CASE STUDY: An AIMS Success Story

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The Mount Sinai Medical Center began using an anesthesia information management system (AIMS) (CompuRecord®, Philips Medical Systems, Andover, Massachusetts) for electronic intraoperative anesthesia recordkeeping in 1991 in cardiothoracic and liver transplant O.R.s. The AIMS was extended to all O.R.s by 1998 and to the labor and delivery (L&D) suite in 2006. Currently, approximately 40,000 anesthetic records are created annually, and it is presently used in approximately 50 O.R.s, 16 L&D rooms and 10 non-O.R. procedural areas. Use of an AIMS for intraoperative recordkeeping has been associated with numerous benefits when compared to handwritten paper records, including improved capture of physiologic data, increased legibility, less time requirement and stronger legal defensibility.[1]

In addition to intraoperative record-keeping, our AIMS includes a generic form-management module that is flexible and can be adapted to many uses. Forms that have been developed include postoperative evaluations, pain management notes for both consultations and procedures, and critical care progress and procedure notes.

The proprietary AIMS software is the core system upon which we have created custom applications using departmental and medical center information technology resources. These custom applications fall under the general categories of performance improvement, departmental administration (billing and physician compensation), patient tracking, perioperative administration, regulatory/compliance reporting, and research. Thus, the term "AIMS" refers to a multitude of linked information systems that support the needs of the department and the institution.

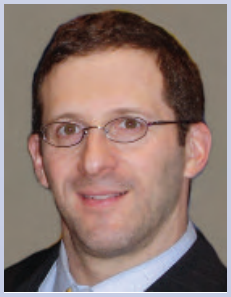
Performance Improvement Applications

Our AIMS is used to promote compliance with clinical guidelines. For example, the Surgical Care Improvement Project (SCIP) calls for administration of most prophylactic antibiotics within one hour before the start of the surgical procedure. To improve compliance with antibiotic guidelines, our AIMS was modified to include an antibiotic reminder icon on the AIMS workstation screen. The addition of the reminder was associated with a 47-percent decrease in tardy administration of prophylactic antibiotics.[2] In addition to the contemporaneous reminder, data from our AIMS are extracted and analyzed to generate daily reminders for the Physician Quality Reporting Initiative reports and periodic "report cards" that are sent to practitioners, thereby encouraging the staff to improve its performance.

Post-anesthesia evaluation forms allow documentation of postoperative findings and complications. Significant postoperative complications (e.g., neurologic injury, death) recorded in the AIMS trigger investigations by the performance improvement committee. When appropriate, this process may result in educational efforts or policy changes to prevent recurrence.

Point-of-Care Charge Capture

Although the health insurance industry has moved to electronic claims submission for back-office processing, only a minority of health care providers utilize electronic charge capture. This situation persists even though manual billing processes contain inherent sources of errors and omissions that may result in suboptimal reimbursement for providers or increased costs. To optimize our collections,



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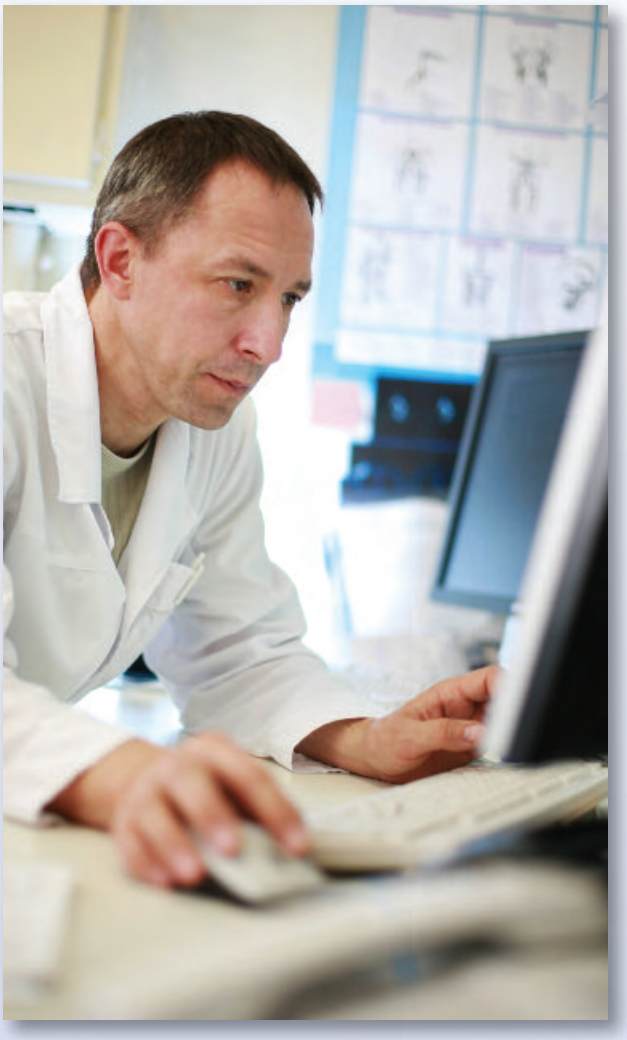

we use our AIMS as a point-of-care charge capture system to assemble all of the data necessary for the generation of electronic billing vouchers.[3] Each billing worksheet is cross-checked against applicable business rules to ensure that all necessary information for a compliant bill is present. Any deficiencies (e.g., missing electronic signature, Current Procedural Terminology™ code or teaching rule attestation) are flagged, and the responsible practitioner is alerted. As the billing vouchers are completed, the pre-screened bills are transmitted to the billing vendor for review and submission to payers. As a result of implementation of the point-of-care charge capture, the average charge lag decreased by 7.3 days following full implementation. There have been additional ongoing savings related to reduction of personnel and expenses related to paper charge voucher handling as well as a likely reduction in missed/lost charges.

