

Indicators to improve clinical quality across an integrated health care system

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Abstract

Purpose. To describe key historical and operational elements of change that may assist an organization to develop quality indicators for implementing a strategic plan to improve care, align health care improvement efforts with national directions, and examine the types of medication indicators used to assess these changes.

Setting. The Baylor Health Care System (BHCS) is an integrated health care delivery organization in Dallas-Fort Worth, Texas. It includes 11 hospitals with 83 000 admissions per year and 47 primary care and senior centers with more than 500 000 visits annually.

Intervention. Following a charter by the BHCS Board of Trustees to develop a health care quality improvement strategic plan, BHCS undertook a system-wide effort to improve care supported by the use of clinical quality indicators.

Results. Consistent with the direction of the US Institute of Medicine, BHCS has implemented a clinical indicator system focused on measures of health care underuse, overuse, and misuse. These indicators demonstrated the accomplishments of specific process of care improvements throughout BHCS. Despite implementing Web-enabled error reporting systems and pilot work with an adverse drug event hospital medical record abstraction tool, BHCS indicators of medication misuse continue to be in a formative stage, much like the national consensus.

Conclusion. Organizational, compensatory, and cultural commitments may be important for successful implementation of clinical indicator initiatives by health care systems. Using clinical indicators to establish baseline performance and to assess the effectiveness of proposed quality improvements provides quantitative and qualitative means to identify and disseminate best care practices. Although indicators to measure underuse of clinically necessary care are well established, there remains a need to achieve consensus regarding practicable medication quality indicators for overuse, misuse, and adverse drug events.

Keywords: adverse drug event, medication error, misuse, overuse, underuse

Health care delivery organizations around the world are focusing considerable attention on the definition and use of clinical quality indicators to identify health care improvement opportunities, to measure the efficacy of specific interventions, and to provide a quantitative link between quality of care and cost effectiveness. In many countries, including the United States [1,2], efforts are underway to develop a national health care report card, although this remains elusive for the near future given the evolutionary state of scientific evidence about the effectiveness of health care interventions and the practicability of specific clinical indicators. Despite this absence of imminent authoritative standards, there is nonetheless an opportunity for public and private health care delivery organizations to align their own clinical quality indicator development efforts with anticipated national directions.

The Baylor Health Care System (BHCS) is a large, US, integrated health care delivery system with a recent but strong commitment to using clinical indicators as powerful tools in the implementation of its organizational strategy. As more and more health care delivery systems embrace the value of clinical indicators in improving their quality of patient care, the BHCS experience in building its own program serves as an instructive case study. Health care organizations around the world—rural or urban—of all sizes and affiliations, in any political economy, and using any business model, face organizational, clinical, and professional barriers to implementing clinical quality indicator tools, as did BHCS. As such, it is useful to explore the BHCS process in addressing its constraints as much as how it used clinical indicators—in this case those associated with medication quality—to achieve its strategic goals.

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Setting

The Baylor Health Care System is a not-for-profit health care system located in and around Dallas-Fort Worth, Texas. The present BHCS began in a renovated 14-room home in 1903 and hosted the Baylor College of Medicine from 1903 to 1943. In 1981 BHCS developed a multi-hospital system, and during 1994 it established a primary care network by merging several primary care medical groups. By 2003 BHCS included 14 hospitals with in excess of 83 000 admissions per year and 55 primary care and senior centers with more than 500 000 visits annually, and has an operating budget of approximately \$1.6 billion. There are >15 000 employees, with >3000 physicians on staff throughout the BHCS operating units, including 400 employed by the medical group practice of the BHCS, Health Texas Provider Network (HTPN).

During the 1990s, when many US health care organizations considered mergers and were targets of acquisition efforts by for-profit organizations, BHCS confronted similar issues that served to help the organization renew its focus on optimizing health care quality. After nearly being acquired by a national for-profit hospital chain, BHCS established its autonomy from Baylor University in 1997. By 1999 BHCS leadership decided not to proceed with a plan to merge with another not-for-profit health care organization in the Dallas-Fort Worth area, opting instead to articulate new long-term goals. This strategic planning effort charged BHCS with the vision to 'become the most trusted source of comprehensive health services' by 2010 and, as one of its 10 strategic objectives, 'to deliver the best and safest care available, focusing on wellness, prevention, early detection, acute and subacute care, and supported at every point by education, research, and improvement'. Concurrently, the Dallas-Fort Worth Business Group on Health launched a significant commitment to health care quality and pledged in 2002 to be one of the 12 'second-wave' US regions in which the LeapFrog group is implementing its standards [3,4].

Defining health care quality improvement at BHCS

Amid this visionary atmosphere of independence and reaffirmation of quality, the BHCS Board of Trustees established an ad hoc quality measurement review committee that was given the task of identifying key health care quality indicators and benchmarks, and recommending implementation of plans to measure and improve BHCS quality of care. The ad hoc committee began its work prior to the release of the first report of the Institute of Medicine's (IOM) Committee on Quality of Healthcare in America, and completed its response before the release of the second IOM report [5,6].

