

## Comparing Hospital Performance by Measuring Medication Error Rates: Is It Possible?

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In June 2002, the National Coordinating Council for Medication Error Reporting and Prevention (NCC-MERP) opined that "the use of medication error rates to compare healthcare organizations is of no value."<sup>1</sup> With much public attention focused on the problem of error in health care—particularly on medication errors, the largest single category of error—this statement seemingly challenged calls for accountability of healthcare organizations.

Some regulators and consumer groups have seen the public release of data comparing the performance of hospitals based on their individual medication error rates as evidence of true accountability. Others have argued that meaningful error rates can be calculated and used to compare performance for improvement purposes.<sup>2</sup> Either case is founded on the assumption that hospitals would work to lower their rates of medication error because of their competitive nature or because of the adverse effects of public opinion, payer disincentives and regulatory intervention.

However, the validity of this line of reasoning depends wholly on whether reliable and reproducible medication error rates for comparative purposes can be calculated. While the NCC-MERP recommendations do not minimize the need for accountability, they do suggest that the use of medication error rates is not a valid method to compare or evaluate a healthcare organization's performance.

### What causes variability in medication error rate calculation?

Calculating medication error rates requires the consistent identification of medication errors to include in the numerator of the rate. Many factors influence the ability to identify medication errors, including: defining medication error; the organizational culture; the nature of the patient population; and the type of reporting and detection system used for medication errors.

### Defining medication errors

NCC-MERP defines medication error as "any preventable event that may cause or lead to inappropriate medication use or

patient harm while the medication is in the control of the healthcare professional, patient, or consumer."<sup>3</sup> Since this widely accepted definition includes harm or potential for harm and inappropriate use and potential for inappropriate use, it casts a wide net around the medication use process. Therefore, any calculation of an error rate would have to account for all these actual and potential events to be valid for comparison purposes.

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Even a simpler definition of medication error offered by Barker of "deviation from the prescriber's medication order"<sup>4</sup> still requires identifying a large number of events—up to 300,000 annually in the average hospital.<sup>5</sup> Measuring these large numbers of events can lead to wide variability, particularly when combined with the additional factors discussed below.

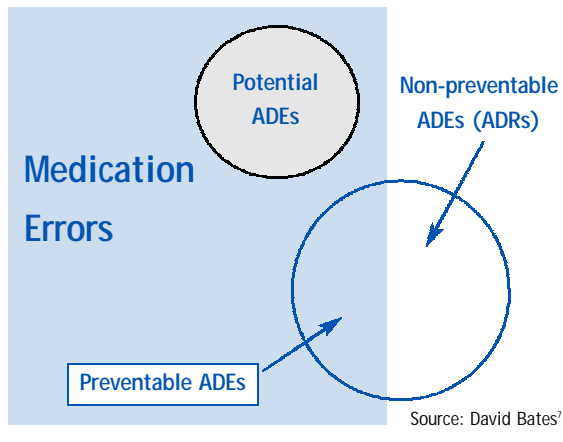
Another problem with defining medication errors is the imprecise use of terminology in describing these events. Patient harm resulting from a medication intervention is called an adverse drug event (ADE), of which only a portion is preventable and should be considered an error. However, only a small proportion of medical errors are preventable ADEs. Non-preventable ADEs are not errors and are called

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adverse drug reactions (ADRs). Another subset of medication errors are those with a potential for harm, which are also known as potential ADEs.<sup>6</sup> Using these terms interchangeably has led to further confusion and lack of precision in identifying events. The illustration below shows the correct distinction among these types of events.

## Distinction Between Medication Errors, Potential ADEs and ADEs



### Organizational culture's effect on reporting errors

Identifying medication errors depends on the observational skills and the willingness to report the events by those closest to them. Frequently, the culture in healthcare organizations does not encourage error identification and reporting. The hierarchical nature of medicine, the sense of personal culpability and fear of professional embarrassment often create an atmosphere of "shame and blame." In this type of environment, the number of medication error reports may be low, leading to the calculation of a spuriously low medication error rate.

Other organizations that have developed a more open culture and have placed an emphasis on learning from errors may receive many more reports of errors for the same volume of prescriptions, leading to a higher calculated medication error rate. Depending on which culture is present, calculated medication error rates may not be an accurate measure of organizational performance, but rather an indicator of that culture.

