Anesthesiology is the safest of all medical disciplines, with a ‘failure’ rate of fewer than 1 in 10,000 cases. Our specialty has a history of interest in patient outcomes that dates back more than a century, and includes such landmarks as Rovenstine’s promulgation of collected anesthesia case records in the 1930s; Beecher and Todd’s examination of perioperative mortality in the 1950s; and creation of the Anesthesia Patient Safety Foundation, the Foundation for Anesthesia Education and Research and the Anesthesia Closed Claims Project in the 1980s. In 2000 the Institute of Medicine published To Err is Human, calling attention to preventable errors in healthcare and calling for a focused effort to improve. Anesthesiology was singled out as the medical discipline which had done the most to improve patient safety. In 2009 the American Society of Anesthesiologists took another step forward by founding the Anesthesia Quality Institute (AQI). The AQI’s mission is to improve patient outcomes through development of a national anesthesia registry.

The AQI was created in part because information technology has advanced fast enough to make a national case registry feasible, and in part because of a tidal wave of regulations bearing down on anesthesiologists and their practices. With increasing government subsidy of the US healthcare system – approaching 50% of all payments to hospitals and physicians – has come increased government interest in assuring good value for the money spent. This trend leads to the concept of ‘Pay for Performance,’ under which reimbursements will be tied to the healthcare outcomes achieved, rather than to traditional fee for service. Beyond that is a healthcare landscape dominated by Accountable Care Organizations (ACOs) and Medical Homes. While many details are hotly debated, the overall trend of healthcare financing towards bundled payments for specific outcomes (such as annual management of diabetes or diagnosis-to-recovery of cholecystitis) cannot be disputed. Anesthesiologists of the future will be required to document not just what they do (procedures) but also how effective it was (outcomes) if they wish to be paid. While this cultural shift is beneficial to us as taxpayers and patients, it will impose new and challenging regulatory hurdles on practicing physicians.

Every anesthesia practice or department needs a Quality Management (QM) program. While names and structure vary, the purpose of QM is for the group to understand its own practice and outcomes, to have a mechanism for managing adverse events, and to meet regulatory requirements imposed by the government or the facilities they work in. A detailed explanation of recommended practice QM activities can be found in the Manual for Anesthesia Department Organization and Management (MADOM), a comprehensive document produced by ASA for its members and available on the Society website. A more concise and concrete QM plan can be found on the AQI website at http://aqihq.org/qm-in-your-practice.pdf. The 8 recommended steps of this plan are summarized in Table 1.

Table 1 – The 8 recommended steps for quality management in an anesthesia practice.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Designate a physician to lead</td>
</tr>
<tr>
<td>2</td>
<td>Establish a list of indicators</td>
</tr>
<tr>
<td>3</td>
<td>Gather and record data</td>
</tr>
<tr>
<td>4</td>
<td>Report to the group and to local stakeholders</td>
</tr>
<tr>
<td>5</td>
<td>Review unusual events</td>
</tr>
<tr>
<td>6</td>
<td>Make improvements</td>
</tr>
<tr>
<td>7</td>
<td>Re-measure, and automate the process</td>
</tr>
<tr>
<td>8</td>
<td>Participate in a national registry</td>
</tr>
</tbody>
</table>

WHAT TO MEASURE

Any number of performance measures can be created to describe the practice of anesthesiology, but each will require investment of resources to define, create, validate, analyze, and report. In real life, what we measure is determined by the following factors:

- What is incentivized
- What is locally important
- What is possible to collect

As irrelevant as they may be to an anesthesia-related patient outcome, the most commonly collected performance measures in our specialty are the three approved process measures of the Physician Quality Performance System (Table 2). This is a program of the Center for Medicare and Medicaid Services (CMS) that offers a financial incentive to physicians who can
document compliance with CMS approved measures. While any physician can theoretically submit data on any of the 300+ PQRS measures, in practice only these three apply to routine operative anesthesia. Although the financial rewards are small (an additional 1% reimbursement on Medicare cases in 2012), anesthesiologists have pressed their billing companies to facilitate this documentation because in 2015 the incentives will turn into penalties for non-compliance. Of the 4,000,000 cases in the National Anesthesia Clinical Outcomes Registry as of April, 2012, more than 75% included PQRS data.

PQRS measures for anesthesiologists are process surrogates known to be associated with the patient’s risk of developing a surgical wound infection. While those measures are based on actual outcomes, that reflect the core quality of anesthesia practice, and that apply to a majority of the patients we care for.

About 40% of all anesthesia practices collect “homegrown” performance measures that help them recognize improvements in care at the local level. The advantage of these measures is that they are developed out of local logistics (what data is easy to collect or report), local conditions (the kinds of surgical procedures done) and the local patient population. These private measures are very useful for assessing the performance of the group that develops them, especially when followed as trends over time. The disadvantage of these measures is that they are difficult to compare to other institutions.

