What Can Aviation Teach Us About Patient Safety?

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December 29, 1972: While flying over the Florida Everglades the entire flight crew and an observer on an Eastern Airlines flight to Miami become pre-occupied with fixing a burnt-out landing gear light. They fail to realize the aircraft has been descending slowly until just before it crashes—101 people dead (NTSB, 1972).

March 27, 1977: At a small airport in the Canary Islands two fully loaded 747's are on the runway. Despite concerns expressed by his crew to the contrary, the Captain of one of the aircraft is convinced the other aircraft has departed the runway. He was wrong—583 people dead (ACIO).

December 28, 1978: On a United Airlines flight over Portland, Oregon, only two of the three landing gear lights have illuminated. While troubleshooting the problem—and despite the recommendation of his co-pilot—the Captain continues to circle the airport. The aircraft eventually runs out of fuel and crashes—10 people dead (NTSB, 1978).

These were not isolated events, and the world's flying community knew they had a problem. Very well trained and highly skilled pilots were crashing perfectly good airplanes simply because their crews could not function as a team

(Cushing, 1997). Policy makers turned to Human Factors experts at the NASA Ames Research Center to determine how group dynamics affect such things as situational awareness, risk-taking and decision-making in the flight arena. Their findings and recommendations formed the basis of what came to be known as Crew Resource Management (CRM), which over the years has now gone through at least five generations of development. CRM is the effective use of all available resources, including human resources, hardware and information needed to complete a safe and efficient flight. It presents a process for understanding the basic tenets of group dynamics and limitations of human performance, while utilizing proven techniques of communication to develop optimal levels of situational awareness and decision-making. One aspect of CRM became particularly clear: It was no longer thought to be an act of insubordination to make a statement or perform an act related to the safety of flight. Accidents due to dysfunctional crew coordination became less frequent, and CRM is now required training of all commercial aircrew on a recurring basis (Proctor & Van Zandt, 1994).

Medicine has to some extent borrowed from these lessons with regard to patient safety. Surgical time-outs and the Universal Protocol are one example of CRM in action; anyone on the team who may have doubts or concerns about such things as the correct patient, correct procedure, correct site, etc. are now rendered a safe atmosphere in which to raise their concerns. It is hard to say

exactly how many wrong-site surgeries have been prevented with surgical time-outs, since it is hard to measure what does not occur. But anecdotal reports abound, and wrong-site surgery will hopefully one day be relegated to the pages of medical history.

But CRM did not hold the complete answer for an organization's safety issues. Root cause analysis of the aforementioned accidents, as well as others in various industries, revealed that the unsafe act triggering an accident was inevitably the final component of a series of pre-conditions leading to the accident. Oftentimes the latent conditions existing just prior to the unsafe act were just as important to the overall outcome. Moreover, there were many and varied supervisory practices that resulted in the latent conditions, as well as management influences (e.g. policies, procedures and culture) that shaped supervisory practices. Professor James Reason (1990,1997) described these upstream elements as layers, or slices, of Swiss cheese. The holes of the cheese represented absent or failed defenses that led to vulnerabilities in safety. When the holes of the different slices all lined up, an accident occurred. This model has since become the basis of the Human Factors Analysis and Classification System (HFACS) used widely in aviation today (Shappell & Wiegmann, 2000). In this model, accident avoidance is not simply a matter of good people pushing themselves to perform better, since any one person's performance is just one part of an overall chain of events. For an organization to

be truly safe, it must be able to identify its holes of vulnerability, and must have processes in place to reduce the size of the hole and/or to prevent the holes from lining up (see Figure I).

How does an organization do this? Whereas the principles of CRM require a subordinate crewmember to speak up in the face of safety, in the same way aviation has shown with regard to Reason's model that often it is the front-line workers themselves who will identify latent conditions, practices and polices that can lead to adverse events. They will likewise often be able to render ways to correct or mitigate these vulnerabilities. The key to a well-functioning system is to keep these people the opportunity and the environment in which to communicate their insights.