### What is the effect of patient population and setting of care?

The occurrence of error increases with complexity of care and severity of illness. Healthcare organizations that provide a high percentage of complex care to severely ill patients may have high numbers of medication errors with overall higher medication error rates.

While risk adjustments to the rates may be made to account for severity of illness, there is no such adjustment available to reflect the complexity of care afforded by technological advances. Medication error rates calculated for organizations that provide such care may place them at a disadvantage when their performance is compared to organizations that provide much-less-complex care. Therefore, the value of error rates for comparative performance is limited.

### What is the effect of the detection and reporting system?

Accurate calculation of medication error rates requires awareness of such errors from the passive receipt of reports from healthcare workers or from the more active search for errors through automated triggers, observation and chart review.

Depending on the design of the reporting system, the number of reports of medication errors can vary widely. Flynn et al have indicated almost a three-hundred-fold variation in reports received, depending on whether more active or passive methods are employed to capture the errors.<sup>8</sup> With this wide variation, calculating comparative rates without standardized collection methodologies would be meaningless in evaluating organizational performance. The type and purpose of the reporting system can also influence the number of reports received. Most systems can be classified as either voluntary or mandatory. Arguments can be advanced favoring either type as yielding more reports.

Looking at the purpose of the reporting system may be more useful in understanding whether the system will consistently yield medication error reports across organizations. Systems designed for regulatory purposes frequently produce fewer reports with less detail than those designed solely for learning or improvement. Not only does this discrepancy lead to variation in the calculation of the error rate, but it could lessen the value of the reports themselves in providing information helpful to understanding the causes of error.

### What is the value of medication error reports?

If the purpose of developing comparative medication error rates is to provide information to consumers, purchasers and regulators about the relative performance of healthcare organizations, the exercise would be misleading, unrepresentative and possibly damaging to improvement efforts.<sup>9</sup> As simply stated by the NCC-MERP, "the use of medication error rates to compare healthcare organizations is not recommended."<sup>1</sup> However, this is not the only purpose of identifying and reporting medication errors.

# Creating Value-focused Patient Safety

BY MICHELLE BOYLAN, VICE PRESIDENT, QUALITY MANAGEMENT FOR COMMUNITY HEALTH CARE, WAUSAU HOSPITAL, WAUSAU, WISC.

Health systems today are struggling to create focused priorities aimed at containing or reducing operational cost and decreasing organizational liability. Hospitals are stepping up to the challenge, using data to reengineer the process to create value for the organization and the consumer.

Consumer-driven health care, influenced by the Institute of Medicine Report, *To Err is Human*,<sup>1</sup> media, technology and disclosure of patient care outcomes to the public, has jump-started the next evolution: **value-focused patient safety (VFPS)**.

## What do we know about the current environment?

- Americans look to four indicators to assess the quality of a hospital:<sup>2</sup>
  1. Medical errors that harm patients;
  2. The hospital's experience in performing a test or surgery;

3. Whether doctors at the hospital are board-certified; and
4. How many patients die after having surgery.

- Racial and ethnic minorities are almost twice as concerned as the general population about errors when they receive health care.<sup>2</sup>
- Because medical management will depend on information systems to monitor processes and outcomes, improving these procedures is estimated to take close to 15 years.<sup>3</sup>
- By 2010, 50% of all consumers will have access to understandable comparative information on plan quality.<sup>3</sup>
- Fortune 500 companies, led by the Leapfrog Group, will steer 25 million covered lives to hospitals that invest in computerization, employ intensivists, and meet volume benchmarks for specialized services.<sup>4,5</sup>

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## Comparing Hospital Performance

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Reports of medication errors can help assess the internal organizational environment, drive quality improvement efforts and initiate proactive hazard analysis. An organization may want to calculate its own medication error rate if it can consistently control for the variables described. Using this rate could be valuable in tracking the organization's progress in addressing medication errors internally, but would have no value for comparative performance purposes.

The ultimate goal of any medication error-reporting system is to reduce harm to patients. By measuring this reduction in harm and reporting on it, organizations can demonstrate their accountability to the publics they serve.

