Improving Quality, Minimizing Error: Making It Happen

A five-point plan and why we need it.

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ABSTRACT: Medical errors and the quality problems to which they lead harm millions of Americans each year. If we are to reduce errors and improve quality substantially, we must create systems and care processes that anticipate inevitable human errors and either prevent them or compensate for them before they cause harm. Formidable barriers now stand in the way of progress. Success will require a multifaceted strategy, including public education, government investment and regulation, payment system restructuring, and leadership from within the delivery system.

Concern about medical errors is running high in the wake of an Institute of Medicine (IOM) report. Print and electronic media have sustained coverage; state and federal lawmakers have debated proposed legislation; and the Clinton administration took executive action to mobilize federal health programs to respond to the problem. However, As Lawrence Altman put it in the New York Times, “Doctors have amputated the wrong leg...for centuries.” Quality has been a major focus of concern in health care for several decades. How should we fit the recent discourse about medical errors into the larger issue of health care quality? How big a problem is the harm done by medical errors? In this paper we explore these questions, consider how health care would have to change for errors to occur far less often, discuss the barriers to such change, and identify five directions for policies that might accelerate it.

A Theoretical Framework

Error. The definition of error adopted from cognitive psychology and used in the IOM report is “the failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim.” Researchers have observed recurring patterns in the kinds of errors people make: on the basis of normal thought processes this work... Adherence in:

This theory, however, is not what we planned. Lapses are usual actions not well rehearsed or absent. One result is that instead of responding to an intended objective, one turns a three or further subtypes of it, and each has its own harshness between the Challenger disaster. These catastrophe pro- sthetics,” are not physical individuals. Reacting to calamity, the health care system [...] absorbing the entity’s defensive “in its own terms,” individuals (“relations”) that low where thinking...

Quality: “Quality of care and population health are considered two kinds of quality: the likelihood of health services outcomes occurs when the requisite is met. So how can we... and patients’ nature of the issue focused on errors...
people make in ordinary life. They have categorized types of errors on the basis of how those errors relate to particular aspects of normal thought processes. James Reason has summarized the history of this work, added his own insights, and integrated this body of knowledge into a powerful set of analytic principles.6

This theoretical framework identifies three types of error: slips, lapses, and mistakes. Slips are observable actions that deviate from what was planned (for example, pouring coffee into the sugar bowl). Lapses are usually failures of memory that also result in planned actions not being carried out (such as going to a bookshelf to retrieve a dictionary but removing a novel instead). While slips and lapses are errors of execution, mistakes involve failures of reasoning that result in the choice of a plan that is inadequate to achieve the intended objective (for example, selecting a half-inch wrench to turn a three-quarter-inch bolt). Each of these kinds of errors can be further subtyped based on the cognitive processes associated with it, and each has different implications for remediation.

Reason has used this formulation of error to explain the relationship between errors made by individuals and calamities such as the Challenger disaster and the Chernobyl nuclear reactor accident.5 These catastrophes, which Reason terms “organizational accidents,” are not the result of single, identifiable errors made by single individuals. Rather, a series of individual errors occurs. To prevent a calamity, the organization’s defenses must be able to intercept or “absorb” the errors. Yet every organization experiences weaknesses in its defensive systems. It is the interaction between the errors of individuals (“active errors”) and these system flaws (“latent conditions”) that leads to harm. These insights have just begun to influence thinking about errors in health care.6

Quality and error. In the words of the IOM’s 1990 definition, “Quality of care is the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.” Three kinds of quality problems expose patients to harm by decreasing the likelihood of desired outcomes.8 Overuse occurs when we provide health services even though their risk exceeds their benefit. Underuse occurs when we fail to provide effective care that would improve outcomes. Misure occurs when we provide appropriate care without the requisite skill, thereby increasing the risk of complications.

So how can we integrate these two bodies of thought on quality and errors? We suggest that Reason’s analytic formulations of errors and organizational accidents provide important new insights into the nature of our quality problems. Although the IOM report focused on errors leading to misuse, errors trigger all three types of
quality problems. But not all errors lead to quality problems—only those errors that decrease the likelihood of desired health outcomes do so. A patient need not suffer an injury as the result of an error to characterize its effect as a quality problem; all that is required is that the error decrease the likelihood of a desired outcome. Thus, quality problems include both near misses and actual injuries. At the same time, not all injuries that occur during the course of medical care are associated with errors. Injuries not associated with errors do not represent quality problems.

