CHAPTER 1

# INTRODUCING CLINICAL MICROSYSTEMS

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## LEARNING OBJECTIVES

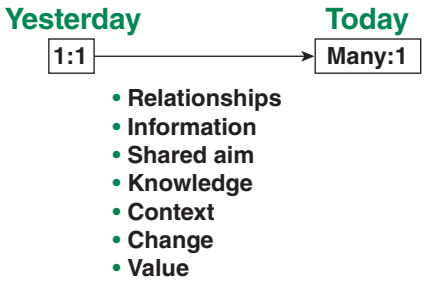
- Introduce the theory and contexts for microsystems in health care.
- Discuss ways microsystems function in a health care system.
- Summarize important research on microsystems in health care.
- Describe concepts and mechanisms for improving quality and value in clinical practice.

This chapter begins with a *sharp* focus on *clinical microsystems* in health care and then expands its focus to explore contexts for microsystems within the overall health care system. After summarizing some important research on microsystems, the chapter concludes with a discussion on essential elements for making sustainable improvements in the quality and value of health care.

## MICROSYSTEMS IN HEALTH CARE

There was a time when health care was a simpler affair. The doctor-heroes of such classic television programs as *Marcus Welby, M.D.* or *The Cosby Show* modeled practice styles we could recognize in our own personal physicians. Omniscient clinicians delivered care in patients' homes or in a solo office. Unhurried nurses met every clinical need in hospital settings. Health care was embodied in an intimate one-to-one relationship that joined patient with doctor or nurse and that was supported by relatively little medical science. We developed and maintained a romantic view that health care was a professional activity for heroic soloists.[1,2]

FIGURE 1.1 Many-to-One Diagram.




Today, however, that activity, those participants and relationships, and indeed the very goals of health care are much more complex. An interdisciplinary team of clinicians and staff backed up by ancillary services and information technology work in partnership with patient and family members to promote health and to care for health problems. Participants draw upon medical science and biomedical technology that expands at an astonishing (and sometimes overwhelming) rate. Diverse clinical settings with specialized resources, but also unique safety hazards, provide numerous settings in which care may be delivered. Regulators, payers, and *consumers* all have vested interests in quality performance data that are increasingly available for public review. Health care today has grown, for the most part, into a many-to-one relationship as shown in Figure 1.1, where "many" refers to health care professionals and "one" refers to the patient. Health care is now supported by rapidly proliferating biomedical knowledge, expensive technology, and administrative infrastructure.

And yet, if we look again at the sharp end of the health care system, at the place where each patient is in direct contact with health care professionals, we can discern the fundamental building block that remains the foundation of all health care systems. We call this building block the clinical microsystem. *Clinical* reflects the essential priorities of health and care giving. *Micro* reflects the *smallest replicable unit* of health care delivery. *System* reflects that this frontline unit has an aim and is composed of people, processes, technologies, and patterns of information that interact and dynamically transform one another. The clinical microsystem is the place where patients, families, and caregivers meet. It is the locus of value creation in health care.

The theoretical and empirical foundation of clinical microsystem ideas rests upon many decades of pioneering work by such authors as W. Edwards Deming,[3] Kerr White,[4] Avedis Donabedian,[5] and others. But one person in particular, James Brian Quinn, can be regarded as the *father* of clinical microsystem thinking. Professor Quinn, now Emeritus at Dartmouth's Tuck School of Business, conducted research in the early 1990s on the economy's rapidly growing service sector. Quinn wished to understand why some service organizations enjoyed such explosive financial growth and also received accolades from consumers. His research of the world's best of the best service organizations culminated in publication of the seminal work, *Intelligent Enterprise*.[6] Quinn discovered the world's most successful service organizations placed a major focus on what he called the *smallest replicable units* (SRUs) or *minimum replicable units* (MRUs) within their enterprise. These were the places where true value transfer took place, where suppliers interacted directly with the customers, and where service was delivered.

Quinn found the highest performing service organizations had several features in common, including the following:

- The front office was fixated on the ongoing perfection of frontline services within SRUs because value and loyalty are created at the customer-provider interface.
- Quality, efficiency, timeliness, service excellence, and innovation were designed into frontline work processes of SRUs.
- Information flows were engineered into frontline work of SRUs to create supportive, real-time information environments that facilitated swift and correct delivery of services.
- The smallest units of activity within frontline SRUs were measured and tracked over time for monitoring, managing, and improving performance.
- Increasingly rich information environments were created for the frontline SRUs. Data systems were designed to feed information forward and to feed information back so the right information was at the right place at the right time at the right level of aggregation.
- Based on systemic learning, ongoing improvements, and standardization of most effective practices, these *best in the world* service sector leaders could rapidly grow by replicating frontline SRUs through time and across space, reliably extending the delivery of high-value services.

The authors of this text, after reading Quinn's important book, recognized the relevance and prescience of the SRU concept for health care systems. These SRUs, these discrete points of services that unite supplier with customer, are precisely the points that also unite health professionals with patients. The clinical microsystem is the smallest replicable unit of health care. Services are provided or received, and quality, safety, and value are created in microsystems. In this chapter we explore general features of the clinical microsystem, which include its properties, contexts, and empirical supports. In subsequent chapters we examine specific microsystem components that support its optimal function as a self-contained clinical unit and as a building block for larger (macrosystem) health care organizations.

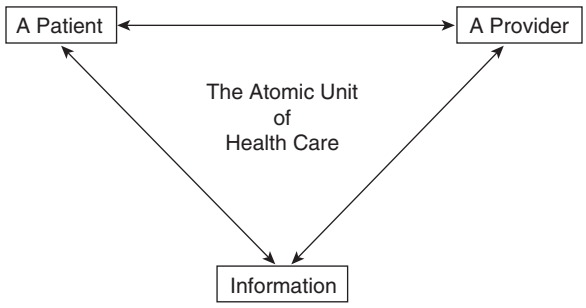
## The Functional Unit in Health Care

Although far-reaching in its practical implications, the notion of a *functional unit* in health care is neither a new nor a radical idea. As long ago as 1935, Dr. Lawrence J. Henderson, who more famously described the Henderson-Hasselbalch acid-base equation taught to chemists, physiologists, and medical students, observed in *The New England Journal of Medicine* that "doctors and patients are part of the same system."[7] More recently, Dr. Staffan Lindblad from the Karolinska Institute in Stockholm, Sweden, has asserted that the clinical microsystem is the *atomic unit* of all health care systems and it is composed of three particles ($P_2I$), a Provider, a Patient, and Information, all of which dynamically interact with one another over brief or extended periods of time.[8] These elements form a system when there is an aim that makes their interdependencies sensible. Figure 1.2 depicts the microsystem as the *atomic unit of health care delivery.*

We have already described the clinical microsystem as the place where patients, families, and caregivers meet. A more formal definition is now useful.

- A *health care clinical microsystem* is the small group of people (including health professionals and care-receiving patients and their families) who work together in a defined setting on a regular basis (or as needed) to create care for discrete subpopulations of patients. As a functioning unit it has clinical and business aims, linked processes,

**FIGURE 1.2 The Simplest Clinical Microsystem.**




*Source:* Adapted from Staffan Lindblad, MD, September 2007.

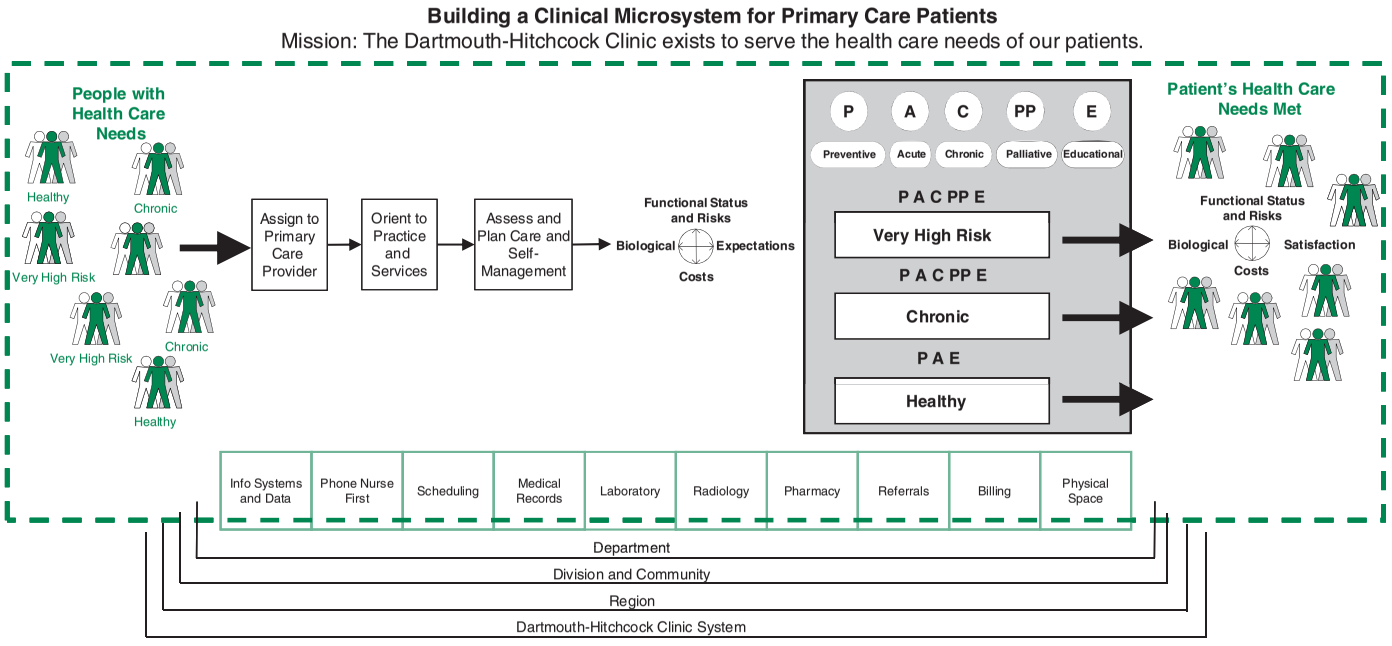
> a shared information and technology environment, and produces care and services that can be measured as performance outcomes. The clinical microsystem evolves over time and is often embedded in larger systems or organizations. As a living, complex, adaptive system, the microsystem has many functions, which include (1) to do the work associated with core aims, (2) to meet member needs, and (3) to maintain itself over time as a functioning clinical unit.[9]

Zimmerman and colleagues have observed that every complex, adaptive system has structure, processes, patterns, and outcomes.[10] To the extent that we recognize clinical microsystems as living and dynamic entities of this sort, we can also describe and assess them in terms of both structure (or anatomy) and function (or physiology). The anatomy of the clinical microsystem highlights its major structural elements, including its *Purpose, Patients, Professionals, Processes,* and *Patterns,* which together are known as the *5Ps.* To design, implement, and improve frontline clinical services, members of clinical microsystems must first gain self-understanding of their own system's 5Ps. Figure 1.3 depicts structural (anatomical) relationships.

Similarly, caregivers' rich knowledge of the physiology of the microsystem permits detailed exploration of care processes' functional *inputs* and *outputs.* Patients and families enter a system of care with specific health needs; they participate in clinical processes of orientation, assessment, intervention, and reevaluation; and they hopefully emerge from that system satisfied that their health needs have been met. The physiology model is introduced in the Preface as the Clinical Microsystem Model, Figure P.1.

The elements of the anatomy and physiology models offer powerful insights into systematic assessment of clinical microsystem performance, and they enable formulation of sound recommendations for improvement and innovation. Chapter One Action Guide provides the diagram of the anatomy model with detailed description and useful tools for self-assessment of the 5Ps, and the reader is encouraged to use this resource on a frequent basis when engaged in microsystem design and improvement. In addition, the Web site www.clinicalmicrosystem.org offers downloadable tools based on the 5Ps anatomy model, with options to assess and to understand performance of different types of clinical microsystems, including primary care practices, medical homes, specialty medical practices, inpatient care units, neonatal intensive care units, long term care, and supporting microsystems (such as pharmacy, laboratory, and environmental services). The *Assess, Diagnose and Treat* workbook profiles are introduced in Chapter One Action Guide. Two examples of unique clinical microsystems such as primary care

## FIGURE 1.3 Anatomy of a Microsystem.




**STAFF MEMBERS:**

| | | | |
|---|---|---|---|
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| Ron, PA | Katie, RN | Amy, Secretary | |
| Erica, RN | Bonnie, LPN | Buffy, Secretary | |
| Laura, RN | Carole, LPN | Mary Ellen, Secretary | |

**Skill Mix:** MDs 1.8 **RNs** 5.8 **NP or PAs** 2 **MAs** 1.8 **LPNs** 3 **SECs** 5

**Measuring Team Performance and Patient Outcomes and Costs**

| Measure | Current | Target | Measure | Current | Target |
|---|---|---|---|---|---|
| Panel Size Adjusted | | | External Referral per Member per Month Adjusted | | |
| Direct Patient Care Hours: by MD or Associate | | | Patient Satisfaction | | |
| Percent of Panel Seeing Own Primary Care Provider | | | Access Satisfaction | | |
| Total per Member per Month Adjusted | | | Staff Satisfaction | | |

and specialty care are outlined; the details and variables of assessing the anatomy of a clinical microsystem then lead to a diagnosis and treatment plan. The Action Guide offers some of the discoveries made through exploring the 5Ps and provides a few examples of what 5Ps might be uncovered by assessing supporting microsystems.

The *physiology model* and *anatomy model* both offer ways to make a systematic assessment of clinical microsystem performance and to formulate informed recommendations for improvement and innovation. More detailed information about using the anatomy and physiology models can be learned at www.clinicalmicrosystem.org.

## A BROADER VIEW OF SYSTEMS AND MICROSYSTEMS

We have introduced the concept of clinical microsystems, and have viewed them first from an up close perspective that highlights local structure and function. Let us now consider systems thinking more broadly and conceptualize clinical microsystems within a larger health care context.

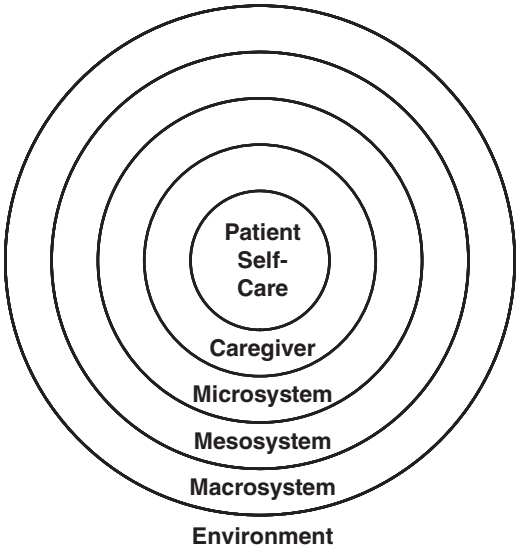
### Systems Dynamics and Embedded Systems

In the second half of the twentieth century, researchers in various disciplines have explored and characterized properties of numerous complex systems, and this work has influenced thinkers and practitioners in academia, commerce, social policy, and medicine. Biologist Karl Ludwig von Bertalanffy was an early investigator of such systems, and developed perspectives and principles of general systems dynamics[11] that have been subsequently adopted and adapted in such diverse fields as sociology,[12] social psychology,[13] quality and productivity improvement,[14] leadership and program development,[15] human factors in high reliability industries,[16] and complexity science.[10,17]

Unifying the common themes across these numerous disciplines, Plsek and Greenhalgh have defined complex adaptive systems as collections of individual agents with "freedom to act in ways that are not always predictable, and whose actions are interconnected so that one agent's actions change the context for other agents."[18] Such systems are notable for their distributed rather than centralized control, for their nonlinearity (and non-singularity) of relationship between cause and effect, and for their capacity to learn and to adapt (based on continuous feedback) in a spontaneously self-organizing and reorganizing manner.[10] Importantly, despite their unpredictability at the level of fine detail, complex systems commonly exhibit behavior that is integrated and purposeful. Thus W. Edwards Deming could succinctly assert that "a system is a set of interrelated parts that work together to achieve a common aim."[14] As we shall observe in the present and subsequent chapters, this combination of spontaneity, interconnection, and shared purpose is a key driver of successful work in health care's clinical microsystems. Chapter Eight provides a more extensive discussion of systems thinking in the care of people who have chronic illness.

