A SYNTHESIS OF THE AUSTRALIAN PATIENT SAFETY FOUNDATION ANESTHESIA INCIDENT MONITORING STUDY, THE AMERICAN SOCIETY OF ANESTHESIOLOGISTS CLOSED CLAIMS PROJECT, AND THE AMERICAN ASSOCIATION OF NURSE ANESTHETISTS CLOSED CLAIMS STUDY

The study of anesthesia risk is fraught with methodological challenges and the epidemiological uncertainty peculiar to anesthesia: the true frequency of anesthetic mortality is unknown. If anesthesia mortality is as rare as 1 in 200,000 cases, the sample needed to study this phenomenon would be enormous. Existing studies provide insights to the genesis of damaging events and adverse outcomes in anesthesia.

We examined research design, methodology, and findings to date in 3 studies of anesthesia risk. Limitations include self-report by providers in the Australian study and the retrospective nature of closed claims research in American studies. Respiratory events were the largest class of injury in all 3 studies; substandard care frequently was involved. Australian investigators noted a high rate of patient acuity and monitoring issues. American physician investigators found that death or brain damage occurred in 85% of respiratory cases, 72% of which were deemed preventable. Nurse anesthetist investigators had similar findings for respiratory claims. Patient acuity and procedure complexity may be less significant contributory factors to anesthesia risk than are provider vigilance and clinical decision making. Prospective multicenter studies conducted apolitically may be the only type of research that definitively addresses the myriad issues in anesthesia risk research.

Key words: Adverse events, closed claims, critical incidents, monitoring, patient safety.

“The only real mistake is the one from which we learn nothing.”—John Powell

Since Morton’s introduction of surgical anesthesia in 1846, anesthesia has been linked to morbidity and mortality. Simpson (in Edinburgh, Scotland), the discoverer of chloroform, was the first to perform outcome analysis in anesthesia, developing a method to study the effects of ether-related outcomes of a single surgical procedure: above-the-knee amputation. The single largest study of morbidity and mortality reported in the 1800s was by Andrews in the Chicago Medical Journal finding that ether had a lower mortality rate than chloroform as administered in that time period.

The sentinel article, “Preventable Anesthesia Mishaps: A Study of Human Factors,” by Cooper et al triggered the beginnings of and provided pressure to consider a closed claims analysis. By using the critical incident method, the investigators noted that 87% of all preventable incidents involved human error. These investigators urged replication of their study by others using the same methodology to verify their results so that from the anesthesia community “…can come the motivation and resolve to take specific action and make specific investments to obviate some of the recurrent problems of anesthesia practice.”

The first closed claims analysis, using data from 900 malpractice insurance closed claims reviewed in the Closed Claims Project of the American Society of Anesthesiologists (ASA) proved illuminating. Fourteen cases of sudden cardiac arrest had occurred in healthy patients who underwent spinal anesthesia. Of these patients, 6 suffered severe neurological damage and ultimately died in the hospital, 7 incurred severe permanent neurological damage, and only 1 patient recovered sufficiently to permit the resumption of independent daily self-care. Keats, in an accompanying editorial, noted that the data from the 900 claims described “…a phenomenon of which anesthesiologists have been unaware, and which is now apparent only because of their review of a collection of rare events.”

A few years later, an entire issue of Anesthesia and Intensive Care was devoted to anesthesia incidents: “Symposium: The Australian Incident Monitoring Study (AIMS).” This was the first time a survey of such a large group of anesthesia incidents had been published. Despite acknowledged limitations of the AIMS (eg, voluntary self-reporting), the information garnered served as a milestone in patient safety, with practical implications.

History of the AIMS
A critical-incident technique patterned after the work of Cooper et al was first used in Townsville, Australia, in the early 1980s to study anesthesia problems. Following this pilot study, incident reporting systems were established at both the Prince of Wales Hospital, Sydney, and the Royal Woman’s Hospital, Melbourne.
After publication of standards for basic intraoperative monitoring\textsuperscript{7,8} by the 9 Harvard hospitals and promulgation of the ASA monitoring standards in 1986, a symposium on “Patient Safety and Monitoring” was convened in May 1987 in Adelaide, Australia. At the conclusion of the symposium, the Australian anesthetists agreed to establish the Australian Patient Safety Foundation to advance patient safety.\textsuperscript{9-11}

