
CQI: MAKING A DIFFERENCE AT ONE ACADEMIC HEALTH SYSTEM

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The focus on assuring and improving the quality of medical care and service has increased during the late 1990s, as witnessed by intensified legislative and health policy activity, consumer advocacy, and industry debate on the subject of health care quality [1,2]. Although not as highly evolved as in other industries, quality improvement in health care has become an important strategy for achieving and maintaining market share. Quality improvement represents a systematic approach for continuously improving processes of critical importance to customers and is typically described in terms such as *total quality management* or *continuous quality improvement (CQI)*.

As the industry evolves and multiple stakeholders demand greater accountability for high quality health care, suppliers of health care are approaching quality improvement initiatives with a greater degree of commitment. However, the gaps between known best practice and current practice remain startlingly large and widespread. For example, in its second annual report on managed care quality, the National Committee on Quality Assurance found that on a nationwide basis, the managed care industry is performing below 80% on all but one of its clinical quality performance measures [3]. These include use of β blockers after acute myocardial infarction, cervical and breast cancer screening, diabetic retinal examination, and childhood immunization. Effective interventions that can save lives, prevent disabilities, and improve quality of life are not consistently implemented in health care.

A recent national policy statement from the Institute of Medicine urged leaders in health care professions as well as practicing clinicians to take the lead in improving the quality of the U.S. health care system [1]. This

leadership in quality improvement is a joint responsibility, and physicians-in-training will increasingly be asked to serve not merely as participants but as stewards for the next generation of health care excellence.

This article explores basic principles of CQI as it has come to be applied within the health care industry, with a look at one academic health system's approach to using clinical pathways within its system-wide CQI program. The article concludes with recommendations for how residents can become involved with CQI activities and in doing so ensure their role in defining the quality of health care in the future.

CQI Basics

CQI is used throughout health care as a tool to achieve desired results, such as better patient satisfaction, improved clinical outcomes, and reduced costs. CQI uses data-driven interventions to test and improve processes by which health care and services are delivered as a means to meet or exceed customer needs. CQI involves answering the following questions:

- What do health care consumers need and value?
- Are these needs being met by current health care delivery processes?
- How can current processes be improved to more effectively and/or efficiently reach desired outcomes?

PDCA Model for CQI Activities

One of the most widely used models for CQI is PDCA—Plan, Do, Check, Act [4].

Plan. CQI initiatives begin with a planning stage in which data are analyzed to measure the effectiveness of existing processes by pinpointing discrepancies between current practice and known best practice. Appropriate use of data can focus attention on outcomes that genuinely need improvement. For example, data analysis can help a CQI team determine that patients are dissatisfied with the amount of time it takes to make an appointment with their physician or that a hospital's complication rate for coronary artery bypass graft patients is twice the lowest rate in the local region.

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Table 1. Key Concepts in CQI Programs

<p>Committed leadership: Involvement at all levels, from CEO to direct service providers; personal involvement in promoting CQI values and developing guidelines</p>
<p>Focus on the customer: Customer input valued; customer expectations defined; commitment to empowering the patient</p>
<p>Multidisciplinary team approach: Crossfunctional, diverse care teams that link interdependence with improvement</p>
<p>Data-driven processes: Patient care and clinical improvement interventions based on evidence, not anecdote; benchmarking facilitates continuous improvement toward desired outcomes</p>
<p>Balanced performance measurement system: Data integrated into a concise set of meaningful indicators; strategic goals linked at all organizational levels; performance feedback provided to caregivers</p>
<p>Integration and alignment of management systems: Goals aligned strategically, operationally, clinically, and financially; incentives used to provide stimulus for CQI; incentives aligned with organizational goals to increase accountability</p>

Do. Once an opportunity for improvement is identified, the CQI team develops and tests new care or delivery processes to replace the existing practice. These interventions may be as simple as patient or physician education or as complex as developing and implementing clinical practice guidelines.

Check. The success of CQI programs relies on developing interventions effectively and efficiently through a multidisciplinary team effort in which success or failure of the interventions is evaluated through statistical analysis of multiple data points.

Act. Finally, the CQI team acts on the results of its initial effectiveness studies. If an intervention does not improve targeted outcomes, other interventions are developed and tested and the process loop begins again. If an intervention does improve outcomes, the team determines how to implement it in other sites and practices. To ensure continued success, follow-up monitoring and data analysis are necessary.

