

# Risk-Based Patient Safety Metrics

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## Abstract

Patient safety programs require meaningful metrics. Dominant frameworks are based on two safety metrics: one that seeks to identify, measure, and eliminate error and one that seeks to identify, measure, and eliminate injuries. However, non-health care safety programs suggest a third framework, hazard- or risk-based measurement. Error measurement has many limitations, including the issues of error identification, hindsight bias, outcome-based judgment, and reinforcement of blame. Although injury-based metrics might aid the prevention of harm, limitations include poor discrimination of preventability, resulting in misdirected interventions, missed opportunities, and disregard for the systems-based nature of unsafe health care. In contrast, work in safety science allows for a third framework: risk-based patient safety metrics that are consistent with systems thinking in health care. These metrics focus on identifying the underlying hazards or risks in the system that ultimately lead to errors and injuries. In this article we explore the strengths and limitations of these frameworks and describe a practical application of risk-based patient safety metrics.

## Introduction

A valid, reliable, and usable system of metrics is integral to any patient safety program. Data related to patient safety can be used for a range of purposes, including the selection of improvement initiatives, measurement of the success of safety improvement efforts, enhanced transparency by public reporting, organizational accreditation, and even contracting and reimbursement. With the increase in patient safety data applications, the importance of the data has increased commensurately.

Several data attributes should be considered in the context of patient safety metrics. First, are the data feasible to collect? Are the collected data reliable and valid? Do the data support their intended use? What is the rationale for using a given patient safety metric? It is the rationale for using a given patient safety metric that underlies the focus of this article. The mere creation or use of patient safety measures does not assure that they will be useful for improving safety and reducing harm. Even worse, invalid measures can lead to poor decisionmaking, whereas measures that do not lead to safety improvements can be viewed as lost opportunity costs.

The two dominant frameworks for patient safety metrics focus on measurement of errors and measurement of injuries.<sup>1, 2</sup> While arguably there is a role for including both of these frameworks, a third model—i.e., metrics focused on hazards or risks—is based on safety science and human factors engineering.<sup>3</sup>

The following discussion explores the strengths and limitations of these frameworks with practical suggestions for the range of patient safety data consumers.

## **Error-Based Patient Safety Metrics**

The work of James Reason and others has clearly identified the role of errors in preventable harm to patients. In the context of patient safety, errors are defined as a failure of a planned action to be completed as intended—i.e., an error of execution—or the use of a wrong plan to achieve an aim —i.e., an error of planning.<sup>4, 5, 6</sup> These definitions are based on the premise that the goal of health care is to successfully execute the correct plan of care for any given patient. Thus, error-based metrics seek to identify deviations from this health care goal.

The measurement of errors in health care might appear like a reasonable means of assessing safety. First, errors in the delivery of health care are common. Studies of both pediatric and adult populations reveal that medication errors occur in 3.0 to 6.9 percent of inpatients.<sup>7, 8, 9, 10, 11, 12</sup> The relatively high frequency of errors leads to a second potential advantage of measuring errors in health care: errors seem easy to identify and measure. Finally, errors can guide improvements. If errors are the source of unsafe health care, then one needs to prevent the errors.

There are, however, significant limitations inherent in efforts to measure errors. One of the important limitations is the inability to create a meaningful metric or rate. To have a rate that is valid, reliable, and ultimately meaningful, both a numerator and denominator are necessary. In the context of errors, denominators are not necessarily problematic. Medication error rates might utilize denominators of patient days, number of medications dispensed, or number of patient admissions. However, it is entirely possible that an appropriate denominator might not be readily available for calculating an error rate. For instance, any attempt to measure the error rate in infusion pump programming requires a choice between potential denominators, including number of medications infused, number of pumps programmed, number of programmers involved, number of steps in programming process, or even the number of key punches involved in programming.

A greater limitation of error rates in patient safety is the inability to identify a valid and reliable numerator. If an error rate is:

<b>Identified errors</b>
<b>Potential opportunities for that error to occur</b>

then, the numerator is only as valid and reliable as the means of identification. Unfortunately, there is no valid and reliable means for identifying all errors.

Voluntarily reported events provide one means of identifying errors as a potential numerator. Yet, reported events, by definition, reflect only those events that individuals recognized as an error and then reported. Errors could go unrecognized, particularly by the person committing the error.<sup>13, 14, 15</sup> Reporting itself depends on the ease of use of a reporting system, the organizational culture and its attitude toward reporting of errors (including any consequences of reporting), and the competing demands on a potential reporter.<sup>16</sup> For example, nurses with multiple patient care demands might not realistically have time to report, independent of her/his belief in the importance of reporting.























