

Connections Between Quality Measurement and Improvement

DONALD M. BERWICK, MD,* BRENT JAMES, MD, MSTAT,[†] AND MOLLY JOEL COYE, MD[‡]

BACKGROUND. Measurement is necessary but not sufficient for quality improvement. Because the purpose of the national quality measurement and reporting system (NQMRs) is to improve quality, a discussion of the link between measurement and improvement is critical for ensuring an appropriate system design.

OBJECTIVES. To classify approaches to the use of measurement in improvement into two different—although linked and potentially synergistic—agendas, or “pathways.” To discuss the barriers encountered in each of these pathways and identify steps needed to motivate improvement in both pathways.

RESEARCH DESIGN. Descriptive, conceptual discussion.

FINDINGS. The barriers to the use of information to motivate change include, in Pathway I

(selection), the lack of skill, knowledge, and motivation on the part of those who could drive change by using data to choose from among competing providers, and, in Pathway II (change in care delivery), the deficiencies in organizational and professional capacity in health care to lead change and improvement itself.

CONCLUSIONS. Neither the dynamics of selection nor the dynamics of improvement work reliably today. The barriers are not just in the lack of uniform, simple, and reliable measurements, they also include a lack of capacity among the organizations and individuals acting on both pathways.

Key words: Evidence-based medicine; health care quality measurement; national quality measurement and reporting system; selection. (Med Care 2003;41:I-30-I-38)

In the pursuit of health care quality improvement, measurement is necessary but is no more sufficient than measuring a golf score makes for better golf. In this article, we outline a framework that more explicitly connects the processes of measurement to the processes of improvement. The purpose of the national quality measurement and reporting system (NQMRs) is to improve quality. Understanding the link between measurement and improvement is therefore critical for ensuring an appropriate system design.¹

Measures of Results: The Performance of the System of Care

Figure 1 contextualizes measurement in a larger system of improvement. It begins with the pur-

pose of the system of care² and the set of national goals selected in support of that purpose.³ One way to define a goal more clearly is to specify its metric. No such metric is a perfect representation of a goal, but many metrics can be useful. For example, the metric “Adverse Drug Events” is a highly incomplete but rather useful metric to study the goal to “Improve Safety.”

In the past few decades, health services research has had some remarkable successes in developing useful quantitative tools to measure many dimensions of quality.⁴ Practical, reliable, and valid measurements exist today for such complex quality dimensions as patient satisfaction,^{5,6} severity-adjusted surgical mortality rates,⁷ appropriateness of tests and therapies,⁸ and functional status out-

*From the Institute for Healthcare Improvement, Boston, Massachusetts.

[†]From Intermountain Health Care, Salt Lake City, Utah.

[‡]From the Health Technology Center, San Francisco, California.

Address correspondence and reprint requests to: Donald M. Berwick, MD, MPP, President and CEO, Institute for Healthcare Improvement, 375 Longwood Avenue, 4th Floor, Boston, MA 02215. E-mail: dberwick@ihi.org

comes in chronic disease. Less mature, but very promising, measurements are now in development for even more performance characteristics, such as patient safety, pain control, and the quality of preventive practice.

Clear purpose, focused goals, and valid and reliable performance metrics set the stage for the use of measurement to pursue changes that are improvements. But, at this point, things become a little more complicated. The model in Figure 1 classifies approaches to the use of measurement in improvement into two different—although linked and potentially synergistic—agendas, or “pathways.” Pathway I relies primarily on the act of selection to improve quality and Pathway II relies primarily on process changes to improve quality. In a complete improvement strategy, both pathways are important.

Pathway I: Improvement Through Selection

Any population group evaluated (eg, hospitals, surgeons, or health care plans) will have a distribution of performance levels. The shape of the distribution can vary from population to population and from one performance dimension to another; it may be bell-shaped, skewed, or multimodal, for example. In general, most members of a population will be clustered around some central value (the median, mean, or mode, depending on how one chooses to characterize it) and a smaller proportion will lie nearer the extremes. For example, most cardiac surgeons measured on the dimension “case-mix adjusted operative mortality rate” will appear to perform near the average mortality rate, while a few will have rates surprisingly better or worse than the average.

