Systems-Based Practice:

Improving the Safety and Quality of Patient Care by Recognizing and Improving the Systems in Which We Work

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Abstract

As the complexity of health care delivery has increased, it has become essential for physicians to understand how individual practices relate to a larger system of care.[1] It is within this context that the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identified systems-based practice (SBP) as one of the six core competencies in which physicians must be proficient to deliver patient care that is safe and of high quality. SBP is challenging to define, to incorporate into training and practice, and to evaluate. Competency in SBP requires that physicians understand how patient care relates to the health care system as a whole, and how to use the system to improve quality and safety of patient care. Systems thinking is the cornerstone of SBP. Fostering the ability to recognize the contribution of the system is important for medical students, residents, and practicing physicians. However, current efforts in medical education focus on mastering knowledge of disease, diagnostic skills, and treatment at the level of the physician-patient interaction. As a result, there is a preoccupation with system components while the system as a whole, and its effect on the quality and safety of care, remains invisible. To clarify the definition of SBP and to develop effective strategies for teaching and assessing SBP, it is necessary to provide a broad awareness of systems within a context of systems thinking. Patient safety is a good entry point into SBP because the concepts of safety, errors, and harm all nest the individual, whether patient or provider, within a system.

Background and Rationale

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identified six core competencies in which residents and physicians must be proficient to deliver high quality medical care – patient care, medical knowledge, practice based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice. Of these six, systems-based practice is one of the most challenging to define, to incorporate into training and practice, and to evaluate.

Systems-based practice can be thought of as an analytic tool, as well as a way of viewing the world, both of which can make care-giving and change efforts more successful. The focus is on understanding the interdependencies of a system or series of systems and the changes identified to improve care that can be made and measured on the system. The metaphors “a village” and “a mirror” have been used to illustrate and differentiate the concepts of systems based practice (SBP) and practice based learning and improvement (PBLI). “SBP is like a village. A physician must work with a community of providers to deliver optimal patient care”[2] This is contrasted to the core competency of PBLI, where the metaphor is “a mirror”. “PBLI is like holding up a mirror to ourselves to document, assess, and improve our practice”[2]

In clinical settings, we can operationalize these concepts by asking two separate but related questions:

1. “How can I improve the care for my patients?” – the PBLI question
2. “How can I improve the system of care?” – the SBP question.

Since the landmark IOM report focused national attention on patient safety, it has been generally agreed that the systems we work within are at the root of many of our patient safety problems.[3] Safety is a property of systems. Many of our patient safety initiatives belong to the system. Furthermore, certain patient safety issues are especially relevant for system solutions, for example, The World Health Organization's list of "High 5" patient safety initiatives (managing concentrated injectable medicines, assuring medication accuracy at transitions in care, communication during patient handovers, improved hand hygiene to prevent healthcare-associated infections, and performance of correct procedures at correct body sites)[4] as well as The Joint Commission's patient safety goals, which are updated yearly.[5]

Although an understanding of systems is essential to improving quality and safety of patient care, training in SBP falls outside the scope of traditional training. As result, undergraduate medical institutions, residency programs, specialty boards, and societies may have difficulty effectively teaching and evaluating SBP. In addition, although SBP is required by the ACGME as one of the core competencies that residents must demonstrate, there is a lack of literature about how to integrate the theory of systems and systems thinking into medical education.

The common program requirements for SBP, as approved by the ACGME in February 2007, are outlined as:

- Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Residents are expected to:
    - work effectively in various health care delivery settings and systems relevant to their clinical specialty;

- coordinate patient care within the health care system relevant to their clinical specialty;
- incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-based care as appropriate;
- advocate for quality patient care and optimal patient care systems;
- work in interprofessional teams to enhance patient safety and improve patient care quality; and
- participate in identifying system errors and implementing potential systems solutions.[6]

The aim of this paper is to further refine the definition of SBP by providing a broad awareness of systems within a context of systems thinking and to highlight the importance of teaching SBP as part of any program focused on improving the quality and safety of care.

What is a System?

Implementing and evaluating SBP in a medical context requires a broader understanding of what constitutes a "system" coupled with an understanding of systems thinking.