While issues related to causality and culture would still need to be overcome, harm—as an outcome—should be easier to measure. A culture of safety will be truly achieved only when organizations can identify hazards reliably and consistently, and overcome them as part of their routine operations. **NPSF**

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# Creating Value-focused Patient Safety

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## Using data to improve practice

By using data to track, understand, and reduce risks, hospitals can improve outcomes for patients while bringing down the cost of insurance and preventing claims. Each member of the healthcare team plays a vital role in utilizing the data to improve practice. The most important enhancement that can be made by all members of the healthcare team is to improve communication.

## The Pathways Project offers practical tools

There are tools available to help healthcare organizations jump-start the journey to decreasing organizational liability and enhancing safe care. The tools are part of the Pathways Project, supported by the Commonwealth Fund in partnership with the American Hospital Association, Health Research and Educational Trust and Institute for Safe Medical Practices. These tools are available on the Internet at [www.medpathways.info](http://www.medpathways.info).

The second tool in the series, "Looking Collectively at Risk," provides a set of key elements allowing the hospital to systematically assess and evaluate risk. The tools are evidenced-based and contain contemporary references to educate the organization. The tools are easy to implement and can be incorporated into all types of health system strategies and structures.

Applying the Pathways tool set to an organization creates an increased awareness of the environment and a cultural shift from responsibility to accountability, and from volume to value.<sup>7-8</sup> This sets the foundation for VFPS.

## Setting a new direction for cultural change

Creating a culture shift from responsibility to accountability is a necessary and challenging process—and an important step in moving toward VFPS. The interplay between the human relationships and using what was learned from analyzing the process becomes the catalyst in working toward a more autonomous environment that focuses on value.

Creating patient safety value is the next step in the evolution of safety, quality, and performance improvement. VFPS combines the work of several methodologies: financially focused quality, performance improvement, engineering, and risk reduction.

## Creating value and accountability

Value processes look at product, results, outcomes, differences, and most importantly, doing the right thing. The table below outlines the characteristics of responsibility and accountability.

<b>Responsibility and Accountability</b>	
<b>Responsibility looks like:</b>	<b>Accountability looks like:</b>
Process	Product
Work	Results
Action	Outcomes
Do well	Difference
Right	Right thing
Volume	Value

The framework for creating value originates with value engineering—an organized effort directed at identifying the functions of a product or process to achieve those functions at the lowest overall cost consistent with performance, reliability, quality, safety, and maintainability.<sup>9</sup> This requires working with root-cause analysis methodology and failure-mode effect analysis as starting points to VFPS and adds a fiscal component.

VFPS requires someone with a true financial perspective to coordinate efforts. Ideally, a member of the finance department would be involved, but often a member of management coordinates these activities. The approach includes:

- Evaluating the practicality of pursuing the identified action;
- Expending the appropriate amount of resources to understand the process (effective meetings, etc.);
- Generating a comprehensive cost analysis; and
- Giving appropriate weight and priority to cost when selecting options.

Typically, hospitals apply these principles only to capital projects, major purchases, and outsourced work. VFPS applies these principles to the work of providing safe patient care.

## Looking at costs

There are four basic quality costs for quantifying the value of

risk-reduction activities using VFPS. The process identifies potential costs as well as savings.

Applying the definitions in the table below to the work process of a root-cause analysis or failure-mode effect analysis creates another tangible aspect of what is required to create a safe healthcare environment. Working with a medication use process, VFPS starts to create a tangible value that quickly gains organizational attention.

Value Costs	
Cost	Definition
Preventive costs	Costs/potential savings applied proactively to enhance system before harm.
Appraisal costs	Cost of conducting an RCA, FMEA, HVA.
Internal cost of an error	Tangible/potential costs incurred by the system because of error or harm.
External cost of error	Tangible/potential cost incurred by the system due to the external error.

### Example

#### Value-focused patient safety: Medication-use process

- 1. Start with a failure-modes effect analysis or root-cause analysis.** This methodology is identified on the JCAHO Web site at [www.jcaho.org](http://www.jcaho.org).
- 2. Define focus area.** This aspect of the process delves into detail. In this case, storage of narcotics and first doses are evaluated utilizing value-focused methodology.
- 3. Apply a financial focus.** The financial focus encompasses monitoring preventive and appraisal costs, internal cost of error, potentially compensable events, precautionary files as a result of harm, medical malpractice litigation activity, care activity costs, and the external cost of error.
- 4. Formulate report totals.** Formulating report totals greatly depends on incorporating the information the organization deems to add value demonstrating outcome and products. In applying the value-focused methodology, the preventive and appraisal costs, internal and external cost of error, and care activity costs form the financial

story. Bringing together risk events further enhances value-focused methodology. This serves as an excellent tool for management to monitor value.