To ensure that future BHCS quality care programs would align with national directions in health care quality, the ad hoc committee used the 1990 IOM definition of quality care as 'the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge' [7]. The committee integrated perspectives of the IOM and the RAND (research and development) organization by defining a health

care strategy as one that was considered necessary 'to the extent that it would be improper care not to recommend the strategy, that the strategy had a reasonable chance of benefiting the patient, and that the potential benefit was not small' [8]. Moreover, the committee anticipated IOM directions [6] by adopting their definitions for health care underuse, overuse, and misuse. The committee defined underuse as the failure to recommend clinically necessary care. Overuse is the delivery of clinically inappropriate care. Appropriate care refers to the expected health benefits relative to the expected negative consequences of a particular health care strategy. A health care strategy where the expected negative consequences outweigh the expected benefits is clinically inappropriate and constitutes overuse of health care services. Misuse is the failure of a planned action to be completed as intended.

Implementing health care quality improvement at BHCS

The ad hoc committee report identified three key elements of an implementation plan for measuring and improving quality of care across BHCS primary care centers and hospitals. The first of these was the creation of a dedicated BHCS entity to prioritize and commit the resources necessary to enable the successful implementation of system-wide health care improvement initiatives by assimilating the efforts of administrative, nursing, and physician leadership. This led to the formation of the BHCS Best Care Committee, which would generate and develop project concepts, designs, and budgets, coordinate the implementation of projects with BHCS operating units, and report project results to BHCS accountable leaders. Members of the Best Care Committee include the vice president for health care improvement (as chair), the extant quality directors from each BHCS hospital and the employed physician group, physician quality leaders and nursing leadership council members, the BHCS vice-president for risk management, representatives of the BHCS chief information officer and chief financial officer, and the physician and pharmacist leaders of the BHCS pharmacy and therapeutics committee. The BHCS chief executive officer, senior vice-president for clinical integration and senior vice-president for health care research and improvement/chief quality officer are invited to attend the committee meetings and receive all committee materials.

The ad hoc committee also recommended establishing incentives to encourage the expedient achievement of Best Care objectives. One such incentive applied health care improvement performance management compensation tools to the extant BHCS performance compensation program, which was historically based on fiscal performance and patient satisfaction measures. The ad hoc committee believed that such incentives should be linked to specific clinical indicators, such as the percentage of patients with acute myocardial infarction discharged on beta-blocker therapy who fulfill guidelines for this therapy. The BHCS Board of Trustees Nominating and Governance Committee accepted this recommendation. Beginning with the fiscal year July 1, 2001 to June 30, 2002, BHCS applied specific financial incentives

related to performance across BHCS hospitals for the four topic areas of the Sixth Scope of Work identified in the Centers for Medicare and Medicaid Services (CMS) Health Care Quality Improvement Program, specifically those for acute myocardial infarction [9]. This marked, for the first time in the nearly 20-year history of the BHCS performance award program, the direct linkage of management incentives to clinical quality indicators, and placed clinical indicators prominently on the radar screens of BHCS operating unit presidents and managers. The Board of Trustees continued this program for the year July 1, 2002 to June 30, 2003. Financial incentives were linked to a composite index using specific thresholds calculated from the individual processes of care components of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) hospital core measure program for acute myocardial infarction and community-acquired pneumonia (details available from the author) [10]. For the fiscal year July 1, 2003 to June 30, 2004, this compensation program is defined by performance on the 10 CMS public-domain process of care measures for acute myocardial infarction, congestive heart failure, and community-acquired pneumonia [11]. Similar incentives linked to clinical preventive services performance by primary care physicians are being implemented across the 47 BHCS primary and senior care facilities.

The final byproduct of the ad hoc committee report was an initiative by one member who also served as Chair of the Board of Trustees of the BHCS flagship hospital, Baylor University Medical Center. This resolution publicly reaffirmed the BHCS commitment to the ad hoc committee's recommendations to improve quality throughout BHCS, and was signed by each member of each BHCS operating unit board. More recently, BHCS physician leaders prepared a similar resolution, which is being endorsed by the medical staff leaders of each BHCS hospital.

These three elements—the creation of a multidisciplinary health care improvement operations team across all BHCS operating units, the introduction of performance management incentives linked to clinical indicators, and the alignment of every board member across BHCS—were the critical factors for the early success in improving care related to clinical indicators across BHCS.

Measuring BHCS health care quality improvements

Readers may well be familiar with the discussion surrounding the definition of performance measures used to assess baseline data and improvements in quality of care [12]. BHCS uses three broad categories of indicators: fiscal, which addresses economic issues; service, which focuses on satisfaction topics such as appointment waiting times; and clinical, which evaluates the relationship of specific processes of care and/or their patient health states outcomes. As such, the term 'clinical indicators' is used throughout this essay to distinguish this indicator from fiscal and service markers. Moreover, BHCS quality improvement efforts use clinical indicators in both a primary care and hospital setting.

