in the procedure area	127	77.2*	17.3	3.9	0.8	0.8
34. Assure that an individual or service is immediately available with advanced life support skills	127	77.2*	13.4	7.1	2.4	0.0
35. Assure that members of the procedural team are able to recognize the need for additional support and know how to access emergency services from the procedure room	127	89.0*	11.0	0.0	0.0	0.0
Sedative or analgesic medications not intended for general anesthesia						
36. Combinations of sedative and analgesic agents may be administered as appropriate for the procedure and the condition of the patient	124	65.3*	32.3	0.8	1.6	0.0
37. Dexmedetomidine may be administered as an alternative to benzodiazepine sedatives on a case-by-case basis	124	30.6	37.9*	21.0	9.7	0.8
38. In patients receiving intravenous medications for sedation/analgesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression	124	83.1*	12.9	3.2	0.8	0.0
39. In patients who have received sedation/analgesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of establishing or reestablishing intravenous access on a case-by-case basis	124	48.4	40.3*	1.6	6.5	3.2
40. Administer intravenous sedative/analgesic drugs in small, incremental doses or by infusion, titrating to the desired endpoints	124	71.0*	26.6	1.6	0.0	0.0
Sedative or analgesic medications intended for general anesthesia						
41. When moderate procedural sedation with sedative or analgesic medications intended for general anesthesia by any route is intended, provide care consistent with that required for general anesthesia	122	65.6*	18.9	4.9	4.9	5.7

(*Continued*)

Table 7. (Continued)

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
42. Assure that practitioners administering these drugs are able to reliably rescue patients from unintended deep sedation or general anesthesia	122	87.7*	9.8	0.8	0.8	0.8
43. For patients receiving intravenous sedatives intended for general anesthesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression	123	85.4*	9.8	1.6	1.6	1.6
44. In patients who have received sedatives intended for general anesthesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of establishing or reestablishing intravenous access on a case-by-case basis	121	51.2*	24.8	4.1	13.2	6.6
45. Administer intravenous sedative/analgesic drugs intended for general anesthesia in small, incremental doses, or by infusion, titrating to the desired endpoints	122	73.0*	21.3	2.5	1.6	1.6
Reversal agents						
46. Assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia regardless of administration route	123	74.0*	17.1	5.7	1.6	1.6
47. If patients become hypoxemic or apneic during sedation/analgesia, encourage or physically stimulate patients to breathe deeply	120	82.5*	16.7	0.0	0.8	0.0
48. If patients become hypoxemic or apneic during sedation/analgesia, administer supplemental oxygen	124	84.7*	10.5	3.2	1.6	0.0
49. If patients become hypoxemic or apneic during sedation/analgesia, provide positive pressure ventilation if spontaneous ventilation is inadequate	122	82.8*	13.1	1.6	1.6	0.8
50. Use reversal agents in cases where airway control, spontaneous ventilation, or positive pressure ventilation is inadequate	124	69.4*	19.4	7.3	4.0	0.0
51. Administer naloxone to reverse opioid-induced sedation and respiratory depression	118	61.9*	25.4	8.5	3.4	0.8
52. Administer flumazenil to reverse benzodiazepine-induced sedation and respiratory depression	123	58.5*	23.6	12.2	4.1	1.6
53. After pharmacologic reversal, observe and monitor patients for a sufficient time to ensure that sedation and cardiorespiratory depression does not recur once the effect of the antagonist dissipates	120	87.5*	10.8	0.0	1.7	0.0
54. Do not use sedation regimens that include routine reversal of sedative/analgesic agents	123	78.9*	13.0	3.3	3.3	1.6
Recovery care						
55. After sedation/analgesia, observe and monitor patients in an appropriately staffed and equipped area until they are near their baseline level of consciousness and are no longer at increased risk for cardiorespiratory depression	123	85.4*	14.6	0.0	0.0	0.0
56. Monitor oxygenation continuously until patients are no longer at risk for hypoxemia	123	87.8*	10.6	0.0	0.8	0.8
57. Monitor ventilation and circulation at regular intervals until patients are suitable for discharge	122	83.6*	13.9	2.5	0.0	0.0
58. Design discharge criteria to minimize the risk of central nervous system or cardiorespiratory depression after discharge from observation by trained personnel	123	83.7*	16.3	0.0	0.0	0.0
Creation and implementation of patient safety processes						
59. Create and implement a quality improvement process based upon national, regional, or institutional reporting protocols	123	70.7*	26.0	2.4	0.8	0.0
60. Strengthen patient safety culture through collaborative practices (*e.g.*, team training, simulation drills, development and implementation of checklists)	122	73.8*	22.1	3.3	0.8	0.0
61. Create an emergency response plan (*e.g.*, activating "code blue" team or activating the emergency medical response system: 911 or equivalent)	121	77.7*	19.0	2.5	0.8	0.0

*N = the number of consultants who responded to each item. An asterisk beside a percentage score in the columns to the right indicates the median.