CQI Success Factors

Although CQI is best implemented as a dynamic and flexible framework for achieving best practice outcomes, six key success factors form the foundation for all CQI activities and are briefly described in **Table 1**. Two of these factors warrant further discussion.

Balanced performance measurement system. CQI efforts are grounded in data collection and analysis. Using data effectively is critical to designing and evaluating best practices, and in CQI this is best achieved through a system that can measure multiple outcomes across the spectrum of care, such as patient satisfaction, clinical results, resource use, and cost-effectiveness.

New management tools such as “dashboards,” “instrument panels,” and “balanced scorecards” offer an organization-wide strategy for monitoring performance measurement and improvement at multiple levels. These tools can provide a graphic or tabular snapshot of the performance within a particular service or area (eg, a clinical department, care unit, or hospital) across multiple dimensions. Using these management tools can be compared to a pilot using the data on an airplane console to assess the performance of the aircraft. A balanced measurement system can:

- Integrate multiple data elements into meaningful information
- Provide a monitoring system that identifies improvement opportunities, recognizes accomplishments, identifies resource requirements, and sets priorities
- Facilitate evaluation of multiple dimensions of performance, including clinical quality, cost, and customer value
- Provide feedback to individual care providers regarding their performance

Alignment of management systems. This final piece of the CQI puzzle is often ignored in health care. Goals must be aligned strategically, operationally, clinically, and financially to facilitate achievement of quality outcomes. Linking both financial and nonfinancial incentives to overall organizational goals provides a stimulus for quality improvement and organizational success and minimizes conflicts in priorities.

If clinical pathways are an organizational goal for quality improvement, all individuals accountable for implementation of pathways must work according to the same agenda and be rewarded for achieving its goals. Alignment of systems thus requires building accountability for implementation across planning and operational lines.

CQI In Action: Examples from the University of Pennsylvania Health System

The University of Pennsylvania Health System (UPHS) is an academic, integrated delivery system whose approach to quality improvement is a foundation for the organization’s mission and vision. UPHS is composed of 4 owned hospitals (over 1700 total beds), 15 affiliated

hospitals/health systems, 400 primary care physicians, 1400 specialty physicians, and services in behavioral health, skilled nursing, home care, long-term care, rehabilitation, and hospice care. Annually, UPHS encounters over 70,000 admissions and 2 million outpatient visits.

Inpatient Clinical Pathway Program

Implementation of inpatient clinical pathways is a strategic priority within the overall CQI program at UPHS. The pathway development and implementation process, like the CQI program in general, is a dynamic and ongoing quality improvement effort and not solely a resource reduction strategy. The pathway program is designed to improve patient satisfaction and to reduce complications, length of stay (LOS), and cost per case by reducing variability in practice. It consists of streamlined documentation requirements, automated pathway variance data, patient versions of pathways, educational materials, and standardized order sets. Current performance is compared to past performance as well as to local and national peer organizations. To date, 36 inpatient pathways, which address 30% of the total inpatient population, have been implemented.

Pathway development process. Areas for inpatient pathway development are selected based on quality issues (from analysis of mortality, morbidity, complications, readmission rates, and patient satisfaction), volume (more than 100 cases/year), high interest from physicians or payers, or LOS and cost (higher than benchmark data of peer organizations).

The success of the pathway development program at UPHS hinges on the commitment and leadership of clinical champions, with support from quality improvement professionals. A multidisciplinary team co-chaired by a physician and nurse is formed for each pathway. Teams consist of physicians, nurses, clinical administrators, and other practitioners as appropriate (eg, infectious disease specialists, respiratory therapists, pharmacists, laboratory technicians). These teams seek to identify national best practices and outcomes through analyzing local data, searching the literature, and networking with colleague institutions. After project selection, each team creates a clinical pathway based on available evidence or expert opinion. Prior to implementation, each pathway is distributed for approval to all department directors, administrators, and physicians who were involved in the care of affected patients during the preceding year.

The pathways are then implemented to test their effectiveness and physician compliance. Key process data are reported from scannable variance tools and integrated with measures of patient satisfaction and clinical and

financial outcomes. On an ongoing basis, the pathway teams review and refine the pathways as necessary using their pathway balanced scorecards. Data are aggregated, compared to the data of peer organizations, and benchmarked nationally to identify longitudinal improvement.