Primary care-based clinical indicators

During 1999, the HTPN quality committee began to assess ways to measure and improve delivery of clinical preventive services. Using tools provided by colleagues from the Mayo Health System to reduce start-up time and to enable benchmarking, HTPN focused on 10 clinical preventive services (Table 1) endorsed by the US Clinical Preventive Services Task Force [13,14]. HTPN achieved a nearly 20% improvement in the composite clinical preventive services index score for preventive services listed in Table 1 over the first 3 years of measurement by developing and using patient activation tools, office flow sheets, physician-to-physician academic detailing, and the training of a core group of physician champions in rapid-cycle clinical process improvement.

The extant clinical indicator approach is labor intensive, however, and is based on a retrospective review of the clinical records of 10 randomly sampled patients per physician among patients seen each month at one of the primary care or senior centers. This currently requires the use of an external nurse abstracting resource to collect data for >30 000 patients per year. As HTPN implements an electronic medical record program over the next 2 years, the time and resources spent on chart review will be better applied to other efforts and data mining will become faster, easier, and more precise. Work is also under way to develop organization-wide primary care indicators for chronic illness care, with an initial focus on indicators for diabetes mellitus care based on the National Quality Forum (NQF) performance indicator program [15].

Hospital care-based clinical indicators

Clinical indicators for hospital-based care derived from the CMS Sixth Scope of Work measures were based on data collected using tools provided by the Texas Medical Foundation, the quality improvement organization for Texas. An external nurse abstractor group conducted a retrospective review of hospital medical records for a random sample of up to 25 admissions per month during the period July 1, 2001 through June 30, 2002, for each Sixth Scope of Work clinical condition (acute myocardial infarction, community-acquired pneumonia, congestive heart failure, and pregnancy-related admissions) at each BHCS hospital. With the JCAHO hospital core measure program beginning July 1, 2002, all hospital admissions for the four topic areas are abstracted, initially retrospectively, with a transition by the end of 2003 to concurrent data abstraction by case managers.

Reporting BHCS health care quality improvement measurements

Each month the BHCS Board of Trustees receives a clinical quality indicator report, known as the 'Best Care Measures Report'. The Vice-President for Health Care Improvement produces a summary based on information provided by the various quality measurement staff throughout BHCS, including

Table 1 Clinical preventive services indicators of areas of focus for improvement aligned with the US Clinical Preventive Services Task Force recommendations, June 2003 [Baylor Health Care System (BHCS), Dallas-Fort Worth, TX]

Clinical preventive services Measures (HTPN)	BHCS current performance	Goal ¹	Greenlight status (comment reflects change from previous period)
Overall performance	80%	82.1%	Improved
Colorectal cancer screening	69%	80.8%	Worse
Cervical cancer screening	81%	88.1%	Improved
Breast cancer screening	68%	82.8%	Worse
Hypertension screening	99%	100%	Improved
Cholesterol screening	88%	91.5%	Improved
Diphtheria-tetanus done/recommended	56%	63.3%	Improved
Pneumococcal immunization done/recommended	77%	87.5%	Worse
Influenza immunization done/recommended	69%	74.8%	Worse
Tobacco use screening	93%	97.7%	Improved
Tobacco use counseling	68%	84.6%	Improved

HTPN, Health Texas Provider Network.

¹Defined as the physician-level 75th percentile performance of HTPN for the previous fiscal year, 1 July 2001 to 30 June 2002, for each measure.

This table can be viewed in colour as Supplementary data at *IJQHC* Online.

clinical quality, infection control, risk management, and pharmacy. The report also includes goal performance, if applicable, for each measure, and the monthly direction of change in each measure (Table 2). This document continues to evolve in scope and format, and is guided by the IOM's 'six aims' for improvement: safe, timely, effective, efficient, equitable, and patient-centered [6]. The first letter of each of these aims forms the acronym STEEEP, adopted within BHCS to refer to Best Care improvement initiatives. This acronym also suggests that work to move from the current BHCS level of clinical quality performance to that expected by the BHCS Board of Trustees and the nearly perfect performance challenges of the IOM *Crossing the Quality Chasm* report will indeed be a STEEEP climb for BHCS and its employed and affiliated physicians.

Current status of National Health Care Quality Report Card development efforts vis-à-vis medication quality indicators

Following the publication of the third report of the Committee on Health Care Quality in America [2], the NQF released its interim consensus report, entitled *Hospital Care National Performance Measures (Group 1)* [16]. Among these 31 measures, 14 are in the domain of medication underuse or timing for the initiation of clinically necessary medication, and only one measure (discontinuing antibiotics within 24 hours postoperatively) pertains to medication overuse. The NQF addressed additional draft measures [17]. Three of these 34 measures pertain to medication underuse, and none of these measures pertains to medication overuse or misuse.

