What Can Regional Anesthesiology and Acute Pain Medicine Learn from "Big Data"?

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KEYWORDS

● Big data ● Outcomes ● Regional anesthesia ● Mortality ● Anesthesia technique

KEY POINTS

- The concept of value-based health care is now reality for anesthesiology and surgery practices. Physicians practicing regional anesthesiology and acute pain medicine must demonstrate the value they add to patients' perioperative experience.
- Database research can provide good insight into rare outcomes and demonstrate effectiveness of regional anesthesiology and acute pain medicine interventions across different practice settings.
- This type of research may provide an alternative to the resource-intensive randomized clinical trials in certain situations and help generate hypotheses that can be further tested in prospective studies.
- Results of different types of research (prospective or retrospective) should be interpreted in the context of methodological limitations.
- Outcomes associated with regional anesthesiology and acute pain medicine that have been studied using "big data" include but are not limited to mortality and morbidity, resource utilization, surgical site infection, inpatient falls, and local anesthetic systemic toxicity.
- Results of these studies may inform health policy and decision making in terms of payment models and adoption of best practices.

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INTRODUCTION

Value-based health care represents a delivery model in which providers, including hospitals and physicians, are paid based on the quality of care and costs of providing it rather than the volume of interventions. In the perioperative realm, providers are rewarded for helping patients improve their surgical outcomes, reduce postoperative complications, and decrease readmissions after surgery. Capturing outcome data about the results of each intervention has become a priority in this health care environment. In its effort to adapt to this new value-based model of health care delivery, the American Society of Anesthesiologists has promoted the Perioperative Surgical Home model in which physician anesthesiologists function as leaders in the coordination of perioperative care for surgical patients with the goal of improving outcomes.[1,2] Critics argue that anesthesiologists are not ready to take on this expanded role and question whether the financial aspects of this model are sustainable.[3–5] Alternative perioperative care models have been proposed, such as service line models,[6] where anesthesiologists play an integral role within an evidence-based care pathway but are not necessarily the sole leaders. Multiple enhanced recovery after surgery protocols have thrived within the latter model.[7] Irrespective of the care model and its name, it is clear that the unifying challenge continues to be the selection of outcomes and demonstration of improved quality attributable to the anesthesiologist's role and/or his/her choice of anesthetic or analgesic technique. In this context, it has traditionally been challenging to derive conclusive information from clinical studies due to the often rare nature of outcomes in question. The advent and evolution of large database research, however, facilitated by ever-increasing computing power and advances in methodology has allowed for analysis of large data constructs collected by an increasing number of hospitals, thus providing answers to important questions that previously seemed elusive. Therefore, this review addresses anesthesiologist-driven factors related to regional anesthesiology and acute pain medicine with an emphasis on selecting perioperative outcomes using big data and potential future directions that may influence research, clinical practice, and health policy.

PROS AND CONS OF BIG DATA RESEARCH

The major advantage of randomized clinical trials is that randomization and blinding provide reasonable protection against bias and confounding. Strict inclusion and exclusion criteria, however, are built into the structure of these trials, which may keep some patients who may benefit from the intervention from being enrolled. Consequently, patients who frequently represent problem cases in real-world practice are often not included, thus leaving results subject to questions of applicability in these populations. The fact that such studies are usually performed at academic institutions may limit external validity. Additionally, management pathways within the clinical trials are often detailed and enforced by the study protocol. These factors may limit the generalizability of the results to different patient populations or practice settings and even routine clinical practice at the same institution. Large randomized trials are expensive, resource intensive and time intensive, and sometimes marginally powered.

Studies of clinical and administrative databases use epidemiologic and statistical techniques to evaluate the effects of treatments in real-world situations. A major advantage of this approach is that the results come from data collected in routine clinical practice and may thus be more generalizable. Another advantage is that it allows study of rare outcomes/events and their association with perioperative patient-specific or surgery-specific variables. Database research suffers, however, from some inherent biases. Selection bias occurs when treatments are nonrandomly