How Selection Works

From the viewpoint of the consumer of health care, this reliable spread of performance offers a straightforward opportunity for improvement through selection, especially if the distribution of performance is relatively stable (that is, if a surgeon’s current rank in the distribution is a decent predictor of his or her future rank). The mechanism is simple: if you need heart surgery, you can select the surgeon whom (you predict) will give

you the best odds of the outcome you want. To accomplish that requires three tasks:

- (1) Identify the outcomes of importance to you
- (2) Learn the performance levels of surgeons with respect to those outcomes
- (3) Choose your surgeon

Of these, Task 2 (“Learn the performance of surgeons. . .”) is actually a bit more complicated than stated. To make such knowledge useful, you must assume or discover two other related facts: (1) that the performance results (by definition, past performance) can reasonably predict the surgeons’ future performance (stability), and (2) that the population of patients from which the past performance is calculated is similar enough to you that the results have some predictive power for you as an individual (applicability).

The left side of Figure 1 traces the chain of events in the use of measurement for selection. Results metrics, applied in a relevant population, are used in the processes of selection. These results, in the form of reports, which can be as simple as a single summative ranking or as complicated as a many-page treatise, yield “knowledge about performance.” (The Medicare Hospital Mortality Data on 6,000 hospitals published by the Health Care Financing Administration in the late 1980s and early 1990s occupied seven volumes, each the size of a metropolitan telephone directory.⁹)

Examples of Selection

The customers of this knowledge about performance are the people or organizations who can make choices among providers of care or otherwise act on their judgements. Selection can take many forms, such as the following:

- An individual patient needing surgery decides which surgeon to engage
- A corporation sponsoring health insurance for its employees decides which health plans to offer
- A health plan medical director decides which cardiologists to empanel under the plan’s coverage scheme
- An internist chooses an oncologist to whom he refers a patient with cancer

- The Joint Commission on Accreditation of Healthcare Organizations decides which hospitals it will accredit (and which with commendation)
- A multispecialty group practice board decides which physicians will receive a financial bonus this year for “outstanding care”

Although we use the term “selection” in Figure 1, the actual activities implied, all riding on performance measurement, go well beyond “in-or-out” choices. As the last two examples above illustrate, “measurement for selection” can be used for reward, recognition, punishment, payment, and other forms of decision with more continuous properties. Regulators can affect quality by using selection directly (such as suspending a license) or indirectly, using the threat of action to motivate changes among providers of care who wish to avoid that threat. (The motivational pathway leading to change is discussed in more detail later in this article.)

Selection as a mechanism for improvement does not by itself change the basic distribution of performance. It does not automatically cause any surgeons to become better at surgery. It can nonetheless improve the outcomes of care by shifting business to the caregivers with better outcomes. Selection is the main approach to improvement from the pure consumer standpoint—get better care by choosing better care. If the distribution of performance levels among would-be caregivers is wide, and if the choice is well informed and unconstrained, the impact on quality can be substantial.

Barriers to Selection

Although they look simple, the circumstances that make selection a powerful tool for improvement have been hard to achieve in health care. Among the main barriers are the following:

- The measurements may not reflect the actual performance wanted. For example, patients who want the best preventive care may be able to learn about only mammography rates.
- The reports on measurements may be difficult to understand or consume. Empirical studies show that health care consumers may lack the skills to understand even simple reports on outcomes.¹⁰ Useful research on how best to

display information to health care consumers is in its early days.

- Belief may be weak that quality itself is variable. Despite vast research literature on the high degree of variation in quality of care, most consumers believe that their own source of care is excellent.¹¹ Therefore, they may lack the curiosity or motivation to seek out or study information on performance.
- Performance benchmarks tend to be local. In considering the range of accessible performance, consumers tend to think in very local terms rather than seeking knowledge about the full range of achievable quality.
- For many decision makers, concerns about variations in price drive out potential concern about all other dimensions of performance. The dynamics of choice in health care tend to be based on cost alone, making information on variation in other qualities of care uninteresting to those who select.
- The consumer may not be able to personalize a medical statistic into the full context of his or her life. Patients routinely rely on secondary measures of quality related to personal interactions, even after they have reviewed good, simple, understandable, and quite strikingly different medical outcomes measures.¹²