Table 8. ASA Membership Survey Responses

		Percent Responding to Each Item				
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
Patient evaluation						
1. Review previous medical records and interview the patient or family	444	91.0*	7.0	1.4	0.5	0.2
2. Conduct a focused physical examination of the patient	445	85.2*	13.5	0.9	0.2	0.2
3. Review available laboratory test results and order additional laboratory tests when needed	441	77.6*	19.0	2.7	0.2	0.5
4. *If possible*, perform the preprocedure evaluation well enough in advance (*e.g.*, several days to weeks) to allow for proper patient preparation	441	37.6	34.7*	18.4	7.0	2.3
5. Reevaluate the patient immediately before the procedure	444	83.8*	14.0	1.6	0.2	0.5
Preprocedure patient preparation						
6. Consult with a medical specialist, when appropriate, before administration of moderate procedural sedation to patients with significant underlying conditions	445	61.3*	29.7	7.4	1.3	0.2
7. When feasible before the procedure, inform patients or legal guardians of the benefits, risks, and limitations of moderate sedation/analgesia and possible alternatives and elicit their preferences	443	74.9*	19.9	4.1	0.7	0.5
8. Before the day of the procedure, inform patients or legal guardians that they should not drink fluids or eat solid foods for a sufficient period of time to allow for gastric emptying	443	89.2*	9.0	1.4	0.0	0.5
9. On the day of the procedure, assess the time and nature of last oral intake	442	91.6*	7.2	0.7	0.2	0.2
10. In urgent or emergent situations where complete gastric emptying is not possible, do not delay moderate procedural sedation based on fasting time alone	440	27.5	27.5*	11.8	18.6	14.5
Monitoring patient level of consciousness						
11. Periodically monitor a patient's response to verbal commands during moderate sedation, except in patients who are unable to respond appropriately or during procedures where movement could be detrimental clinically	443	48.3	30.5*	13.8	5.4	2.0
12. During procedures where a verbal response is not possible, check the patient's ability to give a "thumbs up" or other indication of consciousness in response to verbal or tactile stimulation	444	43.5	35.1*	14.9	4.7	1.8
Monitoring patient ventilation and oxygenation						
13. Continually monitor ventilatory function by observation of qualitative clinical signs	418	80.6*	15.3	1.9	1.9	0.2
14. Continually monitor ventilatory function by capnography unless precluded or invalidated by the nature of the patient, procedure, or equipment	419	75.4*	17.7	4.1	1.9	1.0
15. Monitor all patients by pulse oximetry with appropriate alarms	415	95.7*	4.1	0.2	0.0	0.0
Monitoring hemodynamics						
16. Determine blood pressure before sedation/analgesia is initiated unless precluded by lack of patient cooperation	415	84.3*	12.8	0.5	1.2	1.2
17. Once moderate sedation/analgesia is established, continually monitor blood pressure and heart rate during the procedure unless such monitoring interferes with the procedure	414	82.1*	12.6	1.2	2.4	1.7
18. Use electrocardiographic monitoring during moderate sedation in patients with clinically significant cardiovascular disease or those who are undergoing procedures where dysrhythmias are anticipated	415	82.2*	13.0	1.0	2.7	1.2
Contemporaneous recording of monitored parameters						
19. Record level of consciousness, ventilator and oxygenation status and hemodynamic variables at a frequency that depends on the type and amount of medication administered, the length of the procedure, and the general condition of the patient	414	64.7*	26.1	2.7	4.1	2.4
20. Set device alarms to alert the care team to critical changes in patient	418	76.3*	18.7	3.6	1.2	0.2
Availability of an individual responsible for patient monitoring						
21. Assure that a designated individual other than the practitioner performing the procedure is present to monitor the patient throughout the procedure	418	90.4*	7.9	1.0	0.2	0.5

(*Continued*)

Table 8. (Continued)