An example of using medication clinical indicators at BHCS

The need to assess the level of medication errors at BHCS proved an early opportunity to test these clinical indicators in examining drug underuse, overuse, and misuse (errors), as well as adverse drug events (ADE). In each case BHCS used the indicators to establish baseline data, after which a specific quality improvement process was implemented and the indicators were employed to determine its efficacy.

Medication underuse

One category of indicators is the underuse of medication or the timeliness of administering medications; indicators derived from the CMS Sixth Scope of Work. Efforts to resolve medication underuse at BHCS hospitals are also aligned with the JCAHO hospital core measure program [10]; six of the nine measures for acute myocardial infarction (AMI), for example, pertain to medication underuse or timing in administration. Baylor established emergency room standing orders for early administration of aspirin and beta blockers to presenting AMI patients, as well as including preprinted guides in the physician notes to remind physicians to prescribe this course of medication at discharge. Table 3 shows the results of the AMI indicators, including those measuring the efficacy of the new protocols, and reflects improved results over time as well as those measures that met or exceeded the 'greenlight' threshold of success.

Medication overuse

The only medication overuse measure included in the Sixth Scope of Work was avoidance of sublingual nifedipine in acute

Table 2 Executive summary of the clinical indicators report framed along the aims of safety, timeliness, effectiveness, efficiency, equity, and patient-centeredness (STEEEP), March 2003 [Baylor Health Care System (BHCS), Dallas-Fort Worth, TX]

	BHCS current performance	Greenlight goal ¹	Greenlight status (comments reflect change from previous period)
Safe			
Total patient occurrences/1000 patient days (per quarter)	12.83	TBD	New measure
Total patient falls with injuries (per quarter)	120	0	New measure
Total reported medication errors/10 000 doses	1.956	TBD	New measure
Total reported medication errors with harm/10 000 doses	0.072	TBD	New measure
Evidence-based hospital referral volumes (LeapFrog)	[4]	TBD	Mixed
Evidence-based hospital referral mortality: (LeapFrog)	[4]	TBD	Mixed
Surgical infection rate (abdominal hysterectomy)	0.20	1.14	Improved
Surgical infection rate (inguinal hernia)	0.30	0.64	Improved
Surgical infection rate (total knee replacement)	0.00	0.57	Improved
Timely			
First-dose antibiotic given within 4 hours (pneumonia)	71%	90%	Improved
Antibiotics started within 1 hour before surgical incision (CABG and cardiac surgery)	68%	90%	New measure
Antibiotics started within 1 hour before surgical incision (hip and knee arthroplasty)	47%	90%	New measure
Effective			
Early aspirin use (acute MI)	98%	90%	Improved
Aspirin at discharge (acute MI)	96%	90%	Improved
Early beta-blocker use (acute MI)	85%	90%	Improved
Beta-blocker at discharge (acute MI)	90%	90%	Improved
PTCA within 90 minutes of arrival (acute MI)	42%	80%	Improved
Thrombolytics within 30 minutes of arrival (acute MI)	35%	80%	Worse
ACEI use for LVEF (acute MI)	84%	90%	Improved
Smoking cessation counseling (acute MI)	94%	90%	Improved
Inpatient mortality (acute MI)	5.5%	TBD	Improved
Smoking cessation counseling (pneumonia)	88%	90%	Improved
Smoking cessation counseling (congestive heart failure)	87%	90%	Improved
Blood cultures prior to first dose antibiotic (pneumonia)	81%	90%	Worse
Oxygenation assessment (pneumonia)	99%	90%	Same
Pneumococcal vaccine screening/immunization (pneumonia)	54%	90%	Worse
Assessment of LVEF (congestive heart failure)	89%	90%	Same
ACEI at discharge with EF <40% (congestive heart failure)	83%	80%	Improved
Discharge instructions (congestive heart failure)	39%	90%	Improved
Vaginal birth after cesarean section (pregnancy)	9%	TBD	New measure
Neonatal mortality (pregnancy)	0.31%	TBD	New measure
Third or fourth degree laceration (pregnancy)	6.1%	TBD	New measure
Colorectal cancer screening (preventive)	65%	80.8%	Worse
Cervical cancer screening (preventive)	72%	88.1%	Improved
Breast cancer screening (preventive)	68%	82.8%	Worse
Hypertension screening (preventive)	97%	100%	Improved
Cholesterol screening (preventive)	85%	91.5%	Improved
Diphtheria: tetanus done/recommended (preventive)	47%	63.3%	Improved
Pneumococcal immunization done/recommended (preventive)	74%	87.5%	Improved
Influenza immunization done/recommended (preventive)	59%	74.8%	Worse
Tobacco use screening (preventive)	90%	97.7%	Same
Tobacco use counseling (preventive)	65%	84.6%	Same

