Seeking Better Outcomes in Coronary Artery Bypass Grafting
Lessons From Past Experience

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Are we delivering the safest and most effective care? How best can we learn from our experience? For healthcare professionals who ask these questions, the article by Guru and colleagues in this issue of *Circulation* is essential reading. These Canadian investigators performed an implicit review and retrospective analysis of 347 randomly selected in-hospital deaths after coronary artery bypass grafting (CABG) surgery and determined that approximately one third might have been prevented by better care. The study offers many important lessons with implications far beyond cardiac surgery.

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Guru and colleagues uncovered many opportunities for important improvements in a hospital system that could have been content with its successes. Their investigation was conducted in a system with no low-volume hospitals and low risk-adjusted mortality rates and involved the participation of experienced staff surgeons and division chiefs. They found remarkably high percentages of preventable deaths, defined as deaths that could have been avoided had optimal care been delivered. Optimal care was considered to be the best possible care that could be delivered if current resources were operating at peak performance in accordance with the best available evidence at the time of the hospital admission.

The investigators found that as many as 107 preventable CABG-related deaths occurred in Ontario in fiscal year 2000 to 2001. These deaths occurred in every institution. In particular, the highest percentages of preventable deaths were not clustered at the institutions with the highest risk-adjusted mortality rates, indicating that even a low mortality rate should not beget complacency. Even in the hospital with the lowest risk-adjusted mortality rate, about 20% of deaths were deemed to be preventable. Guru and colleagues focused specifically on contributing causes of deaths that may have been prevented. In this way, many deaths had more than 1 potential contributing cause. In each case, the reviewers identified a clinical situation in which death may have been averted had better care been delivered. Interestingly, preventable deaths occurred frequently across the spectrum of patient risk and were actually more common among patients with lower preoperative risk.

The Guru study is not without precedent. In a retrospective chart review of 15,000 randomly selected admissions in Colorado and Utah during 1992, Gawande and colleagues sought to identify surgical adverse events and classify them as to whether they were preventable. Among the surgical adverse events, 54% were deemed preventable. For those adverse events associated with CABG surgery, 38% were labeled as preventable, a percentage that is similar to the preventable death rate in the present study. The phenomenon of preventable deaths is not unique to cardiac surgery but is likely present for many high-risk medical and surgical conditions at hospitals throughout the world.

We have a growing proficiency in measuring and highlighting problems in our healthcare system, yet our current measures have limits. The quantitative measures, such as those in the public profiling effort by the Centers for Medicare & Medicaid Services, illuminate more information about hospital performance, but we need increasingly sophisticated approaches to diagnosing the underlying causes of suboptimal performance. Looking at outcomes provides a more comprehensive view of performance than does the narrow assessment of specific processes, but it does not indicate where improvement can occur.

Thus, our movement toward explicit, quantitative measures of quality has improved the reliability of our assessments and revealed opportunities for improvement that were once invisible, but it has fallen short in providing insights about how to improve. Although outcomes measures are intended to stimulate efforts to improve, they are also designed for accountability. The national publicly reported outcomes measures can only give hospitals a sense of where they stand compared with others and how they perform compared with historical standards; guiding actions within institutions requires more nuanced information from the experience of the institution and the experience of others. This insight may only be achieved through implicit review of patient records and thoughtful investigation of the details of patient care. The methods of Guru and colleagues provide an example of how this approach can best be achieved among a consortium of institutions intent on finding out how relatively low bypass mortality rates might be made even lower.
Careful case review of serious adverse events is not new to medicine. The mortality and morbidity conference is a common event at most hospitals, with an emphasis on case learning within a format that varies among institutions. This study takes that approach to the next level through an intensive, structured, implicit assessment of a random sample of patient deaths. The study enlisted surgeons to cooperate across institutions and to develop common definitions and methods in the service of helping each other to improve. This methodology could be employed at every institution that seeks to incorporate quality improvement into its clinical teaching conferences.

Root cause analysis is another tool that is being used with increasing frequency. The safety movement has brought this technique to health care, and it is often directed toward sentinel events, defined as any unanticipated event in a healthcare setting resulting in death or serious physical or psychological injury to a person or persons, not related to the natural course of the patient’s illness. However, looking only at sentinel events can limit what can be learned. Guru and colleagues examined deaths that were representative of all the deaths; they were not identified on the basis of any unique characteristic or because they were anticipated or suspected of being preventable.

