Editorial

We Have Newton on a Retainer: Reductionism When We Need Systems Thinking

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Something must have gone terribly wrong when a 16-year-old patient died after a nurse accidentally administered a bag of epidural analgesia by the intravenous route instead of the intended penicillin. What was it? We typically want to find the broken parts, fix them, remove them, and make sure that they can't contribute to failure again. The root cause analysis (RCA) described by Smetzer et al. in this issue of the *Journal*[1] does precisely that. As a *starting point,* the RCA identified four proximate causes of the error: (1) availability of an epidural medication in the patient's room before it was prescribed or needed, (2) selection of the wrong medication from a table, (3) failure to place an identification band on the patient, which was required to utilize a point-of-care bar-coding system, and (4) failure to employ available bar-coding technology to verify the drug before administration. Then, the analysis explored why each of these proximate causes happened, working its way from the sharp end of the error to the underlying system problems that contributed to the error, which included a nonexistent system for communicating the pain management plan of care for the laboring patient to the nurse responsible for getting the patient ready for an epidural; variable expectations from anesthesia staff regarding patient readiness for an epidural; staff scheduling policies that did not guard against excessive fatigue; interconnectivity of tubing used for epidural and intravenous (IV) solutions; and system, process, and equipment problems that led to a 50% unitwide compliance rate with scanning medications using available bar-coding technology. The recommendations stemming from the RCA included designing a system to communicate the anesthesia plan of care, defining patient readiness for an epidural, establishing dedicated anesthesia staff for obstetrics, differentiating between epidural and IV medications, designing a quiet zone for preparing medications, establishing maximum work-hour policies for staffing schedules, and remedying issues with scanning problematic containers to improve bar code–scanning compliance rates.

See also pages 152–163.

It seems as if human error is still seen as a meaningful target for intervention by itself. Failure in health care, says Gawande,[2] is a result of human ineptitude. This notion is informed by a kind of Newtonian, reductionist thinking in which we hunt for the "broken part" that needs fixing or replacement. Yet "errors" come from somewhere, occurring in spite of people's continuous efforts to accommodate the enormous complexity that typifies health care today. People have to reconcile a multitude of goal conflicts, production pressures, discontinuities across specialties and departments, resource constraints, new technologies, and patient expectations. When things go well, health care tends to celebrate "good doctoring"[3]—acts by competent people who succeeded despite the organization and its complexity. When things do not go well—when adverse events occur—health care tends to zero in on the people at the sharp end who, for once, failed to hold that complex, pressurized patchwork together—rather than inquire about the systemic sources behind the production of all that complexity.

Nowhere do I encounter these simultaneous beliefs in individual strength and brittleness as persistently as in health care: Safety lies in the hands through which care ultimately flows to the patient. Thus, we can ask caregivers to try harder, to stare at labels more aggressively, and to double-check more often, with more technology. To instead invoke "systems problems," it might be thought, is to engage in a "dry language of structures, not people."[3 (p. 73)] Pellegrino contends that rather than "systems," health care needs individuals with "strength of character to be virtuous."[4(p. 95)] According to this line of thinking, promoting "systems problems" undermines the unique fiduciary relationship between caregiver and patient and shortcuts personal control over, and accountability for, clinical outcomes. Of course, there is no substitute for medical experience, expertise, and competence, and the deference and ethical responsibilities that come with it. Yet there seems to be something path-dependent here: a historical residue of the uniquely gifted shaman, witch doctor, healer, medicine man—who is able to interlocute between mortals and the metaphysical, ruling over life and death. Real medicine men perform dancing art. *They*

don't use a checklist to map out the steps.

Indeed, health care seems to be obsessed with the autonomy of its individual actors—which produces fascinating cognitive dissonances. For example, 20% of staff surveyed by Gawande about a surgical checklist (which, in another study, nearly halved surgical deaths[5]) said that it wasn't easy to use and that it didn't improve safety.[2] Yet 93% wanted to have the checklist used when *they* were undergoing an operation. Medicine's deontological principle means that nothing is more sacred than your obligation to the patient in your care. Except when you are the patient yourself. Then suddenly that surgical checklist sounds like a good idea. Then the ethical obligation and fiduciary relationship that form the bedrock of medicine's unique subculture can apparently no longer be trusted to provide safe care.