In addition to this fundamental interconnection of component parts, many systems reveal the further property of multiple *levels* of organization, so that systems and subsystems are actually embedded one inside another. Like Russian matryoshka dolls of increasing size that are nested one inside the next, we can think of systems in nature. For example, cells cohere into organs, then into human beings, families, communities, nations, and finally into all of humanity. Each cell is a system in its own right, and each is intrinsically bound to systems at higher and lower levels. Of course, this nested

FIGURE 1.4 Embedded Provider Units in a Health System.




structure adds still further levels of complexity; multilateral relationships and influences exist among components within single levels and also across levels.

In health care this property of embedded systems is especially apparent and important. Figure 1.4 introduces a straightforward *target* design to illustrate the nesting of clinical relationships. At the center of the target, one person links with health-specific information to form a *system* that provides self-care.

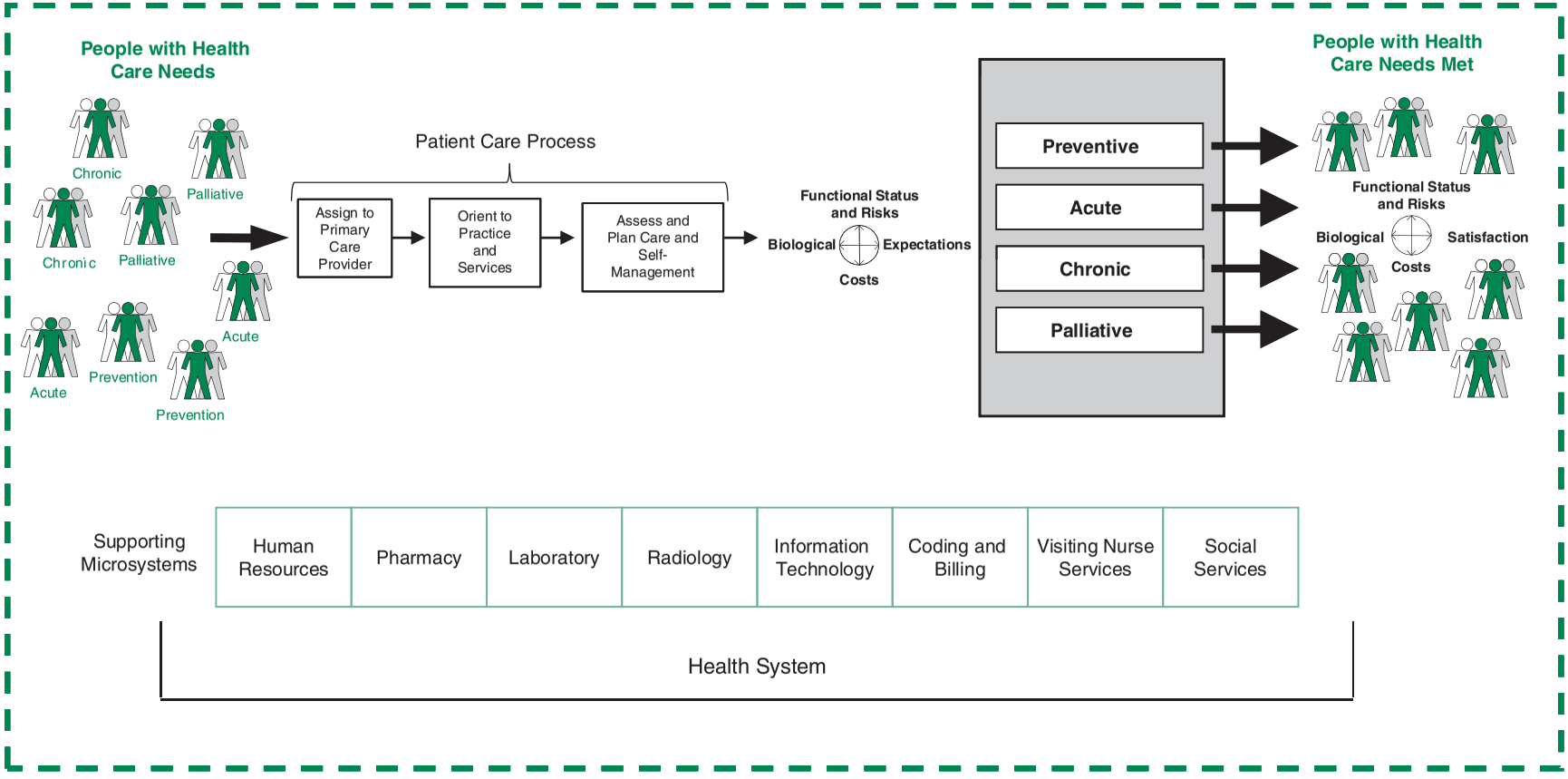
Moving out from the target's bull's-eye, we find a patient in relationship with an individual caregiver, then a clinical microsystem, then a mesosystem (of two or more linked clinical and supporting microsystems), then a macrosystem (of interdependent microsystems and mesosystems) that forms a larger organization such as a hospital or integrated health system, then finally a broader environment that can be described in terms of geography, markets, political jurisdictions, regulatory and legal requirements, and biomedical knowledge and technology.

The mesosystem, made up of the linked clinical and supporting microsystems, is part of the embedded systems within the larger organization. Figure 1.5 depicts the relationship of a clinical microsystem with some of the possible supporting microsystems, such as pathology, nutrition, informatics, transportation, and so on, that contribute to the clinical microsystem's processes of care. Every organization will have different supporting microsystems. Figure 1.5 intends to provide an example of supporting microsystems that might exist in one organization.

## The Institute of Medicine's Chain of Effect in Health Care

These ideas about system dynamics have become a major force for change and improvement in health care. In generating its highly influential *Chasm Report,* the Institute of Medicine (IOM) performed its analysis and offered its recommendations based on assumptions of health care *as a system.* The IOM committee responsible for this report identified not individuals but the entire health care system as dysfunctional and unsafe. The entire basic chassis was broken. The report states, "The current care systems cannot

## FIGURE 1.5 Supporting Microsystems for a Clinical Microsystem.



do the job. Trying harder will not work. Changing systems of care will."[19] The committee asserted that systemic change would require action at all levels of the health care system, and it identified four particular levels that required specific attention:

1. Patient and community
2. Microsystem of care delivery
3. Macrosystem
4. Environmental context

The IOM committee referred to this hierarchy of system levels as the chain of effect in health care improvement.[20] Quality aims of the system were defined broadly and included six related dimensions: health care must be *s*afe, *t*imely, *e*ffective, *e*fficient, *e*quitable, and *p*atient-centered. These system attributes, remembered easily by the mnemonic STEEEP, are themselves interconnected, and imply general and specific targets and interventions for health care improvement and redesign.

## Horizontal and Vertical Levels of the Health Care System

How do we begin to apply general systems thinking to the urgent challenges of health care redesign, improvement, and innovation? Before we turn our attention to the clinical microsystem approach in particular, we will be wise to consider the specific embedding of frontline clinical microsystems in higher nested levels of the meso and macrosystem. Let us imagine, for example, that leaders at all levels of a health care system (for example, a hospital, a multispecialty group practice, or an integrated delivery system) wish to visualize the whole of their system, so that everyone, at all levels, can gain a big-picture view that locates their own work within the larger organization. Figure 1.6 provides such a panoramic view.

The Jönköping County Council health system in Sweden uses a version of this figure to understand both horizontal and vertical dimensions of its organizational structure.

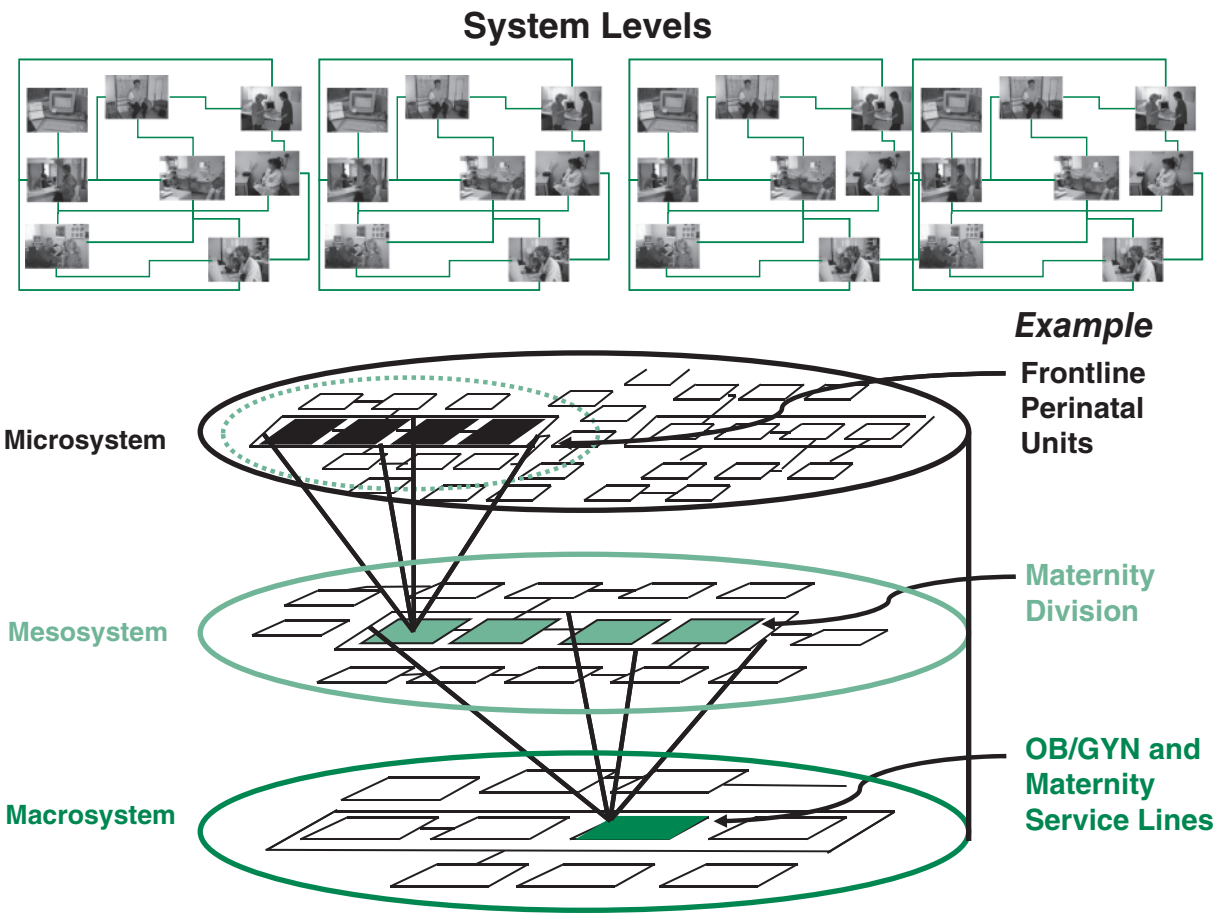
First, analyze the lateral flow of the diagram. At the system's *top* are patients and families interacting with clinical microsystems (the health system's building blocks) and progressing horizontally (from left to right) and through related microsystems on their health care journey. Consider the subjects on this journey: a young mother and father in their first pregnancy who are seeking prenatal, perinatal, and postnatal care, and then effective transition to a primary care clinician in the community; or an octogenarian who fell and broke her hip and will move through hospital admissions, rehabilitation, discharge, and then outpatient services.

Individuals enter each microsystem with specific needs and hope to transition to subsequent settings with the best possible outcomes.

Second, analyze the vertical flow of this same diagram. Here we find, for example, a frontline clinical microsystem such as the local inpatient birthing pavilion, in relationship to a set of inpatient and outpatient clinical and support units. These units in turn form a perinatal and obstetrical institute to care for Jönköping County's maternity population, in relationship to population-specific health care programs with similar aims. These programs are further linked to a nationally organized infrastructure for care of major health conditions or diseases, such as trauma, cardiovascular disease, cancer, and mental illness.

From this high-level and multitiered perspective, all participants can recognize where they fit in the larger system and how their own work contributes to local (micro

FIGURE 1.6 Panoramic View of a Health System.




*Source:* Adapted by G. Henriks to include macro, meso, and micro levels, from Langley, G., Moen, R., Nolan, K., Nolan, T., Norman, C., & Provost, L. *The improvement guide: A practical approach to enhancing organizational performance, Second Edition.* San Francisco: Jossey-Bass, An Imprint of John Wiley & Sons, Inc., 2009.

and meso) and global (macro) system aims. Apparent in this analysis is the potential for tension that calls for harmonizing the horizontal and vertical dimensions of care. We observe that health care is experienced by the patient and family in a *horizontal* fashion, with seamless or coordinated or disjointed or defective linkages within and between frontline microsystems. But health care systems themselves are traditionally organized in a *vertical* manner, with attention to organizational structure, chains of command, and *silos* of performance, that is, compartmentalized operation of each department, without real consideration of the whole system or of what needs to happen "upstream" or "downstream" in the flow of care. Leaders at all levels of health care systems must ensure that our traditional emphasis on vertical structures does not distract from efforts to optimize horizontal flow and functioning.

Of course, the *tension* of horizontal and vertical priorities can be positive, so long as reflective leaders are conscious of the dynamic and do not sacrifice quality. Careful consideration of the *architecture* depicted in Figure 1.6 (and of microsystem anatomy and physiology as previously discussed) empowers health care leaders to identify specific areas requiring functional assessment and redesign, so the quality of system perfor-

mance is improved in all STEEEP dimensions. Some common areas needing attention include leadership development, effective communication, design of coherent mesosystems, patient and family engagement, clarity about mission, vision, values and goals, and relevant measurement within and across all levels of the system.

### Microsystems and Their External Context

Another critical perspective for improvement of clinical microsystems is a map of surrounding (external) contexts that provides the view of each microsystem from the inside out. To be successful, every microsystem must interact effectively with other clinical and supporting microsystems. Indeed, microsystems depend on each other in the following ways:

- To provide each microsystem with patients to care for
- To receive patients who are discharged after care is complete
- To assist with the provision of need-based specialty and social services
- To provide ancillary services, such as diagnostic tests and assessments
- To administer supporting services, such as informatics, transportation, and nutrition
- To exchange essential information (feed forward and feedback) that facilitates each next step in the patient's journey through microsystems

Figure 1.7 shows the external context map drawn by Godfrey (one of this chapter's authors) for a general practice in one of England's communities. The mapping reveals this particular general practice can engage in a rich mix of health and social resources to provide comprehensive care to individual patients.

Use of an external mapping tool helps microsystem members break traditional patterns of thinking regarding scarcity of resources available to patients and practitioners. Indeed, when external relationships are formally mapped in this manner, an abundance of resources is often identified, and insights are gained into common interactions, possible improvement or redesign priorities, and functional necessities for cooperative work in the care of patients. Chapter One Action Guide presents more information on the external context of microsystems.