		Percent Responding to Each Item				
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
22. The individual responsible for monitoring the patient should be trained in the recognition of apnea and airway obstruction and be empowered to seek additional help	416	93.8*	5.0	0.2	0.0	1.0
23. The designated individual may assist with minor, interruptible tasks once the patient's level of sedation/analgesia and vital signs have stabilized, provided that adequate monitoring for the patient's level of sedation is maintained	418	32.5	28.0*	12.0	17.0	10.5
Supplemental oxygen						
24. Use supplemental oxygen during moderate procedural sedation/analgesia unless specifically contraindicated for a particular patient or procedure	417	67.9*	21.1	8.6	1.7	0.7
Emergency support						
25. Assure that pharmacologic antagonists for benzodiazepines and opioids are immediately available in the procedure room	417	73.6*	19.4	5.5	1.2	0.2
26. Assure that an individual is present in the room who understands the pharmacology of the sedative/analgesics administered and potential interactions with other medications and nutraceuticals the patient may be taking	415	83.1*	14.0	2.7	0.0	0.2
27. Assure that appropriately sized equipment for establishing a patent airway is available	416	91.6*	7.7	0.2	0.2	0.2
28. Assure that at least one individual capable of establishing a patent airway and providing positive pressure ventilation is present in the procedure room	415	84.8*	12.8	2.4	0.0	0.0
29. Assure that suction, advanced airway equipment, positive pressure ventilation, and supplemental oxygen are immediately available in the procedure room and in good working order	415	90.4*	8.7	0.5	0.2	0.2
30. Assure that a member of the procedural team is trained in the recognition and treatment of airway complications, opening the airway, suctioning secretions, and performing bag-valve-mask ventilation	415	89.6*	9.4	0.7	0.2	0.0
31. Assure that a member of the procedural team has the skills to establish intravenous access	416	87.0*	11.1	1.7	0.0	0.2
32. Assure that a member of the procedural team has the skills to provide chest compressions	414	88.9*	10.1	1.0	0.0	0.0
33. Assure that a functional defibrillator or automatic external defibrillator is immediately available in the procedure area	412	83.5*	13.6	2.2	0.7	0.0
34. Assure that an individual or service is immediately available with advanced life support skills	414	74.6*	17.1	5.6	2.2	0.5
35. Assure that members of the procedural team are able to recognize the need for additional support and know how to access emergency services from the procedure room	415	88.4*	11.6	0.0	0.0	0.0
Sedative or analgesic medications not intended for general anesthesia						
36. Combinations of sedative and analgesic agents may be administered as appropriate for the procedure and the condition of the patient	403	57.8*	37.7	3.2	0.5	0.7
37. Dexmedetomidine may be administered as an alternative to benzodiazepine sedatives on a case-by-case basis	403	30.5	40.9*	17.4	8.4	2.7
38. In patients receiving intravenous medications for sedation/analgesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression	400	89.8*	9.5	0.3	0.3	0.3
39. In patients who have received sedation/analgesia by non-intravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of establishing or reestablishing intravenous access on a case-by-case basis	402	51.2*	33.3*	3.7	6.2	5.5
40. Administer intravenous sedative/analgesic drugs in small, incremental doses or by infusion, titrating to the desired endpoints	402	82.1*	16.2	0.5	0.7	0.5
Sedative or analgesic medications intended for general anesthesia						
41. When moderate procedural sedation with sedative or analgesic medications intended for general anesthesia by any route is intended, provide care consistent with that required for general anesthesia	401	83.5*	11.7	2.2	1.5	1.0

(*Continued*)

Table 8. (Continued)

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
42. Assure that practitioners administering these drugs are able to reliably rescue patients from unintended deep sedation/general anesthesia	404	94.1*	4.5	0.5	0.0	1.0
43. For patients receiving intravenous sedatives intended for general anesthesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression	399	93.7*	5.8	0.0	0.0	0.5
44. In patients who have received sedatives intended for general anesthesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of establishing or reestablishing intravenous access on a case-by-case basis	401	57.4*	20.2	2.7	9.5	10.2
45. Administer intravenous sedative/analgesic drugs intended for general anesthesia in small, incremental doses or by infusion, titrating to the desired endpoints	403	83.1*	12.7	2.0	1.0	1.2
Reversal agents						
46. Assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia, regardless of administration route	402	78.4*	16.2	3.7	1.0	0.7
47. If patients become hypoxemic or apneic during sedation/analgesia, encourage or physically stimulate patients to breathe deeply	404	84.9*	13.4	1.2	0.2	0.2
48. If patients become hypoxemic or apneic during sedation/analgesia, administer supplemental oxygen	402	89.1*	8.0	0.7	1.5	0.7
49. If patients become hypoxemic or apneic during sedation/analgesia, provide positive pressure ventilation if spontaneous ventilation is inadequate	397	89.4*	9.8	0.8	0.0	0.0
50. Use reversal agents in cases where airway control, spontaneous ventilation, or positive pressure ventilation is inadequate	400	72.5*	22.5	3.8	0.8	0.5
51. Administer naloxone to reverse opioid-induced sedation and respiratory depression	399	61.2*	29.1	6.5	2.3	1.0
52. Administer flumazenil to reverse benzodiazepine-induced sedation and respiratory depression	396	59.6*	29.0	8.1	2.0	1.3
53. After pharmacologic reversal, observe and monitor patients for a sufficient time to ensure that sedation and cardiorespiratory depression does not recur once the effect of the antagonist dissipates	401	87.8*	11.5	0.2	0.0	0.5
54. Do not use sedation regimens that include routine reversal of sedative/analgesic agents	401	80.3*	14.5	3.5	1.2	0.5
Recovery care						
55. After sedation/analgesia, observe and monitor patients in an appropriately staffed and equipped area until they are near their baseline level of consciousness and are no longer at increased risk for cardiorespiratory depression	403	87.3*	12.7	0.0	0.0	0.0
56. Monitor oxygenation continuously until patients are no longer at risk for hypoxemia	402	89.1*	10.7	0.2	0.0	0.0
57. Monitor ventilation and circulation at regular intervals until patients are suitable for discharge	400	85.8*	12.5	1.3	0.3	0.3
58. Design discharge criteria to minimize the risk of central nervous system or cardiorespiratory depression after discharge from observation by trained personnel	399	85.7*	14.3	0.0	0.0	0.0
Creation and implementation of patient safety processes						
59. Create and implement a quality improvement process based upon national, regional, or institutional reporting protocols	403	73.7*	21.8	4.0	0.2	0.2
60. Strengthen patient safety culture through collaborative practices (*e.g.*, team training, simulation drills, development and implementation of checklists)	401	72.1*	24.2	3.5	0.0	0.2
61. Create an emergency response plan (*e.g.*, activating "code blue" team or activating the emergency medical response system: 911 or equivalent)	401	82.3*	16.0	1.7	0.0	0.0

