PATIENT SAFETY INITIATIVE

SPECIAL FEATURE

The Role of Human Error in Medical Errors

David A. Wong, MD, FRSC(C)
NASS President
Co-chair, Patient Safety Task Force
Denver Orthopedic Clinic
Denver, CO

Stanley A. Herring, MD
NASS Past President
Co-chair, Patient Safety Task Force
Puget Sound Sports & Spine Physicians
Seattle, WA

Research now tells us that, although medical errors may have a human component, they are rarely entirely the fault of an individual. Rather, medical errors take place because of a system design failure in which a chain of events occurs that allows an error to happen.

One thing the 1999 Institute of Medicine (IOM) report on medical errors got right was the title—*To Err Is Human*. Error is a normal condition of human existence, not an abnormal event. Because of the innately human limitations of the mind and body, we are vulnerable to:

- limitations in memory capacity
- limited ability to deal with multiple competing demands
- weakened mental abilities, including decision-making, by things such as fear and fatigue
- influence from the effect of group dynamics and culture[1]

In recognizing these vulnerabilities, we have the opportunity to design systems to counteract our basic human frailties.

Medical errors have two components: human and systems. Many times individual health care providers are held responsible when medical errors take place. Research now tells us that, although medical errors may have a human component, they are rarely entirely the fault of an individual. Rather, medical errors take place because of a system design failure in which a chain of events occurs that allows an error to happen. The human factor is but one small link in this chain of events that bears examination. However, taking into account the fallibility of the human mind and body, we must understand its role and work to design systems that counteract its effect.

Types of Human Error

The IOM report defined an error as the failure of a planned action to be completed as intended (eg, error of execution) or the use of a wrong plan to achieve an aim (eg, error of planning). There are two main types of human error: active and latent. "Active errors occur at the level of the frontline operator and their effects are felt almost immediately. This is sometimes called the sharp end. Latent errors tend to be removed from the direct control of the operator and include things such as poor design, incorrect installation, faulty maintenance, bad management decisions and poorly structured organizations." Latent errors are the most menacing in today's complex health system because they frequently remain unnoticed and have the capacity to cause many types of active errors. For example, following the *Challenger* space shuttle explosion, latent (or contributing) events were traced back nine years. At Three Mile Island, latent errors were found as far back as two years.[2]

It is difficult for people involved in a system to recognize latent errors. They may be concealed in the design of computer programs, organizational composition or administration. People can also adapt to flaws, learning to work around them, which can cause them to go unrecognized.[2]

What the Research Says

Human error is one of greatest contributors to accidents in any industry. An analyst who investigated the Three Mile Island incident and how systems may cause or thwart accidents, estimates that human error is involved in an average of 60% to 80% of accidents.[2] A number of different disciplines have been involved in the research relative to human error.

Human Factors Research. Human factors research combines aspects of industrial engineering and psychology to study "the interrelationships between humans, the tools they use, and the environment in which they live and work."[2] Human factors research examines the reasons that errors occur. Much of this research focuses on "improving the human-system interface by designing better systems

and processes. This might include, for example, simplifying and standardizing procedures, building in redundancy to provide backup and opportunities for recovery, improving communications and coordination within teams or redesigning equipment to improve the human-machine interface."[2]

Examples include designing device ports exclusive to their mated connectors, rather than interchangeable, to prevent inadvertent and potentially dangerous connections to unintended gases, feeding tubes, etc. Another example is limiting the number of different types of equipment available so that providers need to be familiar with only a few, making the chance of error caused by inexperience less likely.[2]

Cognitive Psychology. In the 1970s, cognitive psychologists concluded that errors are not random but happen in specific patterns and predictable circumstances.[6] In fact, errors are based in only a few mental mechanisms (**Table 1**). The lesson from cognitive psychology is that errors are part of the human condition but bad outcomes due to error don't have to be. Human work conditions can be changed to improve safety. Another significant finding is that much information processing is done while perceiving situations before any mindful thoughts or decision-making. This makes punitive actions against individuals involved in medical errors even less logical.

Work Group and Organizational Sociology. In the health care environment, many people need to work together cooperatively and investigators in sociology and organizational science have recognized that breakdowns in communication, coordination, workload assignment and planning lead to accidents. "The key insight from this body of research is that good teamwork is a specific set of behaviors that improve performance, not simply a subjective state of working nicely together, and that it does not appear spontaneously but requires specific effort to establish and sustain."[3]

A good example of this in another industry is aviation crew resource management training which is now required by all US airlines.[3] Airline flight crews bear many similarities to health care teams and crew resource management training has been suggested as an appropriate technique that may transfer well to health care. Unlike the medical environment, where medical team members may be hesitant to question a team leader, co-pilots are required to question the decisions of pilots if they believe safety is at issue. The safety of the passengers is paramount and concerns about hierarchy of command come second. This safety-based mindset has been very successful in the prevention of airline incidents.

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Scientists have also studied safety in large organizations, some of which has focused on "high reliability" organizations. These organizations run high-risk operations for extended time periods with low rates of adverse events. A good example is an aircraft carrier flight deck. Several factors contribute to the success of high-reliability organizations:

- preoccupation with failure and lack of complacency in down times
- reluctance to simplify explanations and develop more varied opinion
- training to "assume less but notice more"
- when faced with unusual events, they shift to more flexible decision making, lending more credence to experience and expertise and less to rank

Many believe that health care organizations can be transformed to become high-reliability.[3]

Prevention

In the past (and, unfortunately, sometimes currently), the response to a medical error was to penalize the individuals involved in the incident. Except in cases of deliberate noncompliance, punishment will not work to prevent a problem caused by the convergence of multiple latent errors of which human error is just one factor. Focusing on active errors allows the latent errors to continue to exist and makes the system even more error prone.[2] Two important ways to minimize the role of human error in patient safety are:

- **Nonpunitive, Confidential Reporting.** NASS believes nonpunitive, confidential reporting is an important preventive measure. The goal is to identify errors, including near misses, for correction and prevention—not punishment or liability. Drawing attention to errors in the system and putting them under scrutiny is the first step in correcting them.

Table 1. Error Occurrence

Frequency	Type of Activity
Less Common	Automatic Skill-based Example: driving
More Common	Procedural Rule-based Example: following a treatment protocol
Most Common	Cognitive Knowledge-based Example: within novel situations

■**Heeding the Lessons of Human Errors Research.** Although only one factor, it is important to recognize the role human error plays in the event of medical errors. This examination allows preventive measures to be taken that take into account that we are, after all, only human.

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