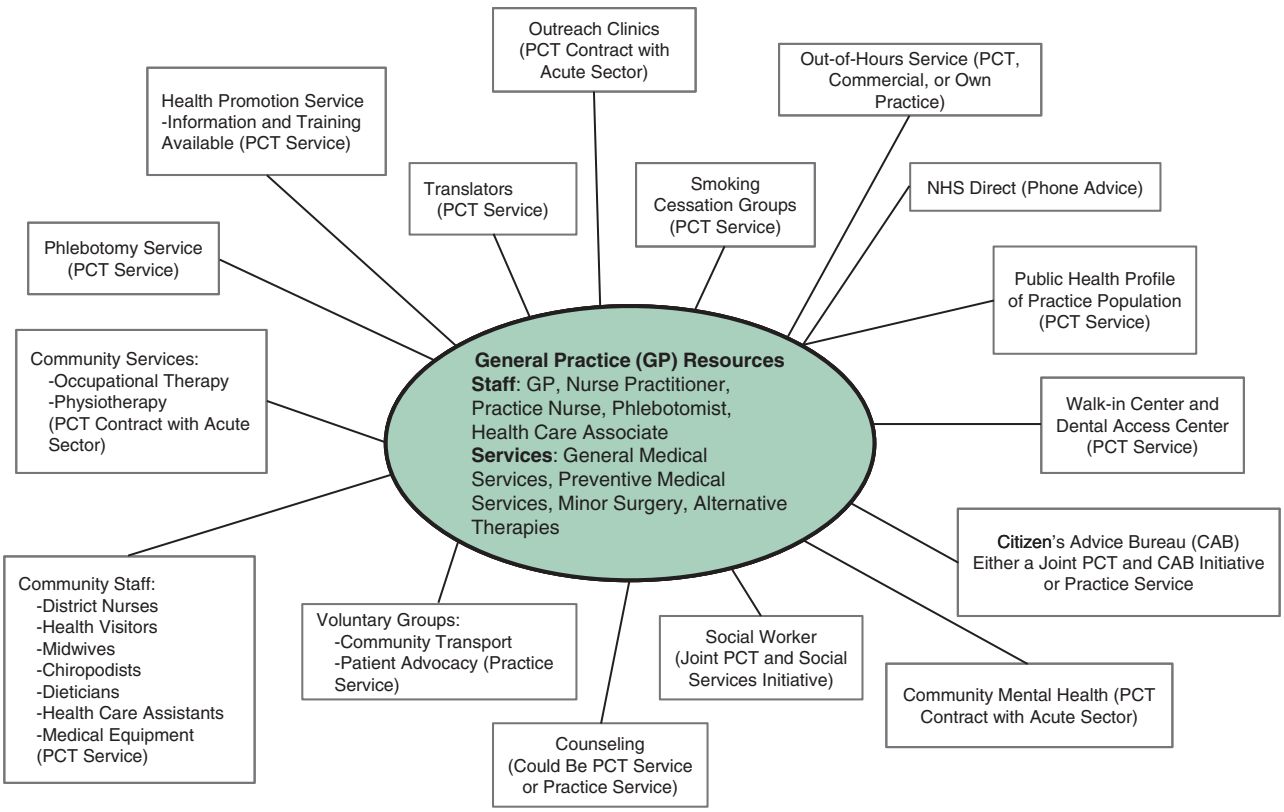
## RESEARCH ON MICROSYSTEMS IN HEALTH CARE

We have considered the benefits of system analysis in general and microsystem assessment and intervention in particular. Let us now examine scholarly work that explores the value of this organizing framework in real-world settings. Although research on clinical microsystems is relatively new, a number of important studies and summaries have been published in the last decade. In general, research and evaluation literature on microsystems can be divided into two broad categories: studies that focus on the performance of individual microsystems in specific clinical settings; and studies that address microsystems as elements in the design, improvement, and performance of larger (meso and macro) systems of care.

### Microsystem Research

One of the first published research accounts to use microsystems as an organizing framework was commissioned by the IOM and published in 2000 as a technical report

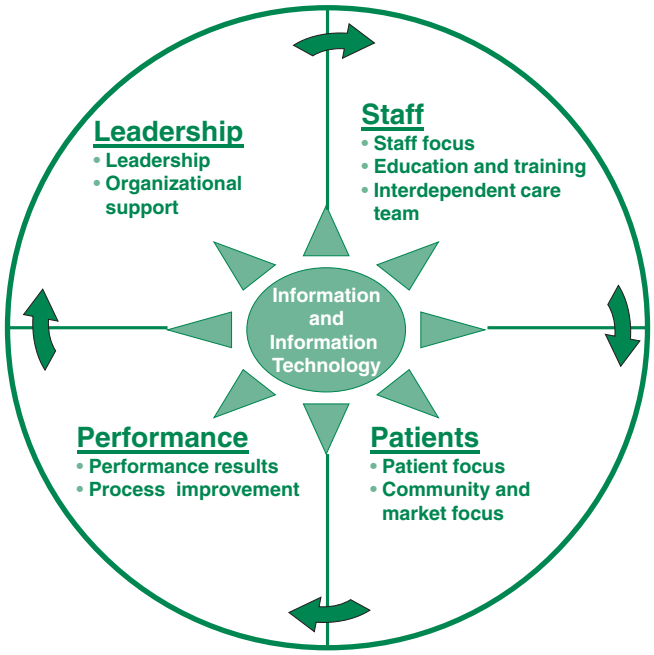
**FIGURE 1.7 External Mapping of a Clinic in the United Kingdom.**




for the Committee on Quality of Health Care in America.[21] In this qualitative assessment, the investigators identified forty-three high performing clinical microsystems, conducted interviews with their leaders, and identified eight core characteristics associated with their superior performance. These characteristics included: constancy of purpose, investment in improvement, alignment of role and training for efficiency and staff satisfaction, interdependence of care team to meet patient needs, integration of information and technology into work flow, continuous measurement of outcomes, supportive larger organization, and connection to community.

A Dartmouth-based team built on this first microsystem study and, with support from the Robert Wood Johnson Foundation, assessed twenty of the best performing clinical microsystems that could be identified in North America.[22] A mixed method study design was employed to sample microsystems from across the care continuum (ambulatory, inpatient, home health, nursing home, and hospice care). Investigators screened more than one hundred fifty potential sites, conducted preliminary interviews at more than fifty sites, and ultimately selected twenty microsystems that appeared to be the best performers. The selection of sites was based on a combination of five complementary methods for identifying *best of the best* clinical sites: literature review,

FIGURE 1.8 The Success Characteristics of High Performing Clinical Microsystems.




identification of sites that had won quality awards, interviews with national experts to identify exemplary microsystems, prior research, demonstration projects conducted by the IOM and the IHI respectively, and interviews with leaders of some of the leading health care systems in the United States and Canada (asking them to identify *best of the best* microsystems within their large health care systems.) The investigators then conducted multi-day site visits to the twenty top performing sites. Extensive qualitative information was collected based upon individual and group semi-structured interviews with microsystem members and with other staff and leaders in the larger organization. In-depth interviews were supplemented with direct observation of care delivery and with quantitative medical record review of quality metrics and financial data on efficiency and costs.

The research team analyzed all of this information and concluded that these twenty top performing microsystems shared a set of characteristics that combined to produce sustained, superior results. These ten success factors are depicted as dimensions of a microsystem performance wheel, illustrated in Figure 1.8. The success wheel features the following five interrelated components with an information hub at its center:

1. *microsystem leadership actions* (usually through physician and nurse and/or administrative co-leadership) that motivated and guided staff and that gained support from the larger organization
2. focus on the needs of *staff,* who were learning and growing, appreciated by their leaders, and aware of their interdependence
3. primary emphasis on the needs of *patients* and families and on the priorities of local communities and markets
4. full attention to *outcomes and performance results* desired by patients and families and to analysis, improvement, and standardization of effective care *processes*

5. a rich *information environment* and intelligent use of information technology, with recognition of communication's essential role in linking all microsystem participants and activities

The Microsystem Assessment Tool (MAT) is a qualitative tool developed from the research-based microsystem performance wheel. This assessment scheme offers the opportunity for members of microsystems to reflect upon and assess their perceptions of the microsystem before beginning a microsystem development journey. Microsystem members may then reassess six to twelve months later to review their progress. Chapter One Action Guide provides the MAT model, the MAT definitions, and the MAT scoring tool. Although the Dartmouth study focused on top performing clinical systems and identified factors that contributed to superior care, a case study published in 2003 by Weick and Sutcliffe focused on a low performing clinical system in the tragic Bristol Royal Infirmary (BRI) case. In an article aptly titled *Hospitals as Cultures of Entrapment: A Re-analysis of the Bristol Royal Infirmary*, the authors described conditions that contributed to a clinical unit's generation of consistently poor outcomes over a long time span.[23] In this now well-known instance, the BRI, a pediatric cardiac surgery program in the United Kingdom, had consistently higher mortality rates compared to peer programs, and it also failed to achieve the longitudinal decrease in mortality similar programs had experienced. "Why did the Bristol Royal Infirmary continue to perform pediatric cardiac surgeries for almost fourteen years (1981–1995) in the face of poor performance?" asked Weick and Sutcliffe.[23] The authors offered this remarkable conclusion, shown in the sidebar.

**Culture enables sustained collective action by providing people with a similarity of approach, outlook, and priorities. Yet these same shared values, norms, and assumptions can also be a source of danger if they blind the collective to vital issues or factors important to performance that lie outside the bounds of organizational perception. Cultural blind spots can lead an organization down the wrong path, sometimes with dire consequences. This was the case at the Bristol Royal Infirmary.[23]**

Although Weick and Sutcliffe found some clinical microsystems can develop cultures that are resistant to change and can even avoid information that may facilitate such change, Luan[24] explored the shared mental models that can lead to self-sealing entrapment in some clinical microsystems or that can conversely break these negative cycles. Luan examined shared mental models in neonatal intensive care units (NICUs) that were members of the Vermont Oxford Network (VON). She hypothesized NICU staffs shared beliefs regarding either the preventability or inevitability of hospital-acquired infections (HAIs) could predict the actual rate of those infections. Her research was based on the observations of a leading neonatologist, William H. Edwards, that staff in NICUs with the lowest rates of infection believed HAIs were 100 percent preventable by good care processes, whereas staff in high infection rate NICUs believed infections were inevitable. In effect, some staff felt infants were *entitled* to become infected, but then could be cured and saved by rapid diagnosis and treatment.[25]

Luan[24] identified several low and high infection rate NICUs, conducted in-depth interviews with staff, observed care routines and clinical processes, and analyzed mental models with respect to the preventability or inevitability of infection. Her results confirmed the hypothesis: staff expectations of inevitability were self-fulfilling. In NICU microsystems that attributed infection to reversible errors in process of care, HAIs were virtually eliminated over time. In microsystems that believed infections were inevitable, processes were not selectively improved to prevent them, and infection rates ranged from 32 to 54 percent of neonates.

In a fourth research project, Homa analyzed the sustainability of clinical microsystem improvements over time.[26] In her careful review of clinical performance at a regional Spine Center, Homa demonstrated clinical staff were able to appropriately increase mental health referrals from 29 percent to 59 percent (for spine patients with emotional difficulties) using microsystem assessment and intervention methodologies. During two subsequent years, however, as attention shifted to other priorities, referral rates dropped back down and actually settled in a zone that was lower than the pre-intervention phase.

Based on extensive interviews with staff and on direct observations of care patterns, Homa concluded that diminished attention to previously successful microsystem processes (such as performance monitoring, corrective response to worsened outcomes, and believing standardized protocols would improve local mental health outcomes) all contributed to the failure of *sustainable* improvement efforts. This study makes clear that long term improvement in clinical microsystems requires attention to not only quality *innovation* (as the Spine Center accomplished in its early phase) but also quality *maintenance*.

Taken together, these intriguing research results suggest the following:

- Microsystems can create either open or self-sealing cultures with respect to better or worse performance.
- Shared mental models are a powerful and often hidden source of both desired and undesired results.
- Initiation of quality improvements does not assure maintenance of them, unless continuous monitoring, reflecting, learning, and responding are built into local microsystem routines.

## Microsystem in Macrosystem Research

As suggested earlier in this chapter, systems are commonly embedded within and mutually influential across multiple levels of organization from micro to macro. The relationships across these levels can also be studied empirically, providing further insight into the function and value of clinical microsystems. Thus, for example, Golton and Wilcock have examined and extensively described the United Kingdom National Health Service's (NHS) early adoption of a microsystem approach in large health systems. In 2003 the NHS Clinical Microsystem (CMS) Awareness and Development program was launched "to investigate the utility and application of the microsystem framework for improvement."[27] The pilot program began in both inpatient acute care hospital and primary care settings spread throughout England. Program leaders deployed coaches to work with microsystems to assess and to improve their performance and to fortify preexisting quality initiatives that were part of Great Britain's major campaign to modernize health care delivery. Action-learning methods (including the 5Ps approach[9]) were used to engage frontline microsystem members in self-assessment, and the Dartmouth Microsystem Improvement Curriculum (DMIC) was adapted to fit the NHS's culture and conditions. The evaluation research report, published in 2005, offers the conclusion in the sidebar.

> **The initiative has shown that the CMS [Clinical *Micro*system] framework is an effective way to promote service improvement and the cohort of pilot sites has used it to good effect. . . . It is relatively easy to adapt microsystems working to complement local improvement initiatives that are already underway. . . . Finally, it is important to emphasize how this initiative has contributed to our understanding of how learning in the work place can produce real benefits for service users . . . it offers some insight into approaches to learning that are close to those we serve and that can be better tailored to meet the needs of learners and the needs of those who depend on them in their care settings.[27]**

Works published in 2007 from two leading regional health systems in the United States, Intermountain Health Care in Utah and Geisinger Health System in Pennsylvania, provide different examples of microsystem principles, concepts, and methods in action. These programs have bridged the gap between microsystem and macrosystem by creating innovative mesosystems to serve discrete patient populations.

James and Lazar describe the strategic development of health care delivery programs for patient subpopulations in Utah's highly regarded Intermountain Health care system.[9] This program employs *clinical process models* (CPMs) that design technical quality and evidence-based care into the flow of care for specific patient groups. The CPMs, based on ideas of Deming,[28] Juran,[29] and clinical microsystems,[9] bring together frontline generalists and tertiary and quaternary specialists to continually define the state of the art of evidenced-based care and to embed the provision of this care into regular work routines of health professionals in primary, specialty, and inpatient care settings. A strong information system supports provision of evidence-based care through active decision support tools and constant monitoring of care processes and outcomes, including performance in clinical, cost, and satisfaction domains. Feedback reports on performance are distributed to all relevant frontline clinicians as well as other clinical microsystem members and constantly emphasize the need to find ways to improve performance.

CPMs include modules for health care professionals and also self-management programs for patients and families, who are thus empowered to provide intelligent self-care and to partner effectively with care teams that serve them. The entire CPM infrastructure has been developed by senior leaders to: (1) link frontline microsystems into well-designed mesosystems (that are supported by effective leaders at all levels of the system and a rich information environment) to optimize care within and between microsystems; (2) to provide ongoing means to execute quality planning, quality control, and quality improvement throughout the care continuum and across a large geographic area; and (3) confer upon IHC a competitive advantage, through attention to higher quality care using lower cost methods whenever possible.

Using similar concepts and methods to those employed in Utah, senior leaders in the Geisinger Health System (which offers care in approximately half the state of Pennsylvania and to a third of its population), have refined a novel system, *ProvenCare (SM),* to provide superior care to diverse clinical populations. *The ProvenCare (SM)* approach focuses on specific patient subpopulations undergoing care episodes, such as open heart surgery, labor and delivery, back surgery, and total joint replacement.[30] Clinical leaders and staffs from contributing microsystems are brought together into functional mesosystems that identify implementable best practices and embed these into structured flows of care. The model is supported by an active information environment that uses state-of-the-art electronic health records (EHRs) and specially designed performance feedback reports that cascade to all levels of the system. Of special note is the use of risk-based pricing and service guarantees, which enable the Geisinger system to explicitly compete in the market on quality and price. Senior leaders of the *ProvenCare* (*SM*) program link strategy with execution and accountability by engaging microsystem leaders and staff, measuring the quality and costs of performance at all levels of the system, and creating incentives to reward quality and productivity.