An overriding issue in the use of measurement for selection is this: selection itself involves skills and relationships not yet well developed in health care. To make the left side of Figure 1 operate properly will require more than refining the measures; it will require serious investment in developing the reporting formats, skills, attitudes, and decision levers of those who potentially can translate sound measurement into wise selection.¹³

Pathway II: Improvement Through Changes in Care

Pathway I (Selection) can be a powerful tool for getting the best out of the current distribution of performance. “Pathway II”—improvement through changes in care—can shift the underlying distribution of performance itself. Its dynamics are different from those of Pathway I. The biggest difference is that whereas Pathway I can rely nearly totally on the actions of people and organizations other than those who actually provide care, Pathway II cannot. A grocery shopper can select the best bananas without

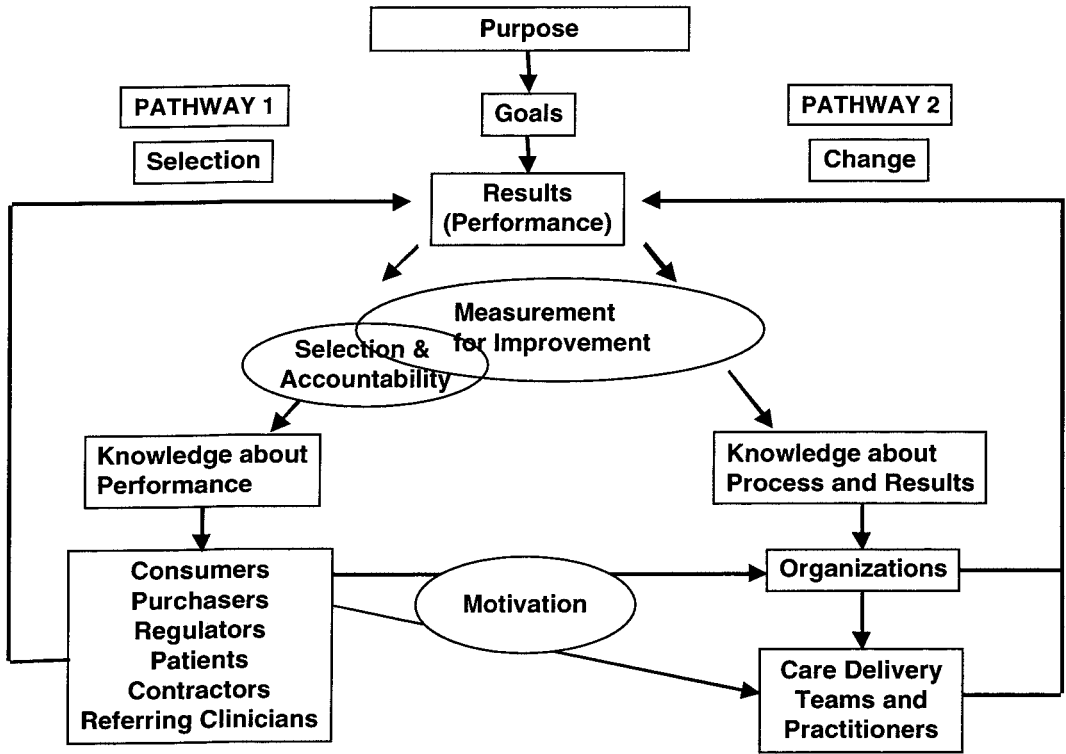


FIG. 1. Two pathways to quality improvement.

having the slightest idea about how bananas are grown or how to grow better bananas. Her job is to choose (Pathway I). Banana growers have quite a different job. If they want better bananas, they have to understand the processes of growing, harvesting, shipping, and so on, and they have to have a way to improve those processes. This is Pathway II.

The Relationship of Improvement and Change

The core mechanism in Pathway II is change. The theoretic foundation for the focus on change is the understanding that “every system is perfectly designed to achieve exactly the results it gets.”¹⁴ Any specific car is a system and it has a top speed that is a characteristic of that system; that top speed will not change in response to exhortation, incentive, or measurement. The way to change the speed of a car is to change the car—install a new carburetor or design a new, more aerodynamic shape. All improvements are

changes, although, of course, not all changes are improvements.

