

# Quality Measurement in Healthcare

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## Abstract

Measurement is the basis for assessing potential improvements in healthcare quality. Measures may be classified into four categories: volume, structure, outcome, and process (VSOP). Measures of each type should be used with a full understanding of their cost and benefit. Although volume and structure measures are easily collected, impact on healthcare results is not always clear. Process measures are generally more difficult and expensive to collect, and the relationship between process and outcomes is only recently being explored. Knowledge of measure types and relationships among them, as well as emerging evidence on the role of patient satisfaction, must be used to guide improvements and ultimately for demonstrating value in healthcare.

**VSOP:** volume, structure, outcome, and process

**QPS:** quality and patient safety

**CMS:** Center for Medicare and Medicaid Services

## INTRODUCTION

The concept of quality measurement in health-care is traceable to Florence Nightingale. During her service in the Crimean War, she pioneered the use of statistical analysis, as well as graphical representations of quality data (1). Codman, in the early twentieth century, reported on the relationship between volume and outcomes (2). The modern era of quality measurement began in the 1960s, when Avedis Donabedian proposed that quality metrics fall into three categories: structure, outcomes, and process (3). Combining the Donabedian classification schema with “volume” results in the acronym VSOP for the types of quality and patient safety (QPS) indicators utilized in healthcare today. (The terms metric, measure, and indicator are used interchangeably herein.) Traditionally, metrics have been used to evaluate care in acute-care hospitals and long-term care facilities, but indicators are increasingly focused on providers and innovative models of healthcare delivery (4).

QPS metrics have multiple purposes with varying priorities that depend on which healthcare stakeholder is involved. Clearly, a major institutional use of QPS metrics is to improve the quality and safety of healthcare that we provide. This is often driven internally by the management and demanded by the governance of healthcare organizations. Some experts feel that public reporting is also an important driver of improvement, although this has not been a universal finding. During the first four years of New York State’s cardiac reporting program, cardiac surgery mortality fell >40% (5). This reduction was sustained over many years. In contrast, Fung et al. conducted a systematic review of the literature and concluded that “studies of the effect of public reporting on outcomes provide mixed signals, and the usefulness of public reporting in improving patient safety and patient-centeredness remains unknown” (6).

Others feel that the primary purpose of public reporting of quality metrics is to assist patients as they make choices regarding providers and healthcare organizations. Con-

cerns about the complexity of healthcare data have been raised, and despite the increasing availability of publicly reported data, consumer use has been mixed (7, 8). Programs have also been developed that utilize QPS data in order to rank hospitals and healthcare organizations, either globally or by specific clinic program (e.g., *U.S. News & Report* “Best Hospitals”). Indeed, the federal government’s “Physician Compare” and “Hospital Compare” websites (9) aim for this goal. Individual hospitals and healthcare systems are also increasingly publishing quality metrics in the name of “transparency” (but also perhaps for purposes of marketing).

A third use of QPS data is as a component of reimbursement methodologies. Since the mid-2000s, quality metrics have been tied to pay-for-performance programs (10). Initially, these programs were structured around “pay-for-participation,” with hospitals receiving a small increment in reimbursement in return for submitting quality metrics. The impact of these programs has been neither predictable nor consistent (11). Hospital-based “pay-for-performance” programs are evolving into a model of reduced reimbursement for poor performance (12). The Center for Medicare and Medicaid Services (CMS) has recently implemented the Value-Based Purchasing program, which withholds a small portion of each hospital’s annual Medicare payment and allows hospitals to recoup the withheld funds based on their performance on quality process and outcome measures as well as patient experience indicators. It is expected that the percentage of reimbursement withheld from hospitals will gradually increase over the next several years (although at the time of this writing the exact formulae have not been determined), in effect punishing hospitals that do not score well. Additionally, more indicators, particularly measures of health outcomes, will be added to the roster of indicators designed to impact reimbursement.

A fourth use of quality metrics is increasingly important in the era of healthcare reform. The ratio of quality to cost is being used to define efficiency in healthcare. The goal of reducing

cost while maintaining (or improving) quality is the key to clinical resource optimization.

## INDICATORS

Measures may be classified into four categories: volume, structure, outcome, and process (VSOP). Measures of each type should be used with a full understanding of their cost and benefit.