## Emerging Microsystem Research in Sweden and the Future

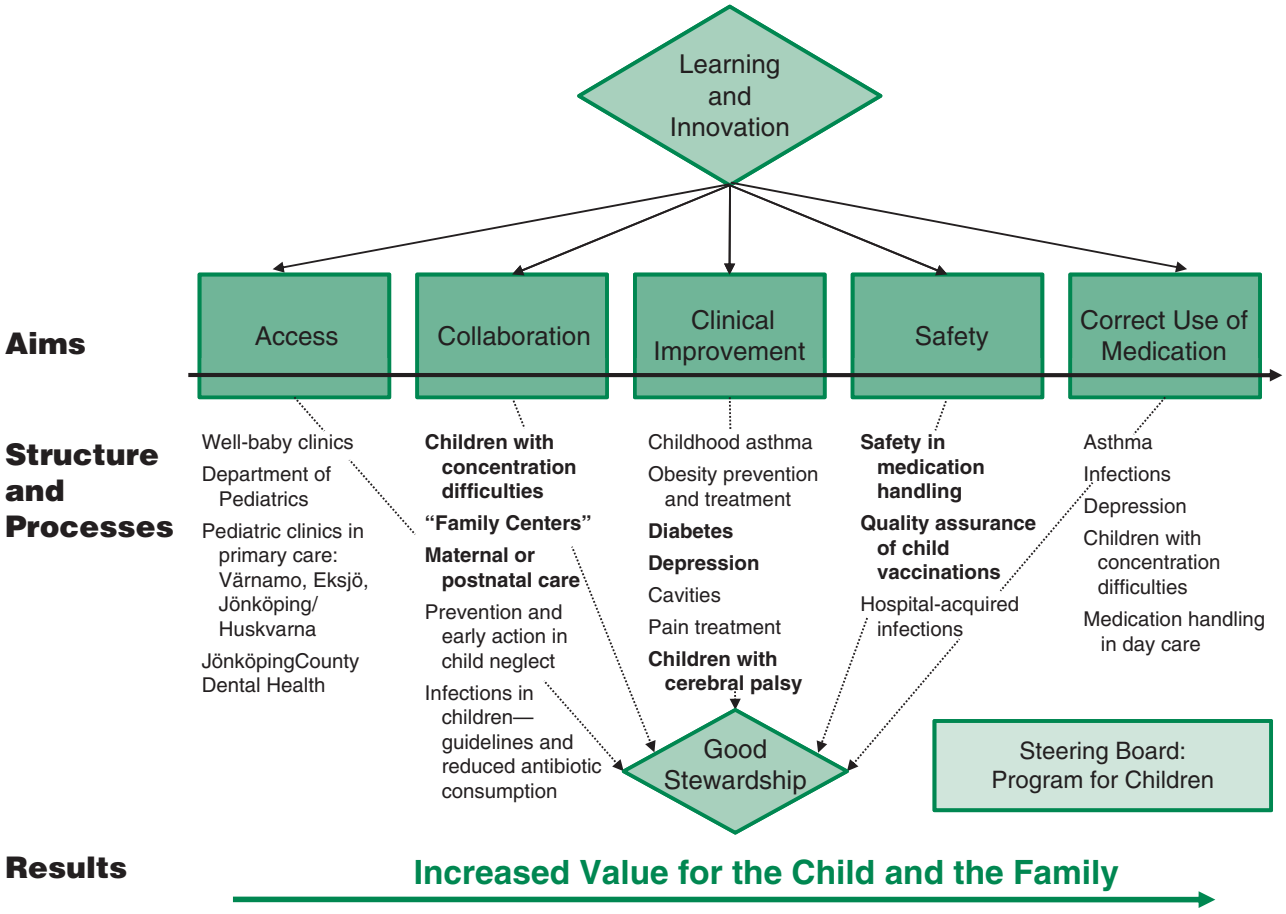
*Bridging the Gaps* is a unique collaborative effort between the County Council of Jönköping (CCJ), Sweden, and four academic schools: Jönköping University, Linnaeus University, Uppsala Clinical Research Center, and Helix Vinn Excellence Center. This national

initiative is supported by the Vinnvård research program in Sweden. The gaps to be bridged include those between knowledge and practice, between professionals themselves within multiprofessional organizations, and between different levels and groups within the larger health care system. The vision is multifaceted in the following ways:

- Interactive research will inspire development of new arenas for knowledge exchange and will stimulate new methods for the design of continuous learning, innovation, and improvement.
- Collaborative research will include interactions among frontline microsystems and will generate outstanding examples in practice and research.
- The results of the research (described as new insights, methods, approaches, good examples, and illustrative knowledge) will be integrated into undergraduate AND GRADUATE education, into continuing development activities for health care professionals, and into management training for health care administrative leaders.

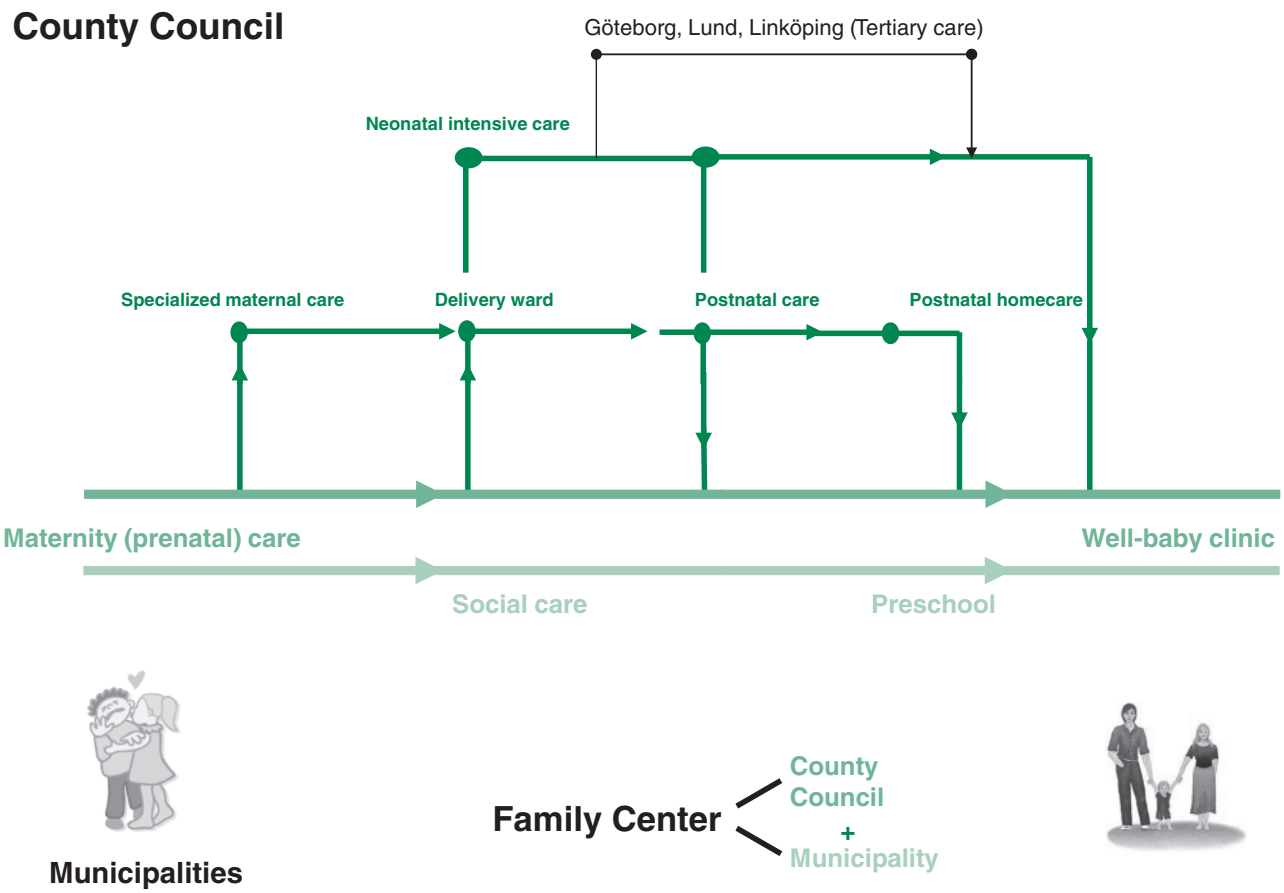
Figures 1.9 and 1.10 illustrate the aims, structures, and processes of one of the collaborative efforts sponsored by the County Council of Jönköping that led to increased value for the child and the family.

**FIGURE 1.9 Jönköping County's Child HealthCare Collaboration.**




*Source:* Adapted from Henriks and Bardon by Andersson-Gäre.

FIGURE 1.10 Panoramic View of Jönköping County's Maternity and Newborn Mesosystem.




Much research is being conducted by doctoral students in collaboration with faculty and health system leaders throughout Jönköping, Sweden. Table 1.1 lists several promising projects currently underway.

## Organizing for Quality

Some final empirical insights are offered by Bate, Mandel, and Robert in their fascinating study of seven leading hospitals and health systems in the Netherlands, United Kingdom, and United States. Bate et. al. studied health systems that had set out to organize around quality and safety and that had made good progress on their never ending journey. The research is unique because it focuses on both the macro and micro levels of these health care systems.

The final report of this work, *Organizing for quality: The improvement journeys of major hospitals in Europe and the United States*,[31] offers numerous insights into the structure and function of successful health care organizations. The authors first conclude that improving quality and safety requires aligned action at all levels of the organization, including top, bottom, and middle. Second, effective deployment of quality actions generates integration and coordination across the different levels of the organization. Third,

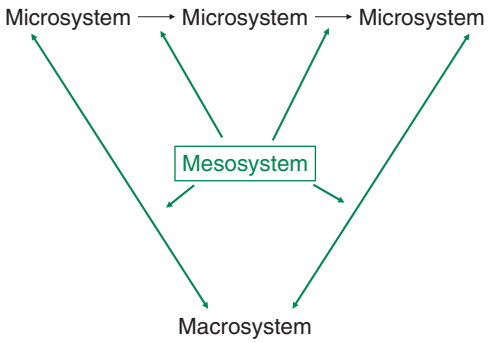
**Table 1.1 Bridging the Gaps: Jönköping, Sweden, Research Studies**

| Title of Research | Researcher and School |
|---|---|
| *Patient Centered E-Health: An Extended Perspective on Information Systems in Clinical Microsystems?* | Eva Lindholm<br>County Council Jönköping-Qulturum<br>International Business School<br>Jönköping University |
| *Microsystem Theory—A Paradigmatic Change in Health Care?* | Joel Hedegaard<br>School of Education and Communication<br>Jönköping University |
| *The Physician, Learning, and Interprofessional Collaboration—Essential Conditions for Creating Better Patient Results* | Karin Thörne<br>County Council Jönköping-Futurum<br>Health University of Linköping |
| *The Art and Science of Coaching Interdisciplinary Health Care Teams to Achieve Strategic Health Care Improvement* | Marjorie M. Godfrey<br>School of Health Sciences<br>Jönköping University |
| *One Lens Missing? The Clinical Microsystem in a Pedagogical Theory Framework* | Ann-Charlott Norman<br>Växjð University and School of Health Sciences, Jönköping University |
| *Interprofessional Experiences of Quality Improvement Work* | Annette Nygardh<br>School of Health Sciences<br>Jönköping University |
| *Who and What Is in Focus? A Study of Documentation in Electronic Patient Records and Quality Registers* | Eva Gustaffson<br>School of Health Sciences<br>Jönköping University |
| *TechnoOrganizing—Make the Microsystem Work with Efficient Information Provision* | Klas Gäre<br>Jönköping International Business School<br>Linda Askenäs<br>School of Mathematics and Systems Engineering<br>Linné University |
| *Can Complex Adaptive Systems Contribute to the Understanding of Microsystem Thinking?* | Annika Nordin<br>Martin Reiler<br>Jönköping International Business School Jönköping University |
| *Collaboration in health and welfare. Service user participation and teamwork in interprofessional microsystems.* | Susanne Kvarnström<br>School of Health Sciences<br>Jönköping University |

different organizations may take different routes to attain the same goal of safe, high-quality care that is appreciated by patients and families and that enriches the lives of employees. Fourth, local (microsystem-based) communities of practice exert an important and powerful influence on both the quality of patient care and the quality of caregivers' own work experience. In a very real sense, the local communities of practice that thrive in small clinical microsystems provide an antidote to feelings of alienation from being a small part of a larger bureaucratic organization. Fifth, the organization's *mesosystems* can, under some circumstances, positively and proactively align the goals, aspirations, and insights of people in both clinical and administrative service sectors.

Figure 1.11 demonstrates the pivotal integrating and buffering role mesosystems can play in the luminal space between microsystem and macrosystem levels of a health

FIGURE 1.11 Mesosystems as a Connector Entity.




*Source:* Adapted from Bate, P., Mendel, P, & Robert, G. Organizing for quality: The improvement journeys of major hospitals in Europe and the United States. Abingdon, UK: Radcliffe Publishing, 2008.

care organization. Bate finds mesosystems emerging in these high performing organizations that promote alignment and positive interactions within and between linked microsystems (through which patients move horizontally) and that connect direct care delivery work at the front line (microsystems) with strategic and executive work in the front office (macrosytems). Finally, the authors offer a very helpful assessment tool to stimulate organizational response to six universal challenges. The assessment provides discussion opportunities to explore current gaps within and future direction of local quality improvement efforts.

## THREE CONCEPTUAL IMPERATIVES IN THE WORK OF VALUE IMPROVEMENT

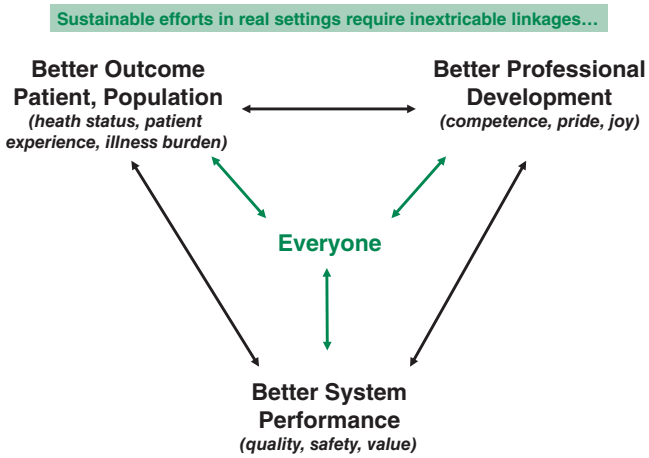
We have considered clinical microsystems as *structural* and *functional entities* and have reviewed the small but growing body of *descriptive research* that explores their pivotal role in real-world settings. Before analyzing specific components of clinical microsystems in richer and more practical detail, we introduce three *conceptual imperatives* that may guide microsystem members in the continuous improvement of their work. These imperatives offer some scaffolding upon which more precise manifestations of value can be built in the chapters that follow.

### *Imperative Number 1: Engage Everyone in Value Improvement*

Implicit in the traditional training of health care professionals, of nursing and support staff, and even of quality administrators, is an artificial distinction between the activities of clinical care and of continuous value improvement. Improvement is deemed as extra (rather than essential) work. It is delegated to special *quality improvement (QI) teams*. It is monitored in contexts that feel foreign or even threatening to clinicians.

Increasingly, however, members of highly effective clinical microsystems recognize that everyone in health care really has two jobs: to do the work and to improve the value of that work. These two functions are inextricably linked in professional activity, and indeed are yoked to a third essential responsibility: all microsystem members "must endeavor *to learn* continually, so that both clinical care and its system-based improve-

FIGURE 1.12 Annotated Sustainable Improvement Triangle.




ment are performed with ever-increasing effectiveness and creativity."[32] As depicted in the sustainable improvement triangle of Figure 1.12, the activities of patient care, system performance, and professional development are interdependent and mutually supportive.

In this context, Batalden and Davidoff offer an especially inclusive description of quality improvement, which they define in the sidebar.

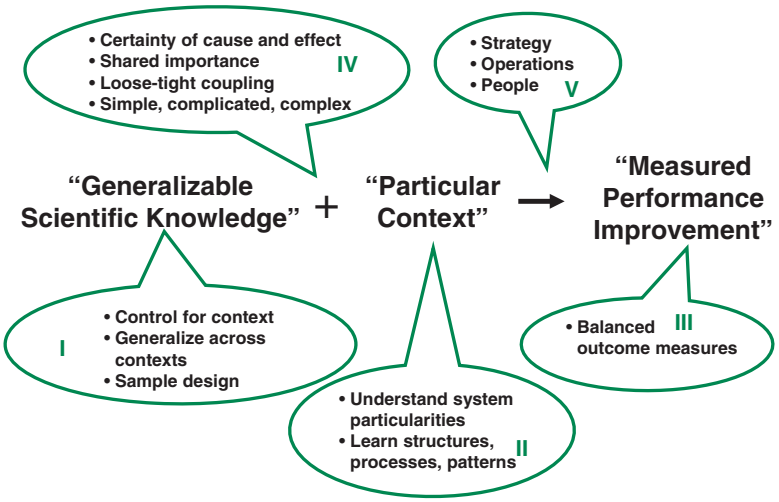
Observe in Figure 1.12 that the sustainable improvement triangle has *everyone* at its center. The work of value improvement must be understood not as an extra or a parceled-off function, but as an essential component of everyone's job, every day, in all parts of the system. Observe as well, in this same figure, that arrows emanating from this central term are bidirectional: not only does everyone participate, so too does everyone benefit. Health care professionals, patients and families, researchers, payers, planners, and educators all are rewarded by the mutually achieved outcomes of this important work. Rewards include the following:

**The combined and unceasing efforts of everyone—health care professionals, patients and their families, researchers, payers, planners, educators—to make the changes that will lead to better patient outcomes (*health* in physical, psychological, and social domains), better system performance (*care* that is safe, timely, efficient, equitable, and so forth), and better professional development (*learning* new knowledge, skills, and values).[33]**

- Better performance measured in terms of improving system quality, safety, and value (or cost)
- Better patient outcomes measured in terms of health status, patient experiences, and actual reductions in the burden of illness
- Better professional development for professionals and staff measured in terms of job satisfaction, competence, pride, joy, and mastery of their work

Because achieving sustainable improvements requires recognition that *every system is perfectly designed to get the results it gets* and because health systems throw off multiple and interdependent results rather than single and isolated outcomes (such as life or death or profits or losses or motivated or demoralized staff), members of clinical microsystems must collectively build new forms of knowledge and skill to support their work.