Information for Improvement “Contains” Information for Selection

The right side of Figure 1 shows the steps in improvement through change. Like improvement through selection, Pathway II involves measurements closely related to aims. In fact, as Figure 1 indicates, many properly constructed measurements for selection are identical to good measurements for improvement. More accurately, when a health system collects information to understand and improve its own care processes, it can automatically have information that could be useful to those acting on the left side of Figure 1 (ie, for selection).

For example, imagine a hospital trying hard to reduce its background surgical infection rates. To improve, it likely will store case-by-case data on each surgical patient so that it can study its

processes of clinical management. This local data set will include information on the presence or absence of a postoperative infection, and that information would be a performance measurement of interest to those who are acting in a selection mode outside the hospital. Improvement information generally must include process-level and outcome-level data, and therefore a sound data system for improvement will almost always contain the results data on the basis of which others may wish to make selections.

The reverse is not the case. It is easy to imagine performance measurements for purposes of selection that are not at all useful for internal improvement work. For example, a payer deciding on annual contracts with providers may be satisfied with summary statistics that are so remote in time or so coarsely granular that they contain little or no useful knowledge for the caregivers interested in improvement.

Front-line clinical data systems that simultaneously generate information for improvement require careful planning. In this issue of *Medical Care*, James¹⁵ outlines critical design principles for that purpose, such as “collect data once, as close to its point of generation as possible,” and “use patient registries for chronic diseases” (to establish denominators for key rates). Those principles should be built into, and used to evaluate, any quality measurement set that becomes part of an NQMRS.

Front-line clinical data systems are not static. Health care delivery groups are constantly upgrading, modifying, and replacing the manual and automated data systems they use for internal management and improvement. With a set of strong design principles and a compelling vision shared across the nation, software vendors and care delivery groups can develop compatible data systems over a period of time. One key role of a standardized set of national quality measures is to provide that shared vision and data system specification. A set of quality measurement standards, properly designed, would achieve a third benefit (beyond local improvement and inspection): a standardized outcomes tracking system that spans the nation as a critical research tool for understanding the effectiveness of clinical interventions.¹⁶

Sharing Measurements for Improvement and Selection

The fact that improvement data can be useful for selection does not necessarily mean that those

who collect the data will be willing to share it. The problems are not technical; they are political and economic. Providers collecting data for improvement may fear disclosure, believing that outside pressure will deter open and honest exploration of problems and their causes. In addition, even the small additional cost of configuring internal quality information for external use may seem burdensome to providers who consider themselves to be resource-strapped. Our point is not that organizations committed to improvement will share information to be used for selection; it is rather that such organizations will generally have such information whether or not they choose to share it. A key role for the NQMRS is to articulate a vision that makes sharing this information compelling for those who hold the data.

Organizations as Intermediaries in Improvement

The internal consumers of “measurement for improvement” usually are not individuals. One can imagine elaborate systems of “feedback to physicians” concerning their individual performance by their employer or payer, but such systems generally operate primarily as selection or incentive systems, although sometimes in disguise. A great deal of the “performance” assessed is a property of the overall clinical and organizational system in which individuals work. Such performance variables as safety, patient satisfaction, surgical outcomes, infection rates, and even appropriateness of care are tightly linked to systems of information management, architecture, training, job design, purchasing, scheduling, resource allocation, and many others that lie far outside the sphere of influence of any individual doctor, nurse, or technician. This is the case often enough that organizational quality measurement systems can be far more powerful in improving care than individually focused measurement.

The usual internal customer for measurement for improvement is an organization (eg, hospital, group practice, or health plan). The organization may be trying to improve its own systems or it may be acting as an intermediary or knowledge broker between the measurement processes and its individual employees and clinicians. For example, a hospital may use information on adverse drug events to understand and improve procedures for medication administration in its intensive care

units (a system-level application). The same hospital might also gather information on antibiotic use to help individual physicians recognize when their own clinical choices are differing substantially from those of their peers or from scientifically developed guidelines (acting as a broker of knowledge for individuals to use).

In Pathway II, organizations and individuals achieve improved performance, guided by measurement, through changing the processes of work. Juran¹⁴ has classified approaches to change into three types:

- (1) Methods that stabilize processes, making them highly reliable, well-controlled, and conforming to standards (quality control)
- (2) Changes that improve processes, reducing their costs or increasing their performance to new levels (quality improvement)
- (3) The design of totally new processes, products, or services, working *de novo* rather than improving an existing process (quality design)¹⁴

To improve performance, organizations and individuals need the capability to control, improve, and design processes, and then to monitor the effects of this improvement work on the results. Measurement alone will not suffice. Pathway II (unlike Pathway I) relies for its effects on the ability of organizations and providers of care to undertake systematic change.