### Volume

Volume has become a frequently utilized indicator of healthcare quality. In the early years of the twentieth century, Ernest Codman observed that a surgeon's amount of experience, i.e., case volume, directly correlated with patient outcomes (2). "A hospital. . .organized to obtain the best results could not possibly allot such cases to its less experienced surgeons." The notion that higher volume correlates positively with better outcomes is intuitively attractive, but data to support this notion are mixed (13).

Most studies on the volume–quality connection have focused on procedural volume; a direct correlation between volume and outcome has been demonstrated, for example, with bariatric surgery (14) and lung resection (15). Little has been published on the impact of volume on nonprocedural care. Many factors affect the assessment of volume's effect on procedural outcome. For example, is volume cumulative or is the interval between cases more important? Consider a surgeon who has performed a particular procedure in 400 cases. Does it matter whether the surgeon performed the procedure 20 times per year for 20 years or 200 times over two years? Are the outcomes the same? What is the unit of time being assessed? Traditionally, volume is expressed as "procedures per year." Does daily/weekly volume influence the results? A proceduralist who operates one day every other week at a particular hospital will likely have different daily volumes than a surgeon who operates at the same hospital three days a week. Does the volume–outcome relationship apply only

to the operator, to the entire team, or to the entire facility? Billingsley et al. reported on post-procedural interventions in patients undergoing cancer surgery (16) and found a significant inverse correlation between complications and both surgeon and hospital volumes. They attributed the hospital effect to the broader range of clinical services available at high-volume facilities. When informally queried, clinicians and clinical leaders vary considerably in their opinion as to whether operator volume or team volume, i.e., institutional volume, is more important (17). A key observation in Billingsley's study is that although high-volume surgeons had a lower surgical mortality, very-high-volume surgeons were not significantly better than low-volume surgeons. This finding raises the question of whether there is a volume level that is excessive (17).

As Epstein states, "the imperfect correlation between volume and risk-adjusted mortality reminds us that volume is not an indicator of quality of care. . .it is easy to calculate and is often associated with quality" (18). Volume metrics have been widely used in healthcare research and in quality assessment because of the relative ease of data collection. Volume data are readily available in administrative data sets, which are based on the medical information abstracted from each patient record for the purposes of billing and reimbursement. The easy availability of these data saves the time and money required to obtain more precise patient information.

### Structure

Structural metrics comprise the second type of quality measure. Structural measures are generally binary, assessed by a yes/no answer. Structural metrics can be applied to individual practitioners and to particular clinical programs, institutions, or healthcare organizations.

Most structural metrics fall into two broad categories: those that indicate a certification, award, or accreditation by an external group and those that pertain to aspects of the facility, equipment, or technology. Examples of the

former include healthcare licensure, physician board certification, and program certification such as bariatric surgery or trauma designation. Indeed, The Joint Commission (TJC), which accredits hospitals and healthcare organizations in the United States, also now provides program-specific certification in stroke, cardiac surgery, and a dozen other areas. (TJC certification is based on process and outcome measures as well as other structural metrics, but whether or not a facility is “TJC accredited” is a structural measure.) Examples of structural metrics based on facility, equipment, or technology factors include whether or not the facility has its own cardiac catheterization laboratories, advanced imaging equipment, or electronic health records.

Structural metrics are appealing because they are generally easy to collect by simple survey or inventory; assessment does not require sophisticated data-collection and analytic methodologies.

## Outcome

Outcomes are the ultimate measure of healthcare. However, outcome data are often challenging to collect and interpret. Traditionally, outcome data have focused on mortality and complications. Recently, the spectrum of outcome metrics has been expanded to include indicators such as readmissions, functional status, and quality of life. Several issues complicate the interpretation of outcome metrics.

First, patient populations across facilities or geographic regions are dissimilar, rendering comparisons difficult. Statistical approaches have been employed to normalize populations to allow more valid comparisons. These methods are known broadly as severity adjustment or risk adjustment. All such adjustment methods are limited by our inability to collect enough data to encompass all of the factors that might possibly affect patient outcomes. At present, there is no “gold standard” for the type and level of risk adjustment that should be applied to patient data. In addition, many of the adjustment methods are proprietary;

therefore comparative analysis of data from multiple sources is not possible.

A second issue with outcome data is the need to ensure that rigorous scientific data principles are applied. In a manner similar to that employed in careful clinical and bench research, detailed “data definitions” must be developed. Best practices for data definition include detailed specifications for every metric, with inclusion and exclusion criteria, sources of compliance, time periods, and sampling methodologies. Appropriate statistical tests should be used to ensure the data are representative of the population and are reliable and valid. However, even when these standards are met, inconsistent data definitions across organizations undermine the ability to perform benchmarking and comparisons across facilities.