**FIGURE 1.13 Improvement Equation Annotated: Linking Evidence to Improvement.**




The richly annotated improvement triangle of Figure 1.12, and also the Improvement Equation (Figure 1.13), suggest several knowledge and skill domains that require microsystem mastery. These domains include knowledge of evidence-based practice, appreciation of change management and complexity, deep understanding of local context, capacity to execute change and improvement, and ability to generate and analyze balanced measures of outcomes and costs.

### *Imperative Number 2: Work the Improvement Equation*

We have learned in the past two decades that development of evidence-based guidelines does not guarantee reliable implementation in real-world clinical settings. McGlynn, for example, reported in an extensive literature review that Americans receive only half of the evidence-based and guideline-specified care for which they are appropriate candidates.[34] Although data from randomized controlled trials and other scientific forms of knowledge are necessary components of real-world clinical quality, these components alone are far from sufficient. Broader forms of knowledge are required.

Pawson and Tilley have developed a framework for program evaluation that is based on a brief equation:[35]

*mechanism + context = outcome*

Batalden and Davidoff have customized and specified this equation for health care:[33]

*generalizable scientific knowledge + particular context → measured performance improvement*

In this seemingly simple formula, the textual elements *and* the syntactic connectors (that is, the + and → signs) embed specific operational tasks and depend upon specific cognitive skills. These tasks and skills are elaborated on in Figure 1.13.

Let us briefly consider the methodologies and special forms of knowledge unique to each *Improvement Equation domain*. Generalizable scientific knowledge derives from decontextualized research and accrues over time. Research designs emphasize controlling for the effects of specific contexts to the greatest degree possible; generalizability is valued, which means specificity of application may be diminished. Particular context

knowledge recovers this diminished specificity and focuses upon assessment of local culture and the unique patients, professionals, processes, and patterns (see again the 5Ps) of this clinical setting. In contrast to randomized clinical trials, which eliminate consideration of local context by controlling for it in statistical models, this second knowledge domain focuses sharply on the particular setting and all that contributes to its identity.

Effective integration of both these domains is depicted in the Improvement Equation's + symbol, which suggests methodologies of adaptation and redesign. This *bridging* domain emphasizes reflective planning of specific care algorithms to match locally available resources; it includes management of conflict and negotiation in the context of unique practice histories.

Equally important as a bridging function is activity represented by the Improvement Equation's → symbol, which suggests knowledge necessary for actual execution of change. How is vision communicated, how are stressful transitions managed, how are positive achievements honored and sustained? *Measured performance improvement* permits recognition and analysis of these achievements themselves and is a final knowledge domain necessary for sustainable value creation. Statistical process control charting, graphical data, and other techniques permit monitoring of quality performance and facilitate refinement of improvement efforts over time.

The Improvement Equation's practical relevance becomes apparent in specific clinical contexts. In Chapter Six we elaborate upon the Equation's significance in greater detail and explore (as an extended example) the Equation's value in the design and implementation of preventive care services. The reader is invited to consider other applications as well.

### *Imperative Number 3: Frame Problems and Practice Solutions as Simple, Complicated, or Complex*

Glouberman and Zimmerman[36] have observed that organizational *problems* of all sorts, including most challenges in health care, may be categorized generally as simple, complicated, or complex. These categories have practical consequences in clinical microsystems. The conceptual framework is discussed in great detail in Chapter Eight, where it is applied specifically to the design and improvement of chronic illness care. Anticipating that discussion, we invite the reader to consider iconic examples in these three activity domains.

As Glouberman and Zimmerman,[36] and later Zimmerman, Lindberg, and Plsek,[10] have described, *baking cookies* is a classically simple problem, and *following a recipe* is a correspondingly simple solution. All ingredients are known and stable. Special expertise is not required, but cooking experience increases success rate. The aim of the recipe is to produce standardized products and the best recipes produce good results every time. Complicated problems and solutions offer similar degrees of certainty, although greater technical knowledge is required to achieve a desired end. *Sending a rocket to the moon*, for example, requires great expertise, but discrete elements of the system are knowable in detail; one successful rocket launch greatly increases the likelihood the next will succeed as well.

Both these examples may be contrasted with the truly complex task of *raising a child*. Recall the discussion of complex adaptive systems earlier in this chapter. Components of such systems are simultaneously interdependent and autonomous. Because these components change both within themselves and in relationship to each other, outcomes are inherently less predictable. Expertise may contribute to better results, but is neither necessary nor sufficient to assure success.

FIGURE 1.14 Simple, Complicated, Complex Framework.

| Simple "Yes/No" | Complicated "If, then…" | Complex "? Maybe" |
|---|---|---|
| Known elements | Elements are knowable | Elements partly known, but they can change… |
| Predictable outcome | Largely predictable outcome | Essentially unpredictable |
| Checklist (or other forcing function) | Algorithm-driven structured orders, decision making | Shared aim, relationship |
| Oxygenation status, smoking cessation, culture before antibiotic, antibiotic in four hours | Antibiotic tolerance/intolerance | Co-morbidities, social situation |
| Low provider autonomy | Variable provider autonomy | High provider autonomy |
| Aim: reliability | Aim: reliability | Aim: resiliency |


Building on the Glouberman and Zimmerman work, Liu, Homa, Butterly, Kirkland, and Batalden[37] offer practical guidance for people who wish to improve the quality, safety, and reliability of health care systems. This is based on the observation that all clinical microsystems and all health care mesosystems and macrosystems are complex, but not all the activities within these complex systems are themselves complex. It is possible, therefore, to analyze a clinical system, to identify specific challenges that are simple, complicated, or complex, and to improve system performance by matching discrete clinical problems to interventions of comparable simplicity or complexity. Figure 1.14 illustrates the logic of this simple, complicated, complex framework. See Chapter Eight for a more extended discussion.

## CONCLUSION

The road to better value health care has been partially mapped by research on small clinical microsystems and large health care macrosystems. We have focused attention on the sharp microsystem end in particular, for it is here that patients, families, and caregivers meet, and here that services are delivered and safety realized. In these smallest replicable units of the health care system, both quality and costs (and therefore value) are generated. In the upcoming chapters we analyze the actions and the interactions of these microsystem units, and we build from them a working vision of sustainable high-value care.

The ultimate aim of any health care system is to provide high-quality and high-value care for individuals and for populations. Value-based competition, supported by transparent performance measures and value-based payment schemes that reward higher quality, better outcomes, and lower costs, are emerging as a potent force for change in health care. This creates new energy to build knowledge and to redesign care. In order for health systems to respond positively to this new force, they will need to put into place mechanisms to engage all of their employees and staff to provide care and to

improve care, by working the improvement equation and by taking effective actions to enhance the reliability and resiliency of care.

## SUMMARY

- Large health care systems (macrosystems) have fundamental building blocks (clinical microsystems), which are the places where patients and families and health caregivers meet.
- Most health care systems are organized vertically, but patients experience care horizontally as they move from their homes and their community into and out of specific clinical microsystems and as they establish, maintain, and terminate caring and curing relationships with individual clinicians and interdisciplinary health care teams.
- The set of clinical microsystems patients move through on their health care journey during an episode of illness, along with ancillary and supporting microsystems that contribute to the patient's care along the way, form a de facto mesosystem that can be analyzed and improved and that can be measured and redesigned to promote better performance.
- Research on specific clinical microsystems and on health systems that adopt a microsystem-smart and enterprise-wide change strategy, reveals the need for alignment and improvement of the health care enterprise at all levels of the system, beginning with leadership and ending with care provided to patients at the sharp end (the clinical microsystem).
- Sustainable improvement requires everyone to focus on better patient or population outcomes, better system performance, and better professional development.
- Real improvements-measured performance is often produced by successful adoption of generalizable scientific knowledge in particular local contexts.
- Although clinical systems are inherently complex they will usually have parts that are simple, parts that are complicated, and parts that are complex. Many problems within systems can be framed as simple, complicated, and complex.

## KEY TERMS

Anatomy model of a microsystem
Clinical microsystem
Clinical process models
Communities of practice
EHR
5Ps
Improvement equation
Macrosystem
Mesosystem
Microsystem
Minimum replicable units or smallest replicable units
$P_2I$
ProvenCare (SM)
Self-sealing cultures
Shared mental models
Sharp end
Simple, complicated, complex framework
STEEEP attributes of quality
Sustainable improvement triangle
Systems thinking

## REVIEW QUESTIONS

1. What are the different *levels* of a health care system? Can you describe a real health care system and point out micro, meso, and macro levels?
2. Think about a person who has a serious injury or illness and describe his or her health care journey. What clinical microsystems might she or he enter as a patient? What ancillary and supporting systems also contribute to care of the patient as his or her journey progresses?
3. What aspects of quality are described by the STEEEP mnemonic?
4. Examine the performance wheel. What are the important dimensions of a high performing clinical microsystem and how might these interact with one another?
5. What are some research findings and implications of the research for health care improvement?
6. What is meant by the term *value* of health care? What can be done to improve the value of care?

## DISCUSSION QUESTIONS

1. How might a clinical microsystem become a culture of entrapment? What are the risks of an entrapment culture, and how might these risks be mitigated?
2. Is it possible to have a system in the absence of a common aim or purpose? What is the aim of a health care system? Do patients and clinicians and health administrators have a shared aim?
3. What is meant by the statement that most health care systems are organized vertically but patients experience care horizontally? How might a health care system be organized to smooth the patient's horizontal flow while improving outcomes and decreasing costs?
4. What are the three corners of the sustainable improvement triangle? How might these be connected and made to interact with each other?

## REFERENCES

1. Morse, G. Health care needs a new kind of hero: An interview with Atul Gawande. *Harvard Business Review*, April 2010, pp. 1–2.
2. Batalden, P., Ogrinc, G., & Batalden, M. (2006). From one to many. *Journal of Interprofessional Care*, *20*, 549–551.
3. Deming, W. E. *Out of crisis.* Cambridge: Massachusetts Institute of Technology, Center for Advanced Engineering Study, 1989.
4. White, K. L. *Healing the schism: Epidemiology, medicine, and the public's health.* New York: Springer-Verlag, 1991.
5. Donabedian, A. *The definition of quality and approaches to its assessment.* Ann Arbor, MI: Health Administration Press, 1980.
6. Quinn, J. *Intelligent enterprise: A knowledge and service based paradigm for enterprise.* New York: Free Press, 1992.
7. Henderson, L. Physician and patient as a social system. *The New England Journal of Medicine*, 1935, *212*(18), 819–823.

8. Lindblad, S., *personal communication*. Stockholm, Sweden, 2007.
9. Nelson, E., Batalden, P., & Godfrey, M. *Quality by design*. San Francisco: Jossey-Bass, 2007.
10. Zimmerman, B., Lindberg, C., & Plsek, P. *Edgeware: Insights from complexity science for health care leaders*. Irving, TX: VHA, 1998.
11. von Bertalanffy, K. L. *General system theory: Foundations, development, applications*. New York: George Braziller, 1968.
12. Homans, G. *The human group*. Harcourt, Brace, 1950.
13. Lewin, K. Frontiers in group dynamics. *Human Relations*, 1947, *1*, 5–41.
14. Deming, W. *The new economics for industry, government, education*. (2nd ed.) Cambridge: Massachusetts Institute of Technology, Center for Advanced Engineering Study, 2000, p. 50.
15. Senge, P. *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday/Currency, 1990.
16. Wiener, E., & Nagel, D. C. (Eds.) *Human factors in aviation*. San Diego, CA: Academic Press, 1998.
17. Stacey, R. *Complexity and creativity in organizations*. San Francisco: Berrett-Koehler, 1996.
18. Plsek, P., & Greenhalgh, T. Complexity science: The challenge of complexity in health care. *British Medical Journal*, 2001, *323*(7313), 625–628.
19. Institute of Medicine. *Crossing the quality chasm: A new health system for the 21st century*. Washington, DC: Committee on Quality of Health Care, 2001, p. 4.
20. Berwick, D. (2001). *What hat is on?* Plenary address at the Institute for Health Care Improvement's 12th Annual National Forum, Orlando, FL, December 4, 2001.
21. Donaldson, M., & Mohr, J. *Exploring innovation and quality improvement in health care microsytems: A cross-case analysis*. Washington, DC: Institute of Medicine, 2000.
22. Nelson et al. Microsystems in health care: Part 1. Learning from high-performing front-line clinical units. *Joint Commission Journal on Quality and Patient Safety*, 2002, *28*(9), 472–493.
23. Weick, K. E., & Sutcliffe, K. M. Hospitals as cultures of entrapment: A re-analysis of the Bristol Royal Infirmary. *California Management Review*, 2003, *45*(2), 73–84.
24. Luan, D. M. *The influence of shared mental models of nosocomial bloodstream infections on neonatal intensive care unit infection rates*. Hanover, NH: The Dartmouth Institute of Health Policy and Clinical Practice, Dartmouth Medical School, Dartmouth College, 2009.
25. Edwards, W. H. Preventing nosocomial bloodstream infection in very low birth weight infants. *Seminars in Neonatology*, 2002, *7*(4), 325–333.
26. Homa, K. *Evaluating the sustainability of a quality improvement initiative*. Unpublished PhD dissertation, The Dartmouth Institute of Health Policy and Clinical Practice, Dartmouth Medical School, Dartmouth College, 2006.
27. Golton, I., & Wilcock, P. *Clinical microsystems awareness and development programme. Final report*. London: NHS Modernisation Agency, 2005, p. 3.
28. Deming, W. E. *Quality, Productivity and Competitive Position*. MIT Center for Advanced Engineering Studies. Cambridge, MA. 1982.
29. Juran, J., Godfrey, A. B., Hoogstoel, R. E., & Schilling, E. G. *Juran's quality handbook*. (5th ed.) New York: McGraw Hill, 1999.
30. Casale et al. "ProvenCare": A provider-driven pay-for-performance program for acute episodic cardiac surgical care. *Annals of Surgery*, 2007, *246*(4), 613–623.
31. Bate, P., Mendel, P., & Robert, G. *Organizing for quality: The improvement journeys of major hospitals in Europe and the United States*. Abingdon, United Kingdom: Radcliffe Publishing, 2008.
32. Nelson, G., Batalden, P., & Lazar, J. *Practice-based learning and improvement: A clinical improvement action guide*. (2nd ed.) Oak Brook, IL: Joint Commission Resources, 2007, p. 3.

33. Batalden, P., & Davidoff, F. What is "quality improvement" and how can it transform healthcare? *Quality and Safety in Health Care*, 2007, *16*(2–3).
34. McGlynn et al. The quality of health care delivered to adults in the United States. *The New England Journal of Medicine*, 2003, *348*(26), 2635–2645.
35. Pawson, R., & Tilley, N. *Realistic evaluation.* London: Sage, 1997.
36. Glouberman, S., & Zimmerman, B. J. *Complicated and complex systems: What would successful reform of medicare look like?* Ottawa: Commission on the Future of Health Care in Canada, 2002.
37. Liu, S., Homa, K., Butterly, J., Kirkland, K., & Batalden, P. Improving the simple, complicated and complex realities of community-acquired pneumonia. *Quality and Safety in Health Care*, 2009, *18*, 93–98.