- 5: Implement.** Monitor activities in cooperation with your performance improvement program and risk management program.<sup>11-12</sup> Specific tools for monitoring can be found online at [www.asq.org](http://www.asq.org).

Value-focused patient safety is gaining momentum. Finding efficiency in the utilization of data, moving the culture from responsibility to accountability and demonstrating efficient use of healthcare dollars to create quality and safe patient outcomes is the trend of the future. Visionary hospitals are moving to value-focused patient safety. [NPSF](#)

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# A Solution for Safer Intravenous Drug Delivery at the Point of Care: A Team Approach

BY ELLEN KINNEALEY, BSN, RN; GAYLE FISHMAN, BSN, RN, MBA; HAROLD DEMONACO, MS; JEFFREY COOPER, PHD; NATHANIEL SIMS, MD.

The challenge to all who endeavor to make medication delivery safe is to understand the key systems issues, and—more difficult still—to develop strategies, devices, tactics and tools to make errors less frequent and to make new systems that are highly responsive to the needs of patients and clinicians. Here is a brief background on how a team effort at Massachusetts General Hospital (MGH) allowed development of pioneering technology and systems solutions, and successful wide implementation of those systems throughout the hospital's critical care and operating room environments.

## Defining the problem

The most serious errors in intravenous (IV) medication delivery involve misprogrammed drug infusion pumps that infuse powerful drugs directly into the patient's vein during hospitalization or outpatient care. Underlying the problem of dosing errors is the complexity of existing systems and practices.

Drug pharmacology is complex. Preparing powders or concentrated solutions into properly diluted liquid mixtures suitable for administration is also intricate; this is usually done in the pharmacy, but often must be done at the bedside in response to urgent patient need. Drug dosing calculations often involve individualized dosing based on patient weight and arcane "dose rate units" such as "micrograms per kilogram of body weight per minute." These dosing calculations are very involved. Until recently, end users—nurses and physicians assisted by pharmacists—bore the entire responsibility for mathematical conversion of dose rate units into fluid-flow units, proper keypad data entry, and recall of key pharmacologic details or institutional practice regarding dosing or titration strategies—often from memory—for every drug administration.

These factors are aggravated by the challenges of maintaining staff training in the presence of employee turnover; the current shortage of experienced critical care nurses; and the effort and cost of updating and distributing paper-based knowledge dissemination systems such as hospital formularies, and policy and procedure protocols and manuals.

Our team comprised a group of individuals who recognized that, from time to time, patients had been harmed in their own practice or in incidents involving other caregivers. The motivation to address the challenges of IV medication error

prevention came from extensive experience in several medical institutions, witnessing incidents like these:

- Years ago, an anesthesia resident was caring for a newborn baby with congenital heart disease who needed a precise intravenous infusion of a powerful drug to dilate the blood vessels prior to surgery. After the infusion was started, the baby remained inadequately oxygenated. Eventually the clinicians discovered that an error in the complex dose calculations had led to a serious under-dosing of the critical drug. This sentinel experience resulted in a personal resolve by the anesthesiologist to devote significant energy to addressing patient safety.

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**'[C]ompelling incidents and near-misses motivated the formation of our team, and led to the devotion of significant energy to preventing IV drug administration errors.'**

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- Two experienced ICU nurses were shocked to discover they had accidentally given a significant overdose of a new medication to a patient. They knew the error occurred due to the complex calculations required for proper dosing, and consulted a colleague for assistance in developing "smarter" drug infusion pumps that could provide them with guidance in carrying out these calculations correctly at the bedside. That colleague became the lead advocate and implementer of the new system.
- A double-check system established in an outpatient chemotherapy infusion center caught the misprogramming of an infusion pump with a chemotherapeutic agent—the third such occurrence that month. Although the double-check system prevented delivery of incorrect dosages, this near-miss event signaled a need to find a way to eliminate the complex programming steps required by many devices. A task force was put in place to adopt advanced technology and to standardize clinical protocols.