Head and Neck Cancer Pathway

In July 1996, an interdisciplinary team that included residents and medical students was convened to develop a clinical pathway to guide the evaluation and treatment of head and neck surgery patients, specifically those needing major upper aerodigestive tract cancer resection and tracheostomy. The pathway was constructed to be dynamic and flexible to meet the complex needs of this patient population. Patients were admitted on the operative day with expected pathway outcomes identified (and modified, if necessary, based on the individual patient's needs) and monitored through daily variances by the multidisciplinary team. The majority of patients were expected to be discharged on postoperative day 8.

Critical steps for meeting the goals established for this population included early initiation of physical therapy, aggressive self-care protocols, and timely initiation of referrals for home care support. Appropriate perioperative antibiotic management was another key process variable included in the pathway. Clinical trials support the use of broad-spectrum coverage for no more than 24 to 48 hours, yet head and neck surgeons practice wide variability in their choice and duration of antibiotic administration [5,6]. The clinical pathway was used to provide physicians with appropriate recommendations for antibiotic management to reduce this variation in practice.

Patient data were compared before and after pathway implementation. Univariate analysis of the continuous variables was done using the Mann-Whitney test; the categorical variables were analyzed using Pearson's correlation coefficient with Yates correction, where applicable. Demographic variables were evenly matched between the two groups, and the types of procedures did not vary appreciably. A significant decrease in the median LOS to 5 days ($P < 0.001$), due primarily to a reduction in non-intensive care unit (ICU) days, was accomplished without a change in complication, readmission, or mortality rates [7].

Implementation of the pathway has resulted in more efficient communication among all clinicians involved in managing these complex patients. Quarterly education forums regarding the pathway are held for house staff who rotate through this service to ensure their understanding and support of the pathway initiative. Patients

are better informed through improved preoperative counseling and receipt of the patient version of the pathway. The financial impact of this pathway has evidenced an average savings of \$26,000 per patient [7].

Urinary Tract Infection Pathway

Quality improvement initiatives should not be limited to the care of designated patient populations but should also focus on conditions that traverse diagnoses and procedures. Many patients present with conditions that are multifactorial, span the continuum of care, and are not specific to one population or treatment area, challenging clinicians and hospital staff to work across the boundaries of traditional operational lines. Urinary tract infections (UTIs), for example, do not result from one specific disease or condition, nor does their treatment rely on a single procedure. Nosocomial UTIs are one of the most common infections in acute care facilities, and they can further complicate a patient's hospitalization and result in additional tests and treatments [8]. UTIs thus represent a "defect" in the goal of providing optimal quality of care because they present a clinical and financial risk for hospitalized patients. By taking a horizontal, cross-condition approach toward improving care in addition to the vertical, condition-specific approach, clinicians can weave a stronger, more comprehensive strategy for improving patient care. Despite the difference in scope, this type of quality improvement process follows the traditional CQI principles.

At UPHS, a team of physicians, nurses, and infection control specialists was established to develop a set of guidelines to decrease the incidence of nosocomial UTIs. After extensive review of the available research and evidence, the team developed a risk-assessment algorithm that was used to stratify patients into appropriate risk categories, to guide the appropriate placement and removal of urinary catheters, and to test the use of bladder scanners. (Bladder scanners are ultrasound-like devices designed to easily determine urine volume in the bladder and therefore assess the need for a urinary catheter. Although the scanners represent an effective decision support tool, they are also costly. An appropriate risk-benefit analysis was conducted to assess their overall effectiveness.) The UTI reduction interventions were tested in selected high-risk patients (ie, ICU and other patient populations with known elevated UTI rates) to evaluate their effectiveness and appropriateness.

Preintervention data indicated 10.0 infections per 1000 device days, whereas postintervention data indicated a significant reduction to 5.4 infections per 1000 device days. The per patient cost of a UTI was reduced to an estimated \$1875, with an estimated annual sav-

ings of \$950,000. The great success of the strategy for reducing cost and improving outcomes resulted in hospital-wide implementation of the guideline.