*N = the number of consultants who responded to each item. An asterisk beside a percentage score in the columns to the right indicates the median.

Table 9. American Association of Oral and Maxillofacial Surgeons Member Survey Responses

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
Patient evaluation						
1. Review previous medical records and interview the patient or family	68	82.4*	16.2	1.5	0.0	0.0
2. Conduct a focused physical examination of the patient	68	80.9*	17.6	1.5	0.0	0.0
3. Review available laboratory test results and order additional laboratory tests when needed	68	76.5*	17.6	5.9	0.0	0.0
4. *If possible*, perform the preprocedure evaluation well enough in advance (*e.g.*, several days to weeks) to allow for proper patient preparation	67	53.7*	28.4	9.0	9.0	0.0
5. Reevaluate the patient immediately before the procedure	69	78.3*	17.4	0.0	4.3	0.0
Preprocedure patient preparation						
6. Consult with a medical specialist, when appropriate, before administration of moderate procedural sedation to patients with significant underlying conditions	69	68.1*	24.6	5.8	1.4	0.0
7. When feasible before the procedure, inform patients or legal guardians of the benefits, risks, and limitations of moderate sedation/analgesia and possible alternatives and elicit their preferences	69	73.9*	23.2	2.9	0.0	0.0
8. Before the day of the procedure, inform patients or legal guardians that they should not drink fluids or eat solid foods for a sufficient period of time to allow for gastric emptying	68	86.8*	10.3	1.5	1.5	0.0
9. On the day of the procedure, assess the time and nature of last oral intake	68	89.7*	10.3	0.0	0.0	0.0
10. In urgent or emergent situations where complete gastric emptying is not possible, do not delay moderate procedural sedation based on fasting time alone	62	25.8	30.6*	21.0	22.6	0.0
Monitoring patient level of consciousness						
11. Periodically monitor a patient's response to verbal commands during moderate sedation, except in patients who are unable to respond appropriately or during procedures where movement could be detrimental clinically	67	40.3	29.9*	22.4	7.5	0.0
12. During procedures where a verbal response is not possible, check the patient's ability to give a "thumbs up" or other indication of consciousness in response to verbal or tactile stimulation	69	30.4	36.2*	26.1	7.2	0.0
Monitoring patient ventilation and oxygenation						
13. Continually monitor ventilatory function by observation of qualitative clinical signs	66	84.8*	13.6	1.5	0.0	0.0
14. Continually monitor ventilatory function by capnography unless precluded or invalidated by the nature of the patient, procedure, or equipment	61	65.6*	21.3	11.5	1.6	0.0
15. Monitor all patients by pulse oximetry with appropriate alarms	66	87.9*	12.1	0.0	0.0	0.0
Monitoring hemodynamics						
16. Determine blood pressure before sedation/analgesia is initiated unless precluded by lack of patient cooperation	63	84.1*	14.3	0.0	1.6	0.0
17. Once moderate sedation/analgesia is established, continually monitor blood pressure and heart rate during the procedure unless such monitoring interferes with the procedure	64	79.7*	18.8	0.0	1.6	0.0
18. Use electrocardiographic monitoring during moderate sedation in patients with clinically significant cardiovascular disease or those who are undergoing procedures where dysrhythmias are anticipated	65	76.9*	12.3	7.7	3.1	0.0
Contemporaneous recording of monitored parameters						
19. Record level of consciousness, ventilator and oxygenation status, and hemodynamic variables at a frequency that depends on the type and amount of medication administered, the length of the procedure, and the general condition of the patient	66	54.5*	24.2	16.7	4.5	0.0
20. Set device alarms to alert the care team to critical changes in patient	66	72.7*	22.7	4.5	0.0	0.0