**History of the ASA Closed Claims Project**

In the early 1980s, investigators studied the closed malpractice claims against anesthesiologists in the state of Washington, observing that the claims represented a repository of rare but often catastrophic events. Anesthesia-related closed malpractice claims could provide an opportunity to reveal recurring themes and insights that would be difficult to discern by the practitioners who experienced these cases as isolated events.\textsuperscript{12}

Within the ASA and the National Association of Insurance Commissioners, rising malpractice premiums and the identification of anesthesia as a high-risk specialty, stimulated the development of the ASA closed claims study.\textsuperscript{13} Arrangements were made with professional liability insurance companies to conduct an in-depth review of malpractice claims filed against anesthesiologists. A closed claim is one in which both parties agree to a settlement, either with a payout to the plaintiff or by simply dropping the allegation. Under the closed claim agreement, information is kept confidential. The claim is “closed” to everyone except the parties concerned. Each review was undertaken by an anesthesiologist who relied on a predetermined, standardized format. No identifying data were included in the review.

In 1985 the ASA Closed Claims Project began with the participation of 17 professional liability insurance companies. Anesthesiologists began reviewing and extracting data from claims generated between 1975 and 1984.\textsuperscript{14} Claims included a wide range of anesthesia-related injuries, from emotional trauma to death. Dental injury claims were not included, since the mechanism of injury usually was obvious. By 1999, there were 35 insurance organizations participating in the ASA Closed Claims Project, and 4,459 claims had been entered into the database, with approximately 300 new claims added annually.\textsuperscript{15}

**History of the American Association of Nurse Anesthetists Closed Claims Study**

The leadership of the American Association of Nurse Anesthetists (AANA) recognized the need to examine adverse outcomes of anesthesia care provided by Certified Registered Nurse Anesthetists (CRNAs). Subsequently, the AANA Foundation began an ongoing study, sponsored by AANA Insurance Services, to examine anesthesia care provided by CRNAs. This ongoing study involves analysis of closed malpractice claims files from the St Paul Fire and Marine Insurance Company. In the period 2000-2001, a team of 8 CRNA researchers investigated 223 closed claim files that involved incidents from 1989 to 1997. Follow-up work with additional committee members has resulted in refinement of the data, an emerging set of publications, and a commitment to ongoing analysis. Findings of the AANAs closed claims study began appearing in the August 2001 issue of the AANA Journal.

The primary goal of the AANA Foundation closed claims study has been to improve patient safety. Study data have influenced the development of a variety of educational and practice standards. For example, the number of required pediatric cases was increased by the Council on Accreditation in response to concerns raised in the closed claims analysis. Pediatric advanced life support training is now required for all student anesthetists. Likewise, the AANA office-based practice standards were influenced by findings from the review of closed claims data.

**Sources of data**

- **Anesthesia Incident Monitoring Study (Australia).** If the anesthetist experienced an incident, no matter how trivial, that affected or could have affected the safety of a patient, the anesthetist was asked to voluntarily complete a standardized anesthetic incident report. It is not known what percentage of the Australian anesthetists have sent or continue to send in incident reports. Once the incident report is completed, it is given to a coordinator at the hospital to “…be discussed at regular intervals at a meeting of the anesthetists involved in the study.”\textsuperscript{16} After the report has been discussed, the coordinator forwards the report to the data depository bank at the Australian Patient Safety Foundation office in the Royal Adelaide Hospital, where it is entered into the database, ensuring patient and provider anonymity.

- **The Anesthetic Incident Report** was divided into the following 7 areas:

  1. **Description of the incident** asks the anesthetist to provide a narrative summary of the incident and include details that might have contributed to or minimized the incident.

  2. **What happened?** Questions include the following: Was there a communication problem, distraction, mislabeled drug? Was there an error of judgment? Did the provider fail to check equipment? Was the provider too fatigued or too ill to function properly?
Was the provider too hasty? Did the provider lack experience in the involved procedure and other relevant questions?

3. Why it happened allows the evaluator to provide an opinion on the etiology and circumstances involved in the evolution of the event.

4. Anesthesia procedure documents the type of surgery, the anesthesia time, the type of ventilation used, and the monitors used during the anesthesia.

5. To whom it happened identifies the patient's age, the ASA classification, and whether the case was an emergency.

6. When and where it happened documents the time and date, phase of the anesthetic, and where the patient was at the time of the incident.

7. Patient outcome delineates the duration of the incident, the immediate effects of the incident, and the final outcome.