Bertalanffy, the founder of the scientific, mathematical Theory of Systems, defined a system as a set of interacting, interrelated, or interdependent elements that work together in a particular environment to perform the functions that are required to achieve the system's aim.[7] The importance of understanding systems as interrelated parts of a whole cannot be overstated. Systems can be continually improved, but one must consider how its products are created, why they are created, and how they can be improved. Comprehending the assembly of the system as

a whole can inform the work of those who are trying to create successful, interdependent systems.[8] Learning to see interrelationships rather than linear cause and effect chains, as well as grasping the phenomenon of change as a process, rather than a snapshot, is essential for understanding systems.[9]

Systems have certain rules, or principles, that help us predict how they will behave.[10, 11]

- The whole has one or more defining functions
- Each part can affect the behavior or properties of the whole
- Each part is necessary but alone is insufficient to carry out the defining function of the whole
- Behavior and properties of one part of the system depend on the behavior and properties of at least one other part of the system.

Systems thinking is the cornerstone of how "learning organizations" think about their world.[9] Learning organizations are those that measure outcomes and strive for improvement. Many fields outside health care, including education, telecommunications, and aviation, use systems theory to better serve their clients, understand applicable research, improve outcomes, and ensure quality and safety. Recognizing feedback from the system and then using that feedback for design and redesign of services is an inherent element of systems thinking.

Competency in SBP necessitates that physicians understand how patient care and other practices relate to the health care system as a whole, and how to use the system to improve patient outcomes, safety, and quality. SBP is care that is sensitive to the context in which it is delivered. Fostering the ability to recognize the contribution of the system is important for medical

students, residents and practicing physicians because care is never delivered in a vacuum – there is always a powerful context. However, current efforts in medical education focus on mastering knowledge of disease, diagnostic skills, and treatment at the level of the physician-patient interaction resulting in preoccupation with system elements while the system as a whole and its effect on patients remains invisible. The context is what has been minimized as educators try to standardize the experience for trainees. Systems thinking and the application of system thinking through SBP is the chance to look at the context.

The systems we work in can often be difficult to identify and define. Although we work in numerous systems all day, every day, it's difficult to "see" a system. It's like asking fish to describe water – it's easier to be aware of the system when the system fails.[12]

Health care is composed of a large set of systems – e.g., ambulatory care centers, inpatient hospital units, home health care, as well as laboratories and pharmacies – all interacting with one another. Each of these systems is connected via individuals and teams, regulations and rules, and technology.[13] Understanding how one functions within the system as a whole, and how one's actions affect all other aspects of the system is the key to unlocking an effective SBP strategy.

The concept of systems, in general, often brings up images of "well-oiled machines." However, health care systems are often cumbersome, unwieldy, unfriendly and opaque to its users – patients, physicians, nurses, and staff. Health care systems are best described as complex adaptive systems. As such, they are a collection of individuals that are free to act in ways that are not totally predictable. The organizational boundaries are "fuzzy" in that membership changes and providers can simultaneously be members of other systems. Furthermore, given the

complexity of these systems, the actions of individuals are interconnected so that the actions of one changes the context for all the others.[14, 15]

One organizational construct that operationalizes the concept of a complex adaptive system is the clinical microsystem, which can be defined as a group of clinicians and staff working together with a shared clinical purpose to provide health care for a population of patients.[16-18] The clinical purpose and its setting define the essential components of the microsystem. These include the clinicians and support staff, information and technology, the specific care processes and the behaviors that are required to provide care to its patients. Microsystems evolve over time, responding to the needs of their patients, providers, and external pressures. They co-exist with other microsystems within a larger (macro) organization. Health care organization is composed of multiple microsystems. Examples include a cardiovascular surgical care team, a community based outpatient care center, and a neonatal intensive care unit. Each have common core elements: a focused type of care, clinicians and staff with the skills and training needed to engage in the required care processes, a defined patient population, and a certain level of information and technology to support their work. What often differs across microsystems is the ability of individual caregivers to recognize their efforts as part of a microsystem as well as the microsystem's level of functioning.

The microsystem construct makes explicit the care giving system, yet builds on systems theory by recognizing that "important systems' characteristics include the system-environment boundary, input, output, process, goal-directedness, and interaction of the elements of the system."[7] In its "Crossing the Quality Chasm" report, the IOM identified multiple layers of the health care system that influence the ability to improve care: the experience of patients; the

functioning of the microsystem; the functioning of the organizations that house or otherwise support microsystems; and the environment (e.g., policy, payment and regulation) which shapes the behavior, interests and opportunities of the organizations.[19] Efforts at each of the different levels of the health care system *and the interactions between them* can influence the ability to achieve patient safety and quality of care objectives.