Reason's Swiss Cheese model is perfectly applicable to the world of healthcare delivery. For healthcare delivery to be truly safe, it must be able to identify its holes of vulnerability, and must have processes in place to reduce the size of the hole, and/or to prevent the holes from lining up. And how do medical organizations do this? Certainly established research methods such as multi-center randomized trials are one way of identifying those things that improve patient safety. But the healthcare leaders and policymakers of healthcare organizations need not wait for the perfectly performed randomized trial before implementing smart ideas from their own people about how to make the organization function more safely. Information has to flow from the bottom up, as well as the top down,

in order to identify and mitigate the policies, practices and conditions that set the stage for unsafe acts and adverse events in the patient care setting. There are times when Senior Management, like the Airline Captain, may not have the full picture or the right answer. Healthcare leaders do not always have funded research protocol to provide all the needed guidance. Like the Airline Captain, healthcare leaders must have the input of the other crewmembers in order to recognize danger and avoid disaster. How do they make this happen?

Information regarding patient safety must be not only welcomed, it must be actively sought. Incident Report tracking is a good start, but what is more important is the close call BEFORE an incident occurs. Very often a close analysis of the close call reveals the latent conditions that were a set-up for error. In fact, the reporting of latent conditions before they become close calls is one more step in the right direction. But reporting takes time and effort, and unless the process is easy it will not get done. Moreover, there is the fear of retribution, liability or blame, which may themselves be strong deterrents to reporting. Therefore, anonymous patient safety reporting systems—with options for computerized, phone and/or hand-written input—should be readily accessible and easy to use throughout the inpatient and outpatient settings.

In addition to these passive reporting systems, directed focus groups involving all team members of a particular process are a more proactive way to garner valuable information. Similarly,

active information solicitation by Senior Leadership in Patient Safety Rounds, and through safety culture surveys are two examples in this regard. Furthermore, lessons learned through root cause analysis, and more importantly, through the aggressive tracking of the corrective action plan implementation, are hard-earned sources of information that should never be discounted. Finally, recognizing the patient and the family as an active part of the patient safety team—and actively involving them in the communication process— is another method of mitigating the risk to patient safety. After all, only the most sophisticated airplanes have the systems to recognize a dangerous situation and warn the pilot; in almost every instance of medical practice the patient and/or their close associates can provide input that may be the last barrier to an adverse event.