As of March 2001, the AIMS database contained 7,386 incidents. Data extracted from the incidents in the AIMS database can suggest trends in anesthesia practice and heighten awareness of actual and potential problems. The AIMS database is financed, in part, by a grant to the Australian Patient Safety Foundation from the Australian Society of Anaesthetists. The Australian Patient Safety Foundation initially was financed by a start-up grant from the Australian Federal Government but is now becoming self-supporting.

• ASA Closed Claim Project. Reviewers received training as data extractors and subsequently received assigned closed claims on file with participating carriers. As previously noted, extractors used a predefined and standardized data collection tool. The Closed Claims Project Data Collection Instrument is divided into 9 specific areas:

1. General information includes a series of specific and relevant but nonidentifying questions regarding quality of care and asks the reviewer whether the complication could have been prevented.

2. Personnel involved asks whether the anesthesiologists was or was not board certified and whether a CRNA, anesthesiology resident, a nurse anesthesia student, or a medical or dental student participated in the anesthetic. The level of supervision and medical direction also is requested.

3. Monitors documents what monitors were used.

4. General anesthesia, and

5. Regional anesthesia, local, monitored anesthesia care, or pain management requests specifics on what agents and techniques were used.

6. The damaging event section requests information to attempt to determine whether the damaging event was recorded in the medical record and who was

where at the time the damaging event occurred. Specific information is requested for the respiratory system, the cardiovascular system, equipment, and other selected phenomena.

7. Clinical clues are requested to find out what could have indicated that something was wrong. Three areas were examined: (1) respiratory (eg, cyanosis), (2) cardiovascular (eg, tachycardia), and (3) other (eg, regurgitation).

8. Complications is the most extensive section and contains 55 specific questions about the anesthesia care. The reviewer grades the severity of the patient injury on a scale from 0 (no obvious injury) to 9 (death) using the Severity of Injury Scoring System.

After entering the data in the standardized form for this area, the reviewer was asked for an opinion on a number of specific items regarding the quality and nature of the care provided (eg, preventability).

9. The brief summary of events is the area in which the reviewer provides a case summary and then details the events pertaining to the quality of anesthesia care. If the closed claim involved a newborn injury, an eye injury, or a difficult airway, an additional form was completed.

The time required for data extraction was highly variable; in simple cases extraction required 20 or 30 minutes, while complicated claims required 60 to 90 minutes. The nature of the information in the file varied as well. Usually the claim contained a mixture of the following: hospital record, anesthetic record, depositions of persons involved in the patient's care, expert witnesses' depositions for the plaintiff and the insurance company, outcome reports, autopsy report, claims manager's evaluation, and a summary sheet indicating the outcome of the claim (amount paid or settled).

The insurance company reviewed all completed forms before the forms were sent to the database at the University of Washington, Seattle. Once the forms were received by the ASA Closed Claims Committee (3 volunteer practicing anesthesiologists and 1 full-time paid health services analyst), the forms were reviewed for accuracy, and then a determination was made about whether enough information was available to include the data in the database. Eventually data on specific adverse events were extracted from the ASA Closed Claims database for analysis and publication.

The ASA Closed Claims Project was funded entirely by the ASA. All participating anesthesiologist reviewers are volunteers who are reimbursed for their expenses only.

• The AANA Foundation Closed Claims Study. Since the inception of the AANA Foundation Closed Claims Study, the investigators have collected data primarily from files of the St Paul Fire and Marine
Insurance Company (St Paul, Minn). Another carrier that has been involved in this study is the TIG Insurance Company (Chicago, Ill). Other medical malpractice insurance carriers contacted indicated they had few (eg, <10) or no claims involving CRNAs.

The CRNA investigators on the AANA Foundation study have been involved in all phases of this research: instrument development and revision, data collection and analysis, and development of manuscripts related to specific study content areas. The research instrument included 150 data points including the following:

1. Patient and provider demographics (identities remain confidential)
2. Site and type of facility where anesthesia was administered
3. Evaluation of the adequacy of preinduction activities (eg, was there a complete preanesthetic assessment on the medical record?)
4. Anesthetic agents and techniques
5. Information about the documentation of intraoperative positioning and the use of padding
6. Patient monitors used and values recorded
7. Preexisting patient conditions (eg, diabetes, hypertension)
8. The basis for the lawsuit (eg, aspiration on induction resulting in adult respiratory distress syndrome)
9. Items that ask reviewers to evaluate the preventability of the incident in question and whether provider vigilance was a contributory factor
10. Regarding legal and insurance carrier involvement, documentation of whether a lawsuit was filed, its disposition, the amount of the jury award or settlement, and the involved fees

Limitation of the AIMS, the ASA, and the AANA Closed Claims Studies

Use of the AIMS data was limited because the number of participants submitting reports, the frequency with which each participant submitted reports, and the potential biases of the reviewers completing the reports were all unknown. As with the other databases, the incidence or risk of problems with anesthesia in the general population cannot be predicted because the calculation represents the classic case of a numerator in search of an unknown denominator.