The ability to change should not be taken for granted. It implies a set of specific organizational processes (the processes that facilitate and manage systemic change), which constitute the organizational infrastructure for improvement. The organizational processes that support providers in continuous examination and improvement of care are: (1) a reliable flow of useful information, (2) education and training in the techniques of process improvement, (3) investment in the time and change management required to alter core work processes, (4) alignment of organizational incentives with care improvement objectives, and (5) leadership to inspire and model care improvement.

Barriers to Organizational Leadership and Progress

These organizational processes to support change have not yet been fully developed within most health care institutions and organizations despite more than a decade of efforts to establish

total quality management and continuous improvement programs, as well as licensure and accreditation requirements supporting them. In contrast to other sectors of the economy—manufacturing and service sectors—health care organizations have not made quality improvement a central business strategy; in most places, quality improvement remains a secondary program that affects only a few core processes or diagnoses at a time. Among the many complex reasons for this lack of progress, two are critical: the failure to align incentives and achieve integration across care settings and the absence of a market imperative to improve quality—the lack of a “business case” for quality.

Most health care systems remain a loose confederation of institutions, contractual arrangements, informal referrals, and individual practitioners. Skilled nursing facilities, hospitals, home care agencies, physicians, physical therapists, and laboratories each have their own business imperatives, operating challenges, and isolated information systems. Reimbursement for their services rewards behaviors that isolate each entity, leading them to maximize their own return and frequently to work at cross purposes with other entities. Reimbursement that is not tied to performance on quality, measured in terms that are meaningful to patients and providers, weakens the relationship between quality improvement and organizational success.

This pattern of contradictory incentives and failed integration has stalled progress in quality improvement. It reflects the underlying absence of a clear, shared vision of how providers are supposed to work together for the benefit of the patient. Without this vision, leadership to carry it forward, and a regulatory and reimbursement environment to make it feasible, operating units will not have the technical support and managerial directives necessary to integrate their work processes. As in other service sectors, the ultimate goal of integration and continuous improvement should be to meet or exceed the needs of the consumer (ie, patient).

Barriers to Investment in Information Systems

Some health care organizations have sought to invest in information systems that will collect data across settings, support efforts to understand pat-

terns of care and improve them, and contribute to externally required reporting. But the leaders of many hospital-based systems are wary of further investment in information technology because of failed attempts over the past decade, the absence of industry standards, and the still-emerging role of Internet-enabled communications.

In the 1990s, health care systems invested hundreds of millions of dollars in information systems designed to replace “legacy systems” with integrated systems linking all their component parts. Many investments failed to achieve these objectives and, today, most patients still receive care from an assortment of providers and institutions that barely communicate with each other. The round of new investments that will be required now—both in capital for the information systems themselves and in organizational change management—may well be beyond the capacity of many small and mid-sized health systems. Moreover, in the absence of industry-wide standards for data and communications, it is arguably prudent to defer such investments.

Leadership and Cultural Change for Quality Improvement

Health care system leaders ultimately are responsible for creating a culture that continuously examines, improves, and celebrates the quality of their organization’s performance. The means of accomplishing this, beyond making meaningful information available, largely is an investment of human capital—of time, training, and recognition within the organization. The time required is formidable, at least in the early stages of change management, and the disruptive effects of changing the core work processes of an institution should not be underestimated. For most organizations, investment on this scale is a strategic issue and will only be undertaken if the market—employers and government purchasers, principally, and consumers secondarily—permits and rewards these strategies.

In other sectors, quality improvement works as a business strategy not only because of market incentives (price and volume shifts to reward quality), but also because reducing defects and eliminating waste lowers costs. However, in health care, fragmented flows of money mean that the savings generated by increased quality and efficiency in one organization often accrue to other

institutions or parties. For example, reductions in infection rates and the prevention of other complications may move patients into less-complicated diagnosis-related groups; the hospital will lose more in reimbursement than it saves in lowered costs. In this context, it is difficult to exhort health care leaders who are preoccupied with organizational survival to “do more” in quality improvement.