(*Continued*)

Table 9. (Continued)

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
Availability of an individual responsible for patient monitoring						
21. Assure that a designated individual other than the practitioner performing the procedure is present to monitor the patient throughout the procedure	65	53.8*	26.2	10.8	9.2	0.0
22. The individual responsible for monitoring the patient should be trained in the recognition of apnea and airway obstruction and be empowered to seek additional help	65	63.1*	30.8	3.1	3.1	0.0
23. The designated individual may assist with minor, interruptible tasks once the patient's level of sedation/analgesia and vital signs have stabilized, provided that adequate monitoring for the patient's level of sedation is maintained	64	50.0*	40.6	1.6	7.8	0.0
Supplemental oxygen						
24. Use supplemental oxygen during moderate procedural sedation/analgesia unless specifically contraindicated for a particular patient or procedure	64	78.1*	14.1	4.7	3.1	0.0
Emergency support						
25. Assure that pharmacologic antagonists for benzodiazepines and opioids are immediately available in the procedure room	62	74.2*	14.5	9.7	1.6	0.0
26. Assure that an individual is present in the room who understands the pharmacology of the sedative/analgesics administered and potential interactions with other medications and nutraceuticals the patient may be taking	64	71.9*	17.2	6.3	4.7	0.0
27. Assure that appropriately sized equipment for establishing a patent airway is available	64	87.5*	12.5	0.0	0.0	0.0
28. Assure that at least one individual capable of establishing a patent airway and providing positive pressure ventilation is present in the procedure room	64	82.8*	15.6	1.6	0.0	0.0
29. Assure that suction, advanced airway equipment, positive pressure ventilation, and supplemental oxygen are immediately available in the procedure room and in good working order	64	81.3*	12.5	3.1	3.1	0.0
30. Assure that a member of the procedural team is trained in the recognition and treatment of airway complications, opening the airway, suctioning secretions, and performing bag-valve-mask ventilation	64	87.5*	10.9	1.6	0.0	0.0
31. Assure that a member of the procedural team has the skills to establish intravenous access	64	76.6*	17.2	4.7	1.6	0.0
32. Assure that a member of the procedural team has the skills to provide chest compressions	62	87.1*	12.9	0.0	0.0	0.0
33. Assure that a functional defibrillator or automatic external defibrillator is immediately available in the procedure area	64	78.1*	18.8	1.6	1.6	0.0
34. Assure that an individual or service is immediately available with advanced life support skills	63	73.0*	19.0	6.3	1.6	0.0
35. Assure that members of the procedural team are able to recognize the need for additional support and know how to access emergency services from the procedure room	64	85.9*	10.9	1.6	1.6	0.0
Sedative or analgesic medications not intended for general anesthesia						
36. Combinations of sedative and analgesic agents may be administered as appropriate for the procedure and the condition of the patient	64	81.3*	18.8	0.0	0.0	0.0
37. Dexmedetomidine may be administered as an alternative to benzodiazepine sedatives on a case-by-case basis	63	14.3	17.5	63.5*	4.8	0.0

(*Continued*)

Table 9. (Continued)