Thus, compelling incidents and near-misses motivated the formation of our team, and led to the devotion of significant energy to preventing IV drug administration errors. The internal clash between problem recognition and the ethical guide for clinicians to “above all, do no harm” was intense. The team achieved a “critical mass” of people from diverse disciplines, both clinical and non-clinical, whose combined capability proved unstoppable.

Some team members were physicians or nurses noted for their keen observational skills, technical facility with devices, or ability to communicate clinical issues effectively to engineers; others were engineers or persons with responsibility for such key hospital functions as pharmacy administration or drug therapy management.

An effective team can achieve success by focusing the collective perspective of astute observers and domain experts on a complex problem. In this case, the goal was to distill the problems into actionable issues, so the issues could be resolved by some combination of a new or unique technical solution, and a new clinical practice or process of care that could further empower and enhance the capability of our hospital's caregivers.

#### **How was this plan actualized and implemented?**

After studying this difficult problem, the team concluded that there were two distinct but actionable issues:

1. We had inadequate systems to disseminate intravenous-drug knowledge to physicians and nurses at the exact moment of need; and
2. We had inadequate systems to ensure the right drug and right drug dosing at the time of bedside administration. The team concluded that both problems could be substantially resolved with a single technical solution, plus associated care-process changes; this insight led to the conception and implementation of “smart” infusion devices with “onboard drug libraries.” Supporting the clinician at the bedside was the objective.

The team determined that a new generation of “smart” drug-infusion pumps could be created and directly provisioned with drug information knowledge specific to and managed by the institution. Since 1996, MGH—in collaboration with drug infusion device developers including Harvard Clinical Technology, Inc, of South Natick, MA—has

implemented a solution in all eight intensive care units, and all of its nearly 60 operating room environments, and in the cardiac catheterization laboratory. The solution is a standardized system of over 400 drug infusion pumps that provide clinicians with a frequently updated, clinician-developed, hospital-sanctioned, customizable electronically loadable drug “library” for several hundred IV drugs, housed in the infusion pump at the bedside—essentially, an “on-board formulary” and clinical practice guidance and dose-checking system.

In essence, the system allows the pumps to automatically display initial settings, as well as “default” dose rates and dose rate units, after the clinician selects a drug name and application from a pump screen menu. The system then prompts the end user to make adjustments to those preliminary settings based on clinical need and to confirm the final settings prior to initiation of drug delivery. The pumps provide warnings to the end user if the drug dose rate requested is outside institutional limits for the drug being infused, or simply prohibits drug delivery in excess of these limits.

Similarly, the pumps prohibit administration of a “loading dose” or “bolus” if inappropriate for the particular drug. For example, if the end user wishes to administer potassium at a rate exceeding 20 mEq per hour, the pump will warn the end user and, in this case, prohibit delivery, thereby teaching the clinician safe practices as well as preventing patient injury. This technology has virtually eliminated medication errors involving under-dosing, over-dosing and wrong dosing units in the affected clinical areas.

*The next stage of the medication error prevention technology, due in April 2003, incorporates additional capability in the pumps, enabling automated drug recognition. This is a major milestone on the path to a key major objective of our team: eliminating “wrong-drug” errors.*

*“LAST-ADR”—an acronym for “Library Action Set Technology + Automated Drug Recognition”—conveys our ultimate goal, “LAST Adverse Drug Event,” a moment we hope to celebrate in the not-too-distant future at MGH. [NPSF](http://www.npsf.org)*

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*The authors are the winners of the 2002 NPSF Janssen Elder Care Award for implementation of innovative solutions for medication administration at the bedside.*

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## Plan to Attend 'Integrity and Accountability in Clinical Research,' May 6-8 in Washington, DC

There's still time to register for NPSF's second annual Research Conference, "Integrity and Accountability in Clinical Research," at the Renaissance Washington DC Hotel.

For registration information, please contact Carol Lieser, CMP, at 760-770-0288, or e-mail her at [clieser@npsf.org](mailto:clieser@npsf.org). Exhibitor and sponsorship information is also available; contact Carol Lieser for details.

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