continued

Table 2 *continued*

	BHCS current performance	Greenlight goal ¹	Greenlight status (comments reflect change from previous period)
Antibiotics consistent with current recommendations (CABG and cardiac surgery)	99%	95%	New measure
Antibiotics consistent with current recommendations (hip and knee arthroplasty)	99%	95%	New measure
Efficient			
Median time for thrombolytic administration (acute MI)	39.5	TBD	Worse
Median time for angioplasty administration (acute MI)	101	TBD	Improved
Percent of cases transfused (total joint replacement surgery)	50%	<46%	Improved
Percent of cases passing ACP guidelines (total hip replacement)	39%	60%	Improved
Antibiotics discontinued within 24 hours of surgery end time (CABG and cardiac surgery)	47%	70%	New measure
Antibiotics discontinued within 24 hours of surgery end time (hip and knee arthroplasty)	36%	70%	New measure
Equitable			
Detailed information by gender, age, race, ethnicity, and health insurance status available from the author			
Patient centered			
Would recommend for inpatient stay (in-patient satisfaction)	92.0%	93.9%	Improved
Overall quality of care/services (in-patient satisfaction)	82.7%	87.6%	Worse
Overall quality of nurse care (in-patient satisfaction)	84.8%	88.3%	Worse
Helpfulness of nurses to reduce pain (in-patient satisfaction)	83.6%	86.7%	Worse
Independent providers explained condition to family (in-patient satisfaction)	81.1%	84.0%	Worse
Would recommend for an OP stay (outpatient satisfaction)	93.2%	95.4%	Improved
Overall quality of care/services (outpatient satisfaction)	83.2%	91.6%	Worse
Overall quality of nurse care (outpatient satisfaction)	84.3%	NA	Same
Courtesy/helpfulness of registration (outpatient satisfaction)	84.1%	89.5%	Improved
Satisfaction with registration wait time (outpatient satisfaction)	66.4%	90.1%	Worse
Would recommend for an ED stay (emergency satisfaction)	83.5%	88.0%	Worse
Overall quality of care/services: emergency satisfaction	75.3%	81.2%	Improved
Overall quality of nurse care (emergency satisfaction)	78.4%	NA	Improved
Coordination of ED care (emergency satisfaction)	75.0%	79.5%	Improved
Overall quality of doctor care (emergency satisfaction)	76.6%	81.5%	Worse
Would you recommend your doctor (HTPN)	96.3%	93.3%	Worse
Overall satisfaction with doctor (HTPN)	90.6%	86.2%	Improved
Overall satisfaction with nurse/medical assistant (HTPN)	85.8%	83.5%	Improved
Thoroughness of treatment (HTPN)	89.9%	83.8%	Improved
Attention given to what you have to say (HTPN)	90.0%	84.0%	Worse
Patient awareness of errors (in-patient)	11.96%	TBD	New measure
Patient awareness of errors (emergency department)	10.98%	TBD	New measure
Patient awareness of errors (outpatient)	3.97%	TBD	New measure

ACEI, angiotensin converting enzyme (ACE) inhibitor; ACP, American College of Physicians; CABG, coronary artery bypass graft; ED, Emergency Department; EF, ejection fraction; HTPN, Health Texas Provider Network; LVEF, left ventricular ejection fraction; MI, myocardial infarction; OP, Outpatient; PTCA, percutaneous transluminal coronary angioplasty; TBD, to be determined.

¹Methods used to determine goals varied for each category are available from the author.

This table can be viewed in color as Supplementary data at [IJQHC Online](#).

Table 3 Executive summary of the process of care measures for acute myocardial infarction, March 2003 [Baylor Health Care System (BHCS), Dallas-Fort Worth, TX]

Clinical preventive services measures (HTPN)	BHCS current performance	Goal ¹	Greenlight status (comment reflects change from prior period)
AMI			
Early aspirin use	98%	90%	Improved
Aspirin at discharge	96%	90%	Improved
Early beta-blocker use	85%	90%	Improved
Beta-blocker at discharge	90%	90%	Improved
Thrombolytics within 30 minutes of arrival	35%	80%	Worse
Median time for thrombolytic administration	39.5 min	TBD	Worse
PTCA within 90 minutes of arrival	42%	80%	Improved
Median time for angioplasty administration	101 min	TBD	Improved
ACEI use for LVEF	84%	90%	Improved
Smoking cessation counseling	94%	90%	Improved
In-patient mortality	5.5%	TBD	Improved

ACEI, angiotensin converting enzyme (ACE) inhibitor; LVEF, left ventricular ejection fraction; PTCA, percutaneous transluminal coronary angioplasty; TBD, to be determined.

¹Goals set by the VHA Inc. Chief Executive Officer Workgroup on Clinical Excellence.