For example, giving an antibiotic to a patient with a cold is an error (the use of a wrong plan, since antibiotics do not kill the viruses that cause colds). This error can be further categorized as a mistake. It causes a quality problem because such patients are needlessly exposed to the risk of adverse drug reactions and infections with antibiotic-resistant organisms. On the other hand, if a patient without a known allergy to penicillin has a severe allergic reaction after it is appropriately prescribed, he suffers an injury due to medical care (often called an adverse event). But it is not a quality problem, because no errors were made.

Errors that lead to overuse are typically mistakes. Errors that lead to underuse, such as failing to administer influenza vaccine to an elderly patient during an office visit for hypertension, can be either lapses or mistakes. Misuse problems can be associated with all three kinds of errors. Medication errors, for example, may occur when a physician who intends to write a prescription for 0.5 milligrams of a drug instead writes 5 milligrams (a slip). A nurse may deliver a dose of a medication hours late because of a lapse. Mistakes occur when physicians fail to decrease medication dosages appropriately in patients with poor kidney function.

Within complex health care delivery settings, we often observe the same patterns of individual errors and system flaws that Reason describes in his analysis of organizational accidents. Studies of medication errors that lead to injuries, for example, have found that multiple individual errors frequently occur in the setting of several dysfunctional systems (for example, those that attempt to verify patient identity or assure that information on allergies is always available) that fail to prevent the errors from resulting in harm. Similar patterns emerge from root-cause analyses of errors in which surgeons have operated on the wrong side of a patient’s body.

The Magnitude Of The Problem

Current evidence is overwhelming that errors and the three types of quality problems to which they lead harm millions of Americans every year. The evidence underlying this conclusion has been assem-
bled and evaluated by a presidential commission, academic experts, and an interdisciplinary roundtable sponsored by the IOM. Studies of overuse have found that twenty-four million Americans received antibiotics for colds and other upper respiratory viral infections in 1992: 16 percent of hysterectomies performed on women enrolled in a group of seven managed care plans were inappropriate; and 23 percent of recommended tympanostomy tube insertions (the most common surgical procedure of childhood) had inadequate clinical justification. Recent Medicare data, primarily about underuse, from every state, show that in the median state only 55 percent of hospitalized patients with atrial fibrillation in 1998–99 received anticoagulation, a treatment proven to reduce the risk of stroke. Medication errors, perhaps the most common misuse problem, caused preventable injuries to hospitalized patients at a rate of about ten per week at each of two large (700-bed) urban teaching hospitals; one-fifth were life-threatening. The data are clear. Although the United States may have the capacity to produce the finest health care in the world, it fails to do so with a regularity that is shocking.

Two patterns of error. Two fundamentally different patterns of medical error deserve emphasis. Some health care providers are incompetent, impaired, or corrupt and make errors repeatedly despite multiple attempts at remediation. On the other hand, even the most highly trained and proficient professionals occasionally make mistakes. Although the types of errors made in these two sets of circumstances may at times be similar, they require very different improvement strategies. Addressing the latter requires major changes in the processes and systems through which health care is delivered, aiming to surround fallible individuals with mechanisms that prevent their unavoidable human limitations from leading to errors that do harm. Although most of our analysis focuses on this pattern of error, we must pay attention to both. System improvement can prevent some of the errors made by egregiously poor physicians from doing harm. Often, however, these physicians have distanced themselves from organizations such as hospitals or medical groups whose systems could affect them. Today's disciplinary systems neither adequately identify these doctors nor mete out timely, appropriate punishment. We also emphasize that focusing on system improvement does not absolve individual practitioners from the responsibility to pursue excellence in the care they provide.