Systems and Outcomes

In addition to understanding what a system is, it is important to recognize how systems can contribute to, or undermine, outcomes including quality and safety of care. Patient safety is a good entry point into SBP because the concepts of safety, errors, and harm all nest the individual, whether patient or provider, within a system. It is generally understood that patient safety is a systems issue and that interventions to improve patient safety should be made at the system level.[3] High-risk industries such as chemical manufacturing, nuclear power, aviation, and defense have developed well-defined systems that have resulted in improved safety. Similar to other high-risk industries, the health care industry is complex and high-risk and clinical outcomes can be profoundly affected by lapses in the system, or misunderstanding of how the system operates, both within the sphere of practice, and across the continuum of care.

For several years, the health care industry has had a growing recognition of the important relationship between safety and well-functioning health care systems. In 1999, the Committee on Quality of Health Care in America published the report, To Err is Human: Building a Safer Health System, which included several recommendations to health care providers regarding patient safety in health systems.[3] The committee noted that the "most important barrier to improving patient safety is lack of awareness of the extent to which errors occur daily in all

health care settings and organizations."[3] Individuals in an organization must feel empowered to report errors, while organization leaders must implement ways to discover errors and make process improvements to reduce error. Part of the solution is to ensure that providers have the tools to address system issues.

Every process is a system. Simple systems are individual processes; complex systems may be hundreds, thousands of processes. Processes are inherently hierarchical --- you can drill down into each process, into each step of each process. Finally you hit the level at which people make decisions. This drives where you link outcomes measurement and the data system. Outcomes, like processes, are hierarchical. Managers tend to go high up on the outcomes chain, but we need to drill down to the decision level. Goals need to be set around front line decision making --- then roll them up to senior leaders and the Board. — B. James, MD, Intermountain Health Care[20]

Recognizing that one works within a system and understanding how that system functions is only one aspect. Physicians and other health care providers must be empowered to change aspects of the system that they recognize as failed. Often, well-meaning providers are not sure how to effectively design and test cycles of change, they lack the authority or power, and they lack the time. As regulatory agencies continue to set goals [e.g., Healthcare Effectiveness Data and Information Set (HEDIS) measures for comprehensive diabetes care, the Joint Commission standards for accreditation] that affect the organization, there is a need to understand the underlying processes and systems that are at work at the local level – where patients and providers meet at the sharp end of healthcare.

Systems-Based Practice across the Continuum of Medical Education

As educators begin to include SBP in their curricula, it is important that they have a common understanding of what SBP means, how it should be incorporated throughout the educational continuum, and how it can best be evaluated. Work is needed across the continuum of medical education — from medical school curricula for the student learner to opportunities for life-long learning for the practicing physician.

In 1935, Lawrence Henderson wrote about the Henderson Hasselbach equation. He also wrote that patients and doctors are part of the same system. Students are required to learn the equation, but not about his observation about systems. — P. Batalden, MD, Dartmouth Medical School[12]

Systems-based practice is the deeply fundamental link as we seek to prepare physician learners for participating in and improving systems of care because it unlocks insight into the dynamics of the change that is necessary.

The ACGME states that competency in SBP is "manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value."[21] Compared to medical schools, residency programs have been the most active in developing and assessing SBP curricula. However, similar to most undergraduate medical education programs, residency programs often lack a clear definition of SBP, as well as a consistent and reliable means of assessment. Progress is being made on this front and the ACGME solicits current efforts through

annual conferences which are then disseminated via their web site and through their publications.[21, 22] Without a common understanding of SBP and consistent methods of evaluating competency in SBP, educators cannot hope to effectively incorporate SBP into the daily work of patient care.

Many programs train residents in SBP through brief seminars, courses, or field trips to managed care organizations. There does not seem to be a concentrated effort to integrate SBP into residents' clinical training, although systems issues are prevalent in academic inpatient settings.