That aside, it is not that other fields don't have a deontological commitment. They do. When I fly, I and the rest of the crew have 150 or so lives in our hands. Nothing is more important than those lives and the fact that they are entrusted to us. With some decisions—for example, whether to hold and wait for better weather or to divert to an alternate airport—the airline and its economics must take a back seat to safety. Of course, this may have something to do with the subtle fact that we sit up front and are the first to arrive at the scene of an accident. However, I doubt that this reality changes the deontological dynamic much. Responsible practitioners are responsible practitioners: The consequences of failure are devastating, no matter what. The nurse involved in the error that is discussed in the Smetzer et al. article is a case in point.

The concept of health care as a complex system seems to be widely recognized. Yet there is still a lingering tendency to reach for simple solutions, for silver bullets, for single-factor explanations, and to bemoan the "ineptitude" of those defeated by the system's complexity and to celebrate the "strength of character" of those able to "work around" it.

If the system really *is* complex, let's start to act as if we really understand what that means. Complexity theory, rather than Newtonian reductionism, is where health care should look for answers. With the introduction of each new part or layer of defense, technology, procedure, or specialization, there is an explosion of new relationships *between* parts, layers, and components that spreads out through the system. Complexity theory explains how accidents emerge from these relationships, even from perfectly "normal" relationships, where nothing (not even a part) is seen as broken.[6] The drive to make systems reliable, then, also makes them very complex—which, paradoxically, can in turn make them less safe. Redundancy—putting in extra barriers—or fixing them does not provide any protection against a system safety threat. In fact, it helps perpetuate or even heighten the threat. For example, introducing a layer of technology (point-of-care bar-coding system) for double-checking a medication order against a patient identification may require novel interface management skills that can get in the way of doing the primary task: taking care of the patient.[6] So quality is not safety. Quality is about parts; safety is about systems. A part by itself cannot even be safe or unsafe. Safety or its absence is an emergent property of the relationships between parts.

There is something seductive about "going down and in" to find the "broken part" and fix it—for example, telling professionals to be "more professional." No wonder that Newton has been on a retainer for more than three centuries. However, complexity theory says that if we really want to understand failure in complex systems, we need to "go up and out" to explore how things are related to each other and how they are connected to, configured in, and constrained by larger systems of pressures, constraints, and expectations.[7] As addressed by the RCA, we also would ask why the nurse involved in the error is at work *again* this day after hardly a break, filling in an empty slot (see the recommendation in Table 5 of Smetzer et al. to "reduce the risk of staff fatigue"[1]). However, taking it a step further, we would also identify managerial, administrative, political, and budgetary motivations, which would be linked to insurance mercantilism, the commercialization of disease, and the demand for a commodification of health care's prices and products. We would want to find how, since Florence Nightingale, nursing has steadily lost status, reward, and attraction, with ranks that are hard to fill; how its traditional provision of succor has eroded under the relentless industrialization of care; and how its role as patient advocate has become hollow, because there is always the *next* patient. And the next. And, if we have the societal courage, we might inquire after the conditions and collective norms that make it plausible for a 16-year-old girl in the community to be pregnant and in need of hospital care. If we do not dare undertake this line of inquiry, then it is no surprise that all of the cumulative consequences suddenly emerge one day on the work floor of a busy, understaffed ward at a 440-bed community teaching hospital, with a patient screaming in acute, severe pain, demanding that something be done *now, now*. If we tinker only gingerly with the final, marginal technical minutiae at the sharp end, all of those systemetic influences will collect again and again to shape what any other caregiver will see as the most rational course of action—no matter how large the label on a drug bag or how progressive the discipline. J

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In the course of his professional duties, the author has gotten to know the nurse involved in the case described in the article.

References

1. Smetzer J., et al.: Shaping systems for better behavioral choices: Lessons learned from a fatal medication error. *Jt Comm J Qual Patient Saf* 36:151–162, Apr. 2010.
2. Gawande A.: *The Checklist Manifesto: How to Get Things Right*. New York City: Henry Holt & Company, 2009.
3. Gawande A.: *Complications: A Surgeon's Notes on an Imperfect Science*. New York City: Picador, 2002.
4. Pellegrino E.D.: Prevention of medical error: Where professional and organizational ethics meet. In Sharpe V.A. (ed.): *Accountability: Patient Safety and Policy Reform*. Washington, DC: Georgetown University Press, 2004, pp. 83–98.
5. Haynes A.B., et al.: A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med* 360:491–499, Jan. 29, 2009. Epub Jan. 14, 2009.
6. Cook R.I., Woods D.D.: Adapting to new technology in the operating room. *Hum Factors* 38:593–613, Dec. 1996.
7. Leveson N.G.: *System Safety Engineering: Back to the Future.* Cambridge, MA: Aeronautics and Astronautics, Massachusetts Institute of Technology, 2006.