Congestive Heart Failure Pathway: Case Scenario with Resident Responsibilities

At UPHS, residents determine which patients are appropriate for the inpatient pathways, which serve as guidelines for the care of a typical, uncomplicated patient with the indicated diagnosis. Consider the following scenario:

An elderly man presents to the emergency department via ambulance with acute shortness of breath. The patient is tachypneic and diaphoretic. His blood pressure is 150/85 mm Hg, heart rate is 110 bpm, respiratory rate is 25 breaths/min, and oxygen saturation is 89% on room air. He has rales halfway up both lungs and a jugular venous pressure of 12 cm. The patient is tachycardic with an S3. Chest radiography is consistent with congestive heart failure (CHF). The patient is given supplemental oxygen, furosemide, nitropaste, and morphine and is stabilized on 4 L of oxygen after 800 mL of urine output. He is admitted to the telemetry unit.

The CHF diagnosis is straightforward and the patient matches all inclusion criteria for the CHF pathway, including decompensated heart failure. He is placed on the CHF pathway by the admitting resident using computerized ordering of medications, treatments, and diagnostic testing, but the pathway order set is modified to include isosorbide dinitrate and hydralazine instead of an angiotensin-converting enzyme (ACE) inhibitor because of a history of angioedema. A myocardial infarction is ruled out and the patient is aggressively diuresed 1500 mL/day.

Each morning on rounds, the team reassesses the patient, paying attention to the accepted clinical goals summarized in the pathway; the orders are modified to reflect any changes and communicated to medical, nursing, and social services. The merits of an echocardiogram are discussed but ruled out, as the patient had one 6 months prior to this admission. On day 3, the patient's creatinine level rises and his furosemide dose is decreased. On day 4, he is discharged to home.

This case illustrates that patient care is not solely dictated by the pathway. The pathway can serve as an educational tool, a useful aid for memory and communication, and a documentation device. Nothing crucial to the care of a patient with CHF exacerbation was omitted, and the efficient transit of the patient through the system was achieved with minimal resident effort.

Although pathways have been criticized for discouraging resident autonomy and critical thinking, it is not clear that either is adversely affected by the proper use of appropriately designed pathways. In this case, the clinical goals of the CHF pathway provided guidance for achieving best practice clinical outcomes during hospitalization as well as multiple teaching opportunities (eg, concerning the dosing of furosemide or understanding the data supporting the appropriate use of ACE inhibitors and digoxin). Cost-effective health care was also explored when the merits of a repeat echocardiogram were discussed. The patient was reassessed at regular intervals, and the treatment plan was modified by the team as is customary. The pathway did not dictate care, but it did serve as a clinical guideline for the resident caring for this patient.

Preparing for the Physician's Role in CQI

Barriers to incorporating quality improvement into all aspects of patient care certainly exist, and the successes noted in the UPHS examples could have been matched with failures. Residents should not, however, dismiss the potential for CQI to play a role in the future health care industry. Health systems are increasingly accountable for quality, cost, and value and will look to physicians, as the primary providers, to set new standards of health care delivery. To meet these demands, residents must be prepared to participate in CQI.

Take a Risk

Taking risks in quality improvement may appear to contradict traditional education and training, but it often leads to innovation that involves designing and testing interventions that are against the norm. For many processes, no established benchmarks for achieving best outcomes currently exist, and in such instances a physician must be willing to test new procedures or protocols that may have dramatic impact on improvement.

Be Proactive, Not Reactive

To enhance the educational environment, physicians-in-training should actively participate on committees to develop guidelines or evaluate processes against criteria to measure outcomes. Residents should not only use these guidelines but also be involved in designing or refining the tools that support the implementation of best practice medicine.

Think Outcome, Not Process

Although structure and process are integral to good care and service, they may be emphasized at the ex-

pense of outcomes or, more commonly, may not be linked to outcomes. Patients value the result of their treatment and may be less concerned with the process by which it was achieved.

Incorporate CQI into Daily Practice

CQI must be used to produce change. Integrating basic quality improvement principles with medical practice will lead to organizational and professional success for the resident. Searching for best practices or evidence of a new treatment; evaluating services objectively with data in the form of process results, clinical outcomes, or patient satisfaction; or simply designing new ways to deliver medicine (ie, pathways and guidelines) are all possible within the daily work of a physician. Although CQI methods and clinical practice guidelines are often touted as "cookie-cutter" approaches to care, it is important to remember that they always yield to physician discretion and judgment and that good pathways are based on evidence and best practice.

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