This table can be viewed in color as Supplementary data at *IJQHC* Online.

stroke. The Seventh Scope of Work includes discontinuation of prophylactic antibiotics within 24 hours of the end of surgery as a medication overuse quality indicator [18]. As of October 2002, JCAHO's recommended list of core measures for hospital community-acquired pneumonia included 'excessive antibiotic use' as a measure 'identified for potential future implementation', although no specific implementation date has been determined [19]. Table 4 depicts the BHCS improvement in timely antibiotic start and stop at specific hospitals, and across the system for specific surgical procedures.

The opinions of quality specialists differ with respect to the importance of medication overuse as a clinical indicator, with some arguing that current reimbursement schemes function as a systemic financial limit to drug use, thereby preventing or minimizing overuse (and hence the lower emphasis on the overuse of drugs in national hospital quality indicators). BHCS, however, operates in a financial environment in which it has no capitated care contractual relationships. Thus, unlike health care organizations involved in risk-based care, BHCS-affiliated physicians have few current incentives to focus on clinical indicators of overuse of pharmaceutical care. In a 'fee-for-service' environment where physicians are independently employed and not economically aligned with the hospital pricing structure, the market alone does not eliminate drug overuse. Moreover, in cases such as the excessive prescription of antibiotics for viral respiratory illness, especially in children, overuse is not universally limited by current reimbursement schemes [20].

Medication misuse and error

BHCS defines a medication error based on language developed by the National Coordinating Council for Medication

Error Prevention and Reporting (NCCMEPR) as 'any preventable event that may cause or lead to inappropriate medication use or patient harm' [21]. During the time period of this case study, BHCS employees reported medication errors through two voluntary error reporting systems across BHCS hospitals; one system was developed internally [22] and another by DoctorQuality [23,24]. The Web-based reporting systems have substantially increased medication error reporting across BHCS hospitals and identified important medication safety improvement opportunities, but the incomplete capture of medication errors via this system does not allow one to relate changes in the medication error rate to changes in medication quality across BHCS hospitals for which complete reporting data were available [22,23]. The medication error indicator used by BHCS hospitals is shown in Figure 1. Similarly, using the classification of levels of harm provided by the NCCMEPR, Figure 2 displays the BHCS medication error harm indicator.

Adverse drug events

In the autumn of 2001, BHCS hospitals participated in a VHA Inc. study on Adverse Drug Events (ADEs) [25]. In this study, external nurse reviewers conducted a retrospective review of 100 patient medical records per hospital, and identified potential ADEs and other findings associated with those events. Figure 3 shows the percentage of records that had any type of in-hospital ADEs, and Figure 4 shows the percentage of those ADEs considered serious. Early efforts throughout BHCS to identify and understand ADEs have focused on in-hospital medication use. An important area for future study by BHCS and national researchers is that of ADEs in the outpatient setting [26,27]. As Kilbridge and Classen predicted, there was very

Table 4 Executive summary of the process of care measures for surgical infection prevention, March 2003 [Baylor Health Care System (BHCS), Dallas-Fort Worth, TX]

Clinical preventive services measures (HTPN)	BHCS current performance	Goal ¹ for year 2002	Greenlight status 2003 (comment reflects change from prior period)
Surgical infection prevention			
Antibiotics started ≤1 hour before surgical incision (CABG and cardiac surgery)	68%	90%	New measure
Antibiotics started ≤1 hour before surgical incision (hip and knee arthroplasty)	47%	90%	New measure
Antibiotics consistent with current recommendations (CABG and cardiac surgery)	99%	95%	New measure
Antibiotics consistent with current recommendations (hip and knee arthroplasty)	99%	95%	New measure
Antibiotics discontinued within 24 hours of surgery end time (CABG and cardiac surgery)	47%	70%	New measure
Antibiotics discontinued within 24 hours of surgery end time (hip and knee arthroplasty)	36%	70%	New measure

CABG, coronary artery bypass graft.

This table can be viewed in color as Supplementary data at *IJQHC* Online.