Residents work in the system everyday, but systems-based practice requires cross-disciplinary conversations that are often overlooked by today's busy residents. Furthermore, residents don't feel empowered to address the system symptoms because they lack the tools and required skills to change daily practice. This is manifested as a "workaround." As residents are immersed in the system in which they are trainees, they become experts at finding ways to "workaround" the most problematic system issues. A workaround, which is a jargon term taken from computer programming, is a temporary fix used to bypass or otherwise avoid a bug or misfeature in some system. Workarounds, as a method for navigating system inefficiencies, are present at all levels of training and professional roles and across disciplines. Theoretically, workarounds are intended as a quick fix and are replaced by a solution that addresses the system problems; in practice, people often find themselves living with workarounds for long periods of time, with residents sharing detailed knowledge of the workarounds to the next generation of residents. Adopting workarounds as part of one's clinical practice means that there is a failure to perform an appropriate analysis of the systems failures, or to truly understand systems failures that lead to the workarounds.

Often, even the most experienced persons in the system do not recognize the destructive cycle of the workaround. It is only after a serious breakdown in the system occurs, (e.g., an adverse event), that an investigation may reveal the workaround. For faculty, a key opportunity is to learn to recognize the workarounds their residents adopt because it provides multiple opportunities to tease out the system issues and talk about them.

Surfacing workarounds can be a Pandora's Box – we need to assure that the organization can support the improvement work that will be required once the system issues have been identified.[23] Some suggestions include:

- *Provide an easy avenue to report problems as they occur* – give people an easy avenue to report and communicate issues.
- *Ensure that feedback is part of reporting* – let providers and staff know that they have been heard and that the issue will be addressed.
- *Identify appropriate institutional leaders who are willing to work with providers and staff to tackle system issues.* Identifying system problems is only the first part of any solution. It is critically important that institutional leaders are willing to tackle these issues with physicians and staff.
- *Provide feedback on what is being done to fix the problem.* Once system issues have been identified and reported, provide feedback about how the problem is being solved.

Overall, there is a need for generalizable methods and tools for teaching about the system and the effect of the system on the caregiving process.

Systems-Based Practice for the Board Certified Physician™

In 2000, ABMS began to promote a replacement for recertification known as Maintenance of Certification™ (MOC). MOC, when fully developed, will assess the continuing competencies of physicians. It is based on four components:

- Professional standing (e.g., unrestricted license, hospital privileges, peer ratings)
- Commitment to lifelong learning (e.g., self assessment, CME, simulations)
- Cognitive expertise (e.g., secure exam)
- Evaluation of performance and improvement in practice (e.g., an ability to demonstrate that care is safe, effective, patient-centered, timely, efficient and equitable; and that one has incorporated quality improvement as a habit of practice)

The competency of SBP fits within both the second and the fourth components of MOC. A few medical specialty boards have indicated that they plan to include assessment of SBP in their certification and re-certification exams in the near future. The Practice System Survey, which is part of the American Board of Internal Medicine's web-based Practice Improvement Modules (PIMs), assesses SBP and could be a useful prototype for other specialty boards. The PIM is ABIM's prototype tool for evaluating the fourth component, physician practice performance, of its MOC program. As SBP is incorporated into medical education at the undergraduate, graduate and practicing physician level, it will also become a more integral part of the certification and re-certification process. However, the medical specialty boards can take a leadership role in providing guidance for understanding and evaluating SBP.

Medical specialty boards, in collaboration with specialty societies, can act as a catalyst to help define assessment modalities for SBP, and thus, to promote appropriate and effective education

and training for SBP. By requiring physicians to be proficient in SBP for certification and MOC, specialty boards are sending a clear message across the continuum of medical education about the importance of learning about SBP.

Discussion

Implementing and evaluating SBP in a medical context requires an understanding of what constitutes a "system" coupled with an understanding of systems thinking. Despite the best intentions of health care providers, misunderstanding how the system in which one operates can break down or succeed can interfere with the delivery of health care. Undergraduate medical education, residency programs, and ABMS Member Boards are making progress toward training physicians in SBP. However, it is clear that there are gaps in current curricula and training. The major gaps in SBP curricula identified in this paper include:

1. No clear, common understanding of SBP
2. Lack of assessment methods
3. Lack of understanding of the relationship of SBP to patient outcomes and safety
4. Lack of integration into daily practice

Educators must develop clear, universally accepted definitions of SBP that are consistent with the medical profession's understanding of it as a necessary competency. It may be helpful for each specialty to consider how daily aspects of their clinical practice relate to systems. Once a clear definition has been established, educators must train students, residents and practicing physicians to recognize how they interact with systems, how systems affect their daily medical activities, and how they can change ineffective systems. Understanding the relationship between systems and outcomes of care will help increase the relevance for physicians as they master SBP.