# Chapter One ACTION GUIDE

The action guides that follow each chapter are designed to offer additional resources, insights, and tools to support and encourage your study of clinical microsystems. Each chapter action guide is designed to complement the chapter content to further advance your skills and abilities to design value into all aspects of care.

## INTRODUCTION TO THE 5PS

Strategic focus on microsystems (the small, functional frontline units that provide most health care to most people) is essential to designing efficient population-based care and services. To begin to increase self-awareness and to assess or diagnose the unique features of any microsystem, use the 5Ps framework. The 5Ps framework can be thought of as a structured and organized method of inquiring into the anatomy of a clinical microsystem. Every complex adaptive system has structure, process, patterns, and outcomes. You can make these features more explicit and analyze them by using the 5Ps framework in your clinical microsystem. The 5Ps framework can help you gain deeper knowledge to inform specific improvement activities rather than make decisions based on intuitive perspectives alone to improve care and services.

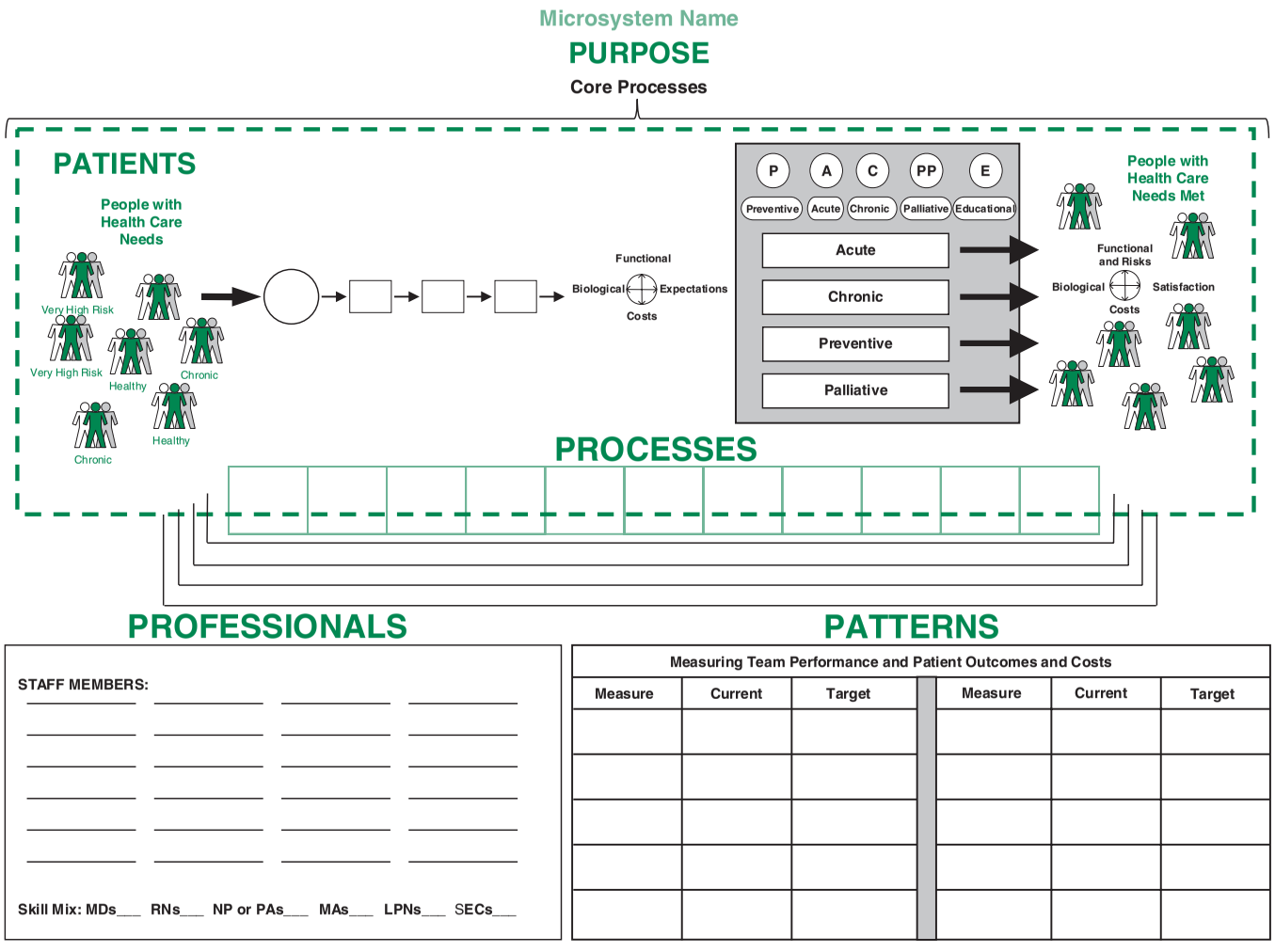
## THE CLINICAL MICROSYSTEM PROCESS AND STRUCTURE OF THE 5PS MODEL

The 5Ps framework can be seen within the anatomy of a clinical microsystem as shown in Figure AG1.1. The study of the purpose, patients, professionals, processes, and patterns of any clinical microsystem provides deep insights and perspectives most busy health care professionals do not usually see or understand in their daily work. This knowledge and information comes from both formal analysis and tacit understanding of the clinical microsystem's structure, patients, processes, and its daily patterns of work and interaction.

The 5Ps framework supports understanding of the (1) needs of the major patient subpopulations served by the clinical microsystem, (2) ways the professionals in the microsystem interact with one another, and (3) the ways professionals in the microsystem interact with the processes that unfold to produce critical outcomes.

Deep understanding of the 5Ps framework begins with an interdisciplinary group representing the various clinical microsystem roles exploring the individual "Ps" by answering the following questions.

## FIGURE AG1.1 Microsystem Anatomy Model.



*Know your purpose:* What is our aim? What do we actually intend to make? Fill in this answer: Our system exists to _____. Remember this purpose exists within the context of the population the clinical microsystem seeks to serve.

*Know your patients:* Whom are we caring for? Are there subpopulations we could plan services for differently? What are the most common patient diagnoses and conditions in our care setting? What other microsystems support what we do to meet patients' needs? How satisfied are patients with our clinical microsystem?

*Know your professionals:* Who provides patient care and who are the people supporting the clinical care team? What skills and talents do staff members need to provide the right service and care at the right time? What is the staff morale? What is the role of information technology as a team member?

*Know your processes:* How do we deliver care and services to meet our patients' needs? Who does what in our clinical microsystem? Do our hours of operation match the needs of our patients? What are our core and supporting processes? How does technology support our processes? How do we learn from failures and near misses?

*Know your patterns:* What are the health outcomes of our patients? What are the costs of care? How do we interact within our clinical microsystem? What are the regularly recurring associated or sequential work activities? What does it feel like to work here? How often do we meet to discuss quality and safety in the clinical microsystem? What is leadership like? What traditions and rituals do we have?

When members of the clinical microsystem work together to gain information about their 5Ps, they acquire knowledge and insights that can be used to make long-lasting improvements in the clinical microsystem.

The series of *Assess, Diagnose and Treat* workbooks, otherwise known as the *Greenbooks,* provide the path forward to guide study of the clinical microsystem anatomy and can be found at www.clinicalmicrosystem.org. Each Greenbook offers facts, figures, tools, and questions to consider for each of the 5Ps. The workbook series is intended to offer introductory material and so does not provide an exhaustive list of measures and information. Rather, the data and exploration often stimulate new conversations for those in the clinical microsystem. New perspectives and new insights can lead to new questions and considerations for a rich interdisciplinary conversation.

It is essential in this exploration to attempt to seek measures even if we feel we "just can't get that data here." Measurement and information about patients, professionals, processes, or patterns may not be regularly collected or monitored. Through the use of the many tools and forms in the Greenbooks you can document measures and data through sampling to gain deeper insight into your clinical microsystem. Health care organizations and clinical microsystems historically document and capture financial data and information and have not had the systems or habits to document process information at the clinical microsystem level. Seeking measurement and information about the 5Ps will enhance overall knowledge of the system of care. If the measures shed light on the patterns of population or professional behaviors or helps describe the process of care more deeply, then it is worth pursuing.

It is important to review the Greenbook workbooks and profiles to determine which measures can be easily obtained from your organization before deciding to use the various tools and forms in the Greenbook. The profiles in each Greenbook provide a high-level view and summary of the clinical microsystem 5Ps. Several profiles can be seen in Figures AG1.2, AG1.3, and AG1.4. Increasingly, organizations are collecting many of these previously undocumented measurements and they may be available to the microsystem to help inform action plans and improvements. Examples include

## FIGURE AG1.2 Primary Care Profile.

# Primary Care Practice Profile

**A. Purpose/Aim of Our Clinical Microsystem:** Why does your practice exist?

| | | |
|---|---|---|
| **Site Name:** | **Site Contact:** | **Date:** |
| **Practice Manager:** | **MD Lead:** | **Nurse Lead:** |

***B. Know Your Patients:*** Take a close look into your practice, create a "high-level" picture of the PATIENT POPULATION that you serve. Who are they? What resources do they use? How do the patients view the care they receive?

| **Estimated Age Distribution of Patients:** | % |
|---|---|
| Birth–10 years | |
| 11–18 years | |
| 19–45 years | |
| 46–64 years | |
| 65–79 years | |
| 80+ years | |
| % Females | |
| **Estimated # (unique) Patients in Practice** | |

| **List Your Top Ten Diagnoses/Conditions** | | **Top Referrals (e.g., GI Cardiology)** |
|---|---|---|
| 1. | 6. | |
| 2. | 7. | |
| 3. | 8. | |
| 4. | 9. | |
| 5. | 10. | |

| **Patients who are frequent users of your practice and their reasons for seeking frequent interactions and visits** | **Other clinical microsystems you interact with regularly as you provide care for patients (e.g., OR, VNA)** |
|---|---|
| | |

| **Disease-Specific Health Outcomes** |
|---|
| Diabetes HgA1c = |
| Hypertension B/P = |
| LDL < 100 = |
| |

| **Patient Satisfaction Scores** | % Excellent |
|---|---|
| Experience via phone | |
| Length of time to get your appointment | |
| Saw who patient wanted to see | |
| Satisfaction with personal manner | |
| Time spent with person today | |

| **Patient Population Census: Do these numbers change by season?(Y/N)** | **#** | **Y/N** |
|---|---|---|
| Patients seen in a day | | |
| Patients seen in last week | | |
| New patients in last month | | |
| Disenrolling patients in last month | | |
| Encounters per provider per year | | |

| **Out of Practice Visits** | |
|---|---|
| Condition Sensitive Hospital Rate | |
| Emergency Room Visit Rate | |

****Complete "Through the Eyes of Your Patient"***

***C. Know Your Professionals:*** Use the following template to create a comprehensive picture of your practice. Who does what and when? Is the right person doing the right activity? Are roles being optimized? Are all roles who contribute to the patient experience listed? What hours are you open for business? How many and what is the duration of your appointment types? How many exam rooms do you currently have? What is the morale of your staff?

| **Current Staff** | **FTEs** | **Comment/ Function** | **3 Next Available** | | **Cycle Time** |
|---|---|---|---|---|---|
| Enter names below totals Use separate sheet if needed | | | PE | Follow-up | Range |
| MD Total | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| NP/PAs Total | | | | | |
| | | | | | |
| | | | | | |
| RNs Total | | | | | |
| | | | | | |
| | | | | | |
| LPNs Total | | | | | |
| | | | | | |
| | | | | | |
| LNA/MAs Total | | | | | |
| | | | | | |
| Secretaries Total | | | | | |
| | | | | | |
| Others: | | | | | |
| | | | | | |

| **Days of Operation** | **Hours** |
|---|---|
| Monday | |
| Tuesday | |
| Wednesday | |
| Thursday | |
| Friday | |
| Saturday | |
| Sunday | |

Do you offer the following? Check all that apply.

- ☐ Group Visit
- ☐ E-mail
- ☐ Web site
- ☐ RN Clinics
- ☐ Phone Follow-up
- ☐ Phone Care Management
- ☐ Disease Registries
- ☐ Protocols/Guidelines

| **Appointment Type** | **Duration** | **Comment:** |
|---|---|---|
| | | |
| | | |

Do you use Float Pool? ____ Yes ____ No
Do you use On-Call? ____ Yes ____ No

| **Staff Satisfaction Scores** | | **%** |
|---|---|---|
| How stressful is the practice? | % Not Satisfied | |
| Would you recommend it as a good place to work? | % Strongly Agree | |

***Each staff member should complete the Personal Skills Assessment and "The Activity Survey"**

***D. Know Your Processes:*** How do things get done in the microsystem? Who does what? What are the step-by-step processes? How long does the care process take? Where are the delays? What are the "between" microsystems handoffs?

1. **Track cycle time for patients from the time they check in until they leave the office using the Patient Cycle Time Tool. List ranges of time per provider on this table**
2. **Complete the Core and Supporting Process Assessment Tool**

***E. Know Your Patterns:*** What patterns are present but not acknowledged in your microsystem? What is the leadership and social pattern? How often does the microsystem meet to discuss patient care? Are patients and families involved? What are your results and outcomes?

- Does every member of the practice meet regularly as a team?
- How frequently?
- What is the most significant pattern of variation?
- Do the members of the practice regularly review and discuss safety and reliability issues?
- What have you successfully changed?
- What are you most proud of?
- What is your financial picture?

***Complete "Metrics That Matter"**

## FIGURE AG1.3 Specialty Care Profile.

# Specialty Care Practice Profile

***A. Purpose/Aim:*** Why does your practice exist?

| | | |
|---|---|---|
| Site Name: | Site Contact: | Date: |
| Practice Manager: | MD Lead: | Nurse Lead: |

***B. Know Your Patients:*** Take a close look into your practice, create a "high-level" picture of the PATIENT POPULATION that you serve. Who are they? What resources do they use? How do the patients view the care they receive?

| Estimated Age Distribution of Patients: | % |
|---|---|
| Birth–10 years | |
| 11–18 years | |
| 19–45 years | |
| 46–64 years | |
| 65–79 years | |
| 80+ years | |
| % Females | |

| List Your Top Five Diagnoses | List Your Top Five Procedures |
|---|---|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| 5. | 5. |

| Patient Satisfaction Scores | % Excellent |
|---|---|
| Experience via phone | |
| Length of time to get your appointment | |
| Saw who patient wanted to see | |
| Satisfaction with personal manner | |
| Time spent with person today | |

| List Your Top Five Referrers | |
|---|---|
| **Referrer** | **What are they referring?** |
| | |
| | |
| | |
| | |
| | |

| Patient Population Census: Do these numbers change by season? (Y/N) | # | Y/N |
|---|---|---|
| Patients seen in a day | | |
| Patients seen in last week | | |
| New patients in last month | | |
| Encounters per provider per year | Out/IN | |
| Same Day Procedures | | |
| Inpatient Procedures | | |
| In-Clinic Procedures | | |
| Specialty Yield Rate | | |

**Health Outcomes**

**Emergency Room Visit Rate**

****Complete "Through the Eyes of Your Patient"***

***C. Know Your Professionals:*** Create a comprehensive picture of your practice. Who does what and when? Is the right person doing the right activity? Are roles being optimized? Are all roles who contribute to the patient experience listed? What hours are you open for business? How many and what is the duration of your appointment types? How many exam rooms do you currently have? What is the moraleof your staff?

| Current Staff | FTEs | Days/Hours | | | | | | 3 Next Available | | | | Cycle Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | New | F/U | OR | Minor | Range |
| MD Total | | M | T | W | TH | F | S | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| NP/PAs Total | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| RNs Total | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| LPNs Total | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| LNA/MAs Total | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Others Total | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Secretaries Total | | | | | | | | | | | | |

Do you use Float Pool? ____ Yes ____ No
Do you use On-Call? ____ Yes ____ No

Do you offer any of the following? Check all that apply.