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
38. In patients receiving intravenous medications for sedation/analgesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression	64	85.9*	14.1	0.0	0.0	0.0
39. In patients who have received sedation/analgesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of establishing or reestablishing intravenous access on a case-by-case basis	63	66.7*	31.7	1.6	0.0	0.0
40. Administer intravenous sedative/analgesic drugs in small, incremental doses or by infusion, titrating to the desired endpoints	64	81.3*	15.6	0.0	3.1	0.0
Sedative or analgesic medications intended for general anesthesia						
41. When moderate procedural sedation with sedative or analgesic medications intended for general anesthesia by any route is intended, provide care consistent with that required for general anesthesia	61	82.0*	16.4	1.6	0.0	0.0
42. Assure that practitioners administering these drugs are able to reliably rescue patients from unintended deep sedation or general anesthesia	64	90.6	7.8	1.6	0.0	0.0
43. For patients receiving intravenous sedatives intended for general anesthesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression	64	87.5*	12.5	0.0	0.0	0.0
44. In patients who have received sedatives intended for general anesthesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of establishing or reestablishing intravenous access on a case-by-case basis	61	73.8*	21.3	0.0	4.9	0.0
45. Administer intravenous sedative/analgesic drugs intended for general anesthesia in small, incremental doses, or by infusion, titrating to the desired endpoints	64	81.3*	15.6	0.0	3.1	0.0
Reversal agents						
46. Assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia regardless of administration route	63	77.8*	17.5	4.8	0.0	0.0
47. If patients become hypoxemic or apneic during sedation/analgesia, encourage or physically stimulate patients to breathe deeply	64	81.3*	15.6	3.1	0.0	0.0
48. If patients become hypoxemic or apneic during sedation/analgesia, administer supplemental oxygen	61	82.0*	16.4	1.6	0.0	0.0
49. If patients become hypoxemic or apneic during sedation/analgesia, provide positive pressure ventilation if spontaneous ventilation is inadequate	64	85.9*	14.1	0.0	0.0	0.0
50. Use reversal agents in cases where airway control, spontaneous ventilation or positive pressure ventilation is inadequate	63	71.4*	22.2	4.8	1.6	0.0
51. Administer naloxone to reverse opioid-induced sedation and respiratory depression	63	55.6*	36.5	3.2	4.8	0.0
52. Administer flumazenil to reverse benzodiazepine-induced sedation and respiratory depression	63	57.1*	33.3	6.3	3.2	0.0
53. After pharmacologic reversal, observe and monitor patients for a sufficient time to ensure that sedation and cardiorespiratory depression does not recur once the effect of the antagonist dissipates	64	79.7*	18.8	1.6	0.0	0.0
54. Do not use sedation regimens that include routine reversal of sedative/analgesic agents	62	67.7*	22.6	6.5	3.2	0.0

(*Continued*)

Table 9. (Continued)

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
Recovery care						
55. After sedation/analgesia, observe and monitor patients in an appropriately staffed and equipped area until they are near their baseline level of consciousness and are no longer at increased risk for cardiorespiratory depression	63	84.1*	15.9	0.0	0.0	0.0
56. Monitor oxygenation continuously until patients are no longer at risk for hypoxemia	63	85.7*	14.3	0.0	0.0	0.0
57. Monitor ventilation and circulation at regular intervals until patients are suitable for discharge	64	73.4*	21.9	4.7	0.0	0.0
58. Design discharge criteria to minimize the risk of central nervous system or cardiorespiratory depression after discharge from observation by trained personnel	64	78.1*	17.2	3.1	1.6	0.0
Creation and implementation of patient safety processes						
59. Create and implement a quality improvement process based upon national, regional, or institutional reporting protocols	61	54.1*	27.9	16.4	1.6	0.0
60. Strengthen patient safety culture through collaborative practices (*e.g.*, team training, simulation drills, development and implementation of checklists)	63	71.4*	25.4	3.2	0.0	0.0
61. Create an emergency response plan (*e.g.*, activating "code blue" team or activating the emergency medical response system: 911 or equivalent)	64	75.0*	23.4	1.6	0.0	0.0

*N = the number of consultants who responded to each item. An asterisk beside a percentage score in the columns to the right indicates the median.

Table 10. American Society of Dentist Anesthesiologists Member Survey Responses

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
Patient evaluation						
1. Review previous medical records and interview the patient or family	104	89.4*	10.6	0.0	0.0	0.0
2. Conduct a focused physical examination of the patient	104	87.5*	12.5	0.0	0.0	0.0
3. Review available laboratory test results and order additional laboratory tests when needed	104	72.1*	24.0	3.8	0.0	0.0
4. *If possible*, perform the preprocedure evaluation well enough in advance (*e.g.*, several days to weeks) to allow for proper patient preparation	104	55.8*	30.8	9.6	2.9	1.0
5. Re-evaluate the patient immediately before the procedure	104	83.7*	16.3	0.0	0.0	0.0
Preprocedure patient preparation						
6. Consult with a medical specialist, when appropriate, before administration of moderate procedural sedation to patients with significant underlying conditions	104	81.7*	13.5	4.8	0.0	0.0
7. When feasible before the procedure, inform patients or legal guardians of the benefits, risks, and limitations of moderate sedation/analgesia and possible alternatives, and elicit their preferences	104	85.6*	12.5	1.9	0.0	0.0
8. Before the day of the procedure, inform patients or legal guardians that they should not drink fluids or eat solid foods for a sufficient period of time to allow for gastric emptying	104	94.2*	5.8	0.0	0.0	0.0
9. On the day of the procedure, assess the time and nature of last oral intake	104	93.3*	6.7	0.0	0.0	0.0
10. In urgent or emergent situations where complete gastric emptying is not possible, do not delay moderate procedural sedation based on fasting time alone	103	16.5	35.0*	21.4	13.6	13.6

(*Continued*)

Table 10. (Continued)