One of the goals of the AQI is to increase consistency in quality measure definitions over time, in order to facilitate national aggregation. Table 3 shows an AQI-suggested template for local outcome capture, for completion at whatever time the practice has its last contact with the patient. Ideally this would be a bedside visit or phone call 24 hours after surgery, but more commonly today is at the time of PACU discharge. Definitions for the various complications listed are in a data dictionary on the AQI website, and are adapted from the efforts of the ASA Committee on Performance and Outcome Measures. This template for assessment has been adopted by a number of practices for clinical use, and by vendors of Anesthesia Information Management Systems (AIMS) and freestanding quality capture software.

**Table 3 – AQI recommended postoperative outcome capture.**

<table>
<thead>
<tr>
<th>CASE INFO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date__________ MR#__________ ASA Class__________</td>
<td></td>
</tr>
<tr>
<td>Anesthesia Type__________ Provider ID__________</td>
<td></td>
</tr>
<tr>
<td>CRNA ID__________ Additional Provider__________</td>
<td></td>
</tr>
</tbody>
</table>

**NO UNTOWARD EVENT**

- [ ] Significant Delay  
- [ ] Unanticipated Hospital Admission
- [ ] Death
- [ ] Cardiac Arrest
- [ ] Perioperative MI
- [ ] Anaphylaxis
- [ ] Malignant Hyperthermia
- [ ] Transfusion Reaction
- [ ] New Stroke
- [ ] Visual Loss
- [ ] PONV

- [ ] Extended PACU  
- [ ] Unanticipated ICU Admission
- [ ] Incorrect Surgical Site Complication
- [ ] Intraoperative Awareness
- [ ] Unrecognized Difficult Airway
- [ ] Unplanned Reintubation
- [ ] Dental Trauma
- [ ] Perioperative Aspiration
- [ ] Medication Error
- [ ] Hypothermia in PACU

- [ ] Case Cancelled  
- [ ] Equipment Problem
- [ ] Vascular Access
- [ ] Infection After
- [ ] Epidural Hematoma
- [ ] High Spinal
- [ ] Postdural Puncture Headache
- [ ] Local Anesthesia Toxicity
- [ ] Peripheral Neurologic Deficit
- [ ] Pneumothorax
- [ ] PACU Pain Control

- [ ] Inadequate

**HOW TO REPORT**

There is considerable heterogeneity in reporting of quality measures across anesthesia practices. A few groups gather patient outcome data from every case, and use this data to generate regular reports to their practitioners. Many more practices gather outcomes only by exception (i.e. when an adverse event is reported) and provide no regular feedback to the clinicians involved. Yet without analysis and reporting there is little utility to collection of data in the first place, a point which is frequently missed in the ongoing stampede to AIMS and electronic records in general. The present landscape in anesthesia QM reflects an ongoing paradox: we have invested millions in digitizing and aggregating our clinical data, but have not taken the time to analyze what we’re collecting or put it to work to improve our practice. As one frustrated Anesthesia Department Chair recently noted: “We bought a very expensive typewriter.”

Efficient use of data requires careful consideration of the context in which it is collected, and the intended purpose of reporting. At one end of the spectrum is reporting intended to improve individual clinical care, one anesthesiologist at a time. These reports are best kept absolutely confidential. Personal data is shown as a trend over time—typically quarters or years, to include sufficient numbers of cases—and is most useful when compared to practice-wide norms or to the performance of other individuals (shown as data points but not
identified). Because the comparisons are local, less risk adjustment or heavy statistical processing is necessary. As the only recipient of the report, the individual provider already has a good understanding of how and where the data is collected, and how seriously to take the results. Simple feedback in this way can have a powerful effect on outcomes; every physician is motivated to do a good job for every patient, and will naturally gravitate towards improvement if a measuring stick is provided.

Reporting at the practice or facility level is appropriate for less common events, such as the rate of serious adverse outcomes, or for events which are difficult to attribute to individual providers, such as unexpected admission after an outpatient procedure. Risk adjustment is not necessary if the patient and surgical population is remaining relatively constant over time. This kind of reporting is ideal for ongoing surveillance of quality and business efficiency issues (such as on-time first case starts) and lends itself to analysis and presentation in a control chart format that shows when a process is remaining stable and when it is improving or deteriorating.