Claims review is limited by the information in the closed claim file. At times, missing data points can be problematic. Malpractice claims represent only the tip of the iceberg for critical incidents in anesthesia because many incidents occur in which the patient is neither injured nor elects to sue.

Bias is inevitable as input is limited to the depositions and to information given by the providers who gave the care. Information extracted from the closed claims was recorded by direct participants rather than observed and recorded by impartial observers. Furthermore, the reviewers made a determination on the standard of care based on limited information in the closed claim file. Reviewers considering cases with adverse outcomes can be influenced by advance knowledge of the severity of outcome in the case. Due to the “long tail” of medical malpractice coverage, closed claims research sometimes has a time lag of up to 10 years from the time of the patient injury until the data are included in a written article. The initial discovery and litigation process is slow; once the closed claim is settled, the insurance company may have it on file for a considerable time before reviewers see the closed claim. Writing the published report and its subsequent appearance in a journal involve an additional lag.

Resources for documenting patient injuries in an open, sharing manner among a large number of hospitals are impossible to establish at present, in part due to fears of litigation. It must be stressed that the critical-incident technique and closed claims analysis are 2 markedly different research methods. Closed claims analysis involves examination of closed malpractice claims to define and analyze damaging events and adverse outcomes. The critical-incident technique focuses on what led to a damaging event or adverse outcome.

Lessons learned

- What has been learned from the AIMS. A number of lessons learned emerged from the first 2,000 incidents in the AIMS database. 19-48 The general themes and categories of these lessons are detailed in Table 1. A few points that bear highlighting include the relative frequency of errors in judgment and performance and the invaluable role of monitors and alarms (especially end-tidal carbon dioxide measurement, pulse oximetry, oxygen analyzers, and ventilator disconnect alarms). Equally important was familiarity with the monitors and conducting the recommended preuse checkout procedure of anesthesia equipment.

From a number of cases, it was clear that automatic, noninvasive blood pressure monitoring frequently detected incidents late in their evolution and that a precordial or traditional stethoscope should be available at all times to augment other monitoring approaches, especially when ambiguous or confusing information is encountered. Injection of the wrong drug has many contributing factors; injection of the
injuries has improved our understanding of problems in anesthesia, and many of the solutions suggested from solving these problems have contributed to what seems to be an improvement in patients safety. The Institute of Medicine report on errors in medicine heightened our appreciation of the extent of errors in medicine and how best to avoid them.  

### What has been learned from the AANA Foundation Study  

A total of 223 nondental claims involving CRNAs were included in the sample. Of these claims, 151 or 68% were CRNA-related and 72, or 32%, were non–CRNA-related, despite the fact that a claim was brought against the CRNA. An example of a non–CRNA-related claim included a patient death from exsanguination following inadvertent surgical transection of a major blood vessel. Of the CRNA-related claims, 44% involved death, brain injury, or both. Brain injury without death was the basis for 12% of CRNA-related claims. The CRNA payout and the total payout were higher for CRNA-related claims than for non–CRNA-related claims. Of the CRNA-related claims, 18% had CRNA payouts of $200,000 or more, compared with only 3% (2/72) of

### What has been learned from the ASA Closed Claims Project.  

Although the ASA Closed Claims Project is limited by its retrospective nature, there are a number of lessons to be learned from the analysis of the claims in the database. These lessons are described as common and emerging themes in Table 2.