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
Monitoring patient level of consciousness						
11. Periodically monitor a patient's response to verbal commands during moderate sedation, except in patients who are unable to respond appropriately or during procedures where movement could be detrimental clinically	104	39.4	38.5*	12.5	8.7	1.0
12. During procedures where a verbal response is not possible, check the patient's ability to give a "thumbs up" or other indication of consciousness in response to verbal or tactile stimulation	104	46.2	38.5*	8.7	4.8	1.9
Monitoring patient ventilation and oxygenation						
13. Continually monitor ventilatory function by observation of qualitative clinical signs	95	84.2*	13.7	1.1	0.0	1.1
14. Continually monitor ventilatory function by capnography unless precluded or invalidated by the nature of the patient, procedure, or equipment	95	54.7*	26.3	11.6	7.4	0.0
15. Monitor all patients by pulse oximetry with appropriate alarms	95	93.7*	6.3	0.0	0.0	0.0
Monitoring hemodynamics						
16. Determine blood pressure before sedation/analgesia is initiated unless precluded by lack of patient cooperation	95	85.3*	10.5	1.1	1.1	2.1
17. Once moderate sedation/analgesia is established, continually monitor blood pressure and heart rate during the procedure unless such monitoring interferes with the procedure	95	84.2*	9.5	1.1	3.2	2.1
18. Use electrocardiographic monitoring during moderate sedation in patients with clinically significant cardiovascular disease or those who are undergoing procedures where dysrhythmias are anticipated	94	81.9*	13.8	1.1	2.1	1.1
Contemporaneous recording of monitored parameters						
19. Record level of consciousness, ventilator and oxygenation status, and hemodynamic variables at a frequency that depends on the type and amount of medication administered, the length of the procedure, and the general condition of the patient	95	63.2*	18.9	8.4	3.2	6.3
20. Set device alarms to alert the care team to critical changes in patient	95	74.7*	21.1	3.2	1.1	0.0
Availability of an individual responsible for patient monitoring						
21. Assure that a designated individual other than the practitioner performing the procedure is present to monitor the patient throughout the procedure	95	77.9*	13.7	6.3	0.0	2.1
22. The individual responsible for monitoring the patient should be trained in the recognition of apnea and airway obstruction and be empowered to seek additional help	94	88.3*	6.4	3.2	0.0	2.1
23. The designated individual may assist with minor, interruptible tasks once the patient's level of sedation/analgesia and vital signs have stabilized, provided that adequate monitoring for the patient's level of sedation is maintained	95	44.2	28.4*	8.4	9.5	9.5
Supplemental oxygen						
24. Use supplemental oxygen during moderate procedural sedation/analgesia unless specifically contraindicated for a particular patient or procedure	95	63.2*	20.0	13.7	3.2	0.0
Emergency support						
25. Assure that pharmacologic antagonists for benzodiazepines and opioids are immediately available in the procedure room	94	79.8*	16.0	2.1	2.1	0.6
26. Assure that an individual is present in the room who understands the pharmacology of the sedative/analgesics administered and potential interactions with other medications and nutraceuticals the patient may be taking	93	91.4*	7.5	1.1	0.0	0.0

(*Continued*)

Table 10. (Continued)