Public reporting of local QM data for purposes of regulatory compliance and transparent communication with external stakeholders is a scary proposition for most anesthesia quality managers, because of the serious risk of unintended consequences when outcomes are compared between different practices. Apple to apple comparisons require common definitions of all variables, standard methods of data collection, active validation and auditing, and complex risk adjustment models. A detailed discussion of this topic and the issues it creates can be found in a recent publication by Glance et al in Anesthesia and Analgesia.6

Aggregate national reporting of anesthesia outcomes is a core purpose of the AQI. Understanding what we do, and how we do it, will be essential for influencing future regulatory efforts and designing educational products. Collecting, validating and analyzing data from practices across the country will be an endless task, especially with the advance of digital technology and the ever-increasing reach of electronic healthcare records. The AQI is off to a good start, with more than 4,000,000 individual case records in hand as of April 2012, and a steadily accelerating rate of practice participation. With about 7-10% of all anesthetics now appearing in the National Anesthesia Clinical Outcomes Registry, the AQI has the power to paint a representative picture of our specialty. Figure 1 describes our patients. Figure 2 describes our practice locations and the type of work we do. Figure 3 shows our outcomes, in very broad strokes. The annual AQI publication Anesthesia in the US, which includes these figures and many other national descriptors of anesthesiology, is made available at no charge through the AQI website to ASA leaders and participating practices, and for a nominal fee to all others.

**Figure 1.** Patient age and ASA Physical Status

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<table>
<thead>
<tr>
<th>Measure Group</th>
<th>Description (n=814,890 cases)</th>
<th>Events</th>
<th>Incident Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Process Failure: PQRS and SCIP measures</td>
<td>11,201</td>
<td>1.37%</td>
</tr>
<tr>
<td>Major</td>
<td>Serious adverse events: actual patient harm or significant risk</td>
<td>3,539</td>
<td>0.43%</td>
</tr>
<tr>
<td>Minor</td>
<td>Minor adverse event: without long-term impact</td>
<td>85,210</td>
<td>10.46%</td>
</tr>
<tr>
<td>Admin</td>
<td>Administrative failure: e.g. case cancelled, extended PACU stay, unexpected admission</td>
<td>11,420</td>
<td>1.40%</td>
</tr>
<tr>
<td>Mortality</td>
<td>Patient death: (excludes patients presenting for organ harvesting)</td>
<td>293</td>
<td>0.04%</td>
</tr>
</tbody>
</table>

**Figure 2.** Location of anesthesia services and types of anesthesia. ESP = Epidural or spinal; Gen = general; MAC = monitored anesthesia care; Reg = non-neuraxial regional.

**Figure 3** – Aggregate data from the National Anesthesia Clinical Outcome Registry. PQRS = Physician Quality Reporting System. SCIP = Surgical Care Improvement Project.

**WHAT THE FUTURE HOLDS**

While the fate of the Affordable Care Act is uncertain at this time, there is little doubt that some kind of healthcare reform will be necessary to address spiraling costs. Elimination of waste through alignment of incentives will likely dictate increasing ‘bundling’ of care, with payment for outcomes rather than procedures. Anesthesiologists who wish to prosper under this model will be required to take an aggressive role in managing patient flow throughout the perioperative period. ASA has developed plans...
and models for the “Perioperative Surgical Home,” and is partnering with willing anesthesia practices to test and validate this concept. Collection and reporting of outcome measures will be essential to this concept, to assure that patient safety is not sacrificed in pursuit of more cost-effective care.

Intertwined with the national landscape of healthcare reform is an ongoing evolution in anesthesia practice models. Although we train as inpatient providers and think of ourselves as hospital-based, data from NACOR shows that more than 60% of all anesthetics occur in outpatients. New practice models have arisen to account for a surging demand in office-based care and procedural sedation. While the value of anesthesia to facilitate routine diagnostic procedures in healthy patients is debatable, there is little doubt that we will be increasingly called on to support advanced non-surgical procedures in the cath lab, invasive radiology and the GI clinic, and to care for patients with high levels of medical complexity. The median anesthesia practice in NACOR currently provides service at 9 different facilities, and this number is likely to rise. Tracking the evolution of anesthesia practice models in size, scope and coverage patterns will be important to the profession going forward.

Medication shortages are a new, but almost universal, issue in clinical anesthesia. There are myriad causes for drug shortages but few easy solutions, so this may remain an aspect of anesthesia care for some time to come. There will be a need for data on the demographics of medication supply and even more so for outcome information that reflects the consequences. These will range from the trivial (prolonged PACU stay based on unavailability of muscle relaxants) to the potentially lethal (unavailability of pressors for resuscitation). This data will be applied to advocacy efforts with pharmaceutical companies and the government, and to development of educational material ranging from practice guidelines to residency curriculum to simulation exercises that help anesthesiologists maintain patient safety.

CONCLUSION

These are dynamic times in healthcare in general and anesthesiology in particular. The purpose of a good QM program is to provide the data needed to improve patient care and drive business efficiency. This is an investment that every practice and department must make, if we are to maintain our status as the leaders in patient safety.

REFERENCES