As noted, outcome data are most commonly obtained from administrative data sets, which were developed for billing and regulatory purposes. These data sets are created by coders who abstract clinical information from each patient’s medical record and convert it to numerical code. As the documentation in each medical record is abstracted, a single primary or principal diagnosis is coded along with multiple secondary diagnoses. This process is extremely proscriptive, requiring the coders to adhere to strict rules. When clinical records are handwritten, variations in legibility also undermine reliability of these data. Although legibility issues alone may not alter the coding designation of the major outcome, such as whether a patient expired, it would likely affect the process of risk adjustment, thus skewing the results significantly. Some of this variation will diminish with the use of electronic medical records, in which it is possible to structure documentation to align documentation for clinical purposes with the data fields required for the analysis of quality.

Physician documentation is key. The physician’s notes are often the only accepted source of information, excluding the notations of other clinicians such as nurses and therapists.

In recent years, payers, particularly Medicare, have implemented coding policies in order to determine whether a particular diagnosis

is a comorbid condition that existed prior to hospitalization (and may add to the complexity and cost of care) or whether the diagnosis is instead a complication that occurred in the hospital (and perhaps reflects a failure in care). Thus, coders now comb through clinical documentation to determine whether the condition was “present on admission” (POA) as a comorbidity or not-POA, i.e., acquired in the hospital as a complication. The process of abstracting whether a condition was POA or not is unreliable because those who code medical records must rely on physician documentation that is ambiguous or incomplete. Further, if the medical staff in a given facility is less diligent about documenting the POA status of a diagnosis, that facility may appear to have more complications than its peers do.

Another factor that may influence the measurement of outcomes is the duration of monitoring. For example, some definitions of mortality include only death during the inpatient stay. This is pragmatic; it is difficult to track patients over longer periods of time. Direct follow-up with individual patients would be expensive. Over time, patients may be seen for healthcare at many sites, including several different hospitals. Tracking these patients across facilities via administrative data sets is difficult because there is no readily available universal patient identifier. Also, even when patients can be tracked, geographic variations and the interaction among variables can be confounding. For example, inpatient length of stay (LOS) varies from region to region across the United States. As a result, there may be apparent differences in inpatient mortality that are spurious: if the LOS is six days in one region and four in another, the mortality rate will appear lower in the latter region, where patients who expire on days 5 and 6 are not counted. CMS has adopted a 30-day mortality definition (Hospital Compare) that should minimize this regional variability at least for Medicare patients (9).

Readmissions have become an important outcome measure. Since 2009, CMS has been publishing readmission data for participating acute-care hospitals. Like mortality measures,

patient readmission rates would seem to be an easy metric to record and analyze. However, on further scrutiny, readmissions are quite complicated. First, one must define whether a readmission rate is limited to a particular clinical condition. Will the measure include only readmissions for that same condition, or will it include all readmissions regardless of cause? If so, which billing codes or diagnoses are included? A determination must be made as to whether to count only readmissions to the same hospital or to any hospital. As noted, nongovernmental entities do not have easy access to universal patient identifiers, so it is not possible to track a particular patient across multiple facilities (unless the hospitals are in a single healthcare system or have data-sharing agreements). If readmission to any hospital is counted, institutions in densely populated areas with multiple hospitals would be affected by the admitting practices at Emergency Departments in other facilities. In contrast, hospitals in rural areas could be disproportionately affected if there are few nonacute options in their geographic area and sick patients need to be readmitted for any type of ongoing care. Although these issues have not been resolved, the current CMS tabulation of readmission for Medicare patients includes readmissions to all facilities, not just to the index hospital (9).

Another important consideration is whether the readmission is related to the “index admission,” or first admission in the chain. It is reasonable to consider that hospitals should be accountable for readmissions within a short time for the same condition. However, most readmission sets do not restrict the calculations to related readmissions and include readmissions for any reason at all. This is because it is extremely difficult to determine the relationship between the index admission and the reason for the subsequent hospitalization when readmissions are calculated from administrative data (based on coding for billing purposes), which do not fully reflect the clinical status of the patient or other factors (e.g., psychosocial issues) that may lead to readmission. Regardless of the exact reason, the discharging institution

has a growing responsibility to provide post-discharge follow-up, which may decrease the likelihood that the patient will need to return to the hospital for follow-up care. Some “readmissions” are, however, truly unrelated to the primary admission. Is it fair, for example, to count the “readmission” of a patient with congestive heart failure who is subsequently readmitted after an unrelated auto accident?