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
27. Assure that appropriately sized equipment for establishing a patent airway is available	94	92.6*	7.4	0.0	0.0	0.0
28. Assure that at least one individual capable of establishing a patent airway and providing positive pressure ventilation is present in the procedure room	93	95.7*	3.2	0.0	0.0	1.1
29. Assure that suction, advanced airway equipment, positive pressure ventilation, and supplemental oxygen are immediately available in the procedure room and in good working order	94	94.7*	4.3	1.1	0.0	0.0
30. Assure that a member of the procedural team is trained in the recognition and treatment of airway complications, opening the airway, suctioning secretions, and performing bag-valve-mask ventilation	93	91.4*	5.4	2.2	0.0	1.1
31. Assure that a member of the procedural team has the skills to establish intravenous access	93	81.7*	5.4	11.8	0.0	1.1
32. Assure that a member of the procedural team has the skills to provide chest compressions	94	95.7*	4.3	0.0	0.0	0.0
33. Assure that a functional defibrillator or automatic external defibrillator is immediately available in the procedure area	94	92.6*	5.3	1.1	1.1	0.0
34. Assure that an individual or service is immediately available with advanced life support skills	94	70.2*	16.0	7.4	4.3	2.1
35. Assure that members of the procedural team are able to recognize the need for additional support and know how to access emergency services from the procedure room	93	89.2*	9.7	1.1	0.0	0.0
Sedative or analgesic medications not intended for general anesthesia						
36. Combinations of sedative and analgesic agents may be administered as appropriate for the procedure and the condition of the patient	89	62.9*	30.3	6.7	0.0	0.0
37. Dexmedetomidine may be administered as an alternative to benzodiazepine sedatives on a case-by-case basis	90	33.3	22.2*	26.7	8.9	8.9
38. In patients receiving intravenous medications for sedation/analgesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression	90	84.4*	15.6	0.0	0.0	0.0
39. In patients who have received sedation/analgesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of establishing or reestablishing intravenous access on a case-by-case basis	90	56.7*	30.0	6.7	4.4	2.2
40. Administer intravenous sedative/analgesic drugs in small, incremental doses or by infusion, titrating to the desired endpoints	89	74.2*	21.3	0.0	1.1	3.4
Sedative or analgesic medications intended for general anesthesia						
41. When moderate procedural sedation with sedative or analgesic medications intended for general anesthesia by any route is intended, provide care consistent with that required for general anesthesia	88	81.8*	13.6	3.4	1.1	0.0
42. Assure that practitioners administering these drugs are able to reliably rescue patients from unintended deep sedation or general anesthesia	90	96.7*	2.2	0.0	1.1	0.0
43. For patients receiving intravenous sedatives intended for general anesthesia, maintain vascular access throughout the procedure and until the patient is no longer at risk for cardiorespiratory depression	90	91.1*	7.8	0.0	0.0	1.1
44. In patients who have received sedatives intended for general anesthesia by nonintravenous routes or whose intravenous line has become dislodged or blocked, determine the advisability of establishing or reestablishing intravenous access on a case-by-case basis	90	62.2*	12.2	4.4	12.2	8.9

(*Continued*)

Table 10. (Continued)

	Percent Responding to Each Item					
	*N**	Strongly Agree	Agree	Equivocal	Disagree	Strongly Disagree
45. Administer intravenous sedative/analgesic drugs intended for general anesthesia in small, incremental doses, or by infusion, titrating to the desired endpoints	90	65.6*	12.2	5.6	5.6	11.1
Reversal agents						
46. Assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia regardless of administration route	90	82.2*	14.4	1.1	2.2	0.0
47. If patients become hypoxemic or apneic during sedation/analgesia, encourage or physically stimulate patients to breathe deeply	90	88.9*	6.7	1.1	2.2	1.1
48. If patients become hypoxemic or apneic during sedation/analgesia, administer supplemental oxygen	90	92.2*	6.7	0.0	1.1	0.0
49. If patients become hypoxemic or apneic during sedation/analgesia, provide positive pressure ventilation if spontaneous ventilation is inadequate	90	92.2*	6.7	0.0	1.1	0.0
50. Use reversal agents in cases where airway control, spontaneous ventilation or positive pressure ventilation is inadequate	89	73.0*	16.9	3.4	3.4	3.4
51. Administer naloxone to reverse opioid-induced sedation and respiratory depression	90	62.2*	25.6	7.8	2.2	2.2
52. Administer flumazenil to reverse benzodiazepine-induced sedation and respiratory depression	90	61.1*	25.6	7.8	2.2	3.3
53. After pharmacologic reversal, observe and monitor patients for a sufficient time to ensure that sedation and cardiorespiratory depression does not recur once the effect of the antagonist dissipates	90	91.1*	8.9	0.0	0.0	0.0
54. Do not use sedation regimens that include routine reversal of sedative/analgesic agents	90	84.4*	10.0	2.2	2.2	1.1
Recovery care						
55. After sedation/analgesia, observe and monitor patients in an appropriately staffed and equipped area until they are near their baseline level of consciousness and are no longer at increased risk for cardiorespiratory depression	88	86.4*	10.2	2.3	0.0	1.1
56. Monitor oxygenation continuously until patients are no longer at risk for hypoxemia	88	86.4*	13.6	0.0	0.0	0.0
57. Monitor ventilation and circulation at regular intervals until patients are suitable for discharge	88	77.3*	18.3	3.4	1.1	0.0
58. Design discharge criteria to minimize the risk of central nervous system or cardiorespiratory depression after discharge from observation by trained personnel	88	84.1*	14.8	1.1	0.0	0.0
Creation and implementation of patient safety processes						
59. Create and implement a quality improvement process based upon national, regional, or institutional reporting protocols	88	58.0*	31.8	9.1	1.1	0.0
60. Strengthen patient safety culture through collaborative practices (*e.g.*, team training, simulation drills, development and implementation of checklists)	88	72.7*	22.7	4.5	0.0	0.0
61. Create an emergency response plan (*e.g.*, activating "code blue" team or activating the emergency medical response system: 911 or equivalent)	88	79.5*	18.2	2.3	0.0	0.0

*N = the number of consultants who responded to each item. An asterisk beside a percentage score in the columns to the right indicates the median.