The ASA Closed Claims Project database is still the world’s single largest resource for in-depth study of major adverse outcomes related to anesthesia care. The ASA Closed Claims Project has permitted the anesthesia community to find previously unrecognized risks in anesthesia, thus allowing planning and research into improving these areas for greater patient safety. Analysis of malpractice claims for anesthesia-related

### Table 1. Common themes emerging from the Australian Incident Monitoring Study  

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<th>Origin</th>
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<th>Emerging and common themes</th>
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| Central incident collection center | Voluntary            | Provider factors  
|                                 |                       | • Human error is common (in > 80% of cases).  
|                                 |                       | • Injecting the wrong drug is commonplace.  
|                                 |                       | • Incorrect injection of a properly labeled syringe is common.  
|                                 |                       | • Inadvertent paralysis before anesthetic induction accounted for 40% of awareness while under anesthesia.  
| Australia                      | Individual reporting  | Equipment-related recommendations or factors  
|                                 |                       | • Routinely following apparatus checkout procedures is essential.  
|                                 |                       | • Anesthetic equipment failure often was judged “life threatening.”  
|                                 |                       | • Automated blood pressure cuffs often are insensitive and may provide misleading information.  
|                                 |                       | Monitoring recommendations or factors  
|                                 |                       | • Always use end-tidal carbon dioxide analysis and pulse oximetry.  
|                                 |                       | • Use pulse oximetry continuously until discharge from the postanesthesia care unit (PACU).  
|                                 |                       | • The electrocardiogram is often insensitive or unreliable as a warning of injury.  
|                                 |                       | • Use a traditional stethoscope to augment routine monitoring.  
|                                 |                       | • Regional anesthesia merits the same level of monitoring and vigilance as general anesthesia.  
|                                 |                       | • Of PACU incidents, 88% were first detected by humans (as opposed to monitors).  
|                                 |                       | • It is essential to have an adequate number of experienced PACU staff  
|                                 |                       | Respiratory factors  
|                                 |                       | • Esophageal intubation is common in difficult airway management.  
|                                 |                       | • Of the PACU incidents, 66% involved the respiratory system.  |

### Note  

19-48
Table 2. Common themes emerging from the American Society of Anesthesiologists Closed Claims Study

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<tr>
<th>Origin</th>
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| Closed claims files         | Standardized retrospective file review | Provider factors                                                                                           • Of the cases of awake paralysis, 92% involved care judged below the standard of care (SOC); most incidents were due to infusion errors or syringe swaps.  
• Claims noting provider substance abuse were very rare. |
| United States               | Review by team of trained physician reviewers | Monitoring                                                                                                    • Pulse oximetry and end-tidal carbon dioxide monitoring are essential and may prevent significant numbers of mishaps in adults and children.  
• Monitoring during regional anesthesia care should parallel that in general anesthesia care; if refractory bradycardia occurs during regional anesthesia, consider early use of epinephrine. |
| Insurance company databases |                                 | Equipment                                                                                                      • Claims involving gas delivery problems were rare but were associated with severe injury and high monetary awards. |
|                             |                                 | Respiratory                                                                                                   • Respiratory adverse outcomes are the largest class of injury; care was judged substandard in 76% of these cases. Death or brain damage occurred in 85% of respiratory cases; of these, 72% were deemed preventable.  
• Esophageal injuries were the most severe airway-related injuries. |
|                             |                                 | Positioning                                                                                                   • Peripheral nerve injury can occur despite the SOC being met. Injury mechanism often not apparent. Ulnar nerve commonly involved. |
|                             |                                 | Obstetric anesthesia                                                                                         • Obstetric cases common in database (maternal death, neonatal brain damage, headache). Less than one half judged to meet SOC. General anesthesia risk greater than regional anesthesia risk. Most cases were cesarean sections. Respiratory events were more common in patients with coexisting obesity. |
|                             |                                 | Blindness                                                                                                     • Blindness secondary to patient movement during eye surgery was considered a result of inadequate compliance with the SOC in 81% of cases. Vision loss was most common after spinal surgery in prone position and coronary artery bypass surgery. |
|                             |                                 | Burns                                                                                                         • Burns occurred from warmed fluid bags placed against the skin and occurred most often in gynecological surgery. |
|                             |                                 | Monitored anesthesia care                                                                                     • Monitored anesthesia care claims were infrequent but associated with a poor outcome and high awards. |
|                             |                                 | Trends                                                                                                        • Claims involving death and brain damage are decreasing.  
• An increase in claims related to nonoperating room pain management is evident.  
• Spinal cord injury is now the most frequent nerve injury claim.  
• Aspiration seems to have less of a role in recent anesthesia claims. |
non–CRNA-related claims. The greater the severity of the injury, the greater was the amount paid on behalf of the CRNA. Of the claims with CRNA payouts of $200,000 or more, 85% concerned death and/or brain injury, compared with 35% of other claims.