Recent Trends in Errors

Very few studies have addressed how the magnitude of these problems has changed over time. There is good reason to believe, how-
ever, that the frequency and adverse impact of serious errors in medicine may be rising. Overall, evidence of improvement is weak. Sustained efforts, especially those involving multiple institutions or geographic regions, are very rare, and failure is common.7 Studies have demonstrated improvements in a few specific areas—such as anesthesia, coronary bypass graft surgery, percutaneous transluminal coronary angioplasty, and antibiotic overuse.9 Two hospitals have been particularly energetic and successful in reducing injuries resulting from medication errors.8

- **Growing body of knowledge.** Unfortunately, several other powerful forces are operating in the other direction, widening the gulf between the benefit our health care system produces today and what it could deliver if errors were drastically reduced. One of these represents another side of the remarkable success we have had in developing new ways to fight disease. The amount of new research about what works to improve health and what does not has reached previously unimagined levels. As a rough index of this phenomenon, consider the form of research that generates the most valid data on the efficacy of health services, the randomized controlled trial (RCT). In the mid-1960s about 100 articles from RCTs were published annually in the medical research literature. By the mid-1990s the number was 10,000 per year and growing exponentially.9 Nonetheless, we have made little progress in creating mechanisms to synthesize this growing body of knowledge, package it in useful ways, and make it available to clinicians at the time they need it to improve decision making.

- **Complex systems.** Alongside the burgeoning amount of information care givers must manage, we have created more and more complex systems in which they must deliver care. Complexity breeds errors. If each step in a ten-step process can be performed with 99 percent reliability, that system functions error-free 90 percent of the time. A similar process with fifty steps functions error-free only 61 percent of the time. Consider, for example, the challenges we face in treating early-stage breast cancer, a condition that is curable more than 90 percent of the time with high-quality care. Typically, a primary care physician refers a woman to a different location for mammography to screen for the disease. If a suspicious lesion is found, another referral occurs—to a surgeon, whose office is usually at another location and who may perform a biopsy at yet another facility. When the surgeon receives the results of the biopsy, a definitive surgical procedure (lumpectomy or mastectomy) is performed (at possibly a fifth location). The woman who was treated with lumpectomy is then referred for radiation therapy (location 6) and then for chemotherapy or tamoxifen by a medical oncologist.

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(location 7)

Often, the practice within any of them has delayed the results of these interventions or plan. Our national patient surveys show that the majority of care provided is teaching hospital care, with a high probability of errors ranging from 3.99 to 3.99 per 1,000.

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Often, the physicians involved in this woman’s care do not practice within any common organizational structure. Most often, none of them has direct access to the records kept by any of the others, to the results of previous tests or examinations, or to the recommendations or plans made by the other treating physicians. Too often, the patient serves as the communication link among her physicians. Can it be surprising, therefore, that errors are common? A study of the care provided to women with early-stage breast cancer at four teaching hospitals in the New York metropolitan area showed that the probability a woman would miss either radiation following lumpectomy or adjuvant treatment with chemotherapy or tamoxifen ranged from one in six to one in three.20

**Cross-sectional studies.** No longitudinal studies have directly addressed the question of whether rates of errors and the quality problems to which they lead are increasing over time. However, one pair of cross-sectional studies does provide some insight. Timothy Lesar and colleagues used the same methods to measure the frequency of errors made by physicians in prescribing medications to inpatients at a large, tertiary care hospital in upstate New York during two twelve-month periods seven and a half years apart.21 Using the same procedures in both time periods, pharmacists caught and corrected errors in physicians’ medication orders. The researchers counted only those errors in which the physicians concurred that they had made errors and tabulated those that had the potential to do severe, serious, or significant harm. The rate of such errors increased 122 percent between 1987 and 1994, from 1.80 to 3.99 per 1,000 orders. Medication use also increased between these two time periods, so the total number of these errors increased more than fourfold, from 522 per year to 2,103 per year. All of these reported errors were intercepted and prevented from doing harm; the researchers did not look for injuries attributable to nonintercepted errors. Their findings do, however, provide evidence that errors of this kind may be increasing.

**How physicians are trained.** At the same time that error-free health care of high quality is becoming increasingly difficult to provide, we persist in using age-old, even medieval, strategies and methods for training physicians.22 The most prevalent model for educating medical students assumes that medical school faculty can identify a finite body of knowledge that all students must master to become physicians. Ordinarily, after learning the basic sciences, students begin apprenticeships that continue during their residency training programs in specific clinical fields. Teaching rounds are conducted with senior physician faculty members instructing rig-