Obviously, some pieces of input, whether from employees, patients or family members, are more valuable than others, and sifting through large volumes of information to determine that which is truly beneficial can be a difficult and time-consuming task. Obviously these efforts are not without cost in terms of time, money and effort. But breeches in patient safety resulting in adverse outcomes have their own costs, direct and indirect. Is it not better to have the problem of sifting through too much information on how best to improve safety, rather than having to "answer the mail" on why something went wrong? Well-functioning safety organizations direct their efforts proac-
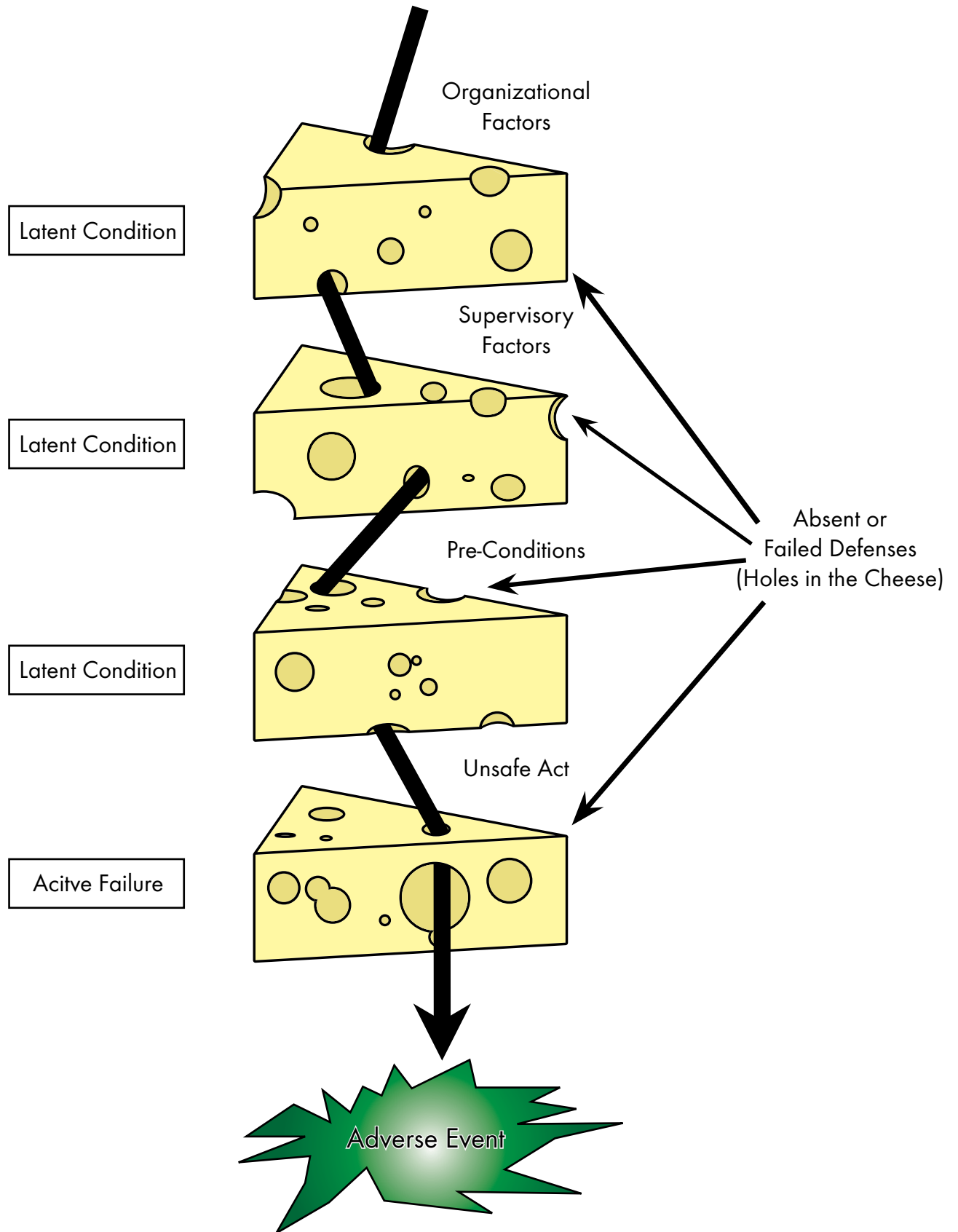
tively rather than reactively.

Nothing speaks more loudly about an organization's values than those things which it rewards or punishes. With regard to patient safety, this means developing a true safety culture by rewarding those events, actions and inputs that address the latent conditions, practices, procedures and policies that either lead to error, or fail to trap such error once it occurs. For example, a brand new OR clerk delays a surgical case while she tracks down the written informed consent that had been misplaced among the patient's other paperwork. Is she likely to be rewarded for such action, or chastised? What if the senior surgeon whose case she delayed yells at her? Will such behavior be tolerated by the Executive Management Team? Clearly these are difficult processes to follow at times, but it is precisely such actions that yield significant payoff in the long-run.

Finally, aviation has taught us one other lesson that should not be overlooked. Lest any should worry to the contrary, it is evident that the power and authority of the Airline Captain has not dwindled away to nothing over the years since CRM first made its appearance. If anything, such authority has been strengthened. Similarly, it is safe to assume that the power, authority or importance of physicians, surgeons, administrators, nurses, pharmacists, researchers, and all others involved in healthcare delivery will not diminish in the face of concerted patient safety efforts. On the contrary, healthcare may effectively fulfill its mandate to above all, do no harm.

FIGURE I

Reason's Swiss Cheese Model, as modified for the
Human Factors Analysis & Classification System (HFACS)

Organizational
Factors

Latent Condition

Supervisory
Factors

Latent Condition

Pre-Conditions

Latent Condition

Absent or
Failed Defenses
(Holes in the Cheese)

Unsafe Act

Acitve Failure

Adverse Event

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