Prologue

Systems Thinking and Patient Safety

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Patient safety is a prominent theme in health care delivery today. This should come as no surprise, given that "*first,* do no harm" has been the ethical watchword throughout the history of medicine, nursing, and pharmacy. In recent years, we have become increasingly aware of the magnitude of our failure to successfully live up to this ethical imperative. We have also become increasingly aware of techniques that we might employ to bring reality closer to the ideal of doing no (preventable) harm.

The realization of the magnitude of this failure and that there are potential routes to reducing harm has fortunately resulted in both a burgeoning of research in the area of patient safety and a willingness to invest in patient safety research. This volume—published by the Agency for Healthcare Research and Quality (AHRQ) with support from the U.S. Department of Defense—along with its three companion volumes, is testimony to this blossoming of research and funding.

The recent advent of the health care field's emphasis on patient safety came at a favorable time. One or two decades earlier, our response would have been "unenlightened," to say the least; we would not have been able to apply systems thinking to patient safety. Even today, preventable patient harm is too often associated with error—usually human error—both within health care and, especially, in the medical liability system. Such error is, in the minds of many, to be met with blame and punishment. But systems thinking is now ubiquitous in health care—due, in large measure, to its successful introduction within the context of *continuous process improvement*—which provides a much less threatening context than the former reliance on accusations of error. It is this systems thinking that has enabled many in health care move beyond the old (and quite ineffective) "name, blame, and shame" approach to improving safety to a more effective focus on human factors engineering and the systems within which doctors, nurses, pharmacists, and other health care professionals work.

However, systems thinking does not come naturally—especially to health care professionals. We have been educated and acculturated to recognize our *personal* responsibility to master the knowledge and skills, and to acquire the wisdom, that enables us to assist sick—and often vulnerable and dependent—individuals. We can be sure that Hippocrates and, centuries later, Florence Nightingale, addressed their dictum to "do no harm" to physicians and nurses as *individuals*—not to the systems within which they worked.

A systems approach to health care safety presents certain new challenges:

(1) It has been said that a system is perfectly designed to produce the output that it produces; or conversely, whatever output we get from a system is what the system is designed to produce—whether the design

of the system was planned or unplanned, and whether the results were intended or unintended.

(2) Systems are composed of multiple, interconnected components: people, machines, processes, and data. Each component may directly or indirectly affect not only the function of the system as a whole, but also the functions of other components.

(3) The goal of a system is to maximize the output of the system, not the output of each of its components. Years ago, an engineer pointed out that one could build a car from the then "best" engine, carburetor (it was many years ago), drive train, suspension, and tires—but it would be unlikely to run. Every system, including those in health care, must *optimize*—rather than *maximize*—the performance of each of its components in order to maximize the system's output.

(4) The output of a system has multiple dimensions. In health care, the dimensions of safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity are often used to describe the output of the system. But it is uncommon for any system to *maximize* the level of every one of the multiple dimensions of its output; rather, the system must *optimize* the level of each dimension. This optimization is a value judgment by those who design the system, who manage the system, and who use the output of the system. And these three parties, the stakeholders in the system, do not always agree on the relative priorities for the dimensions of the system's output.

(5) Most systems are open systems; that is, they are affected by—even dependent upon—larger systems of which they are a part and, in turn, they provide inputs to the larger systems. In health care, we have learned the value of studying and changing Microsystems; the people, machines, and data at the level of direct patient care (the treatment team within the hospital or the physician office practice, for example). But these microsystems are subsystems within macrosystems; the organizations such as hospitals, nursing homes, and clinics of which the microsystems are components. Of course, these macrosystems are part of the megasystem of U.S. health care, which itself is a component of the even larger economic and social metasystems of American society as a whole.

(6) *Complex* systems (and even the microsystems of health care are complex) and *open* systems are both at risk of producing unintended consequences. Even apparently "inconsequential" changes in health care microsystems and macrosystems will almost always produce unintended consequences. While it is predictable that unintended consequences will emerge, what those consequences will be—and whether they will be beneficial or deleterious—is often unpredictable.

As a result, while systems thinking enables new and productive approaches to improving patient safety, it brings with it its own conceptual challenges—

challenges that, if not recognized and addressed, will both slow our progress and introduce new harm.

These challenges require that we learn more about how to apply systems thinking to health care, through answering such questions as: What are the microsystems and macrosystems in health care? How can their performance be measured? How do they interact? What are their vulnerabilities—and strengths? What are the strengths and weaknesses of each component that comprises the system? How can those strengths and weaknesses compensate for each other within the larger system? How can the functions of each component be optimized so that the results of the system are maximized? How can we identify and monitor for unintended consequences? How can we intervene to prevent harm from unintended consequences?

Many of these questions are the direct or indirect foci of the articles in this volume on "Concepts and Methodology." It is worthwhile to step back from the results of the specific research studies, intervention methods, and tools that are reported in other volumes of this compendium, and, instead, to ask these fundamental questions that are derived from systems thinking. The answers to these questions help us to frame the questions that the studies, interventions, and tools attempt to address, and help us interpret and apply the results of those studies, interventions, and tools. The answers to the system questions also remind us of the complexity that is sometimes hidden in the results of other studies.

One of these complexities is that the "systems" we describe or plan are really only mental models of the real world and how it works. No matter how close to complete and accurate our model may be, it is never entirely complete and entirely accurate. And, no matter how useful our model is, it will never answer every relevant question that we can frame. That is why different ways of measuring a system's components and outputs may lead to different findings—even to apparently contradictory findings—and why different ways of analyzing these findings can lead to different conclusions about how the system works or how it can be redesigned to make it safer. The articles in this book describe various measurement methodologies, various event taxonomies, various reporting systems, and various analytic techniques. In reviewing these articles, the first question should not be. Which approach is better? but, rather, What can we learn from each? and How can they complement each other? In fact, some of the articles explicitly explore the utility of employing multiple methods (e.g., a variety of analytic techniques) simultaneously. Sometimes, however, limitations on resources require selection among the various methods available. When selection becomes necessary, understanding what each method tells us—and what it does not—becomes critical in making wise choices among the methods that best answer the questions at hand.

Employing a systems approach to reducing harm in health care also has led to a rethinking of the role of people—including physicians, nurses, and pharmacists—within the system. This reconsideration leads to such questions as: What are the human vulnerabilities with respect to our capacity to keep up with new knowledge, to remember, or to analyze large amounts of data? How might

the principles of distributed cognition and information technology protect us from these vulnerabilities? What are the human vulnerabilities with respect to maintaining motor and cognitive skills in the face of distractions or fatigue? How might system redesign—including improved use of detection and alarm systems—protect us from these risks? What are the human vulnerabilities with respect to our thinking, emotions, and actions? How can we compensate for these often unconscious biases? Some of these questions are addressed in the sections on cognition and risk.

This new systems-based understanding of health care harm and how to prevent it will go for naught if we are unable to translate the new knowledge into new practice. Articles that explore organizational issues focus our attention on the important role that the "learning organization" and a "culture of safety" play in implementing—and maintaining—new processes and practices. An article derived from discussions of the Dissemination Subcommittee of the AHRQ Patient Safety Research Coordinating Center's Steering Committee provides a comprehensive systems view of the steps in translating research into practice.

The contributions to this volume display both the complexity of a systems approach to patient safety, and the promise of new pathways in thinking about the systems within which health care professionals work and the roles those individuals play as *part* of these systems. We hope these new pathways of thought will enable us to meet our obligation in health care to "*first*, do no harm."