Paul Miles, MD, Vice President of the American Board of Pediatrics, delineates questions that every practicing physician, from recent graduates to the established physician, should be able to answer regarding SBP[24]:

1. Can you define a system?
2. How do you describe the system you work in (can you draw a picture)?
3. How well does the system work?
4. How would you analyze and diagnose where the system can be improved?
5. How would you identify and prioritize change?
6. Do you participate in an interdisciplinary team?
7. What are the different systems your system interacts with and how does your system interact with these systems?
8. How is your system financed?
9. How are new members of the team trained (how does the system renew itself)?
10. If your system is involved in medical education, how is medical education done successfully?

SBP involves all aspects of a physician's practice of medicine. Opportunities for identifying system failures and successes, as well as how these failures and successes can affect patient outcomes and safety should be integrated into clinical training. Faculty need effective tools for teaching and assessing SBP as part of daily practice.

Competency in SBP must be measured in a systematic way that assesses how knowledge of SBP contributes to improving quality and safety of care. Explicit strategies are needed for teaching SBP in clinical settings. By focusing on objective criteria and specific skills that relate to SBP,

educators can design effective evaluation tools that truly measure physicians' knowledge and skills in SBP.

References

1. Helmreich R. On Error Management: Lessons learned from aviation. *BMJ.* 2000;320:781-785.

2. Ziegelstein R, Fiebach N. The mirror" and "the village": a new method for teaching practice-based learning and improvement and systems-bsed practice. *Acad Med.* 2004;79(1):83-88.

3. Institute of Medicine. *To err is human - building a safer health system*. Washington: National Academy Press; 1999.

4. World Health Organization. Patient Safety; 2007.

5. The Joint Commission. National Patient Safety Goals 2007.

6. Accreditation Council on Graduate Medical Education. Core Competencies; 2007.

7. Bertalanffy LV. *General System Theory: Foundations, Development, Applications*. New York: George Braziller, Inc.; 1968.

8. Batalden P, Mohr J. Building a Knowledge of Health Care as a System. *Quality Management in Health Care.* 1997;5(3):1-12.

9. Senge P. *The Fifth Discipline*. New York: Doubleday; 1990.

10. Ackoff R. *Redesigning the Future*. New York, New York: John Wiley & Sons; 1974.

11. Ackoff R. *The Democratic Corporation*. New York, New York: Oxford University Press; 1994.

12. Batalden P. Personal Communication to Julie K. Johnson. Chicago; 2005.

13. Van Cott H. Human Errors: Their Causes and Reduction. In: Bogner MS, ed. *Human Error in Medicine*. Hillsdale, NJ: Lawrence Erlbaum Associates; 1994.

14. Plsek PE, Greenhalgh T. Complexity science: The challenge of complexity in health care. *Bmj.* Sep 15 2001;323(7313):625-628.

15. Plsek PE, Wilson T. Complexity, leadership, and management in healthcare organisations. *Bmj.* Sep 29 2001;323(7315):746-749.

16. Batalden PB, Mohr JJ, Nelson EC, et al. Continually Improving the Health and Value of Health Care for a Population of Patients: The Panel Management Process. *Quality Management in Health Care.* 1997;5(3):41-51.

17. Mohr J. *Forming, Operating, and Improving Microsystems of Care.* Hanover: Center for the Evaluative Clinical Sciences, Dartmouth College; 2000.

18. Nelson EC, Batalden PB, Mohr JJ, Plume SK. Building a Quality Future. *Frontiers of Health Services Management.* 1998;15(1):3-32.

19. Berwick D. A user's manual for the IOM's 'Quality Chasm' report. *Health Affairs.* 2002;21(3):80-90.

20. James B. Personal Communication to Julie K. Johnson. Salt Lake City; 2005.

21. Accreditation Council for Graduate Medical Education. Accreditation Council for Graduate Medical Education Outcomes Project: General Competencies. www.acgme.org/outcomes/comptv13.htm] www.acgme.org/outcomes/comptv13.htm. Accessed April 7, 2000.

22. Accreditation Council on Graduate Medical Education. ACGME Bulletin. Chicago; 2007.

23. Mohr J, Arora V. Break the Cycle: Rooting out the Workaround. *ACGME Bulletin.* 2004;November.

24. Miles P. Systems-based Practice: What Every Physician Should Know, 2004; Rosemont, IL.

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