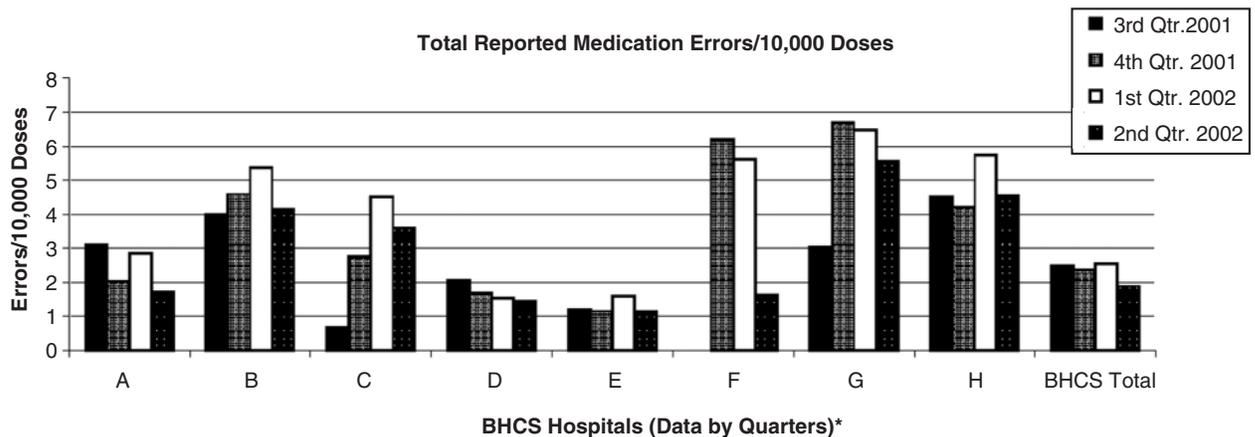


Figure 1 Total reported medication errors per 10 000 doses, July 1, 2001 to June 30, 2002 [Baylor Health Care System (BHCS) hospitals, Dallas-Fort Worth, TX]. Hospital F did not collect these data during the first quarter of the reporting period. This figure can be viewed in color as Supplementary data at *IJQHC* Online.

little overlap between medication errors reported via the voluntary Web-enabled error reporting system and the capture of ADEs via hospital medical record review [28]. Indeed, in 2001, a third of US health care organizations reported having no

medication errors at all [29]. Of the 137 ADEs identified during this medical record review process, only five were captured through the Web-enabled error reporting systems employed by BHCS hospitals [22,23,29].

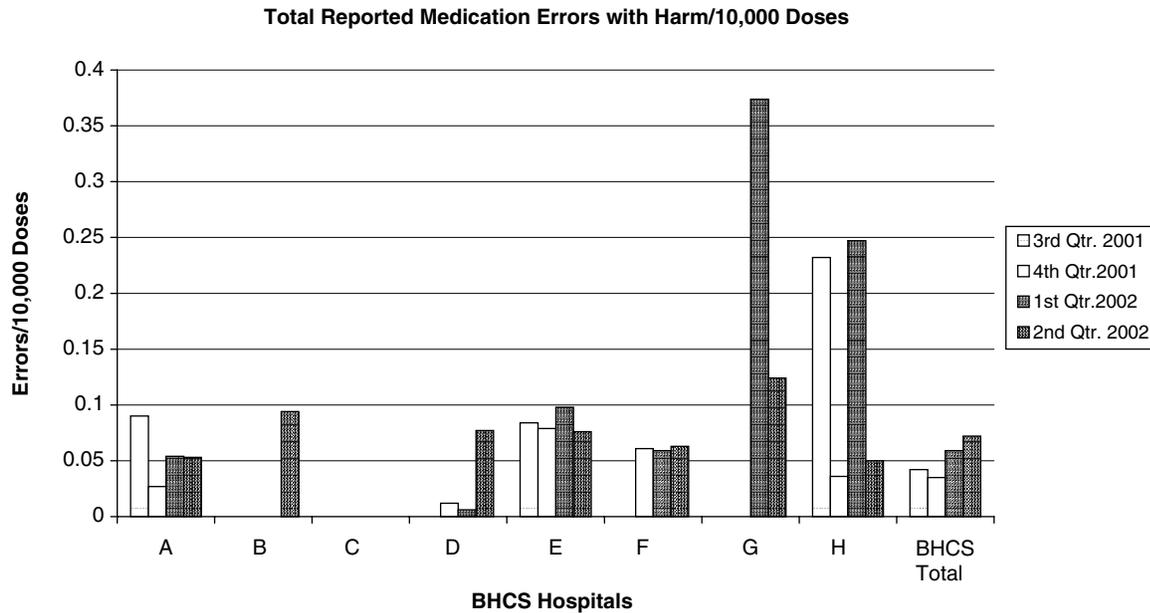


Figure 2 Total reported medication errors with harm per 10 000 doses, July 1, 2001 to June 30, 2002 [Baylor Health Care System (BHCS) hospitals, Dallas-Fort Worth, TX]. Not all hospitals collected these data during all four quarters of the reporting period. This figure can be viewed in color as Supplementary data at *IJQHC* Online.