Another consideration when defining readmission is whether it was planned or unplanned. In certain situations, such as sequential admissions for cancer chemotherapy, it is relatively easy to determine that the repeated admissions are part of a planned course of therapy. In other clinical situations, this is more difficult.

Readmissions have been the focus of increased attention in the healthcare community, particularly since 2009 when Jencks et al. published their seminal work in this area (19). However, the data issues outlined above are representative of those that must be confronted in defining any outcome variable, not just readmission.

Outcomes measures will evolve over time. As we enter the era of healthcare reform, there will be a need to harmonize healthcare metrics across the spectrum. Outcome measures must be reliable, valid, and consistently understood by all users. They must also ultimately reflect the continuum of care, rather than the individual episodes of care, if we are to link outcomes with the total cost of healthcare.

## Process

Unlike outcome measures, process measures do not directly assess the patient’s clinical condition. Processes are defined using specific, evidence-based elements of an encounter or episode of patient care. In the early 2000s, CMS defined process measures for acute myocardial infarction, congestive heart failure, and pneumonia, and these become part of the CMS Hospital Compare database. The CMS process measures are collected directly from the clinical record, based on specific criteria (9).

Process measures are a major component of internal improvement efforts for healthcare

organizations and medical practices. As the number and scope of process measures have increased, the resource burden has increased commensurately. The majority of publicly reported process measures must be manually abstracted. As electronic health records mature, the expectation is that many process measures can be electronically aggregated. However, in order to truly minimize time and expense, data collection should be embedded in the process of care.

The value of process measures to consumers is not clear, particularly as the link to patient outcome is often tenuous, as we will see below. Moreover, as all providers improve, differences between healthcare organizations will diminish, reducing the value of these measures to distinguish high-performing providers.

## PROCESS VERSUS OUTCOME

It is reasonable to expect that patient outcomes will improve as providers become better on measures of process. For example, changes in patient-care processes have brought about reductions in rates of hospital-acquired infections. Pronovost et al. (20) demonstrate reductions of up to 66% in central-line infections through avoidance of femoral insertions, insistence on proper hand washing, proper skin cleaning of the site, barrier precautions during insertion, and subsequent removal of unnecessary lines. The improvements were maintained for the 18-month period of study.

Recent efforts to demonstrate a relationship between process and outcomes at the national level have used the process-of-care measures that were developed by the Hospital Quality Alliance and are publicly available on the CMS Hospital Compare website (<http://www.hospitalcompare.hhs.gov>). Launched in 2005, the Hospital Compare effort was designed to present hospital-specific data on a standardized set of 17 process-of-care metrics for Medicare patients receiving inpatient care for congestive heart failure, heart attack, and pneumonia. The Hospital Compare data were designed to be presented in a way that



consumers could easily understand (21). The goal of this effort is to “spur positive changes in healthcare delivery” (22). Data on the relationship between these process-of-care measures and patient outcomes are only recently becoming available.

Werner & Bradlow (23) evaluated the relationship between process measures for three conditions—congestive heart failure, acute myocardial infarction, and pneumonia—and mortality for these conditions. A total of 3,657 acute-care hospitals were included in this study. The results demonstrated a modest correlation between process measures and mortality, but the mortality differences were small. “Based on these results, the ability of performance measures to detect clinically meaningful differences in quality across hospitals is questionable” (23).

Jha et al. (24) reviewed the data on congestive heart failure, heart attack, and pneumonia for Medicare patients by comparing the performance of hospitals in the top quartile and bottom quartile on process-of-care measures. Their review found that better performance on process measures was associated with slightly lower mortality rates, particularly for heart attack: mortality rate for hospitals in the top quartile on the process measures was lower by 1%. Findings also indicated that this relationship persisted after controlling for hospital characteristics such as size and location as well as teaching status.

Werner & Bradlow (25) also established a relationship between process and outcome using ten process-of-care measures for heart attack, pneumonia, and heart failure. They found that hospitals performing in the top quartile had lower mortality rates, readmission rates and length-of-stay than hospitals in the bottom quartile.

Ryan et al. (26) examined more than 12 million Medicare claims for inpatient treatment of congestive heart failure, heart attack, and pneumonia from 2000 to 2008. In addition to linking process measures to mortality, this analysis also included the effect of mortality trends. These trends have been generally improving

over time as people generally live longer than in the past. When the incremental effect of the process was examined against the generally improving mortality trends, Ryan et al. found that the implementation and public reporting of process measures had minimal if any impact on the mortality trends for these conditions.