- Group Visit
- E-mail
- Web site
- RN Clinics
- Phone Follow-up
- Phone Care Management
- Registries
- Protocols/Guidelines

**# Exam Rooms** _____
**# Minor Rooms** _____

**Supporting diagnostic departments (e.g., respiratory, lab, cardio.)**

| Appt. Type | Duration | Comment |
|---|---|---|
| New Patient | | |
| Follow-up | | |
| Minor | | |

| Staff Satisfaction Scores | | % |
|---|---|---|
| How stressful is the practice? | % Not Satisfied | |
| Would you recommend it as a good place to work? | % Strongly Agree | |

***Each staff member should complete the Personal Skills Assessment and "The Activity Survey"**

***D. Know Your Processes:*** How do things get done in the microsystem? Who does what? What are the step-by-step processes? How long does the care process take? Where are the delays? What are the "between" microsystems handoffs?

1. **Track cycle time for patients from the time they check in until they leave the office using the Patient Cycle Time Tool. Lis t ranges of time per provider on this table**
2. **Complete the Core and Supporting Process Assessment Tool**

***E. Know Your Patterns:*** What patterns are present but not acknowledged in your microsystem? What is the leadership and social pattern? How often does the microsystem meet to discuss patient care? Are patients and families involved? What are your results and outcomes?

- Does every member of the practice meet regularly as a team?
- How frequently?
- What is the most significant pattern of variation?
- Do the members of the practice regularly review and discuss safety and reliability issues?
- What have you successfully changed?
- What are you most proud of?
- What is your financial picture?

****Complete "Metrics That Matter"***

## FIGURE AG1.4 Inpatient Profile.

# Inpatient Unit Profile

***A. Purpose/Aim:*** Why does your unit exist?

| Site Name: | Site Contact: | Date: |
|---|---|---|
| Administrative Director: | Nurse Director: | Medical Director: |

***B. Know Your Patients:*** Take a close look into your unit, create a "high-level" picture of the PATIENT POPULATION that you serve. Who are they? What resources do they use? How do the patients view the care they receive?

| Estimated Age Distribution of Patients: | % |
|---|---|
| 19–50 years | |
| 51–65 years | |
| 66–75 years | |
| 76+ years | |
| | |
| % Females | |

| List Your Top Ten Diagnoses/Conditions | |
|---|---|
| 1. | 6. |
| 2. | 7. |
| 3. | 8. |
| 4. | 9. |
| 5. | 10. |

| Patient Satisfaction Scores | % Always |
|---|---|
| Nurses | |
| Doctors | |
| Environment | |
| Pain | |
| Discharge % Yes | |
| Overall % Excellent | |

| Living Situation | % |
|---|---|
| Married | |
| Domestic Partner | |
| Live Alone | |
| Live with Others | |
| Skilled Nursing Facility | |
| Nursing Home | |
| Homeless | |

| Point of Entry | % |
|---|---|
| Admissions | |
| Clinic | |
| ED | |
| Transfer | |

| Discharge Disposition | % |
|---|---|
| Home | |
| Home with Visiting Nurse | |
| Skilled Nursing Facility | |
| Other Hospital | |
| Rehab Facility | |
| Transfer to ICU | |

| Patient Population Census: Do these numbers change by season? (Y/N) | Y/N |
|---|---|
| Patient Census by Hour | |
| Patient Census by Day | |
| Patient Census by Week | |
| Patient Census by Year | |
| Thirty Day Readmit Rate | |
| Our patients in Other Units | |
| Off Service Patients on Our Unit | |
| Frequency of Inability to Admit Patient | |

| Patient Type | LOS Average | Range |
|---|---|---|
| Medical | | |
| Surgical | | |

| Mortality Rate | |
|---|---|

****Complete "Through the Eyes of Your Patient"***

***C. Know Your Professionals:*** Use the following template to create a comprehensive picture of your unit. Who does what and when? Is the right person doing the right activity? Are roles being optimized? Are all roles who contribute to the patient experience listed?

| Current Staff | Day FTEs | Evening FTEs | Night FTEs | Weekend FTEs | Over-Time by Role |
|---|---|---|---|---|---|
| MD Total | | | | | |
| Hospitalists Total | | | | | |
| Unit Leader Total | | | | | |
| CNSs Total | | | | | |
| RNs Total | | | | | |
| LPNs Total | | | | | |
| LNAs Total | | | | | |
| Residents Total | | | | | |
| Technicians Total | | | | | |
| Secretaries Total | | | | | |
| Clinical Resource Coord. | | | | | |
| Social Worker | | | | | |
| Health Service Assts. | | | | | |
| Ancillary Staff | | | | | |

| Admitting Medical Service | % |
|---|---|
| Internal Medicine | |
| Hematology/Oncology | |
| Pulmonary | |
| Family Practice | |
| ICU | |
| Other | |

**Supporting Diagnostic Departments**

(e.g., Respiratory, Lab, Cardiology, Pulmonary, Radiology)

| | | |
|---|---|---|
| Do you use Per Diems? | _____Yes | _____NO |
| Do you use Travelers? | _____Yes | _____NO |
| Do you use On-Call Staff? | _____Yes | _____NO |
| Do you use a Float Pool? | _____Yes | _____NO |

| Staff Satisfaction Scores | | % |
|---|---|---|
| How stressful is the unit? | % Not Satisfied | |
| Would you recommend it as a good place to work? | % Strongly Agree | |

***Each staff member should complete the Personal Skills Assessment and "The Activity Survey"**

***D. Know Your Processes:*** How do things get done in the microsystem? Who does what? What are the step-by-step processes? How long does the care process take? Where are the delays? What are the "between" microsystems handoffs?

**1. Create flow charts of routine processes.**

a) Overall admission and treatment process
b) Admit to inpatient unit
c) Usual inpatient care
d) Change of shift process
e) Discharge process
f) Transfer to another facility process
g) Medication Administration
h) Adverse event

**Do you use/initiate any of the following?**

Check all that apply

- ☐ Standing Orders/Critical Pathways
- ☐ Rapid Response Team
- ☐ Bed Management Rounds
- ☐ Multidisciplinary/with Family Rounds
- ☐ Midnight Rounds
- ☐ Preceptor/Charge Role
- ☐ Discharge Goals

**Capacity** # Rooms _____ # Beds_____

**# Turnovers/Bed/Year** _____

**Linking Microsystems** (e.g., ER, ICU, Skilled Nursing Facility )

**2. Complete the Core and Supporting Process Assessment Tool**

***E. Know Your Patterns:*** What patterns are present but not acknowledged in your microsystem? What is the leadership and social pattern? How often does the microsystem meet to discuss patient care? Are patients and families involved? What are your results and outcomes?

- Does every member of the unit meet regularly as a team?
- How frequently?
- What is the most significant pattern of variation?
- Do the members of the unit regularly review and discuss safety and reliability issues?
- What have you successfully changed?
- What are you most proud of?
- What is your financial picture?

***Complete "Metrics That Matter"**

patient satisfaction data at the clinical microsystem level or cycle time measure of an office visit.

Key to all the data and information exploration is obtaining recent data because many aspects of the microsystem and organization change over time.

It is often helpful to print the poster-size 5Ps map found at www.clinicalmicrosystem.org to post the 5Ps data on a wall to create a big-picture view of your clinical microsystem. This poster display also serves as a teaching aid to engage other interdisciplinary members of your microsystem in learning more about your system of care. Some examples of how the 5Ps have informed microsystem improvement efforts are noted in Table AG1.1.

Increasingly, organizations are engaging supporting microsystems to improve their awareness of their purpose, patients or customers, professionals, processes, and patterns. A few examples of supporting microsystems include the following: dietary, respiratory, laboratory, radiology, ultrasound, medical records, environmental services and admissions. The method of assessment is similar to the process used to assess a clinical microsystem, but it has been adapted for the supporting microsystem focus. The goal is to provide services to patients so patients are kept in the 5Ps, and customers are added to reflect the dual beneficiaries of the supporting microsystem. Table AG1.2 provides an example of a few supporting microsystems, such as laboratories, environmental services, and admissions. It also provides examples of some of the "Ps" to be considered.

## EXTERNAL MAPPING TOOL

The external mapping tool (Figure AG1.5) identifies resources outside the clinical microsystem. The tool demonstrates the abundance of resources the microsystem can explore and helps identify relationships (or those that may benefit from additional attention) to attain the best results for patients and families.

Use the blank external mapping tool to increase awareness of current state and potential relationships to build your system to achieve optimal patient or population outcomes. Instructions for using the mapping tool follow.

1. Name the clinical microsystem under study.
2. Identify the subpopulation of patients to focus on and identify resources.
3. List the specific health care needs of the identified subpopulation of patients.
4. Identify the external *contributors* who are in the best position to optimize care for the population. Document the information in each box around the microsystem. Add boxes as you identify additional resources.
5. Based on the patient view, circle the names of the most valued contributors.
6. Circle the most important contributor rectangles.
7. Identify the relationships or *connections* between the clinical microsystem and the contributors.
   a. Illustrate the relationships with a blue line.
   b. Where there is a dominant flow of information between the microsystem and the contributor, indicate this with an arrowhead in the direction of the flow.
   c. When there is an opportunity to improve the connection, make the connecting lines red.
8. Based on this assessment, identify improvement opportunities to enhance patient or population care and outcomes.

## Table AG1.1 Assessing Your Practice Discoveries and Actions: The 5Ps

| Know Your Patients | Discoveries | Actions Taken |
|---|---|---|
| 1. Age distribution | About 30% of our patients are greater than 66 years old. | Team designed special group visits to review specific needs of this age group, including physical limitations and dietary considerations. |
| 2. Disease identification | We do not know what percentage of our patients have diabetes. | Team reviewed coding and billing data to determine approximate numbers of patients with diabetes. |
| 3. Health outcomes | Do not know what the range of HbA1c is for our patients with diabetes, or if they are receiving appropriate ADA-recommended care in a timely fashion. | Team conducted a chart audit with 50 charts during a lunch hour. Using a tool designed to track outcomes, each member of the team reviewed 5 charts and noted the finding on the audit tool. |
| 4. Most frequent diagnosis | We had a large number of patients with stable hypertension and diabetes seeing the physician frequently. We also learned that during certain seasons we had huge volumes of pharyngitis and poison ivy. | Designed and tested a new model of care delivery for stable hypertension and diabetes, optimizing the RN role in the practice using agreed-upon guidelines, protocols, and tools. |
| 5. Patient satisfaction | We don't know what patients think unless they complain to us. | Implemented the point-of-service patient survey, which patients completed and left in a box before leaving the practice. |
| **Know Your Professionals** | **Discoveries** | **Actions Taken** |
| 1. Provider FTE | We were making assumptions about provider time in the clinic without really understanding how much time providers are out of the clinic with hospital rounds, nursing home rounds, and so on. | Changed our scheduling process and used RNs to provide care for certain subpopulations. |
| 2. Schedules | Several providers are gone at the same time every week, so one provider is often left and the entire staff works overtime that day. | Evaluated the scheduling template to even out each provider's time to provide consistent coverage in the clinic. |
| 3. Regular meetings | The doctors meet together every other week. The secretaries meet once a month. | Began holding entire practice meeting every other week on Wednesdays to help the practice become a team. |
| 4. Hours of operation | The beginning and the end of the day are always chaotic. We realized we are on the route for patients between home and work, and they want to be seen when we are not open. | Opened one hour earlier and stayed open one hour later each day. The heavy demand was better managed and overtime dropped. |
| 5. Activity surveys | All roles are not being used to their maximum. RNs only room patients and take vital signs, medical assistants do a great deal of secretarial paperwork, and some secretaries are giving out medical advice. | Roles have been redesigned and matched to individual education, training, and licensure. |

## Table AG1.1 Assessing Your Practice Discoveries and Actions: The 5Ps (Continued)

| Know Your Processes | Discoveries | Actions Taken |
|---|---|---|
| 1. Cycle time | Patient lengths of visits vary a great deal; there are many delays. | The team identified actions to eliminate and steps to combine; they learned to prepare the charts for the patient visit before the patient arrives. The team now holds daily huddles to inform everyone on the plan of the day and to review relevant issues. |
| 2. Key supporting processes | None of us could agree on how things get done in our practice. | We created a detailed flowchart of our practice to determine how to streamline and to do so in a consistent manner. |
| 3. Indirect patient pulls | The providers are interrupted in their patient care process frequently. The number one reason is to retrieve missing equipment and supplies from the exam room. | Based on the variation of demand for the practice care and services, a critical review of the staff scheduling was conducted to determine if there was matching of available staff to the varied demands by session of the day and day of the week. Through difficult discussion and review of the purpose of the practice, new schedules were negotiated and tested to better meet patient demand. The new staff schedules for all professionals were more evenly matched to the demand of patients resulting in less stress and volume overload than the group had previously experienced. Patients expressed higher satisfaction. |
| **Know Your Patterns** | **Discoveries** | **Actions Taken** |
| 1. Demand on the practice | There are peaks and lows for the practice, depending on day of the week, session of the day, or season of the year. | The team identified actions to eliminate and steps to combine, and learned to prepare charts for the patient visit before the patient arrives. The team now holds daily huddles to inform everyone on the plan of the day and to review relevant issues. |
| 2. Communication | We do not communicate in a timely way, nor do we have a standard forum in which to communicate. | Every other week practice meetings are held to help communication and e-mail use by all staff and to promote timely communication. |
| 3. Cultural | The doctors don't really spend time with nondoctors. | The team meetings and heightened awareness of behaviors have helped improve this. |
| 4. Outcomes | We really have not paid attention to our practice outcomes. | We began tracking and posting results on a data wall to keep us alert to outcomes. |
| 5. Finances | Only the doctors and the practice manager know about the practice money. | Finances are discussed at team meetings and everyone is learning how to make a difference in financial performance. |

*Note:* HbA1c = glycosylated hemoglobin; ADA = American Diabetes Association; URI = upper respiratory infection.

## Table AG1.2 Supporting Microsystem 5Ps

| Supporting Microsystem | Purpose | Patients or Customers | Professionals | Process | Patterns |
|---|---|---|---|---|---|
| Laboratory | The laboratory exists to provide all aspects of testing and reporting of necessary diagnostic studies to support delivery of patient care. | Outpatients, inpatients, providers, external organizations with referred diagnostic studies | Laboratory technicians, secretaries, phlebotomists | Obtaining specimens, accessioning specimens, conducting tests, reporting results | Errors in accessioning, delays in reporting, frequency of overall laboratory meetings to discuss safety and processes, communication between laboratory departments |
| Environmental Services | Environmental services exist to create the cleanest environment that supports patient care in all settings of the organization. | Patients, staff, vendors, patient units, families, all visitors to the organization | Environmental technicians, housekeepers | Maintaining organization and microsystem hygiene and appearance; maintaining microsystem-specific activities such as cleaning beds and changing linens to support admission and transfer processes | High-volume bed turnover areas, time from patient discharge to cleaned bed, frequency of standard cleaning of public areas, communication processes for all staff, number of falls related to wet surfaces, frequency of meetings to discuss safety and improvement |
| Admissions | Admissions exist to support the patient and family in their interaction with the organization through admission, transfer, and discharge. | Patients, families, providers, patient units, emergency departments (ED), all inpatient and outpatient diagnostic departments, referring organizations, insurance companies | Admission clerks, registration clerks | Preregistration of patients prior to procedures and admissions, real-time registration of patients in ED and unplanned admissions, coordinating patient placement for admissions and transfers, registration of advance directives | Number of admissions per day per unit, frequency of missing information on admission documentation, percentage of patients with advance directives, communication processes with key contacts in organization facilitating admissions and transfers, frequency of all admission staff meetings to discuss improvement |

**FIGURE AG1.5 External Mapping Tool.**

Exploring the external context of the clinical microsystem for improving the health of a given subpopulation of patients

1. Clinical microsystem name: _____ 2. Subpopulation of patients: _____

3. List the specific health care needs

a.

b.

c.