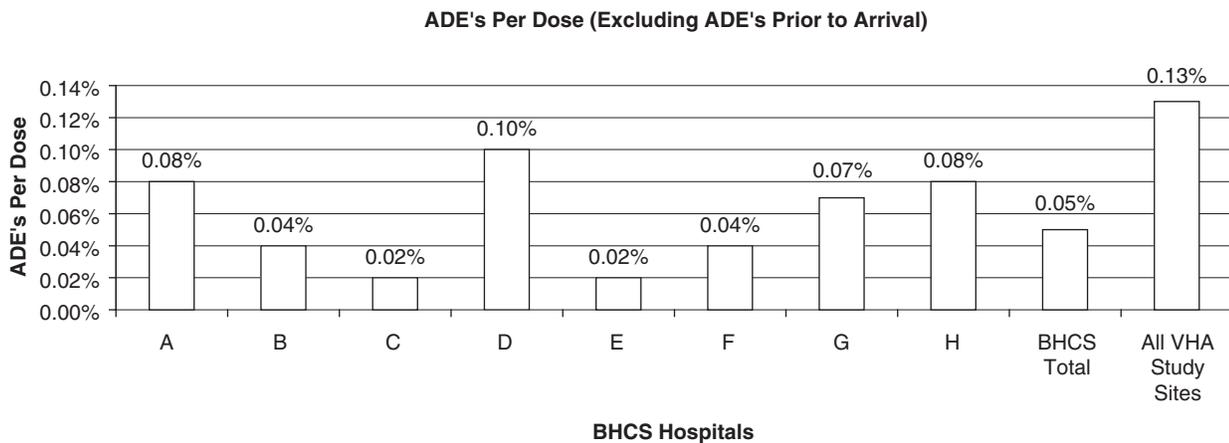


Figure 3 Total in-patient adverse drug events per dose, 2001 [Baylor Health Care System (BHCS) hospitals, Dallas-Fort Worth, TX]. ADE, Adverse drug event; VHA, VHA Inc. This figure can be viewed in color as Supplementary data at *IJQHC* Online.

Conclusions

BHCS has developed an active and evolving quality improvement program that includes organizational, compensatory, and cultural commitments to providing its strategic goal of 'Best Care' medical practices. Specific strategies to achieve this goal include improving medication safety, defining and delivering consistently appropriate care across the system, and promoting STEEP aims and results. The use of clinical indicators to

establish baseline data and to assess the effectiveness of proposed quality improvements enables quantitative and qualitative means to evaluate and implement these strategies.

Although indicators to measure underuse of clinically appropriate care are well established, there remains a legitimate need to achieve consensus regarding practicable indicators for overuse, misuse, and adverse drug events, particularly at a national level. The same holds true for drug error reporting systems and their relationship to measuring ADEs.

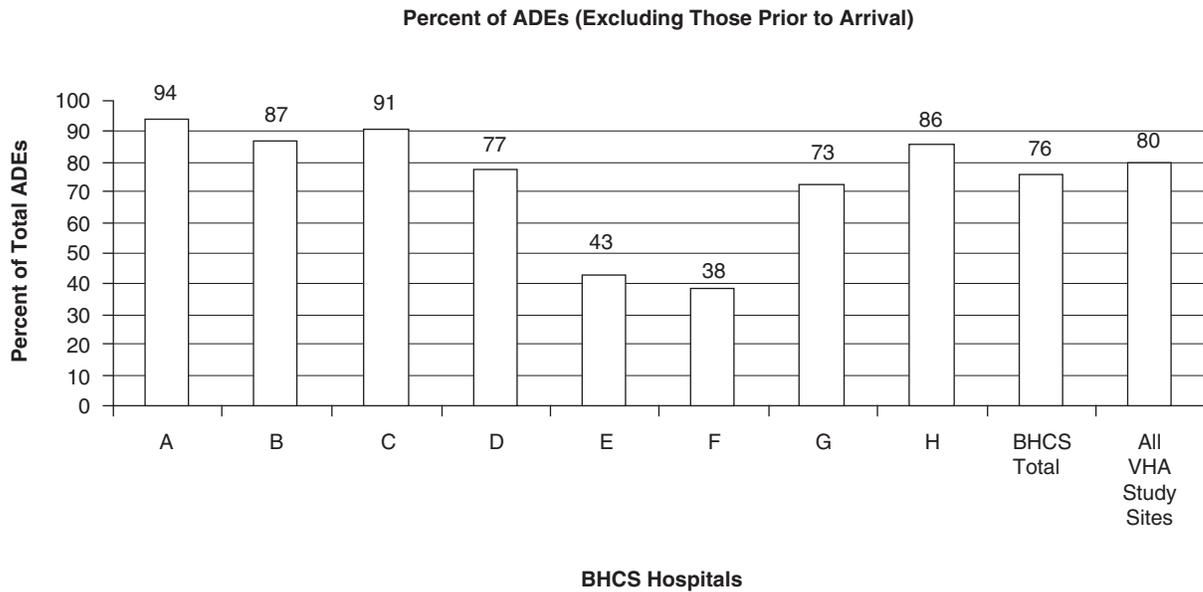


Figure 4 Percent of in-hospital adverse drug events with harm category of E or worse, 2001 [Baylor Health Care System (BHCS) hospitals, Dallas-Fort Worth, TX]. ADE, Adverse Drug Event; BHCS, VHA, VHA Inc. This figure can be viewed in color as Supplementary data at *IJQHC* Online.

Future research can test hypotheses pertaining to the organizational strategy used by BHCS to create a team of stakeholders and to align corporate and medical leadership with the value of quality measurements as tools to achieve health care goals [30], as well as the role of feedback, auditing and financial incentives in implementing quality improvements.

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