All four studies cited above apply only to Medicare inpatients with diagnoses of congestive heart failure, heart attack, or pneumonia, and all four share the limitation of dependence on administrative data. As discussed, these data consist of the billing codes that are abstracted locally from documentation in each patient medical record. Generalizability to other populations and diagnostic categories is thus impossible.

With this limited evidence, it is not clear that the process–outcome connection is sufficiently demonstrated to impact the national debate around healthcare.

The CMS Hospital Compare data set (9) has now been expanded to include measures for inpatient surgical care as well as outpatient care measures. Data now include readmission rates and patient safety indicators derived from billing data, as well as measures of patient satisfaction, which are obtained via direct patient surveys. Hospital Compare also now reports Medicare spending per beneficiary, which includes costs for the three days prior to an admission and the 30 days after discharge (9). With the proliferation of data elements, the opportunities for more and deeper dives into the relationship among VSOP metrics will multiply as well.

Sometimes simply publishing outcome results may be sufficient to influence changes in care. One of the first initiatives in the move toward “transparency” of outcome data was the New York State Cardiac Reporting System, which was able to show a 41% reduction in risk-adjusted operative mortality associated with coronary artery bypass graft procedures over the first years of the program (27). It has also been suggested that participation in “pay-for-performance” programs has improved performance on these measures to a greater

degree than public reporting without economic incentives (28).

At the same time, there is an emerging call for quality to be measured in terms of reliability, which is defined as consistent performance at high levels of safety over long periods of time. Reliability is defined to include mindfulness of failures in processes and protocols, robust process improvement efforts, and an overarching culture of safety (29). We will need all of these elements to improve our measurable outcomes in healthcare.

## PATIENT SAFETY DATA

The 1999 Institute of Medicine (IOM) report *To Err is Human* initiated the modern era of patient safety (30). The report suggested that medical errors were responsible for ~98,000 deaths annually. Errors were defined as events in which the process failed to achieve the intended outcome or in which the wrong process of care was initially selected. An adverse event was defined as an injury unrelated to the patient's medical condition. Since the IOM report, a number of studies have published data on adverse event rates. For example, Thomas et al. reviewed 15,000 discharges from hospitals in Colorado and Utah, reporting an overall adverse event rate of 2.9% (31). Baker et al. reported an adverse event rate of 7.5% in a sample of 20 Canadian hospitals (32).

Data on medical errors and "near misses" have to be interpreted carefully. Many states require adverse event and medical error reporting systems, and many hospitals have implemented such systems voluntarily. Because there is no single reporting system, it is difficult to determine true error rates. Moreover, changes in rates may be due to an actual change in the incidence of error or simply a change in reporting rates. In addition, once event data are collected, classification systems vary from institution to institution, rendering benchmarking difficult.

The problem of medical error reporting is further complicated by the fact that much of the clinical care in the United States is pro-

vided in outpatient settings. There are limited options for practitioners to share adverse event and medical error data in the outpatient arena, particularly in small-practice settings.

Safety experts are often divided as to whether "quality" and "patient safety" are synonymous, partially overlapping, or distinct from one another. When we draw the conceptual distinction that quality is achieving a desired endpoint and patient safety is minimizing undesired occurrences, the differences in quality and safety metrics become apparent. Quality metrics often involve common occurrences whereas safety incidents are generally rare. Thus, quality outcome and process measures tend to have large numerators and denominators whereas patient safety metrics, especially outcomes, tend to have extremely low numerators (requiring huge samples in order to demonstrate differences in performance).

## SATISFACTION

Patient satisfaction is another category of measurement that has been studied in relation to quality outcomes. Patient experience data are collected from patient satisfaction surveys and patient interviews. Measures of patients' self-reported experience in healthcare are not a direct measure of quality but may have important relations to patient outcomes. Patient satisfaction scores have been studied in relation to complications, 30-day readmissions, adverse events, and medical errors.

For example, in one study patients who reported a high level of participation in their care during hospitalization were found to be less likely to suffer an adverse event. It may be that patients who were able to observe and communicate potential problems to the staff were also able to avoid an adverse event (33).

Another study showed that higher overall patient satisfaction, and specifically satisfaction with discharge planning, was associated with lower readmission rates.