External Support Is Necessary for Health Care Leaders

Few health care leaders can be expected to make quality improvement a core business strategy in the absence of market pressure, aligned regulatory and reimbursement incentives, and support for the acquisition and use of new information systems and platforms for integrated data on health care performance. Their commitment will be facilitated by:

- The establishment of industry-wide standards for data elements and the transmission of, storage of, and access to clinical and administrative data
- Broad-scale support for the process of information technology selection, acquisition, and use, including new sources of capital, technical assistance, and the standardization of health data requirements
- The establishment of cross-industry forums for organizational sharing and learning, with incentives that reward collaboration and community development
- The establishment of minimum performance standards for quality performance by health care institutions and providers from private and public purchasers
- The removal of reimbursement barriers to integrated and aligned incentives within health care, replacing fragmented reimbursement with payment systems that recognize and reward responsibility for episodic care, chronic care, and health outcomes

Motivating Improvement: Pathway I Meets Pathway II

Pathway II involves change, and neither organizations nor individuals are routinely comfortable

in the pursuit of change. Instead, they often find it easier and more comfortable to try to preserve and defend the status quo. In that sense, improvement (through change) is not natural; it requires motivation—a source of discomfort with the status quo.

Sometimes, aspiration suffices. For individuals, of course, intrinsic motivators, like pride, love, the need for achievement, or curiosity, can be very powerful. Undoubtedly, these intrinsic motivators operate strongly within the health care workforce, such that doctors, nurses, technicians, managers, and others try on their own a great deal of the time to improve themselves and their work for approximately the same reasons that they try to get better at gardening, tennis, or parenting. Indeed, simple feedback of performance-related information to clinicians and others in health care can apparently induce substantial behavioral changes, even without any proximate threat or promise of consequences.¹⁷ They simply want to be better.

Unfortunately, especially in complex systems with many people depending on each other, intrinsic motivation does not provide enough of a boost to overcome the status quo. Organizations, more than individuals, resist change. It has been a frequent observation among the scions of industrial “total quality management” that few companies have undertaken fundamental change without some severe external threat, often a threat to their very survival.

Whatever one’s view of the power of intrinsic motivation for change in health care, it is hard to deny that health care organizations have not generally used quality improvement on their own as a primary strategy. Figure 1 shows a link between Pathway I and Pathway II involving the crucial force of external motivation in increasing the commitment of organizations and providers of care to change. The “selection” pathway links to the “change” pathway through mechanisms that link the self-interest of health care systems and the self-awareness of individual clinicians with the improvement of performance. The links can be positive (higher payments, greater markets, praise) or negative (the threat of “deselection,” reduced payment, losing markets, criticism, or embarrassment). In this sense, Pathway I operates toward improvement not only through actual selection, but also through the threat, promise, and consequences of selection of producers of care.

The links between Pathway I and Pathway II through “motivation” are largely theoretic, not

empirical. It makes sense that organizations and individuals will be influenced by the real and perceived consequences in a marketplace that is assessing and judging them, but, so far, we lack truly systematic demonstrations that a surveillant marketplace will cause serious investments in improvement of health care. Whether such evidence emerges in the next few years will depend on both the discipline with which performance measurement becomes a routine and valued activity in health care and the growth of capacity among health care organizations to improve their own work in response to the external pressures of measurement and the internal will to do a better job.

A few significant, albeit incomplete, cases do exist of large, integrated health care systems that have been able to tighten links between measurement and improvement and have demonstrated better care, apparently as a result of the effective internal operation of Pathway I and Pathway II. The Veterans Health Administration (VHA) has improved surgical morbidity and mortality rates, for example, in association with a carefully designed effort to measure and feed back information on performance, along with processes to study and report on “best practices” and innovative processes. As a centrally funded, strategically managed, population-based system, the VHA has been able to invest in infrastructures (such as information technology), goal-setting, monitoring, and technical assistance methods that support accountability (Pathway I) and learning (Pathway II).¹⁸

Conclusions

Ideally, in health care, both Pathway I and Pathway II would operate reliably and continually to improve care, and quality measurement would support both dynamics. Through “measurement for selection and accountability,” providers of the best care would experience benefits from their excellence, and those with unacceptable levels of performance would find themselves with less and less to do. The dynamics of selection (real and possible) and the intrinsic motivation of providers to improve would combine to induce and support changes in most care systems so that they continually improve through quality control, quality improvement, and quality design.