The most frequently represented surgical procedures were in the following categories: orthopedic, general surgery, gynecological surgery, obstetrics, oto-laryngology, and ophthalmology. CRNAs provided care with an anesthesiologist in 39% of CRNA-related claims. With respect to injury severity, death, brain injury, or nerve injury, there were no statistically significant differences between claims for which the CRNA provided care with an anesthesiologist and claims for which the CRNA did not provide care with an anesthesiologist.

In this sample of 223 claims, 73% of the anesthetics provided were general, and 27% were regional blocks. No statistically significant differences between general anesthesia claims and regional anesthesia claims were found with respect to injury severity, death, brain injury, or nerve injury.

For 45% of CRNA-related claims, a respiratory or airway event may have contributed to the claim. Of claims with a respiratory event, 66% involved permanent, grave injury or death. Of all claims that could have been prevented by better technical monitoring, 81% involved an airway incident.

Analysis has demonstrated a 72% overall interrater reliability among the team of CRNA closed claims investigators. The common and emerging themes from the AANA Foundation closed claims database are described in Table 3.

Overall, anesthesia care provided in 52% of the cases was judged by the original review team as not congruent with the Scope and Standards for Nurse Anesthesia Practice. Presentations and publications based on this study have emphasized that CRNAs should know and use the Scope and Standards for Nurse Anesthesia Practice.

Summary
The reviewed databases have major inherent limitations. Future trends may include prospective multicenter data collection through mechanisms that reduce the political orientation, interviews with providers who have experienced damaging events or adverse outcomes, more use of simulators, and other methods. Opportunities to “think outside the box” should be encouraged.

Despite the limitations of the AIMS, the ASA Closed Claims Project, and the AANA Foundation Closed Claims Study, the information is valuable and continues to contribute to the enhancement of patient safety. One study (AIMS) has been successful in documenting incidents shortly after they occurred, and the other studies have documented anesthesia patient injuries responsible for malpractice cases. While antecedents often are speculative, the studies are important because they facilitate informing and shaping providers’ practice habits to render the highest patient safety. Our patients will be better off because of the work of a few to improve the care of the many.

REFERENCES
2. Cope DK. Morbidity from various anesthetics during the first 24 years after the introduction of ether (abstract). Anesthesiology 1997;87:A925.
### Table 3. Common themes emerging from the American Association of Nurse Anesthetists Foundation Closed Claims Study

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<tr>
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<th>Nature</th>
<th>Provider issues</th>
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<tr>
<td>Closed claims files</td>
<td>Standardized retrospective file review</td>
<td>• No statistically significant differences were found between Certified Registered Nurse Anesthetist (CRNA) age and the occurrence of damaging events.</td>
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<td>• Factors associated with smaller monetary awards included vigilance, a less severe outcome, nonpreventable outcomes, and practicing within accepted standards of care.</td>
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<td>• Inadequate preinduction activities, eg, missing or incomplete preanesthetic assessments, were issues in 17% of the cases.</td>
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<td>• The amount paid out for the CRNA was higher if care was judged inappropriate by the closed claims investigators.</td>
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<td>• Standard of care (SOC) provided was appropriate relative to national standards in about half the claims reviewed.</td>
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<td>• Collaboration with a physician anesthesiologist was not associated with injury severity or rates of death, brain injury, or nerve injury.</td>
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<td>United States</td>
<td>Review by team of trained CRNA investigators and record reviewers</td>
<td>Patient acuity and procedure complexity</td>
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<td></td>
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<td>• The majority of patients in this database were ASA physical status I or II undergoing elective surgical procedures.</td>
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<td>• The types of cases seen most frequently were orthopedic, general surgery, and gynecological.</td>
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<td>• Preoperative physical status, patient age, procedure type, and type of anesthetic did not have statistically significant associations with adverse anesthetic outcomes.</td>
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<td>Insurance company database</td>
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<td>Monetary awards</td>
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<td>• There was a linear relationship between monetary awards and injury severity.</td>
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<td>Type of anesthesia administered</td>
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<td>• General anesthesia was administered in 73% of the claims and regional anesthesia in 27% of the claims reviewed.</td>
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<td>• No statistically significant differences were noted between general and regional anesthesia regarding injury severity.</td>
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<td>Obstetric anesthesia</td>
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<td>• The leading cause of maternal death and brain damage was failure to secure the airway.</td>
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<td>• General anesthesia was associated with greater risk than regional anesthesia.</td>
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<td>• Lack of vigilance was noted in 65% of the claims in which compliance with the SOC was judged inadequate.</td>
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<td>Respiratory</td>
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<td>Insurance company database Review by team of trained CRNA investigators and record reviewers</td>
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