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Using Data for Safety and Quality Improvement

by Holly B. Ende, MD, and Jonathan P. Wanderer, MD, MPhil

The delivery of safe and effective anesthesia care is grounded in the science of quality improvement, which relies on accurate and timely reporting of patient outcomes. In the era of the electronic health record (EHR) and growing national databases, mountains of data pertaining to patients and their care continue to accumulate, with the potential to guide patient safety initiatives now and into the future. Without extensive training in data science and informatics, anesthesia clinicians on the front lines of patient care may find it daunting to access, interpret, and use data from the EHR and other sources to support patient safety and quality initiatives. To be useful in improving patient care, data must be organized, structured, and given context and meaning. One way to achieve this transformation of data into information and knowledge is to create data models.¹ Data models can be a useful tool in the structuring, simplification, and operationalization of data in the real world.

Data models are a tool to standardize and add meaning to data, which in turn facilitates shared understanding and easy extraction and usage. Through behind the scenes mapping of key data points and subsequent validation, users can dramatically improve the ease of access to important data.^{2,3} For example, if a quality director wanted to develop automated emails to retrieve EHR data for postoperative outcomes and distribute to clinicians weekly, he or she could use a data model to define and identify those outcomes.

At our institution, the Perioperative Data Warehouse (PDW) is a home-grown data repository which collects and stores data from multiple sources enabling easy access for operational, research, and quality initiatives. Data sources for these types of data warehouses can include electronic medical record (EMR) data, patient-reported data (e.g., patient surveys), and non-EMR data from providers

(e.g., adverse event reporting). Collecting and combining data from these diverse sources into a common repository is a powerful way to invest upfront cost and energy to enable easy, efficient, and straightforward access to data by clinicians of all specialties and technology backgrounds. In the prior example, each outcome of interest (acute kidney injury, postoperative nausea and vomiting, reintubation, etc.) has already been defined, mapped, and validated within the PDW, making operational use of that data (e.g., providing automated weekly emails to clinicians) simple and streamlined.

In addition, quality improvement officers and researchers can easily access these data retrospectively to evaluate effectiveness of practice improvement initiatives. As an example, following implementation of an electronic reminder system to prompt clinicians to check intraoperative glucose in diabetic patients, researchers at our institution were able to easily monitor adherence and ultimately publish data showing not only increased rates of glucose monitoring, but also decreased rates of hyperglycemia and surgical site infections.⁴ In another quality initiative on the labor and delivery unit, investigators demonstrated that a standardized algorithm approach to epidural top-ups for breakthrough labor pain subsequently resulted in a greater number of catheters replaced within 30 minutes of first administered top-up, reflecting more rapid identification of non-functioning catheters.

Data models can be internally developed or purchased from third-party vendors, but they are also available through many commercial EHRs, which use data models to create functionality for end users to access clinical and quality data without intensive or time-consuming training requirements. For example, Oracle Cerner (Austin, TX) and Epic Systems (Verona, WI), which are some commonly used EHRs in national health care systems, employ several

user-friendly interfaces to allow clinicians to access patient data (Table 1).

Finally, those interested in understanding national trends in quality and safety data can turn to large national data sources such as the National Anesthesia Clinical Outcomes Registry (NACOR), the Multicenter Perioperative Outcomes Group (MPOG), or the National Surgical Quality Improvement Program (NSQIP). Each of these data sources has strengths and limitations, and those interested in employing these resources to answer questions related to quality must understand these limits. For example, NACOR, which is supported by the American Society of Anesthesiologists and includes data from millions of cases from thousands of practices throughout the United States, has robust capture of data elements related to billing, but non-uniform capture of outcome data elements. Keeping in mind the limits of accessing and analyzing data from these large national data sources, clinicians can appropriately use them to answer safety-related questions requiring longitudinal data, varying practice types, and large numbers of anesthetics. Such methodology has already been used to assess such questions as the effects of overlapping surgery, risk factors for pediatric intraoperative hypoglycemia, and postoperative pain and opioid use patterns.⁶⁻⁸

To power quality improvement initiatives and further patient safety during anesthetic care, it is imperative to have access to perioperative data and the skillsets to work with those data. While grappling with raw underlying data can be challenging, there are multiple tools available to users within EHRs that facilitate data analysis. Using a data model can make developing reports and retrieving data easier, but does require upfront effort to either develop a local data model or to perform the mapping and validation necessary to use an EHR vendor's data model. Ultimately, these approaches can be utilized synergistically to provide a comprehensive view of perioperative operations and anesthetic outcomes, transforming data into actionable knowledge that anesthesia professionals can use to drive practice improvement.

Holly Ende, MD, is an assistant professor in the department of anesthesiology at Vanderbilt University Medical Center, Nashville, TN

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Table 1. User-friendly interfaces for accessing patient data

PowerInsight Explorer	Cerner Millennium® business intelligence reporting tool that allows creation of real-time operational, clinical, and performance reports
Reporting Workbench	Epic tool that allows users to create custom reports using specific templates with criteria that define populations and data elements of interest (e.g., OR location, principal diagnosis, etc.)
Slicer Dicer	Epic tool that allows exploration of data through customizable searches which support multiple data models, including an anesthetic record data model

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Jonathan Wanderer, MD, MPhil, is a professor in the departments of anesthesiology and biomedical informatics at Vanderbilt University Medical Center, Nashville, TN.

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