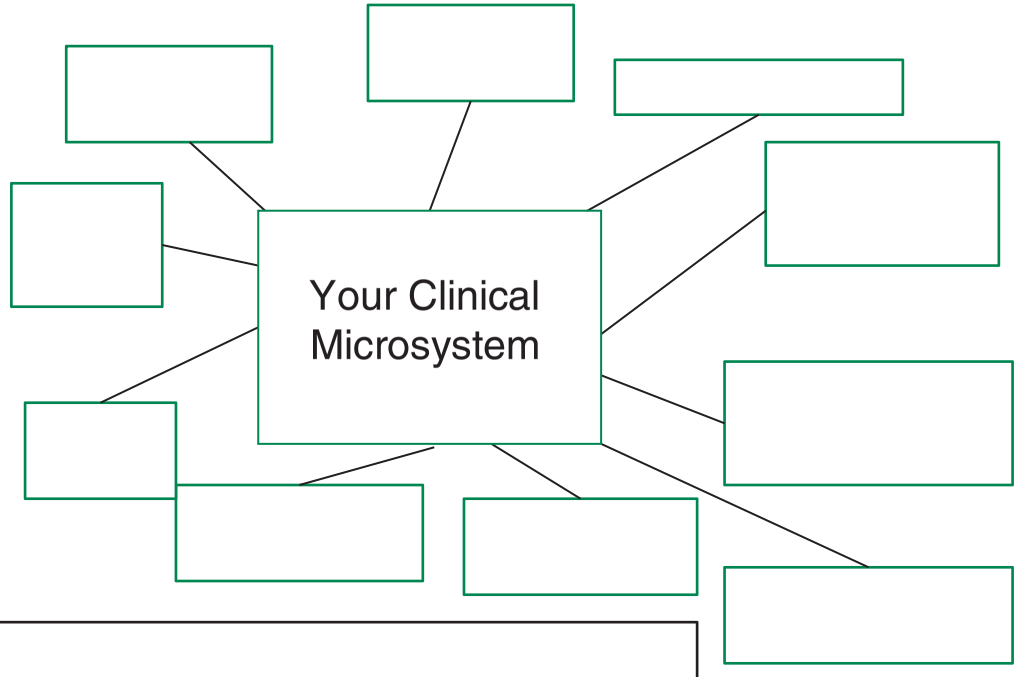
d.

e.

f.

g.

h.




Improvement ideas:

Circle the most important contributor rectangles. Illustrate the relationships with a blue line. Add an arrowhead if the direction of the relationship is clear. If the relationship can be significantly improved, use red for the line.

*Source:* © February 10, 2003 Ruth Kennedy, NHS, UK/MM Godfrey, Trustees of Dartmouth College. Revised March 23, 2004.

## MICROSYSTEM ASSESSMENT TOOL (MAT)

The clinical microsystem relies on a systems approach to provide clinical care based on theories from organizational development, leadership, and improvement. The Microsystem Assessment Tool (MAT) is based on the original qualitative research conducted at Dartmouth where the ten *success characteristics* were identified in practices that provide high-quality, high-value care (see Figure AG1.6). The success characteristics reflect what people working in high performing practices say about their work and also how they work.

The MAT can be used to assess the baseline performance of a clinical microsystem before starting the improvement journey. The MAT can be readministered after a year to determine advancement toward success characteristics. This qualitative tool is intended to provoke conversation and inquiry based on success characteristics. For example, one might use the tool and ask, "What does this mean for my microsystem?" "How might we work toward a high performing scenario?"

Many improvements succeed in the short run but fail to be sustained or spread to other areas. Sometimes practices are challenged by barriers that are best described as constraints on the system. Working to improve the specific characteristics of the microsystem will allow you to improve the system that supports the clinical work in your microsystem.

### Description and Use of MAT

The Microsystem Assessment Tool (MAT) was developed from the ten success characteristics and can be used to assess the functioning of an individual microsystem and to help staff understand how to improve performance. MAT is designed to be used quickly and easily by clinical microsystem members to evaluate their own frontline unit. Table AG1.3 provides definitions for the MAT.

Based on the local context of the organization, many will distribute MAT via an electronic survey tool such as *Survey Monkey* and *Zoomerang*. Other organizations will use hard copy surveys tabulated by a designated resource. Once the survey is completed and reported, the interdisciplinary team members should engage in a discussion specific to the findings and the next steps that might be fruitful. The discussion should involve all members of the microsystem in exploring the findings and variations in the results.

It should be remembered that fixing one of the success characteristics is not the ultimate goal. The characteristics are all interconnected. The special blend produced by combining the characteristics often results in improvement in multiple areas.

### Guidelines for Scoring with MAT

There are 12 categories (3 categories are in the Information and Information Technology section). Each category is scored as 0, 1, or 2, where 0 represents the low end of the spectrum, 1 the middle, and 2 the best possible score. For an overall MAT score, the lowest possible score is 0 and the highest possible score is 24.

Table AG1.4 is an example of a worksheet to tally the responses to the MAT.

## FIGURE AG1.6 Microsystem Assessment Tool.

**Microsystem Assessment Tool**

Instructions: Each of the success characteristics (as, leadership) is followed by a series of three descriptions. For each characteristic, ***please check*** the description that ***best describes*** your current microsystem and the care it delivers OR use a microsystem you are MOST familiar with.

| | Characteristic and Definition | Descriptions | | | |
|---|---|---|---|---|---|
| Leadership | **1. Leadership:** The role of leaders is to balance setting and reaching collective goals, and to empower individual autonomy and accountability through building knowledge, respectful action, reviewing and reflecting. | ❑ Leaders often tell me how to do my job and leave little room for innovation and autonomy. Overall, they don't foster a positive culture. | ❑ Leaders struggle to find the right balance between reaching performance goals and supporting and empowering the staff. | ❑ Leaders maintain constancy of purpose, establish clear goals and expectations, and foster a respectful positive culture. Leaders take time to build knowledge, review and reflect, and take action about microsystems and the larger organization. | ❑ Can't Rate |
| | **2. Organizational Support:** The larger organization looks for ways to support the work of the microsystem and coordinate the hand-offs between microsystems. | ❑ The larger organization isn't supportive in a way that provides recognition, information, and resources to enhance my work. | ❑ The larger organization is inconsistent and unpredictable in providing the recognition, information, and resources needed to enhance my work. | ❑ The larger organization provides recognition, information, and resources to enhance my work and makes it easier for me to meet the needs of patients. | ❑ Can't Rate |
| Staff | **3. Staff Focus:** There is selective hiring of the right kind of people. The orientation process is designed to fully integrate new staff into culture and work roles. Expectations of staff are high regarding performance, continuing education, professional growth, and networking. | ❑ I am not made to feel like a valued member of the microsystem. My orientation was incomplete. My continuing education and professional growth are not being met. | ❑ I feel like I am a valued member of the microsystem, but I don't think the microsystem is doing all that it could to support education and training of staff, workload, and professional growth. | ❑ I am a valued member of the microsystem and what I say matters. This is evident through staffing, education and training, workload, and professional growth. | ❑ Can't Rate |
| | **4. Education and Training:** All clinical microsystems have responsibility for the ongoing education and training of staff and for aligning daily work roles with training competencies. Academic clinical microsystems have the additional responsibility of training students. | ❑ Training is accomplished in disciplinary silos, as nurses train nurses, physicians train residents. The educational efforts are not aligned with the flow of patient care, so that education becomes an "add-on" to what we do. | ❑ We recognize our training could be different to reflect the needs of our microsystem, but we haven't made many changes yet. Some continuing education is available to everyone. | ❑ There is a team approach to training, whether we are training staff, nurses, or students. Education and patient care are integrated into the flow of work in a way that benefits both from the available resources. Continuing education for all staff is recognized as vital to our continued success. | ❑ Can't Rate |
| | **5. Interdependence:** The interaction of staff is characterized by trust, collaboration, willingness to help each other, appreciation of complementary roles, respect, and recognition that all contribute individually to a shared purpose. | ❑ I work independently and I am responsible for my own part of the work. There is a lack of collaboration and a lack of appreciation for the importance of complementary roles. | ❑ The care approach is interdisciplinary, but we are not always able to work together as an effective team. | ❑ Care is provided by an interdisciplinary team characterized by trust, collaboration, appreciation of complementary roles, and recognition that all contribute individually to a shared purpose. | ❑ Can't Rate |
| Patients | **6. Patient Focus:** The primary concern is to meet all patient needs – caring, listening, educating, and responding to special requests, innovating to meet patient needs, and smooth service flow. | ❑ Most of us, including our patients, would agree that we do not always provide patient-centered care. We are not always clear about what patients want and need. | ❑ We are actively working to provide patient-centered care and we are making progress toward more effectively and consistently learning about and meeting patient needs. | ❑ We are effective in learning about and meeting patient needs – caring, listening, educating, and responding to special requests, and smooth service flow. | ❑ Can't Rate |

*Source:* © Julie K. Johnson, MSPH, PhD.

## FIGURE AG1.6 Microsystem Assessment Tool. (Continued)

### Microsystem Assessment Tool (continued)

| | Characteristic | | Definitions | | | |
|---|---|---|---|---|---|---|
| Patients | **7. Community and Market Focus:** The microsystem is a resource for the community; the community is a resource for the microsystem; the microsystem establishes excellent and innovative relationships with the community. | | ❑ We focus on the patients who come to our unit. We haven't implemented any outreach programs in our community. Patients and their families often make their own connections to the community resources they need. | ❑ We have tried a few outreach programs and have had some success, but it is not the norm for us to go out into the community or actively connect patients to the community resources that are available to them. | ❑ We are doing everything we can to understand our community. We actively employ resources to help us work with the community. We add to the community and we draw on resources from the community to meet patient needs. | ❑ Can't Rate |
| Performance | **8. Performance Results:** Performance focuses on patient outcomes, avoidable costs, streamlining delivery, using data feedback, promoting positive competition, and frank discussions about performance. | | ❑ We don't routinely collect data on the process of outcomes of the care we provide. | ❑ We often collect data on the outcomes of the care we provide and on some processes of care. | ❑ Outcomes (clinical, satisfaction, financial, technical, safety) are routinely measured, we feed data back to staff, and we make changes based on data. | ❑ Can't Rate |
| Performance | **9. Process Improvement:** An atmosphere for learning and redesign is supported by the continuous monitoring of care, use of benchmarking, frequent tests of change, and a staff that has been empowered to innovate. | | ❑ The resources required (in the form of training, financial support, and time) are rarely available to support improvement work. Any improvement activities we do are in addition to our daily work. | ❑ Some resources are available to support improvement work, but we don't use them as often as we could. Change ideas are implemented without much discipline. | ❑ There are ample resources to support continual improvement work. Studying, measuring, and improving care in a scientific way are essential parts of our daily work. | ❑ Can't Rate |
| Information and Information Technology | **10. Information and Information Technology:** Information is THE connector of staff to patients, staff to staff, needs with actions to meet needs. Technology facilitates effective communication and multiple formal and informal channels are used to keep everyone informed all the time, listen to everyone's ideas, and ensure that everyone is connected on important topics. *Given the complexity of information and the use of technology in the microsystem, assess your microsystem using A, B and C.* | **A. Integration of Information with Patients** | ❑ Patients have access to some standard information that is available to all patients. | ❑ Patients have access to standard information that is available to all patients. We've started to think about how to improve the information they are given to better meet their needs. | ❑ Patients have a variety of ways to get the information they need and it can be customized to meet their individual learning styles. We routinely ask patients for feedback about how to improve the information we give them. | ❑ Can't Rate |
| | | **B. Integration of Information with Providers and Staff** | ❑ I am always tracking down the information I need to do my work. | ❑ Most of the time I have the information I need, but sometimes essential information is missing and I have to track it down. | ❑ The information I need to do my work is available when I need it. | ❑ Can't Rate |
| | | **C. Integration of Information with Technology** | ❑ The technology I need to facilitate and enhance my work is either not available to me or it is available but not effective. The technology we currently have does not make my job easier. | ❑ I have access to technology that will enhance my work, but it is not easy to use and seems to be cumbersome and time consuming. | ❑ Technology facilitates a smooth linkage between information and patient care by providing timely, effective access to a rich information environment. The information environment has been designed to support the work of the clinical unit. | ❑ Can't Rate |

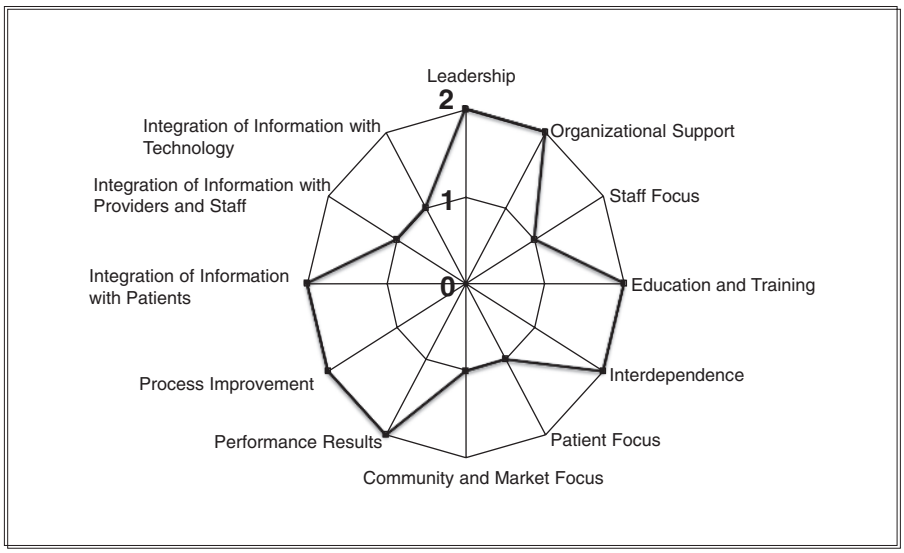
## Table AG1.3 Microsystem Assessment Tool (MAT) Definitions

| Characteristic | Definition |
|---|---|
| Leadership | The role of leaders is to balance setting and reaching collective goals and to empower individual autonomy and accountability through building knowledge, respectful action, and reviewing and reflecting clinical microsystem performance. |
| Organizational support | If a microsystem is part of a larger health care system, the larger organization looks for ways to support the work of the practice and coordinate the handoffs between the practice and other microsystems. |
| Staff focus | There is selective hiring of the right kind of people. The orientation process is designed to fully integrate new staff into culture and work roles. Expectations of staff are high regarding performance, continuing education, professional growth, and networking. |
| Education and training | All clinical microsystems have responsibility for the ongoing education and training of staff and for aligning daily work roles with training competencies. Academic clinical microsystems have the additional responsibility of training students. |
| Interdependence | The interaction of staff is characterized by trust, collaboration, willingness to help each other, appreciation of complementary roles, respect, and recognition that all contribute individually to a shared purpose. |
| Patient focus | The primary concern is to meet all patient needs by caring, listening, educating, responding to special requests, innovating to meet patient needs, and providing smooth service flow. |
| Community and market focus | The practice is a resource for the community; the community is a resource to the practice; the practice establishes excellent and innovative relationships with the community. |
| Performance results | Performance focuses on patient outcomes, avoidable costs, streamlining delivery, using data feedback, promoting positive competition, and frank discussions about performance. |
| Process improvement | An atmosphere for learning and redesign is supported by the continuous monitoring of care, use of benchmarking, frequent tests of change, and a staff that has been empowered to innovate. |
| Information and information technology | Information connects staff to patients, staff to staff, and needs with actions to meet needs. Technology facilitates effective communication; multiple formal and informal channels are used to keep everyone informed all the time, to listen to everyone's ideas, and to ensure everyone is connected and informed on important topics. |

## Table AG1.4 Microsystem Assessment Tool (MAT) Worksheet

| Characteristic | 0 (Lowest) | 1 (Middle) | 2 (Best) | Totals |
|---|---|---|---|---|
| Leadership | | | | |
| Organizational support | | | | |
| Staff focus | | | | |
| Education and training | | | | |
| Interdependence | | | | |
| Patient focus | | | | |
| Community and market focus | | | | |
| Performance results | | | | |
| Process improvement | | | | |
| Integration of information with patients | | | | |
| Integration of information with providers and staff | | | | |
| Integration of information with technology | | | | |
| TOTALS | | | | |

## FIGURE AG1.7 Microsystem Assessment Tool (MAT) Scores.




*Source:* Julie K. Johnson, MSPH, PhD.

## Interpretation of Scores

A score of less than 2 for any success characteristic indicates a potential area for improvement. The radar chart in Figure AG1.7 shows one way to display MAT scores.

If your microsystem has a score of 10 or less, you are probably spending a lot of your time each day working around defects in processes of care. (Some observers have estimated up to one-third of a clinician's time and efforts are wasted by dysfunctional workflow processes.) A score of 18 or higher indicates that overall your practice is functioning well. The MAT is not only a diagnostic tool to help identify where your practice can improve, but it can also, if used for follow-up, help track your progress over time.