Glickman et al. (35) found an association between high patient satisfaction and lower



inpatient mortalities. Also, patients who favorably rated the quality of nurses and doctors were more likely to demonstrate higher levels of patient satisfaction. In contrast, nontechnical variables (e.g., quality of food or room décor) were not correlated with overall patient satisfaction. Perhaps improving the overall satisfaction score is less about “hotel” aspects of hospitalization and “more about increasing the quality of care and the interactions between patients and staff, particularly the nurses and the physician” (35).

In another study, patients who had suffered an infection as a hospital-related complication tended to report negatively on the hospital environment, especially with respect to cleanliness, communication, and responsiveness of staff (36).

Conversely, two studies suggest that patients who feel that they are receiving poor service also believe their care is of poor technical quality. Weingart et al. (37) found that patients may regard service quality lapses as an indication of problems with their care and therefore feel that their care may not be safe. Similar issues were identified by Taylor et al. (38).

Of course, it is not always clear which of these factors are “cause” and which are “effect.” Patients are likely to be happier after a positive outcome, but then are also in a good position to identify and recognize lapses that may increase their risk of adverse effects.

## DISCUSSION

Since publication of Donabedian’s classification schema (3), numerous quality indicators have been proposed and implemented with variable results. The current healthcare climate favors dramatic increases in collection and use of QPS measures to improve care and increase efficiency. This pressure will increase despite concerns about the reliability and validity of QPS data. QPS indicators are increasingly incorporated in reimbursement methodologies and formulae, as well as the new models of healthcare delivery that are being advocated in this era of healthcare reform.

New entities are forming on a seemingly daily basis to provide ratings of physicians, hospitals, and healthcare organizations.

Historically, assessment of healthcare quality has relied predominantly on process measures. It is clear that government reimbursement programs will continue to add process measures, particularly in ambulatory care settings, as well as new measures of outcome. However, despite an evidence-based rationale for many process measures, recent studies have questioned whether performance on clinical process measures correlates with improved outcomes.

There has been another phenomenon observed in process measures defined by CMS. As hospitals have worked to improve, the range of scores has narrowed considerably, clustering at the high end of the performance spectrum. Some measures reported currently on Hospital Compare have average national scores of 100% (9). Although superior performance across the United States is intrinsically good, the value of these data in distinguishing between hospitals is diminished.

The recent explosive growth in the number of QPS indicators has raised concerns in the healthcare community. The inherent good of assessing the performance of providers and institutions over an expanding spectrum of healthcare services is unquestionable, but several issues have emerged. First, healthcare organizations have a finite capacity for collecting and analyzing information. This is especially true when healthcare reimbursement is under pressure.

As new indicators are being rapidly proposed and implemented (and sometimes required by state and federal programs or by nongovernmental payers), the potential for diverting organizational resources from useful and established QPS goals is increasing (17). There is a risk that data-collection efforts will supersede improvement efforts. Similarly, the number of QPS collaboratives aiming to improve performance on these metrics is steadily increasing, compelling institutions and providers to make

difficult choices about participation. It may be useful to participate in a collaborative to improve care in the Emergency Department, for example, but which collaborative? (Our experience has included a hospital that we strongly encouraged to participate in five different Emergency Department collaboratives.) Healthcare organizations and providers will need to develop an approach to evaluating these opportunities, in order to devote resources to the most important organizational issues. Their choices should be based on their own volume and patient mix, risk assessment of potential risk areas, and other factors. Quality leaders will be tasked with evaluating the cost and benefit of participating in each of the proposed initiatives/indicator sets and analyzing all opportunities (and opportunity costs) when seeking resources and approval by their institution's management and governance.

As the burden of data collection and the attendant resource requirement grow, quality leaders will also need to strive for efficiency in

their respective quality infrastructures. Public accountability will demand that issues in care are rapidly identified and rapidly resolved. Healthcare organizations must periodically assess the metrics being collected, the frequency and sample size, and the degree to which these indicators promote improvement and coincide with extant measures.

Development of new models of care delivery, a need that is accelerating with healthcare reform, will require implementation of new outcome metrics. The emphasis on mortality data will likely be supplanted by measures of improved functionality and quality of life. There is likely to be a shift in focus from reducing readmissions to reducing admissions, improving accessibility, and impacting outpatient care. The current focus by payers on acute-care performance will likely change to a paradigm in which the avoidance of hospitalization and the efficient maintenance of health in the community will emerge as the ultimate outcome of interest to policy makers, providers, and patients.

## DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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