Unfortunately, neither the dynamics of selection nor the dynamics of improvement work reliably today. The barriers are not just in the lack of uniform, simple, and reliable measurements. They include, in Pathway I, the lack of skill, knowledge, and motivation on the part of those who could act selectively, and, even more egregiously, in Pathway II, the deficiencies in organizational and professional capacity in health care to lead to change and improvement itself. Both pathways must be pursued to achieve needed gains. In this issue, Galvin and McGlynn¹⁹ and Hibbard²⁰ outline some of the key steps that will be necessary to encourage improvement through measurement.

References

1. **McGlynn EA.** Introduction and overview of conceptual framework for a national quality measurement and reporting system. *Med Care* 2002;41(suppl):I-1-I-7.
2. **President's Advisory Commission on Consumer Protection and Quality in the Health Care Industry.** *Quality First: Better Health Care for All Americans*; March 1998. Available at: <http://www.hcquality-commission.gov>. Accessed May 25, 2001.
3. **McGlynn EA, Cassel CK, Leatherman ST, et al.** Establishing national goals for quality improvement. *Med Care* 2002;41(suppl):I-16-I-29.
4. **McGlynn EA, Brook RH.** Ensuring quality of care. In: Anderson RJ, Rice TH, Kominski GF, eds. *Changing the U.S. Health Care System: Key Issues in Policy and Management*. San Francisco: Josey-Bass; 2001.
5. **Ware JE Jr, Brook RH, Rogers WH, et al.** Comparison of health outcomes at a health maintenance organisation with those of fee-for-service care. *Lancet* 1986;1(8488):1017-1022.
6. **Landon BE, Zaslavsky AM, Beaulieu ND, et al.** Health plan characteristics and consumers' assessments of quality: data watch. *Health Aff (Millwood)* 2001;20:274-286.
7. **Iezzoni I.** *Risk adjustment for measuring healthcare outcomes*. Chicago, IL: Health Administration Press; 1986.
8. **Chassin MR, Koseoff J, Park RE, et al.** Does inappropriate use explain geographic variations in the use of health care services? A study of three procedures. *JAMA* 1987; 258:2533-2537.
9. **Berwick DM, Wald DL.** Hospital leaders' opinions of the HCFA mortality data. *JAMA* 1990;263:247-249.
10. **McGlynn EA, Adams JG.** Public release of information on quality. In: Anderson RJ, Rice TH, Kominski GF, eds. *Changing the U.S. Health Care System: Key Issues in Policy and Management*. San Francisco: Josey-Bass; 2001.
11. **Hays RD, Ware JE.** My medical care is better than yours: social desirability and patient satisfaction ratings. *Med Care* 1986;24:519-524.
12. **Chassin MR, Hannan EL, DeBuono BA.** Sounding board: benefits and hazards of reporting medical outcomes publicly. *N Engl J Med* 1996;334:394-398.
13. **Berwick DM.** A primer on leading the improvement of systems. *BMJ* 1996;312:619-622.
14. **Juran JM, ed.** *Juran's Quality Control Handbook*, 4th Edition. New York: McGraw-Hill; 1988.
15. **James B.** Information systems concepts for quality measurement. *Med Care* 2002;41(suppl):I-71-I-79.
16. **McGlynn EA.** An evidence-based quality measurement and reporting system. *Med Care* 2002; 41(suppl):I-8-I-15.
17. **Greco P, Eisenberg J.** Changing physicians' practices. *N Engl J Med* 1993;329:1271-1274.
18. **Khuri SF, Daley J, Henderson W, et al.** The Department of Veterans Affairs' NSQIP: the first national, validated, outcome-based, risk-adjusted, and peer-controlled program for the measurement and enhancement of the quality of surgical care. *Ann Surg* 1998;228:491-507.
19. **Galvin RS, McGlynn EA.** Using performance measurement to drive improvement: what will it take to make it happen? *Med Care* 2002;41(suppl):I-48-I-61.
20. **Hibbard JH.** Engaging health care consumers to improve the quality of care. *Med Care* 2002; 41(suppl):I-61-I-70.