Compensation

Implementation of our AIMS for all clinical activities provided the necessary platform to add a productivity-based component to the faculty compensation system. We replaced a nearly fixed salary academic physician compensation model with a mission-based productivity model with the goal of improving attending anesthesiologist productivity. The supplemental pay structure was linked to AIMS records and a scheduling database to award points for clinical activity. The system accounts for participation of multiple attendings (e.g., relief by the on-call attending) and for faculty who are simultaneously directing medical care in multiple locations. This structure provides financial incentives for clinical productivity as well as completion of procedure, time and modifier unit (i.e., ASA Relative Value Guide) documentation in our AIMS. To assist in monitoring personal productivity and billing compliance, a listing of all cases performed in the previous week is sent via electronic mail to each faculty member. This encourages faculty to scan for cases that may be missing or incomplete and to identify and correct errors. This productivity-based compensation model has increased practitioner productivity and salaries with fewer clinical faculty relative to the number of daily anesthetizing locations (unpublished data). Incentives are provided separately for educational and academic output.

Operating Room Management Applications

We leveraged the information available in several hospital systems, including our AIMS, to create a custom perioperative patient tracking system. Patient locations are updated and time-stamped as they move through various perioperative areas. Arrival in the O.R. is automatically documented as is the progress of the case based on predefined events (e.g., tracheal intubation, procedure start, tracheal extubation). During the patient's post-anesthesia care unit (PACU) stay, nurses document clinical progress and reasons for transfer delay (if any) after the patient is medically ready for discharge. The bed-management staff enter inpatient room assignments and the status (e.g., awaiting cleaning) into the system for each same-day-admission patient. Administrative documentation of many other parameters, including personnel identity, patient readiness, expected recovery times, reasons for delayed discharges and postoperative inpatient bed assignments can by created.

Tracking data are made available to staff with real-time reporting via a variety of modalities. Some of the information is displayed on large-screen monitors with color-coded patient status that is suited to each display location. For example, names of patients awaiting transport to holding areas are highlighted on the screen in the waiting area so that transporters can quickly tend to the patient. In the PACU, patients who are medically ready for discharge but remain in

the PACU beyond that time are highlighted so that nurse managers can address the delays and minimize backups. On the O.R. coordinators' "big board," rooms that have been empty for prolonged periods of time and "to-follow" patients who have not yet arrived are flagged. Tracking information is also available to authorized users at all hospital workstations through a patient-tracking report that can be used to locate patients based on patient name, surgeon name, O.R., procedure, scheduled time, etc. A HIPAA-compliant tracking display of selected data is also provided in the family waiting area so that relatives and friends can see when surgery begins and ends. Tracking information can also be sent directly to clinicians via their text pagers or personal digital assistants, providing timely notification of events that can reduce delays. For example, both the surgical and anesthesia care teams can be notified as soon as a patient arrives in the holding area, thereby reducing turnover delay.

Compliance Reporting

The Accreditation Council for Graduate Medical Education (ACGME) seeks to ensure that each trainee gains sufficient clinical experience during his/her training. Since most of the information needed for a case log is already stored in the AIMS, this reporting function has been automated to provide real-time tracking, thereby allowing more frequent review by the residency program director to assess and adjust trainee scheduling toward increasing exposure in areas that may be lacking. It also ensures the availability of necessary data for ACGME audits and frees the trainees of the burden of additional documentation.

Another ACGME goal is to provide for fair and uniform evaluation of trainees to ensure competency of graduates, provide timely feedback to trainees regarding their performance and to help training programs improve their training methods. To accomplish this, we created a custom Web-based trainee evaluation report that incorporates the six ACGME-designated core competencies.[4] Similarly, trainees have a mechanism by which to provide feedback to program directors regarding perceived strengths and weaknesses of the training program and its faculty.

Compliance with controlled substance regulations is enhanced by our custom application that extracts case records of controlled substance administration for pharmacy for reconciliation purposes. Similarly, antibiotic administration records are extracted and transmitted to our center's compliance group to merge with other SCIP-related data for monitoring and reporting.

Research

The vast amount of clinical information stored in our AIMS provides a valuable resource for retrospective research efforts since large amounts of data can be mined to answer clinical questions and to test hypotheses. The AIMS data structure can also be modified to include additional variables of interest that will facilitate future retrospective and prospective studies. Since the standards for controlled anesthesia terminologies have only begun to be incorporated by the AIMS vendors, there is very limited exchange of clinical data among AIMS in different institutions, though it can still be accomplished with manual mapping of variables between each system.[5]

Conclusion

The extensive functionality of our AIMS developed over many years. It began with the deployment of a standard commercial AIMS software package, which was then extensively configured to meet our departmental needs. This significant additional programming has been accomplished and supported mainly by our departmental team. Thus, full exploitation of the potential of an AIMS requires initiative and significant investment of resources. Command and control of extensive perioperative information resources is an intangible but real return on investment.

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