PATIENT SAFETY INITIATIVE

SPECIAL FEATURE

# It's More Than Human Error – A Systems Approach to Patient Safety

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"Preventing errors and improving safety for patients require a systems approach in order to modify the conditions that contribute to errors. People working in health care are among the most educated and dedicated work force in any industry. The problem is not bad people; the problem is that the system needs to be made safer."

*To Err Is Human. Building a Safer Health System*[1]

**One of the cardinal concepts in patient safety, borrowed from industry, is systems analysis. This is the concept that systems failures – not individual human failures – are to blame for many of the adverse events occurring in health care.**

Popular press has focused much of its attention related to patient safety on high profile medical errors with catastrophic consequences. In reality, however, not all medical errors are catastrophic and most are not single events associated with specific individuals, but are part of a larger systems context in which multiple factors come together at the same time to allow an error to occur. Understanding that medicine today is a culture of complex systems and how the design of those systems contributes to medical errors is critical to making care as safe as possible for patients.

One of the cardinal concepts in patient safety, borrowed from industry, is systems analysis. This is the concept that systems failures – not individual human failures – are to blame for many of the adverse events occurring in health care. An important part of moving beyond the blame and punishment often associated with medical errors is recognizing that the human factor is only one aspect of today's complicated medical systems. A systems approach to patient safety recognizes that health care providers work in a complex environment[2] that can include these factors as outlined in the landmark Institute of Medicine publication, *To Err is Human. Building a Safer Health System*[1]*:*

- interactions with technology
- large numbers of health care staff involved in provision of care resulting in multiple handoffs
- poor communication between patients and staff and poor staff-staff communications
- stress and fatigue
- human factors design flaws
- lack of appropriate education and training
- higher acuity of illness
- need for rapid decision-making
- reductions in staffing
- lack of redundancies to prevent error

All of these factors (and more) can come together to form a complicated chain of events that allows a medical error to occur. A health care provider may be involved but is not solely responsible. (An exception to this statement would be negligence in following procedure.)

Real life examples most effectively demonstrate how many different factors can come into play to allow errors to occur. For example, in July 2001, a six-year-old New York boy died as a result of injuries received during a magnetic resonance imaging (MRI) exam when a metal oxygen tank was somehow brought into the exam room, became magnetized and hit him in the head. Immediate corrective actions promised by the hospital included "purchasing only nonferrous oxygen cylinders, adding new warning signs to

identify the secure area around MRI machines, starting new in-service training on MRI safety for all staff and overhauling safety orientation for MRI patients and contract service workers such as ambulance drivers."[3,4] The list above demonstrates how a number of factors can come into play when a medical error occurs.

There are many models of complex systems and their malfunction. In my view, the most appropriate to medicine is popularly known as the Swiss Cheese Model of systems failure (**Figure 1**).[5] This model characterizes the latent factors present in medical systems that are the responsibility of management, eg, staff training, policy decisions, resource allocation. It also allows a medical intervention to be broken down into a number of steps (slices of cheese), identifying confounding or contributing factors at each step in the process. Confounding factors are the "holes" in the slice of Swiss cheese and represent the problems or errors that might contribute to failure of the overall system and result in an adverse patient event. An individual human error represents only one hole in a single step or "slice." Usually, for an adverse event to occur, several holes must line up and the path of the intervention, unfortunately, falls through them at every step. Conversely, the more safety barriers erected along the path, the less likely an adverse patient event would occur. Efficient safety barriers (ie, with fewer "holes" or confounding factors) are more likely to stop an adverse patient event.

Consider the fictional example of a wrong level spinal surgery: a wrong-level spinal surgery takes place at hospital "A." In reviewing the case, latent systems factors contributing to the error included poor training of X-ray technologists in operating room radiography; a policy decision not to have an in-house radiologist available after 5 pm; and lack of attention to operating room turnover times so cases frequently start late. Time pressure acted as a psychological precursor on the surgeon and anesthesiologist. The surgeon was trying to get to a daughter's basketball game and the anesthesiologist wanted to get to a group meeting where the compensation formula for the next year would be decided.

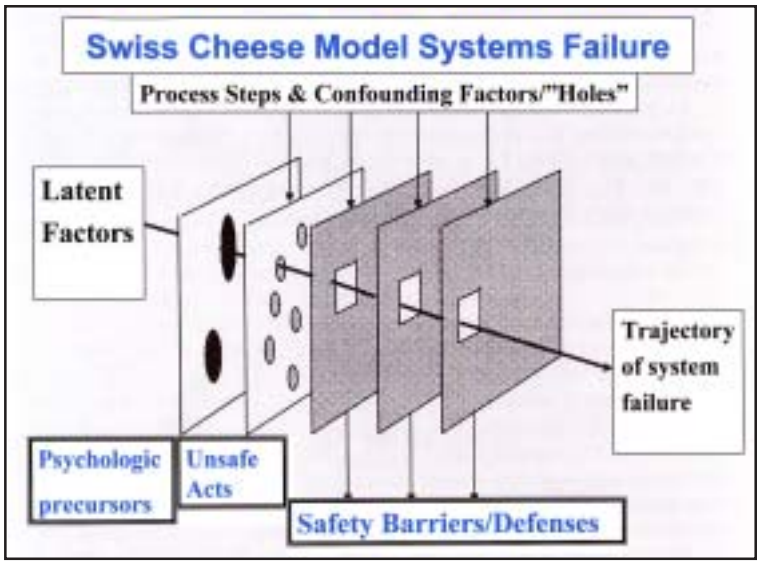


**Figure 1.** Swiss Cheese Model of systems failure.[5] (©1991 Cambridge University Press. Reprinted with permission.)

During the procedure, induction of anesthesia was confounded by a 45-minute delay because of poor turnover. Incision and marking of a spinous process for localization radiography were confounded by the patient's size (250 lbs) and corresponding difficulty feeling landmarks such as the iliac crest. The X-ray film turned into a "cloud-a-gram," compromised by the patient's size and the technologist's lack of training in how to adjust settings. Confirmation of level was negated by the absence of a radiologist, time pressure on the physician's and the surgeon's declaration that they could feel the ala of the sacrum (actually a large L5 transverse process) so another time consuming X-ray film was not necessary. Result: systems failure and a wrong-level surgery not attributable to any one person.

It is important to understand that there are many contributors to a medical error and that each must be addressed to provide our patients with the utmost safety. Complex systems models, like the Swiss Cheese, provide a framework for planning and establishing an environment of patient safety. Reviewing these models and incorporating safety barriers, such as NASS' Sign, Mark & X-ray program (SMaX), provide additional layers of prevention. It's time to begin logically analyzing medical systems that contribute to error and end the blame game.

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