In reviewing deaths, it is certainly appropriate to seek direct causes of harm, situations in which a clearly identifiable act, such as a mismatched blood transfusion, causes a catastrophic outcome. Strong efforts are underway to develop strategies to prevent these types of events. High-profile tragic events that clearly and directly cause harm understandably attract considerable attention, but they represent only a small fraction of the causes of preventable deaths. An important feature of the Guru study is the approach to the identification of preventable deaths. They did not require that a preventable death be one that the expert medical record reviewers were certain was preventable, a standard that would have required a clear cause-and-effect relationship that might have been difficult to prove. The investigators reported a death as preventable if the reviewers felt it was more likely than not to have been preventable, meaning that the likelihood was >50%. This threshold is the proper choice for a quality-improvement effort and is similar to that used by Gawande and colleagues. This approach emphasizes sensitivity over specificity, and it should be recognized that the true number of preventable deaths is uncertain.

How can we best view these contributing causes of adverse events? One way would be to recognize that the hospital environment and the manner in which care is provided produce a certain level of performance that is understood, in part, by the results it achieves. Improving outcomes requires the identification of the areas where factors are contributing to a setting in which patients are not always receiving the safest and most effective care.

Within organizations, we can find modifiable risk factors. These risk factors often do not have a direct cause-and-effect relationship with adverse events, but they contribute to a higher risk. No single event may be linked to the factor with certainty, but on average the presence of these risk factors translates into more events than would have occurred otherwise. The elimination of a risk factor should reduce the number of events, even though it will not be possible to determine which events were averted. If we are to achieve optimal performance, we must identify and address these factors.

An analogy can be made to modifiable risk factors for cardiovascular disease. We know that a population with higher cholesterol levels will have more myocardial infarctions even though we cannot attribute any single myocardial infarction to high cholesterol. Myocardial infarctions occur without an elevated cholesterol level, and within the range of elevated levels in the general population, it is not possible to say that cholesterol level caused a heart attack. We can, however, easily concede that it is a contributing factor, and studies have demonstrated that lowering cholesterol levels using certain medications will reduce risk.

The study by Guru and colleagues also emphasizes that risk and safety should be considered as organizational properties. The issues that were identified required organizational action such as better recognition of life-threatening adverse events or improved communication among members of the surgical team. The findings could not be attributed to a single surgeon or group of surgeons with poor skills. Increasingly, healthcare professionals are understanding the close relationship between preventable errors and the settings in which they occur.

The study and approach are not without limitations. Implicit review, a process by which experts examine aspects of care and make judgments about quality, has been criticized for its lack of reliability. In this study, all cases underwent review by at least 2 surgeons. In situations of disagreement, a third independent reviewer was consulted. The approach sought to investigate why each death occurred and whether something could have been addressed to prevent a similar future death. The effort in this context is exploratory and descriptive, with the intent to find ways to elevate the performance of the system. Perhaps most importantly, the effort is about developing a learning system rather than an accountability system.

An additional limitation of the study was the reliance on the medical record. More information about the care of the patients, possibly identifying other factors, may have been obtained through timely interviews with those providing care. Nevertheless, the use of medical records is efficient and provided for the blinded review by outside surgeons. The medical record in some settings has been shown to have reasonable sensitivity and specificity for the detection of gaps in care.

The study focused on in-hospital mortality, but without doubt these findings indicate that additional consequences to organizational gaps in care are likely. If modifiable risk factors are associated with mortality, then it is likely that they also contribute to complications and quality-of-life outcomes that are less than optimal. Thus, the benefit of addressing these institutional risk factors for mortality is likely to be much greater than an improvement in the percentage of patients who survive until hospital discharge.

Performing and publishing this type of study requires courage. Reporting preventable death rates in one’s own...
healthcare system is never easy. It should be recognized that approximately 98% of the bypass patients in Ontario survived their operation and that risks were low for any individual patient undergoing surgery. The publication of these results, however, indicates a system that is strong enough to critically examine its practices and embrace the opportunity to further improve. We need to develop a culture in which this type of examination, which focuses on systems and our experience in delivering care, is part of the expectation of every hospital, clinician, and patient. In every setting in which patients are exposed to risk, there should be a careful, consistent and regular examination of the contributing causes of adverse events and near misses. How else will we attain the goal of creating the high-reliability, high-performance institutions that we prefer for our practices and that our patients deserve?

The work by Guru and colleagues reveals a surprisingly high rate of preventable death at institutions that appear by their crude mortality rates to be doing well. To reach their full potential, however, these high-achieving institutions should be able to do even better. The success of the work reported in this study will be determined by the changes that are made within the participating institutions and the results that are subsequently achieved. Quality measurement initiatives are ultimately intended to improve practice. The challenge is to convert this knowledge into tangible and substantial improvements in care. For those who have not yet started such a systematic, comprehensive, adverse-event assessment via implicit review as a complement to explicit measurement, now is the time.

Disclosures

Dr Krumholz has contracts with the Colorado Foundation for Medical Care to develop outcomes and surveillance measures for public reporting. He chairs the cardiac scientific advisory board for UnitedHealthcare.

References


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